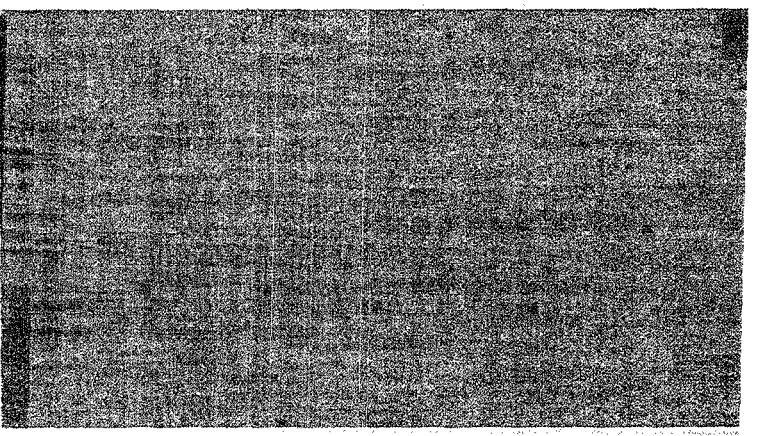
ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

DEL AMO SUPERFUND SITE
LOS ANGELES, LOS ANGELES COUNTY, CALIFORNIA
EPA FACILITY ID: CAD029544731
JULY 29, 2004

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry



THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PUBLIC HEALTH ASSESSMENT

DEL AMO SUPERFUND SITE

LOS ANGELES, LOS ANGELES COUNTY, CALIFORNIA

EPA FACILITY ID: CAD029544731

Prepared by:

California Department of Health Services
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E60), Atlanta, GA 30333.

Table of Contents

List of Tables (Appendix B)

List of Figures in (Appendix C)

List of Abbreviations and Acronyms

ATSDR—Agency for Toxic Substances and Disease Registry
BaP-eq—Benzo(a)pyrene equivalent
bgs—below ground surface
BTEX—Benzene, Toluene, Ethylbenzene, Xylenes
CARB—California Air Resources Board
CDHS—California Department of Health Services
COCs—chemicals of concern
CREG—Cancer Risk Evaluation Guideline for one in a million excess cancer risk (ATSDR)
DAAC—Del Amo Action Committee
DHHS—U.S. Department of Health and Human Services
DTSC—California Department of Toxic Substances Control
EAPC—Exposure Area of Potential Concern
EHIB—Environmental Health Investigations Branch
EMEG—Environmental Media Evaluation Guide (ATSDR)
IARC—International Agency for Research on Cancer
kg—kilogram
LNAPL—light non-aqueous phase liquid
LOAEL—Lowest Observable Adverse Effect Level
MCL—Maximum Contaminant Level for drinking water (state and federal)
mg—milligram
MRL—minimal risk level (ATSDR)
NA—not analyzed or not applicable
NAPL—non-aqueous phase liquid
ND—not detected
NOAEL—no observable adverse effect level
NPL—National Priorities List (EPA)
NS—not sampled
NTP—National Toxicology Program
OEHHA—Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency
PAHs—polycyclic aromatic hydrocarbon compounds
PCBs—polychlorinated biphenyl compounds
PCE—tetrachloroethylene
PHA—public health assessment
ppm—parts per million
ppb—parts per billion
PRGs—preliminary remediation goals (EPA)
PRP—potentially responsible party
RCRA—Resource, Conservation, and Recovery Act
REL—reference exposure level (OEHHA)
RfC—reference concentration (EPA)
RfD—reference dose (EPA)
RI—remedial investigation
RI/FS—remedial investigation/feasibility study
RMEG—Reference Dose Media Evaluation Guide (ATSDR)
ROD—record of decision (EPA)
SCAQMD—South Coast Air Quality Management District
SVOC—semi-volatile organic compound
TCE—trichloroethylene
TRI—Toxic Release Inventory (EPA)
EPA—U.S. Environmental Protection Agency
VOC—volatile organic compound

Summary

The California Department of Health Services (CDHS) has prepared this public health assessment (PHA) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The PHA is a document that provides the community with information on the public health implications of specific hazardous waste sites and identifies those populations for which further health actions or studies are indicated. The glossary in Appendix A contains terms used in the PHA.

The Del Amo site is located in western Los Angeles County, California, between the cities of Torrance and Carson. The site consists of approximately 280 acres, formerly the site of a synthetic rubber manufacturing plant in operation from 1942 until 1972, at which time the facility was sold to a development company and was subsequently dismantled. Most of the 280-acre site has been redeveloped into an industrial park. The area of the site containing the majority of the contamination is called the "waste-pit area." This area is currently fenced and covered with a cap, installed from May 1999 to February 2000. Groundwater under the former Del Amo facility and the waste pit area is contaminated with chemicals from the former rubber manufacturing plant. The groundwater contamination is mixed with contamination from the nearby Montrose Superfund site, on the western edge of the Del Amo plume, and from a few smaller industrial facilities. This PHA provides an overview of the public health hazards posed by contamination in the developed portion of the Del Amo site, the waste-pit area, the groundwater contamination, and possible off-site (community) exposures.

CDHS and ATSDR released a preliminary PHA document on the Del Amo site on January 12, 1994, after the U.S. Environmental Protection Agency (EPA) nominated the site for placement on its National Priorities List (NPL). At the time this PHA was written, only limited site investigation had taken place. In the 1994 PHA document, CDHS and ATSDR concluded that the Del Amo site posed an indeterminate public health hazard to nearby residents and workers. A health study indicated that residents living near the Del Amo site appeared to experience an increased rate of headaches, sneezing and sinus congestion, sore throats, sleep difficulties, and fatigue and tiredness. In the preliminary PHA, CDHS/ATSDR made several recommendations for additional environmental data gathering that would assist in evaluating any public health hazard the site might pose. Follow up on many of the recommendations made in the preliminary PHA provided additional information that was reviewed and evaluated in this PHA.

For the preliminary PHA, CDHS and ATSDR staff began working with the community. CDHS has been working with the community and other agencies on a variety of Del Amo- and Montrose (Cerclis CAD008242711)-related activities since 1991. In particular, ATSDR and CDHS worked closely with the Del Amo Action Committee, a group of former and current residents in the neighborhood to the south of the site.

In this PHA, CDHS determined that direct and frequent contact with contamination in the waste pit area before it was capped posed a public health hazard to children in the past; however, the increased cancer risk is low. CDHS also determined that the indoor air pathway on the developed portion of the site may pose a public health hazard now and is an indeterminate public health

hazard in the future to occupants of a building located over light non-aqueous phase liquid (LNAPL); however, the increased cancer risk is low and noncancer health effects are unlikely. This conclusion is based on a CDHS evaluation of ten environmental pathways of possible exposure related to the Del Amo site—three related to the developed portion of the site, four related to the waste pit area, and three specific to the neighborhood/community south of the site. The following is a summary of the evaluation of each of these pathways:

- On the basis of available soil data for exposed areas of the developed portion of the site, exposure to long-term workers, occasional workers, and hypothetical population of children at a daycare center does not present a public health hazard related to Del Amo-related contaminants. Available test results of the limited surface and shallow soil sampling in the developed portion of the site detected several chemicals (arsenic, dichlorodiphenyl trichloroethane [DDT] and Arochlors/total polychlorinated biphenyls [PCBs]) of health concern that are not definitely related to the Del Amo site. For long-term workers and occasional workers, these non-site-related chemicals pose an insignificant-to-slight increased cancer risk. The chemicals measured in the soil would not result in noncancer health effects for long-term workers, occasional workers, or children in the daycare center. Since soil testing was only conducted in the exposed areas of the site, (e.g., when a building is torn down or a parking lot removed), there is a potential for contaminated soil to be exposed. CDHS recommends that soil sampling be conducted when parking lots or buildings are removed, constructed, or remodeled, or if another major activity occurs that will result in the exposure of soil on the developed portion of the site.

- The groundwater under and around the Del Amo site is contaminated with various chemicals arising from the Del Amo and Montrose sites, as well as other nearby sites. Currently, no domestic, irrigation, or industrial wells are pulling water from the contaminated groundwater; thus, no one has been exposed, and no one is being exposed through using the water as drinking water. If the groundwater is cleaned up and contained as planned, the groundwater contamination will not spread to the drinking water wells. Thus, there would be no concern for future exposure from use of the groundwater as drinking water.

- Indoor air in 13 buildings located on the developed portion of the site may be affected by volatile organic compounds (VOCs) in nearby contaminated soil or groundwater. CDHS used computer modeling—a mathematical approach to estimating what might be occurring in the environment—to estimate indoor-air effects from contaminated soil. The resulting estimates indicate that buildings situated above soil containing light non-aqueous phase liquid (LNAPL) (which primarily contains benzene) may contribute to a low increased cancer risk and the possibility, although unlikely, of noncancer health effects for long-term workers in the building. Although unlikely, a hypothetical population of children attending daycare could experience noncancer health effects from breathing air inside a building located above LNAPL-contaminated soil. Conversely, neither cancer nor noncancer health effects are expected for long-term workers, occasional workers, or a child attending a daycare in buildings situated above soil that does *not* contain LNAPL. Many assumptions made during modeling of this exposure may influence the validity of these findings. On the basis of the analysis of the indoor-air exposure pathway in buildings, CDHS determined that the site may

currently pose a long-term public health hazard to occupants of buildings located above soil containing LNAPL. Thus, CDHS concluded that the site may pose a public health hazard now, and that it poses an indeterminate public health hazard in the future. CDHS recommends additional air sampling in buildings located above LNAPL-contaminated soil.

- On the basis of available data, direct contact with contamination in the waste-pit area posed a public health hazard before the waste pits were capped in 1999/2000, although they were covered with dirt in the 1950s and in the 1980s. However, waste material continued to be seen at the surface, and children reportedly played at the waste pits. The waste-pit material is high in polycyclic aromatic hydrocarbons (PAHs) and VOCs, most prominently naphthalene, benzo(a)pyrene, benzene, and ethylbenzene. Limited surface-soil testing above the waste pits indicates that the soil would not pose a public health hazard. However, if children directly handled the waste material on a frequent basis, it would have posed a public health hazard to children in the past. Estimated exposures related to the contaminated waste-pit material indicate a low increased cancer risk (5.9 in 1,000) for children who played with the waste on a fairly regular basis. These children also could have experienced noncancer health effects (changes in blood-system components) related to benzene exposure. On the basis of this pathway evaluation, CDHS determined that the Del Amo site posed a public health hazard in the past. The waste pits were capped in 1999/2000, eliminating this exposure route as long as the cap is maintained. On the basis of the pathway of direct contact with contamination in the waste-pit area, CDHS determined that the Del Amo site posed a public health hazard in the past.

- On the basis of available data, CDHS determined that air emissions from contamination in the waste-pit area did not pose a public health hazard before the pits were capped in 1999/2000. The undisturbed waste did emit chemicals into the air through the fill material; however, air measurements taken near the waste pits, before the cap was installed in 1999/2000, indicate waste-pit emissions did not significantly affect the air quality in the area when the waste material was undisturbed. If the waste material were disturbed, VOCs (for example benzene and ethylbenzene) would have been released into the air in large amounts.

- The responsible parties, as ordered by EPA, capped the waste-pit area in 1999/2000. The cap eliminates any current or future exposure and emissions from the waste-pit area, as long as the cap is maintained.

- One aspect of the treatment strategy for controlling waste-pit contamination was installation of a treatment system in the soil under the waste pits that pulls volatile organic chemicals to the surface. Such treatment prevents the chemicals from moving into the groundwater; however, the material (VOCs) "pulled" to the surface still requires treatment when it rises to the surface. The choice of the soil gas treatment system is in progress. CDHS recommends review of the pilot and full-scale treatment systems to ensure they operate as designed and in a manner that is safe and does not adversely affect the nearby neighborhood.

- It is theoretically possible that indoor air in residences located south of the Del Amo site might be affected by contaminated groundwater flowing underneath their houses. CDHS

estimates of indoor air levels indicate that the groundwater does not pose a public health hazard to residents of this area. EPA sampled the indoor air in 25 residences along W. 204th Street and found no health threat from groundwater vapors.

- On the basis of soil investigations in and near the residential neighborhood south of the Del Amo site, exposure to surface soils by adults and children does not present a health risk from Del Amo-related contaminants. Some of the soil in the neighborhood contained elevated levels of dichlorodiphenyl trichloroethane (DDT), and several excavations have been conducted to remove the DDT contamination. DDT is not associated with activities at the Del Amo site. Arsenic and cadmium have been detected at levels exceeding typical Western soils and health comparison values for these chemicals. Arsenic and cadmium are not related to activities at the Del Amo site. No detections have been found of other chemicals, primarily polycyclic aromatic hydrocarbons (PAHs), that could be related to the Del Amo site. A low increased cancer risk is associated with incidental ingestion of backyard soil in the area south of the Del Amo site before the parcels of land were bought and regraded.

- The responsible parties for the Del Amo site purchased approximately 55 residences south of the waste-pit area. These houses have been removed. The responsible parties graded the property in preparation for use as a county park. As part of the grading, the responsible parties' contractors were directed by California Division of Toxic Substances Control (DTSC) to collect the blue "lava-rock-like material" seen by community members on the property and to place it at a depth of 3 to 5 feet below the surface in the area where the basketball court is planned. The blue lava-rock-like material contains elevated levels of metals (arsenic, lead, copper, and zinc). Several rounds of testing of the surface soil after the grading did not detect DDT or metals at levels of health concern. Slag material gathered by Los Angeles County contained some elevated metals. Because nonnative material found in the surface soil has in some cases contained elevated metals that might be crushed into the surface soil or handled by park visitors, CDHS recommends that the surface be graded to remove the nonnative material.

CDHS and ATSDR have made several recommendations related to reducing or eliminating any current or future exposures at or near the Del Amo site. In particular, CDHS and ATSDR recommend that additional evaluation of the indoor exposure pathway on the developed portion of the site, especially in areas where LNAPL exists beneath a building.

Background

This public health assessment (PHA) of the Del Amo site near Torrance, Los Angeles County, California, was prepared by the California Department of Health Services (CDHS) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). In this PHA, CDHS and ATSDR evaluate and determine whether adverse health effects may occur as a result of human exposure to Del Amo-site contaminants and recommend actions to reduce or prevent possible adverse health effects. ATSDR, located in Atlanta, Georgia, is a federal agency within the U.S. Department of Health and Human Services. ATSDR is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 to conduct PHAs at hazardous waste sites (1). The conclusions of this PHA of the Del Amo site are based on a review of available environmental data, health concerns of community residents, information obtained from site visits, and consultation with involved government agencies and the public.

In July 1991, the U.S. Environmental Protection Agency (EPA) first proposed that the Del Amo site be added to the agency's National Priority List (NPL), a list of hazardous waste sites designated for clean-up activities. The site was listed on the NPL in 1998, but was subsequently removed due to a lawsuit filed by a group of Del Amo property owners. In December 2000, EPA again nominated the site for placement on the NPL. The site was place on the NPL in September 2002.

Site Description and History

The Del Amo site is located in western Los Angeles County, California, between the cities of Torrance and Carson (Figure 1) (2). The site consists of approximately 280 acres and is the site of a former synthetic-rubber manufacturing plant used during World War II. The plant was constructed in 1942. From 1942 to 1955, private companies (the Shell Oil Company, the Dow Chemical Company, and several others) operated the plant. In 1955, the facility was sold to Shell Oil Company, which operated the plant until 1972. The plant was sold in 1972 to a development company and was subsequently dismantled. Most of the 280-acre site has been redeveloped into an industrial park. The area of the site containing the majority of the contamination is known as the "waste-pit area," which contains three former evaporation ponds (1A, 1B, and 1C) and six disposal pits (2A-2F) (Figure 1). The area is currently fenced and covered with a cap. Groundwater under portions of the former Del Amo facility and the waste-pit area is contaminated with chemicals from the former rubber manufacturing plant. The groundwater contamination is mixed with other contamination from the nearby Montrose Superfund site, mostly on the western edge of the Del Amo contamination plume, and from a few smaller facilities (3). In this PHA, separate discussions will address the public health hazards posed by the developed part of the site, the waste-pit area of the site, groundwater contamination at the site, and off-site exposure locations/areas.

Developed Portion of the Site

The facility formerly consisted of three plants (Figure 1); i.e., a styrene plant, a butadiene plant, and a synthetic rubber plant. Past records regarding the former manufacturing operations at the site provide an indication of some of the materials used and the products and waste materials generated (2). The styrene manufacturing process included ethylene production; ethylbenzene was produced from benzene and ethylene; and styrene was produced from ethylbenzene. Butadiene was manufactured from a petroleum-derived butylene mixture. Styrene and butadiene were piped to the rubber plant to be copolymerized with soapy water to make synthetic rubber.

An independent company called Eston Chemical Company operated an ethylene dibromide facility in the southwestern corner of the styrene plant area (2).The facility operated for approximately 15 years, beginning in 1947. It produced about 8,000 pounds of ethylene dibromide a day by adding bromine to ethylene gas, which was produced at the styrene plant.

An extensive system of aboveground pipelines and some underground pipelines on the site were used to transfer raw materials, by-products, products, and possibly waste products (2). In addition to the pipelines between the plants, some materials like benzene, propane, and butylene were transported by pipeline more than 15 miles to similar facilities in nearby cities. A pipeline easement remains from the southern end of the site between the former waste disposal area and Del Amo Boulevard.

The synthetic rubber manufacturing plant was decommissioned and dismantled in the early 1970s and subsequently redeveloped as a commercial and industrial park during the 1970s, 1980s, and 1990s (4). Currently, virtually all the land surfaces within the business park are covered by buildings, parking areas and/or roadways, and landscaped areas. Of the 67 on-site land parcels, only two remain undeveloped.

The focus of the investigation at the site has been on the historical uses of the land (Figure 3) (5). Historically the site was laid out with multiple areas of densely packed chemical storage and processing areas, separated by large areas of open space, parking, or administration facilities. The responsible parties who responded to EPA's legal request for investigation and cleanup (Shell Oil Company and Dow Chemical Company) began collecting data on the site in the early 1990s, in areas of the site with known chemical storage or processing, as well as in places where access to the land surface could be made without disrupting the businesses currently operating on the site. The first phase included soil gas sampling, groundwater sampling, soil sampling, and the workplace indoor air sampling. These data were summarized in the Phase I Remedial Investigation Report in 1993 (2). Additional data were gathered by the responsible parties through a series of addendum work plans.

Environmental data also were gathered by various entities interested in developing or occupying some of the property on the site (6-22).

The following is a brief summary of the findings for the developed area of the site from all investigations:

- Surface soil (less than 1 foot below ground surface [bgs]) testing detected VOCs in the northwest corner, some SVOCs in the northwest corner of the plant site, DDT in the southwest corner, and arsenic and chromium above background levels in the northwest corner.

- Shallow soil (1–15 feet bgs) is contaminated with benzene, ethylbenzene, xylenes, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene near VOC storage tanks in the styrene plant area. Those shallow soil contaminants are also found near a former plant site laboratory and associated pipelines within the butadiene plant, and near a benzene feedstock pipeline at the southeast corner of the butadiene plant. DDT, arsenic, and chromium was also found in the surface soil.

- Shallow soil gas samples (approximately 7 feet bgs) were collected from more than 900 locations in areas where chemicals were known to have been stored, transported, or processed. Those showed the highest concentrations to be within the former styrene plant, particularly at areas where VOC storage tanks were located, in the vicinity of a former laboratory, and along a benzene feedstock pipeline, both near the southeast corner.

- Workplace air sampling in 13 buildings did not detect any VOCs present above the test-specific comparison values (the worker exposure level, called the PEL, divided by 20).

- Twelve groundwater contamination source areas were identified.

- Three of the groundwater contamination source areas have high enough concentrations of contamination such that the contamination is separated from the water (similar to what happens when you mix oil and water), this is called non- aqueous phase liquid (NAPL).

In the section entitled Environmental Contamination/Pathways Analysis/Public Health implications, there will be a more in-depth discussion of this contamination and the ways that people may or may not be exposed to it.

Waste Pits

The Del Amo waste-pit area comprises 5 acres on the southern end of the site (Figure 1) (23). The waste-pit area was used for disposal of certain wastes generated at the rubber plant. The waste-pit area was covered with clean fill material in the late 1960s and 1970s. The thickness of the cover material ranges from 1 foot to 8 feet. Waste and contaminated soil in the disposal area contain high concentrations of chemicals, primarily PAHs and VOCs. The waste pit-area consists of three former evaporation ponds (1A, 1B, and 1C) and six disposal pits (2A-2F). One of the evaporation ponds (1A) was partially excavated by the landowner in 1982. EPA estimates that 30,000 cubic yards of waste, weighing more than 34 million pounds, currently exists in the former waste-pit area (4).

DTSC[1] began oversight of the waste disposal area in 1982, during the excavation activities at the waste ponds (23). Under DTSC direction, groundwater monitoring, a soil gas study, and soil sampling around the waste-pit area were conducted in the mid-1980s. When the site was nominated to the NPL[2] in 1991, DTSC turned over regulatory responsibility for the waste pits and the rest of the site to EPA. During the mid-1990s, Shell Oil Company and Dow Chemical Company paid for several investigations of contamination at the waste-pit area, the developed portion of the site, and in the groundwater.

EPA selected a plan for dealing with the waste-pit contamination in 1997. The plan called for 1) covering the pits with a particular type of cap that would keep rain water from entering the waste and for 2) a soil-vapor extraction system to capture gases from contaminated soil beneath the waste pits to prevent contaminants from migrating into the groundwater below. The cap was constructed from 1999 until 2000, and the soil-vapor extraction system was built in 2000; the soil cap treatment is currently being chosen. During construction of the cap for the waste-pit area, the material encountered during the grading was buried near the disposal pits, and the cap also covers this material.

In the *Environmental Contamination/Pathways Analysis/Public Health Implications* section, a more in-depth discussion is provided for the waste-pit contamination and the ways in which people may or may not be exposed to contaminants. This includes a discussion of possible exposures from the treatment technology used for soil gas.

Groundwater

Groundwater in the surrounding area of the Del Amo site is contaminated with chemicals that originated from the Del Amo site, the Montrose site, and a few smaller facilities located nearby (Figure 4) (3). Groundwater is heavily contaminated with chlorobenzene, benzene, trichloroethylene, and other VOCs and SVOCs.

Groundwater is water contained in soil beneath the ground surface. Groundwater under the Del Amo site occurs approximately 35–70 feet below bgs (3). Groundwater is considered a resource as it may be used for drinking, irrigation, or industrial purposes. No documentation is available suggesting that anyone has used or is using the contaminated water for drinking water or other purposes.

Because the contamination could spread and threaten drinking water wells in the area in the future, EPA ordered the responsible parties to investigate methods to clean up the groundwater.

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[1]Before July 19, 1991, the California Department of Toxic Substances Control (DTSC) was known as the Toxic Substances Control Program within the California Department of Health Services. DTSC is now part of the California Environmental Protection Agency (Cal EPA).

[2]The NPL is a list of the top-priority sites in the country contaminated with hazardous substances and eligible for investigation and cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, also known as the Superfund program.

In 1999, EPA chose the natural attenuation method to address groundwater contamination in the upper aquifers that contain dissolved Del Amo-related contaminants. Natural attenuation depends on biodegradation (the break down of contamination by microscopic organisms, such as bacteria which naturally occur in soil). Biodegradation of Del Amo-related contamination will result in water and carbon dioxide as breakdown products. Groundwater in the lower aquifers containing dissolved Del Amo- and Montrose-related contamination will be cleaned up to drinking water standards. This will be accomplished by pumping the contaminated water to the surface, treating the water to remove contaminants, and injecting cleaned water back into the ground. In the areas of groundwater in which contamination of light non-aqueous phase liquid (LNAPL) is high, it is technically impractical to clean up the groundwater to drinking water standards; therefore, the LNAPL (mostly benzene) contamination will be contained. In this area, it is anticipated that biodegradation of the LNAPL will occur. Again, the major products of biodegradation will be carbon dioxide and water.

The section of this document entitled *Environmental Contamination/Pathways Analysis/Public Health Implications* contains a more in-depth discussion of groundwater contamination, including the determinations 1) that groundwater currently does not pose a public health hazard because it is not used as a water source, and 2) that groundwater in some areas of the site is highly contaminated and poses a risk of contaminating indoor air in buildings on the site.

Off-Site Investigations

Because of concern about off-site migration of chemicals from the Del Amo site, soil and soil gas sampling has been completed in the area south of the facility. Samples of soil gas (air within the soil) taken along Del Amo Boulevard south of the site indicate that VOC contamination is *not* migrating from the waste pits or from the pipelines that run across the southern border of the site.

In 1993, EPA collected soil samples in the backyards of homes located on the north side of West 204th Street, between New Hampshire Avenue and Normandie (24). No chemicals related to the Del Amo site were found at levels of health concern. The sampling, however, did find the pesticide DDT in two residential yards (1051 and 1055 204th Street). The DDT-contaminated soil was thought to have been taken from the Montrose site and used as fill material when the houses were built. In 1994, EPA conducted a removal action in the two yards where the high levels of DDT were found in the soil. In 1997, EPA conducted further excavation activities along 204th Street to remove DDT-contaminated soil.

The Del Amo responsible parties purchased the two residential properties that contained the high levels of DDT and 63 other properties along 204th Street. The responsible parties offered the homeowners a buyout process for their properties. As part of this process, the responsible parties helped the homeowners form a community advisory panel to determine the future use of the land in the buyout area. The task force met several times and selected a community park as the future land use. The task force helped create the design and layout for the park. The responsible parties have paid for grading of the property and for post grading testing DDT and metals in the soil

(25). The Los Angeles County Department of Parks and Recreation agreed to take over the property, with a contingency for the findings of their own investigations (see the *Environmental Contamination/Pathways Analysis/Public Health Implications* section for more detail).

In the *Environmental Contamination/Pathways Analysis/Public Health Implications* section, a more in-depth discussion is provided for the off-site investigations for Del Amo-related contaminants. The DDT-related investigations and cleanup will not be discussed in this health assessment because they are not related to activities of the Del Amo facility (see Appendix E for more information on DDT contamination issues).

Previous Public Health Activities at the Site

The California Department of Health Services (CDHS) and the Agency for Toxic Substances and Disease Registry (ATSDR) released a preliminary PHA of the Del Amo site on January 12, 1994, after it was nominated to the NPL the first time (26). That PHA was written when very little site investigation had taken place. In the document, CDHS and ATSDR concluded that the Del Amo site posed an indeterminate public health hazard to nearby residents and workers. A health study indicated that residents living near the Del Amo site appeared to experience an increased rate of headaches, sneezing and sinus congestion, sore throats, sleep difficulties, and fatigue and tiredness (27). In the PHA, CDHS/ATSDR made several recommendations for additional environmental data gathering that would assist in evaluating the public health hazard posed by the site. Many of the recommendations included in the 1994 preliminary PHA have been accomplished, providing additional information that was used in this PHA (see Appendix D for a summary of the recommendations from the first PHA and the follow-up actions that have taken place).

As a part of writing the first PHA, CDHS staff began working with the community. CDHS has been working with the community and other agencies on a variety of Del Amo- and Montrose-related activities since 1993 (see Appendix E for a summary of public health activities conducted by CDHS). The community outreach activities will be summarized in the *Community Concerns* section of this PHA.

Site Visits

CDHS staff has visited the neighborhood surrounding the Del Amo site numerous times over the last 10 years. ATSDR-funded staff within CDHS first visited the Del Amo neighborhood in November 1991; the most recent visit was in July 2002. CDHS has conducted community interviews, attended community/agency meetings, visited residents' homes, and observed sampling and excavation activities along 204th Street, Kenwood Avenue, and in other places in the community. Staff has also observed the waste pits from the fence line, and driven around the developed area of the site.

Demographics

At the time of the 1990 census, approximately 15,988 people lived in the zip code where the Del Amo site is located (zip code 90502) (Figure 2) (28). This zip code also includes the neighborhood to the south of the site. The race makeup is 57% white; 22.5% Asian or Pacific Islander; 0.4% Native American; 6% African American; and 13.6% other races. Twenty six percent are of Hispanic origin. In 1990, 22.8% of the total population was under the age of 18 years, and 10.4% was over the age of 65 years.

The Del Amo site is located in the City of Los Angeles, and the neighborhood to the south is in an unincorporated area of Los Angeles County, located between the City of Torrance and the City of Carson. According to the 2000 census, approximately 137,946 people live in the City of Torrance (29). The race makeup is 59% white; 31.1 Asian or Pacific Islander; 2.7% African American; 1.1% American Indian, Eskimo, or Aleut; 0.8% Native Hawaiian or other Pacific Islander, and 6.3% other race. In 2000, 23% of the total population was under the age of 18 years, and 14.1% was over the age of 65 years (29).

Land Use

The Del Amo site is zoned for light industrial and commercial use. Sixty-seven parcels of property are within the developed area of the Del Amo site (30) (Figure 3). Several of these parcels are road strips (Pacific Gateway and Magellan Street). Two of the parcels (Tracts 7351-31-24 and 7351-33-45) have a special designation that would allow live-work uses on the property. These two tracts were formerly within a single tract (Tract 7351-33-37). (The figures included in this PHA are labeled with the previous tract number.) Two of the parcels are utility right of ways (Tracts 7351-34-900 and 7351-33-901). Of the remaining parcels, only two have not been developed (the waste-pit area and the parcel immediately west of the waste-pit area). Figures 3 and 5-11 do not show recent development on the five parcels on the east side of the site.)

The southern portion of the site is bounded by Del Amo Boulevard, which is currently a paved alley. To the south of Del Amo Boulevard is a neighborhood composed of single-family homes, and one condominium complex is located on the eastern edge of the neighborhood, along Vermont Avenue.

Hamilton Avenue is east of the site and has commercial and industrial facilities on the east side of the street. To the east of this is a large state highway, the 110 Freeway.

To the north of the site is 190th Street. On the north side of the street are industrial and commercial buildings. To the north is the 402 Freeway.

To the west of the site is a block-wide swath of commercial and industrial buildings. To the west of this is Normandie Avenue.

In the area surrounding the site, several other facilities are known to use hazardous chemicals and several properties are listed on the county, state, or federal government lists of hazardous waste sites (Figure 5). Some of these properties include the Mobil Oil Corporation Refinery, located ½ mile west of the Del Amo site. Farmer Brothers Coffee Company, is located along Normandie Avenue west of the waste-pit area. Jones Chemical Company is another nearby active site located west of the waste pit area of the Del Amo site. The Douglas Aircraft Company and the Montrose Chemical Corporation, which are closed facilities located west of the Del Amo site, are being cleaned up because of hazardous waste issues. The closed Gardena Landfill #4 is located southeast of the Del Amo site. The landfill is under county oversight and is being reviewed by EPA for possible listing on the NPL. Some of these nearby facilities have affected groundwater and air quality in the area.

Toxic Release Inventory Search

The Toxic Release Inventory (TRI) is an online database maintained by EPA (31). TRI contains information on estimated annual releases of toxic chemicals from active industrial facilities from 1987 through the present. TRI data are used to provide a general conception of current environmental emissions occurring at or near a site and whether the emissions may be causing an additional environmental burden to residents of nearby communities. TRI contains information on 1) estimated annual releases (emission rates) of toxic chemicals into the environment (via air, water, soil, and underground injection), 2) category of each release (routine release, spill, or other accidental release or an occasional release from normal facility operations). Facilities must report releases of toxic chemicals to TRI if the facility fulfills the following criteria: 1) it is a manufacturing facility; 2) it employs the equivalent of 10 full-time workers, 3) it manufactures or processes more than 25,000 pounds (lbs.) per year of the chemical released or uses more than 10,000 lbs. of the chemical per year, and 4) the chemical is one of the 350 specific toxic chemicals or chemical categories on the TRI list of hazardous substances.

CDHS searched the TRI for the years 1988 through 2000 (the most recent year for which data are available) for potential emissions from the area surrounding the Del Amo site (31). CDHS conducted a TRI search for environmental releases from other companies located within the zip code (90502) surrounding the Del Amo site (Figure 2). Releases also were reviewed for zip code 90501, located east of 90502, and zip code 90509, which includes the Mobil Oil Corporation Refinery. The TRI contained reports of 144 releases of 44 different chemicals from companies located in the three zip codes (90502, 90501, and 90509) (Table 1). In addition to on-site contamination at the Del Amo site, releases of contaminants by other sources located near the site are contributing to the contamination in the vicinity of the Del Amo site.

These releases (summarized in Table 1) are primarily air releases (31). The predominant wind direction is from the west and southwest. The largest releases in the area are from the Mobil Oil Corporation Refinery, located west of the Del Amo site in zip code 90509 (Figure 2). Releases from the refinery account for more than 99% of total releases in that Zip Code. In 1999 (the last year for which TRI data are available), three facilities in Zip Code 90502, which includes the Del Amo site, reported air releases to the TRI: Geron Furniture Inc., Stewart Filmscreen Corporation, and R.R. Donnelly & Sons Company. Douglas Aircraft Company, when it was in operation,

reported air releases of more than 500,000 tons per year. Douglas Aircraft Company ceased operation in 1992. Since then, the number of releases has dropped in the zip code containing the Del Amo site.

Information about chemical releases in the vicinity of the Del Amo site will not be evaluated in this public health assessment. It is presented to inform the community about other sources of chemical contamination near their neighborhood.

Community Health Concerns

In 1983, community residents first became aware that the Del Amo site was considered to be a hazardous waste site. That year, residents organized the first of three grassroots community groups that were formed during the 1980s, to take action against environmental pollution in the neighborhood. Reports of skin rashes, numbness of the feet and hands, respiratory problems, prolonged colds, cancers of various types, miscarriages, birth defects, stomach aches, and headaches were reported in an informal survey carried out by community members (26). In particular, in response to these concerns, the Epidemiological Studies and Surveillance Section of CDHS conducted a health study in 1984, and the study report was released in 1987 (27). Adverse health effects detected in the study were those that are often associated with airborne pollutants, such as skin, eye, nose, and throat irritation, as well as sleep difficulties, muscle aches, and fatigue. Specifically, the health study found that those who reported smelling odors greater than 4 times per month reported the following health effects at significantly higher levels than the control community:

- 11.3% in the Del Amo community reported headaches compared to 3.4% in the control area;
- 16.1% in the Del Amo community reported sneezing and sinus congestion compared to 4.3% in the control area;
- 13.4% in the Del Amo community reported throat soreness compared to 2.6% in the control area;
- 11.3% in the Del Amo community reported muscle aches and pains compared to 4.7% in the control area;
- 11.3% in the Del Amo community reported sleep difficulties compared to 5.1% in the control area; and
- 13.0% in the Del Amo community reported fatigue and tiredness compared to 4.7% in the control area.

In the Del Amo area, 45% of the community reported smelling odors greater than 4 times a month compared to 22.8% in the control community (statistically significantly different at $p=<0.001$).

In 1991, as part of the 1994 preliminary PHA, CDHS and ATSDR staff spoke with residents of 10 households during a door-to-door canvas of the area near the site (26). The majority of the households complained of unpleasant odors described variously as gas, burned oil, and/or chemical smells. The adverse health effects described were consistent with those found in the

1984 – 1987 CDHS health study (27). The three predominant complaints reported in 1991 were 1) rashes and other skin irritations; 2) chronic respiratory problems, including asthma, allergies, trouble breathing, and bronchitis; and 3) headaches. Several respondents reported problems with nausea. Seven of the households reported difficulty growing fruits and/or vegetables, including complaints about unusual shape, size, color, or taste of the produce. Concerns also were expressed about the quality of the drinking water and the health problems of their pets.

Since that time, CDHS and ATSDR have continued their involvement with this community, largely in relation to the nearby Montrose Chemical Corporation Superfund site, which affects the same neighborhood as the Del Amo site. In 1993, during EPA off-site soil sampling related to the Del Amo site, the pesticide DDT was found in residential soil on 204th Street, directly across from the Del Amo waste-pit area (24). The DDT, which detected at levels of health concern, appears to have come from the Montrose site where DDT had been manufactured. Contaminated soil from the Montrose site had been used as fill material when the Del Amo residential neighborhood was developed. Until that point, community health concerns had been focused only on the Del Amo site. Now the same community also was concerned about DDT, a contaminant unrelated to the Del Amo site. Many residents now attribute their health problems to one of the two sites, and sometimes to both. A new community activist group, the Del Amo Action Committee (DAAC) was formed, and has since been instrumental in giving a greater voice to community health concerns.

In 1997, the Del Amo/Montrose Interagency Community Partnership (the partnership) was formed by DAAC and the multiple agencies involved at both sites began to collaborate on site-related issues. The major focus of concern regarding the Del Amo site continued to be exposure to toxic air emissions. After the waste pits at the site were capped in 1999/2000, concerns arose about the technology being considered for vapor treatment. DAAC, Communities Against Toxics, Sierra Club, and other groups opposed the use of any incineration technology that produces dioxins. In response, the partnership brought together agencies, community groups, and environmental groups to participate in a detailed review of several treatment technologies that might be applied. This collaboration began in 1999 and continued through the following year. The result was the selection of an alternative treatment technology (the alternative technology is discussed further in the Environmental Contamination/Pathway Analysis/Public Health Implications section). The partnership was subsequently dissolved in September 2001.

As part of the PHA process, Judy Lewis and Dr. Marilyn Underwood, PhD, employees of the CDHS Environmental Health Investigations Branch (EHIB) contacted DAAC in August 2001, to determine community members' current concerns regarding the Del Amo site. The DAAC Director expressed the following concerns: 1) possible health risks from the presence of vinyl chloride in groundwater beneath a complex of condominiums that might commingle with other contaminants (the director stated that this contaminant was detected during monitoring for methane gas from the nearby Gardena Landfill #4); 2) potential health risks from the technology chosen to treat the vapors from the waste pits; 3) possible negative ramifications of using pump-and-treat technology to clean up groundwater contamination; 4) the possibility that a drinking water well has been or may be contaminated; 5) the possibility that the former Eston Chemical Company may have participated in defense research using biological agents and radioactive

materials, which have not been included in the environmental sampling; 6) the fact that unusual storm water or rain events have not been taken into account when assessing potential off-site impacts on an area in a flood plain; and 7) the limited life span of the cap covering the waste pits. Overall, the director is concerned that the Del Amo site has not been sufficiently characterized and thinks more sampling is needed. She suggested that many concerns remain and that CDHS should hold a public meeting to inform new residents of past activities at the Del Amo site.

As part of the process of gathering community concerns, CDHS staff held a public availability session on September 19, 2001. The session was held at the Harbor City/Harbor Gateway Chamber of Commerce, located within the industrial park/business center developed on the site of the former Del Amo facility. A flyer in Spanish and English was mailed to 2,600 nearby residents and 500 businesses, and an announcement was placed in the local newspaper. The session was also publicized by DAAC, and a notice was sent to the members of the Del Amo/Montrose Partnership. Five residents attended the session and four residents responded by phone. Two other concerned residents and three business representatives were contacted by phone as a result of a referral from EPA. The lack of greater response may be attributed, in part, to the timing of this event, which took place just 8 days after the attack of the World Trade Center and the Pentagon. Heightened concern at this time among some residents in the neighborhood concerning issues related to the Montrose site also may have been a factor.

Residents with concerns were equally divided between those who are new to the neighborhood and those who are longtime residents. Two new homeowners and a new renter in the area, who had not been aware of the site, called CDHS to obtain information. Another renter had recently moved into an apartment across the street from the former Montrose facility. He had been unaware of either of these sites or of the other former manufacturing sites in the area where remediation of hazardous materials has occurred. He was upset that he had not been notified by his landlord. He also complained of noise and odors related to a neighboring manufacturing facility, and of poor-quality drinking water. Another person who had bought a home several years ago also was concerned about the lack of full disclosure, especially because he had done extensive landscaping and had come into contact with soil. A Spanish-speaking resident new to the neighborhood said that she asked her neighbors about the site when she received the flyer, and none of them knew anything about it. This resident reported that a neighbor's carrots were "all crooked" and did not seem to be normal.

The concerns of residents who had lived in the area for long periods of time were quite different. Some of these residents attributed their own or their family members' health conditions to either the Del Amo or Montrose sites, in some cases not knowing which site may have been involved. Among the health conditions reported were cervical cancer, multiple sclerosis, possible skin cancer, brain and bladder masses, a large abdominal growth or hernia, and two miscarriages. One man who grew up about 1½ miles from the Del Amo site had both Hodgkin's lymphoma and bone cancer during adolescence, called CDHS to inquire whether a known relationship exists between his cancers and contaminants from this site. One resident's son had often played near the waste pits as a child, coming home covered with mud. She thought his subsequent serious health problems, including juvenile diabetes and hepatitis, might have been related to childhood exposures to toxic chemicals. Her three children who did not play in that area have not had

health problems. There are other reports of children playing in fields near the waste pits before a fence was installed. When it rained, the fields were filled with puddles in which children caught polliwog and played. Two brothers and their friends who played there as children wonder whether they were exposed to toxic chemicals that could affect their health. Possible toxic runoff from the waste pits also was a concern of a resident who had owned several properties on 204th Street since the 1960s. Before the storm drain was installed in the late 1960s to mid-1970s, backyards flooded and the water drained into a low spot in the ground on two vacant lots at the corner of 204th and Catalina.

Businesses located within the area of the Del Amo site, now known as the Harbor Gateway Business Center, have a different set of concerns. In one case, workers had considerable concern for their safety when their company moved into a building in the Del Amo site area. To allay workers' fears, the company began a yearly air-sampling program in and around the building. Results of the sampling have shown no problems with air quality thus far, and the workers apparently are apparently satisfied. In another case, a hotel in the area had problems when it first opened because a small number of potential customers thought it was unsafe to stay there or to drink the water. Over the years, this perception has diminished and has ceased to be a problem. In the past, certain businesses were hesitant to locate in the area because they might be held liable for employee health problems attributed to the site. This was resolved when the property owners took responsibility for any such liability. More recently, the administrative staff at the Harbor City/Harbor Gateway Chamber of Commerce expressed concern that the September 2002 listing of the Del Amo site on the NPL might cause problems for existing businesses and discourage new businesses from moving into the area. The administrative staff person was especially concerned that people would perceive a danger where there is none, which could slow economic development of the area. In addition, the administrative staff person views a healthy local economy as a key factor affecting the social welfare and quality of life in the surrounding neighborhoods.

On May 8, 2003, this Public Health Assessment (PHA) for the Del Amo site was released in draft for public comment. The comment period was scheduled to end June 7, 2003, but at the request of a community group, the California Department of Health Services (CDHS) extended the public comment period to August 3, 2003.

As part of the release of this PHA, CDHS prepared a fact sheet that provides a summary of the PHA (see Appendix G). This fact sheet was mailed to 2,000 addresses, including those located south of the site and to commercial addresses located on the developed portion of the Del Amo site. The PHA was placed in several libraries in the area for public review and comment. The fact sheet and the PHA were mailed to more than 300 addresses from the CDFS mailing list for the Del Amo site. This list contains residents and former residents of the nearby neighborhood, other community stakeholders, civic and political interested parties, and government agencies. The PHA and fact sheet are available on the CDHS web site at www.cdhs.ca.gov/ps/deodc/ehib.

Environmental Contamination/Pathways Analysis/Public Health Implications

Summary: This section examines the environmental pathways for exposure to contamination from the waste-pit area, the developed area, groundwater, and off-site areas of the Del Amo site. CDHS examined each of the environmental media (soil, soil gas, indoor air, groundwater) to determine whether contamination is present and whether people in the community are being exposed to (in contact with) the contamination. If people are exposed to contamination in any of these environmental media, CDHS will evaluate whether the contamination is at levels that would pose a public health hazard among community members. In this analysis, CDHS systematically evaluated each of the media. Table 2 presents a summary of the exposure situations identified at this site.

Exposure occurs only when a chemical comes into contact with a person and enters the body. Exposure pathways are various environmental routes by which contamination can be transported and available for possible contact with a person. Exposure pathways are classified as either completed, potential, or eliminated. For a chemical to pose a human health risk, a completed exposure pathway must exist. A completed exposure pathway consists of five elements 1) a source and mechanism of chemical release to the environment; 2) a contaminated environmental medium (e.g., air, soil, water); 3) a point (known as the exposure point) at which contact can be made with the contaminated medium; 4) an exposure route (e.g., inhalation, dermal absorption, or ingestion); and 5) 1 or more persons who have been exposed to the medium. In completed exposure pathways, all five elements exist. Potential exposure pathways are either 1) not currently complete, but could become complete in the future; or 2) are indeterminate due to lack of information. An eliminated pathway is one removed from further assessment because one or more of the five elements is missing and is never likely to exist.

A time frame given for each pathway indicates whether the exposure occurred in the past, is occurring in the present, or is likely to occur in the future. For example, a completed pathway with only a past time frame indicates that exposure did occur in the past, but exposure is not occurring now and is not likely to occur in the future.

To screen the contaminants for evaluation, CDHS compared contaminant concentrations with health comparison values. Health comparison values are media-specific contaminant concentrations used to screen contaminants for further evaluation. Noncancer health comparison values for soil and water are environmental media evaluation guides (EMEG) or reference dose media evaluation guides (RMEG). These two guides are based on ATSDR minimal risk levels (MRL) or EPA reference doses (RfD) (see Appendix A for a glossary containing these terms (32). Noncancer health comparison values for air are ATSDR MRLs or EPA RfC. Cancer risk evaluation guides (CREGs) are based on EPA or Cal EPA chemical-specific cancer slope factors and an estimated excess lifetime cancer risk of 1 in 1 million persons exposed for a lifetime (70 years).

These comparison values allow an investigator to quickly sort contaminants into groups that are either 1) not likely to cause health effects, or 2) contaminants that should be evaluated further. Contaminants that receive further evaluation are those found at concentrations that exceed the

comparison values; these are called *contaminants of concern*. When a contaminant level exceeds a health comparison value, it does not necessarily mean that the contaminant represents a public health threat; however, it does suggest that the contaminant warrants further consideration.

When contaminants of concern are identified in an environmental medium, CDHS evaluates the pathway by which people are being exposed to the contaminants. In order to determine whether adverse health effects are possible as a result of exposure to a contaminant, an exposure dose is estimated for each exposure pathway and chemical. This exposure dose can then be compared to appropriate toxicity values to evaluate the likelihood of adverse health effects occurring. Toxicity values are used to evaluate noncancer adverse health effects. These include MRL and RfD for ingestion, and EPA Reference Concentrations (RfCs) for inhalation (32). MRL and RfD values are estimates of daily human exposure to a contaminant below which noncancer adverse health effects are unlikely to occur. (See Appendix A for additional information about health comparison values.)

The National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), and EPA have reviewed available information from human and/or animal studies to determine whether certain chemicals are likely to cause cancer in humans (32). The potential for cancer to occur in an individual or a population is evaluated by estimating the probability of an individual developing cancer over a lifetime (70 years) as the result of exposure. EPA has developed cancer-slope-factor values for many carcinogens. A cancer slope factor is an estimate of a chemical's potential for causing cancer.

CDHS evaluated 10 pathways of possible exposure related to the Del Amo site—three for the developed portion of the site, four related to the waste-pit area, and three specific to the neighborhood south of the site. The following pages describe the CDHS evaluation of these pathways. (See Appendix F for a brief summary of the toxicological characteristics of the chemicals evaluated by CDHS.)

Data included in this section are presented in tables in Appendix B. Figures used in this section are presented in Appendix C.

Surface Soil or Near-Surface Soil Exposure in the Developed Portion of the Site

Summary: Based on available soil data for exposed areas of the developed portion of the site, exposure to long-term workers, occasional workers, and hypothetical population of children at a daycare program does not present a public health hazard related to Del Amo-related contaminants. Limited surface and shallow soil sampling in the developed portion of the site (available at the time of the writing of the PHA) indicates that there are several chemicals not related to the Del Amo site (arsenic, DDT, and Arochlors/total polychlorinated biphenyls [PCBs]) found at levels of health concern. For long-term workers and occasional workers, these non-site-related chemicals pose an insignificant-to-slight increased cancer risk. The chemicals measured in the soil would not result in noncancer health effects for long-term workers, occasional workers, or children at a daycare program. Soil testing was conducted in only the exposed areas of the site; thus, covered soil has the potential to contain contaminants that can be

exposed when a building is torn down or a parking lot removed. CDHS recommends that soil sampling be conducted when parking lots or buildings are removed, constructed, remodeled, or another major activity occurs that will exposure soil on the developed portion of the site.

Most of the developed portion of the Del Amo site is covered with buildings or pavement, thereby limiting direct exposure to any contamination in the soil. However, in certain areas the soil is more accessible, and it is possible that on-site workers, utility or construction workers, or occasional visitors could access the surface or subsurface soil. CDHS is not aware of any daycare programs operating on the developed portion of the site, but there is a possibility that such programs may exist. Therefore, potential exposure to children attending a daycare program was evaluated.

Soil data gathered by the Del Amo responsible parties or other interested parties confirm that surface (less than 1 foot) and near-surface soil contamination still exists within the developed area. Although the buildings, tanks, and associated pipelines from the synthetic rubber facility were removed, limited clean up of the soil in the developed portion has ever occurred. (The property owner only conducted a removal action in an area in the northwest corner of the site that encompasses two land parcels (tracts 7351-31-24 and 7351-31-25). The property owner removed all shallow soil containing contaminant concentrations exceeding EPA PRGs. Thus, chemicals could be in soil in areas where no testing has yet occurred (e.g., underneath certain buildings and paved areas). Future development activities on the Del Amo site that would require excavation (e.g., building removal or grading) could expose subsurface contamination and potentially release chemicals from the soil into the working environment. Therefore, safety and engineering controls should be included in any excavation activities at the Del Amo site. Use of such controls will reduce the potential for future exposure to soil contamination.

Only limited sampling of surface soil and near-surface soil in the developed portion of the site had been done before initiation of this PHA. The developed area is largely covered with buildings and parking lots, which limit access to the soil. When soil sampling has occurred, the samples have been taken in exposed areas and in areas where there seemed to be discoloration of the surface, as viewed on aerial photos or by the samplers (5). Soil gas sampling was the main focus, rather than soil sampling for the site characterization, as many of the chemicals associated with the Del Amo site would be found in the soil gas. Each parcel of land was not sampled equally.

CDHS staff reviewed the data gathered for each parcel. Table 3 contains a summary of the data, including the types of activities that may have occurred in each parcel (30). As clearly seen in Table 3, the amount of data gathered on parcels varies widely. Some had no data gathered and others had many soil, soil-gas, and indoor-air data gathered. Typically, the parcels that received the most attention were those with historical activity that could have resulted in contamination. The following paragraphs provide a summary of the results of surface and subsurface soil sampling in the developed portion of the site.

During the remedial investigation phase of this PHA, the responsible parties collected 12 soil samples of composite (a mixture of distinct or discrete samples) surface soil (0 – 6 inches from

the surface) from 51 locations (30). The composite surface samples were focused on three specific unpaved areas of the site during the 1994 – 1996 sampling. Three discrete surface samples were collected in the northwest corner of the facility. All samples were analyzed for pesticides/PCBs, SVOCs, and metals. (See Figure 8 for SVOC sampling locations.) Only a few chemicals were detected at levels of health concern in the sampled surface soil (Table 4). Arsenic and DDT were found in several samples, and total PCBs and benzo(a)pyrene in one sample.

The responsible parties also collected shallow (greater than 6 inches to 15 feet) soil samples during the remedial investigation (Figure 9) (30). The responsible parties dug 31 soil borings in the developed portion of the site, and samples were collected from 1 to 3 different depths in each boring. Most of the samples were analyzed for benzene, ethylbenzene, toluene, and xylenes (BTEX), and SVOCs. Some samples were analyzed for the whole suite of VOC chemicals. Only eight samples were analyzed for pesticides/PCBs (four of which were composites of three different samples), and 11 were analyzed for metals (four of which were composites of three different samples).

Shallow-soil (greater than 6 inches to 15 feet) samples also have been gathered by independent parties outside of the remedial investigation (30). In the two parcels located east of the waste pit area, several independent investigations have been conducted. Only one sample was analyzed for SVOCs, and the remaining 17 samples were analyzed for BTEX only. Independent site investigations in the far northwest corner of the property resulted in 13 samples analyzed for VOCs, 3 for SVOCs, 14 for pesticides/PCBs, and 15 for metals.

A number of chemicals were detected at levels of health concern in near-surface soil samples. The primary contaminants of concern are arsenic, DDT, benzene, and ethylbenzene. Several other chemicals (cadmium, Arochlor 1260, total PCBs, benzo(a)anthracene, benzo(a)pyrene, N-nitrosodiphenylamine, 1,2,4-trimethylbenzene, styrene, and sec-butylbenzene) were detected, but not consistently at levels above health comparison values.

Of 13 chemicals found in soil at levels of health concern, 9 are related to activities at the Del Amo site. The four exceptions are described in the following paragraphs.

DDT was found at elevated levels in the southwest area of the site, near the Montrose site.

Arochlor 1260 and total PCBs have been found in several samples taken in the parcel on the northwest portion of the property. These chemicals are not considered to be related to the Del Amo site.

Arsenic is not considered a contaminant related to the Del Amo site. Levels of arsenic naturally occur at higher levels in Western soils, and most Western soils have concentrations of arsenic that exceed the health comparison value (33). Most of the soil samples taken on the developed portion of the site contain arsenic at levels typical for Western soil, and a few samples contained levels above typical Western soil levels.

CDHS staff estimated the exposure to surface soil in the developed portion of the site to the following three groups of people: 1) long-term workers who come into contact with the soil (e.g., a gardener), 2) an occasional worker in the developed portion who engages in digging in soil or a similar activity once a year, and 3) a child who attends an on-site daycare facility and plays outside in areas with exposed soil (Table 5). For each group, CDHS staff estimated exposure for a person exposed to the average soil level as well as the maximum soil level. (Assumptions used in the calculations are described below and in Table 5.) Although it is unlikely that an individual would be exposed to the maximum soil level of arsenic, DDT, benzene, and ethylbenzene, the maximum level was used as an upper-end risk for the analysis. An evaluation of health effects from exposure to contaminated soil was performed for each of the three population groups. The results follow:

- The cancer risk to the long-term worker, who is exposed to the maximum level of contaminated surface soil on a daily basis while at work, is 4.0 in 100,000 (considered a very low increased cancer risk). The cancer risk to the long-term worker, who is exposed to the average level of contaminated surface soil on a daily basis while at work, is 7.8 in 1 million (considered an insignificant increased cancer risk). Approximately 75% of the cancer risk is due to arsenic and total PCBs. None of the estimated exposures exceed the noncancer health comparison values, indicating that noncancer health effects would not be expected for the long-term worker if he/she is exposed to the maximum or average level of contaminated surface soil.

- The cancer risk to the worker, who is occasionally exposed to the maximum level of contaminated surface soil, is 2.2 in 1 million (considered an insignificant increased cancer risk). The cancer risk to the worker, who is occasionally exposed to the average level of contaminated surface soil on a daily basis while at work, is 4.4 in 1 million (considered an insignificant increased cancer risk). Arsenic contributes the most to the cancer risk. None of the estimated exposures exceed the noncancer health comparison values, indicating that noncancer health effects would not be expected for the worker who occasionally is exposed to the maximum or average level of contaminated surface soil.

- It is not scientifically valid to calculate an increased cancer rate for exposure of short duration, such as 6 years for a child attending daycare on the developed portion of the site. Therefore, only noncancer health effects to the children were considered. None of the estimated exposure doses for the average soil levels exceed the corresponding health comparison values. Therefore, noncancer health effects would not be expected to occur in a child spending time in soil containing an average level of contamination. For the maximum level of contaminated soil, most of the chemicals did not exceed their health comparison value, indicating that noncancer health effects would not be expected to occur. However, the estimated exposure from the maximum level of arsenic (0.000497 milligrams per kilogram per day (mg/kg/day) exceeds its health comparison value (0.0003 mg/kg/day). The health comparison value (chronic MRL) for arsenic is based on the appearance of dermal effects (Blackfoot Disease, hyperkeratosis, and hyper pigmentation) in persons who drank water containing high levels of arsenic. Dermal effects were seen in persons getting 0.014 mg/kg/day arsenic. No effect was seen in those ingesting 0.0008 mg/kg/day. Thus, although

the estimated arsenic exposure exceeds the health comparison value, the dose is well below the dose at which dermal effects were seen. Thus, it is not likely that health effects would occur in children.

Arsenic appears to be the major contaminant of concern in site surface soil. For instance, a large portion of the increased cancer risk for the long-term worker and the occasional worker is due to arsenic. For children at daycare, it is not likely that they would experience any noncancer health effects from playing outside as a result of any of the chemical levels measured in the surface soil—even though the estimated exposure from the maximum level of arsenic contamination exceeds the health comparison value for arsenic. Arsenic levels in soil in the Western United States are typically higher than other places in the country, and these "typical" levels could be considered above a level of health concern (33). The arsenic levels in surface soils on the developed portion of the site reflect the elevated levels found in the Western United States. In addition, no arsenic is involved in processes, byproducts, or waste from the former synthetic rubber plant.

The principal chemicals used in making synthetic rubber are benzene, ethyl benzene, and styrene. These and other VOCs are the contaminants of primary concern in groundwater and subsurface soil at the Del Amo site. These chemicals would not typically be found in surface soils. If these chemicals once contaminated the surface soil, they would have evaporated over time and would no longer be present years after the manufacturing process had stopped. Thus, it is not surprising that the surface soil does not currently pose a public health hazard.

If pavement or buildings are removed or constructed in the developed area of the site, chemicals may be present in the surface soil and shallow soil that could pose a public health hazard. Therefore, when and if the soil is exposed in areas that have not been previously sampled, soil testing is recommended.

Exposure to Contaminated Groundwater If Used for Drinking Water

Summary: Groundwater under and surrounding the Del Amo site is contaminated with various chemicals attributable to the Del Amo and Montrose sites, as well as other nearby sites. Currently, no domestic, irrigation, or industrial wells are pulling water from the contaminated groundwater. Thus, no one has been exposed, and no one is being exposed from using the water as drinking water. If the groundwater is cleaned up and contained as planned, the groundwater contamination will not spread to the drinking water wells. Thus, there is no concern for future exposure from using the groundwater as drinking water.

Ground water beneath the site is found in a number of water-bearing zones (aquifers) (3). Sand and gravel form the water-bearing zones (aquifers), and silts and clay act as confining layers (aquitards) to restrict water movement between the aquifers. From the ground surface downward, the aquifers are named the Middle Bellflower, the Gage, the Lynwood, and the Silverado. Over time, chemicals tend to move deeper into the water-bearing zones. The Middle Bellflower and the Gage Aquifers are contaminated with chemicals from the Del Amo and Montrose sites. Some of the contamination has spread to the Lynwood Aquifer. For example, benzene has been

detected in one Lynwood Aquifer monitoring well, and chlorobenzene, a contaminant from the Montrose site, has been detected in a different well that monitors the Lynwood Aquifer. Contamination has not reached the Silverado Aquifer.

As the chemicals move downward through the water tables, they also move away from the source of the contamination in the direction of the groundwater flow. Groundwater in the area of the site flows in a south-to-southeast direction. As shown in Figure 4, contaminated groundwater from the Del Amo site (using benzene as the marker) extends 1,500 feet south from the Del Amo boundary. As shown in Figure 6, the contaminated groundwater from the Montrose site (using chlorobenzene as the marker) extends 4,200 feet south from the Montrose boundary.

Groundwater in the area has been monitored since 1988 (3). In addition to benzene and chlorobenzene, other VOCs, SVOCs, metals, and para-chlorobenzene sulfonic acid are contaminating the groundwater. Table 6 contains a summary of the groundwater contamination in the various aquifers. The highest concentrations of the chemicals are typically found in water from on-site (Del Amo and Montrose) monitoring wells. In particular, five areas of groundwater contamination on the Del Amo site contain benzene concentrations so high that the material no longer dissolves in the groundwater. Instead, benzene forms a separate layer of LNAPL that floats on top of the groundwater. LNAPL contamination is associated with the Bellflower zone, the upper aquifer.

The nearest municipal water well is located approximately 1.5 miles from the Del Amo site (4). Three water purveyors operate 14 drinking water wells within 4 miles of the site (California Water Service Company, Dominguez District; Southern California Water Company, Southwest District; and City of Torrance Water Department. The municipal drinking water wells in the area primarily pull from the Silverado Aquifer, which is not yet affected by contamination at the Del Amo and Montrose sites. In addition to the municipal wells in the area, there are industrial, irrigation, and domestic wells. Some of these pull from the Gage Aquifer (3). If left untreated, contaminated groundwater from the Del Amo and Montrose sites could possibly continue to move laterally outward and vertically downward, eventually affecting municipal and other types of water wells in the area.

In April 1999, EPA selected a plan to treat the groundwater contamination. The plan calls for natural attenuation and pumping contaminated groundwater to the surface, treating it to remove contaminants, and 1) re-injecting the water back into the ground or 2) discharging it into the Dominguez Channel. The contaminants will be removed from the water to the extent that it will meet drinking water standards. The treatment technology to use for the extracted water has not been chosen yet. In the area where LNAPL occurs, it is not technically possible to clean the groundwater to drinking water standards. Thus, EPA chose to contain the contamination by using a pump and treatment system and biodegradation. Biodegradation involves the breakdown of contaminants by microscopic organisms (such as bacteria) that are already in the ground. These bacteria degrade the contaminants by consuming them as food. Once implemented, EPA estimates that it will take 50 years or more to completely remove all the contamination outside

the LNAPL areas. However, a large portion of the contamination will be removed in the first 15 – 25 years of using the groundwater treatment system. Implementation of this clean-up plan will ensure that drinking water in the area will not be affected in the future.

The responsible parties are currently in the design phase of the remediation system. It is anticipated that the design phase may be completed by August 2004, and implementation of the plan to begin by spring 2005 (personal communication, DTSC project manager, May 24, 2004).

As stated previously, the municipal wells have not been affected by the contamination from the Del Amo and Montrose sites because the contamination has not spread deep enough and wide enough to affect these drinking water wells. However, a mechanism is in place to ensure that water served to the public is not contaminated by contaminants from the Del Amo or Montrose sites, or from any other source. That is, water purveyors test the water for chemicals on a regular basis to ensure that drinking water meets drinking water standards set by the state and the federal government. The drinking water supplies in this area of Los Angeles County are monitored periodically for non-volatile synthetic organic chemicals and inorganic chemicals (such as metals and radiological parameters) (Table 7). As indicated in Table 7, most of the chemicals found in groundwater in the area surrounding the Del Amo and Montrose sites are monitored by the on going drinking-water-monitoring program. CDHS staff has reviewed the Drinking Water Sources Contaminant Levels System Reports for the three municipal water systems and has communicated with a representative of the CDHS Drinking Water and Environmental Health Division concerning the safety of the drinking water. Trichloroethylene has been detected in two wells in the California Water Service Company's Dominquez District, and tetrachloroethylene was detected in one well of the Southern California Water Company's Southwest District. Since these detections, these wells have not been used. On the basis of the distance and the location (up-gradient and cross-gradient), the presence of these chemicals is not related to the plumes located in the vicinity of the Del Amo and Montrose sites.

During August and September 1994, EPA, in conjunction with Dominguez Water Company (now the California Water Service Company, Dominguez District) collected tap water samples from 25 properties on West 204th Street (34). The tap water samples were analyzed for pesticides, SVOCs, and VOCs. Low levels of VOCs were found in all the samples. The VOCs that were measured are typically found in water supplies that are being treated with chlorine for disinfection of microbial organisms. All of these VOC levels were below state and federal drinking water standards and below levels of health concern.

Indoor Air Exposure in the Developed Portion of the Site

Summary: Indoor air in buildings located on the developed portion of the site may be affected by VOCs in contaminated soil or groundwater. CDHS estimates, using modeling, of indoor air impacts from contaminated soil, indicate that chemicals coming from beneath buildings in areas where LNAPL is present may contribute to a very low increased cancer risk and a possibility, though unlikely, of noncancer health effects for the long-term worker in the building. It is possible that a hypothetical population of children attending a daycare could, but are unlikely to, experience noncancer health effects from breathing air inside a building located over LNAPL.

For those buildings in the developed portion of the site under which no LNAPL is present, cancer or noncancer health impacts are not expected for the long-term worker, the occasional worker, or a hypothetical population of children attending a daycare. Many assumptions are made in modeling this exposure that may influence the validity of these findings. Sampling conducted in 13 buildings on the site, including one located over LNAPL, indicates that indoor air quality is similar to typical indoor air. Chemicals are often found in indoor air at levels above health comparison values. Based on this exposure pathway, CDHS determined that the site may pose a public health hazard now and poses an indeterminate public health hazard in the future. CDHS recommends additional air sampling in buildings located over LNAPL.

Several buildings now located in the developed portion of the site are built over areas known to have soil and groundwater contamination. VOCs in the soil and groundwater can move through the soil into buildings, affecting the indoor air quality (35). This occurs when the contamination is close enough to the building that negative pressure within the building can, in a sense, "pull" the chemicals into the structure. Indoor air quality also is influenced by off-gassing of VOCs from furniture, carpet, and other materials used within the building, and by outdoor air. Taking indoor air samples helps to understand whether the contamination levels in indoor air, regardless of their source, pose a public health hazard. However, indoor air sampling probably cannot determine whether soil or groundwater contamination is affecting the indoor air; i.e., benzene found in an indoor air sample would appear to be the same whether it came from the groundwater, outdoor air, or an indoor source. This is because many chemicals commonly found in indoor air are from off-gassing of furniture, carpeting, marking pens, and other materials—the same chemicals that have been detected in soil and groundwater at the site. Thus, an evaluation of the impact of soil or groundwater contamination on indoor air was undertaken in the developed portion of the site (36).

As discussed previously, soil-contamination data gathered from the developed portion of the site indicate that chemicals present in the soil might be "pulled" into a structure (Tables 3 and 4). Soil gas sampling also has been used to document chemical contamination in the soil (5). Specifically, the responsible parties and EPA identified eleven source areas of contamination in the developed (excluding the waste-pit area) portion of site (Figure 3) (4). The responsible parties sampled soil gas in those "exposure areas of potential concern" (EOPCs) in which the soil surface was accessible. The responsible parties did not sample underneath the buildings and only occasionally sampled near the buildings where the best type of data is obtained to use for estimating exposure to indoor air. Soil gas data were also gathered by interested parties and developers of certain parcels of land on the developed portion of the site.

Soil gas data gathered from the developed portion of the site indicate that chemicals present in the soil may be pulled into a structure (Table 8 and Figure 10). Compared to soil data, for which only limited sampling has been done at the site, the responsible parties collected more than 900 soil gas samples. The soil gas samples were collected in places on the site where VOCs were stored, transported, or disposed. As indicated in Table 8, benzene, toluene, ethylbenzene, and the xylenes were detected in many of the soil gas samples. Detected at a lesser extent, but still highly

prevalent, were many chlorinated solvents, such as tetrachloroethylene, trichloroethylene, and 1,1,1-trichloroethane. Other VOCs related to Del Amo activities also were detected in many soil gas samples (1,2,4-trimethylbenzene, 4-ethyltoluene, cyclohexane, and styrene).

As described in a previous section, a contaminated groundwater plume exists under a large part of the developed portion of the site. In some places the contamination is so great that there is a layer of contamination that has separated from the water. This allows LNAPL to evaporate and pass through the soil to ground level, where it might be "pulled" into the nearby building (3).

To examine the impact of contaminated soil on indoor air, CDHS staff conducted modeling to evaluate indoor air exposure for the long-term worker, the occasional worker, and the child attending daycare. The evaluation considered three different buildings in 1) an area that has a relatively large amount of subsurface contamination, and 2) another area that has quite limited subsurface contamination. The Johnson and Ettinger soil-gas-advance model, recommended by EPA, was used to estimate the amount of, and the associated risk from soil gas that could move into the structure from the contaminated soil beneath it (37). The LNAPL screen, or advance model, was used to estimate risk from indoor air for people in buildings with LNAPL under them (38, 39).

Three situations were selected that were representative of the range of possible impacts that the contamination could have on indoor air. The first situation that we evaluated relates to the LNAPL area that is located on the western side of the Del Amo site in Tract 7351-34-57 in the northwest corner of the former styrene plant (Figure 3). For the second situation, including Tracts 7351-34-15, -50, and -56, the building is not located directly over LNAPL (it is located nearby), and the groundwater and soil under and near the building is contaminated. The third situation that we examined was Tract 7351-31-18 in the former copolymer area. Soil and soil gas sampling have shown contamination exists in the area; however the U.S. EPA does not consider it to be a groundwater source area.

The results of this toxicological evaluation of indoor air exposure are shown in Table 10. The exposure parameters and assumptions used in the evaluation also are presented in this table. The estimated indoor air concentrations for the chemicals modeled in the two non-LNAPL areas do not exceed the noncancer health comparison values. This indicates that noncancer health effects would not be expected for the long-term worker, the short-term worker, or the child attending daycare for these two building situations.

For the third building located over the LNAPL (Tract 7351-34-57), the estimated indoor air concentration for benzene (adjusted for time spent in the building and differences in respiration rate and body size) exceeds the health comparison value (intermediate MRL = 4 parts per billion [ppb]) for the child at a daycare center (4.41 ppb) but not for the long-term worker (2.34 ppb) and an occasional worker (0.13 ppb). The intermediate MRL (exposure from 15–365 days) is based on an animal study where mice were exposed to benzene for 2 hours per day, 6 days per week, for 30 days (40). At 780 ppb there was an increase in the mouse's rapid response, i.e., a change in the function of the neurological system of the mouse. At that same exposure level there was an increase in grip strength, but no changes noted in several other areas: immune

system measurements, body, liver or kidney weight, or blood or brain nerve enzyme. The effect level of 780 ppb was adjusted for exposure duration and a ninety-fold uncertainty factor applied to arrive at an intermediate MRL of 4 ppb. Even though the level of benzene modeled for the child attending daycare exceeds the intermediate MRL, it is much lower than the level at which an effect was seen (780 ppb). This indicates that noncancer health effects, such as changes in neurological function, are not likely to occur based on the exposure level that was estimated from the modeling.

The increased cancer risk for the long-term worker who works in the building over LNAPL for 25 years is 1.7 in 100,000—considered a very low apparent increased cancer risk. For the short-term worker in the same building or for the long-term and short-term workers in the other two buildings, an even lower estimated increased cancer risk would be expected (Table 10).

On the basis of the modeling of two buildings that were not located over LNAPL, it appears that the contamination remaining will not significantly affect the health of the workers and other people that may go into the buildings in those areas in which no LNAPL is found underneath or near the building. Based on the modeling of one building situated over LNAPL, the modeling predicts that the contamination may contribute to the overall quality of the indoor air and the health of individuals spending longer periods of time in those buildings (i.e., long-term workers and children in daycare).

Many assumptions used in modeling of this exposure pathway could affect the validity of these results. One important factor is the adequacy of the sampling data. CDHS staff used soil-gas data from sampling locations that were apparently drawn close to the foundation of the building. If the sampling locations selected to use for the modeling were not, in fact, within the influence of the building structure, the soil gas data are not useful for the model and these data would tend to underestimate the indoor-air impact. Ideally, soil gas sampling should be drawn at a diagonal from the edge of the building or at the very edge of the building straight down.

On the other hand, the modeling approach that CDHS staff used does not account for possible degradation (breakdown) of compounds in the soil. In the case of compounds such as benzene, ethylbenzene, toluene, and xylenes, biodegradation can play a significant role and, thus, decrease the estimated impact from the modeling results (41).

To further evaluate the indoor air pathway, CDHS reviewed indoor-air data that have been gathered on the site. Private parties have conducted indoor air sampling (42); however, we concentrated on the data that were gathered EPA with oversight. Namely, the responsible parties conducted indoor air testing as a part of the site characterization (5). In 1996, contractors for the responsible parties sampled the workplace air at 12 buildings in the developed portion of the site (Table 9) (5). Benzene, ethyl benzene, styrene, toluene, 1,1,1-trichloroethane, and xylenes were detected in most of the building samples at levels that are fairly typical for indoor air (43, 44). These chemicals have been found in soil, soil gas, and groundwater on the site, thus the contamination could have made some contribution.

The indoor air study conducted by the responsible parties was designed to measure chemicals in indoor and outdoor air and compare the results to occupational health standards. The study was not designed to assess the soil gas migration pathway. Thus, one can only infer what role the soil gas pathway may play.

Two (Tracts 7351-34-15, -50, and -56 and Tract 7351-34-57) of the three buildings for which we estimated indoor air concentrations using modeling were sampled as a part of the indoor air sampling effort. These tracts contain the three buildings that were used for modeling indoor air. For some chemicals (benzene, xylenes, toluene, and 1,1,1-trichloroethane) in Tract 7351-34-57, the estimates from modeling would contribute a small portion of the total amount of these chemicals that were measured in the indoor air. It is possible that products used in the buildings or activities occurring in the buildings are the largest contributors to contamination of indoor air. For several other chemicals (benzene, ethylbenzene, styrene, cyclohexane, PCE, and TCE in Tract 7351-34-57 and benzene in Tracts 7351-34-15, -50, and -56), the modeled concentrations would appear to be the primary contributors to the amount of these chemicals measured in the indoor air. However, the levels measured in indoor air sampling are typical of indoor air. Thus, if the contamination is affecting indoor air quality, it does not appear to play a large enough role to affect the overall air quality above typical ranges (43, 44).

Exposure to Waste Material and Surface Soil Before the Waste-Pit Area Was Capped

Summary: Based on available data, direct contact with contamination in the waste-pit area posed a public health hazard before it was capped in 1999/2000. The waste pits were covered with fill as far back as the 1950, and fenced during the 1980s. However, children are reported to have played at the waste pits since then, when waste material was seen at the pit surface. The waste-pit material is high in PAHs and VOCs, most prominently naphthalene, benzo(a)pyrene, benzene, and ethylbenzene. Limited surface soil testing above the waste pits indicates that soil in the area would not pose a public health hazard. However, if children directly handled the waste material on a frequent basis, it would have posed a public health hazard to children. The estimated exposures related to the contaminated waste-pit material presented a moderate increased cancer risk (5.9 in 1,000) to children who played with the waste on a fairly regular basis. These children also could have experienced noncancer health effects (changes in blood system components) related to benzene exposure. The waste pits were capped, eliminating this exposure route as long as the cap is maintained. Based on this pathway, CDHS determined that the Del Amo site posed a public health hazard in the past.

The waste-pit area contains three former evaporation ponds (1A, 1B, and 1C) and six disposal pits (2A-2F) (23). The disposal pits came into existence sometime between 1941 and 1947. By 1951, aerial photos show the disposal pits (2A-2F) to be covered with fill material. Although still covered in the years since, later aerial photos show staining around the disposal pits, perhaps indicating material that had become uncovered or where the fill material had become saturated from the contamination below it. The disposal pits extend 20 to 30 feet below the surface. The surface soil ranges in thickness from 1 foot below the surface of pit 2A to 8 feet below the surface of pit 2F. The waste material in the disposal pits has been described as "black clay-like sludge or black tar." The waste material is high in PAHs and VOCs. Naphthalene and benzo(a)

pyrene are the predominant PAHs in the waste, and benzene and ethylbenzene are the predominant VOCs. For example, a sample of waste material in evaporation pond 1A contained 7,900 parts per million (ppm) benzene, 1,840 ppm ethylbenzene, 3,500 ppm benzo(a)pyrene, and 126 ppm naphthalene. Other hazardous substances associated with the waste material are toluene, styrene, and hydrogen sulfide.

Evaporation ponds 1B and 1C are visible in aerial photos taken from November 1946 through September 1965 (4). Pits 1B and 1C were covered when viewed in an October 1967 photo. Evaporation ponds 1B and 1C are approximately 9 feet deep, and were used for evaporation of liquid waste. According to workers, solids in the bottom of the evaporation ponds were periodically excavated and transported off site. Surface soils for the evaporation ponds are approximately 2 to 4 feet thick. The waste material in ponds 1A and 1C resembles clayey sludge and are typical of the fine particles expected to settle out of water in evaporation ponds.

Although the waste-pit area has been covered, aerial photos indicate that the fill material may not have been intact at all times (26). For instance, in 1984, Dames and Moore, contractors for the responsible parties, noted that evaporation pond 1C had areas lacking soil cover, resulting in waste materials being exposed at the surface. Since 1983, a fence has been installed around the pits to restrict access. Currently, a fence is in place preventing access to the waste-pit area.

According to local residents, children often played in the waste-pit area and could have experienced exposure to waste material as well as fill material through skin contact, breathing the dust, and incidental ingestion of the material.

Shallow soil sampling was collected as part of early investigation of waste-pit contamination. In 1987, Woodward-Clyde collected soil from 1 foot bgs at several locations near the disposal pits and at one location near the evaporation ponds (23). No PAHs or VOCs were detected in the soil sample taken near the evaporation pond. Three samples collected at 1 foot bgs near the disposal pits were analyzed for VOCs. Two of the samples contained no detectable level VOCs. One sample taken near pit 2D had a concentration of 9.9 ppm VOCs. Seven samples collected at a depth of 1 foot bgs contained PAHs ranging from 0.59 to 7.3 ppm.

Only limited surface soil sampling has been done in and near the waste pits. As a part of the Phase I Remedial Investigation, one composite sample was collected from the disposal pits and one composite sample was collected from the evaporation ponds (2). The chemicals detected in the samples are summarized in Table 11. No chemicals of concern related to operations at the Del Amo site exceed health comparison values. Arsenic levels in both samples exceed the health comparison value for arsenic but are within the typical range of levels in background soil. The sample collected from the disposal pits slightly exceeds the health comparison value for DDT.

Area residents have told CDHS staff members that children used to play in and around the waste-pit area before it was fenced in 1981 and afterwards when the fence was broken. CDHS evaluated exposure to a 7- to 16-year-old child who played at the waste pits five times a week for 10 years. The evaluation included the exposure that the child would have received if he/she had direct contact with the waste material that was exposed at the surface. The evaluation used the

maximum concentrations of benzene, ethylbenzene, naphthalene, and benzo(a)pyrene detected in evaporation pond 1C. This pond had the least amount of fill cover, and the waste material was visible on the surface. Exposure to surface soil was not evaluated because no site-associated contaminants were detected in surface soil.

The cancer risk to the child trespasser who is exposed to the maximally contaminated waste material in waste pit 1C is 5.9 in 1,000 persons—considered a moderate increased cancer risk. The estimated exposure for ethylbenzene and naphthalene do not exceed their noncancer health comparison values, indicating that noncancer health effects from exposure to these chemicals would not be expected to occur. A noncancer health comparison value is not available for benzo(a)pyrene, a carcinogenic chemical. The estimated dose (0.0184 mg/kg/day) for a child trespasser exposed to the maximum amount of benzene at the site exceeds the health comparison value (RfD = 0.004 mg/kg/day). CDHS further evaluated this estimated dose, determining that the estimated dose is 65 times lower than the effect level on which the RfD is based. The RfD is based on an effect level (1.2 mg/kg/day) at which a decrease in lymphocyte counts (a blood component involved in disease resistance) was seen in workers exposed to benzene by inhaling contaminated air in the workplace (31). Based on this, it is not highly likely that children playing in the waste would have experienced adverse effects on the blood system. Additionally, CDHS assumed a large amount (5 times a week for 10 years) of contact with the waste. However, the study of benzene's effects on the blood system was based on workers, not children, which makes it more difficult to conclusively interpret the estimated dose calculated in this PHA.

Exposure to Air Emissions From the Waste-Pit Area Before It Was Capped

Summary: Based on available data, air emissions from the contamination in the waste-pit area did not pose a public health hazard before it was capped. If the waste material is disturbed, VOCs (for example, benzene and ethylbenzene) are released in large amounts. The undisturbed waste also emitted chemicals through the fill material and into the air. However, air measurements taken around the waste pits before the area was capped indicate that waste-pit emissions did not significantly affect air quality in the area when the waste pits were undisturbed.

In addition to possible exposure from direct exposure to waste material or surface soil around the waste pits, possible exposure to air releases from the waste pits occurred before the pits were capped. As described previously, the waste pits were used for disposal of VOCs in waste material from the former synthetic rubber manufacturing process. These chemicals can evaporate (volatilize) from the waste material, through the fill material, and into the air. By the early 1980s, all waste pits had been covered with fill material, which tends to slow down volatilization of contaminants in the waste material. However, VOCs will still be released, although at lower levels. These emissions contribute to the air quality in the area. Thus, nearby residents and workers could have been exposed to these emissions.

Emissions from the waste material have been evaluated using several different methods. In 1984, the emissions were measured from soil borings (23). These data indicate that disturbing the waste would cause significant releases of benzene, toluene, ethylbenzene, xylenes, styrene, and

hydrogen sulfide. The data also suggest that emissions from the disposal pits could be approximately ten times greater than from the evaporation ponds. Measurements indicate that emissions increase with the increased depth of the waste. Furthermore, the waste material usually showed high peak readings followed by a slow decrease over the next hour, to relatively constant emission rates.

In 1984, the DTSC contractor also measured emissions from the undisturbed waste pits using a device called a flux chamber (23). Peak surface flux emissions of total hydrocarbons from the pits ranged from 0.031–0.55 milligrams per square meter per minute ($mg/m^2/min$). Air measurements taken above the pits ranged from 0.1–1.96 ppm, and peak upwind concentrations ranged from 0.01–1.3 ppm. Average upwind air concentrations in air, measured as total hydrocarbons, ranged from 0.01–0.46 ppm. Average concentrations above the pits ranged from 0.10–1.7 ppm. These data seem to indicate that emissions from the waste pits did occur before the pits were capped, and that the emissions were an additional source of contamination affecting air quality in the area.

To further investigate the impact soil gas from the waste pits may have on air quality, contractors for the responsible parties, with EPA-contractor oversight, conducted flux chamber sampling and air sampling in the waste-pit area in 1994 and 1995 (45). CDHS previously had reviewed the sampling data. The following is a summary of the data and findings on the health impact from the data.

During the same days that ambient air sampling were collected in August and September 1994, emissions from the waste pits were measured using a flux chamber (45). Each day a different location on each pit was sampled. The locations were biased to "worst-case" scenarios and included surface cracks, animal burrows, boreholes from previous investigations, surface depressions, and areas of thin fill. Samples were collected for 4 hours during the warmest hours of the day (11:00 a.m. and 4:00 p.m.). The flux-chamber samples were analyzed for VOCs in the first and the second sampling effort. SVOCs and hydrogen sulfide were sampled in the first sampling event only, because SVOCs and hydrogen sulfide were not detected or were detected at very low concentrations in all samples collected during the first round of testing. The highest flux chamber measurement was 180 ppb benzene. This corresponds to an ambient air level of 0.98 ppb, which exceeds the health comparison value for benzene (0.03 ppb, CREG) (40). Ambient air levels of other chemicals estimated from the surface flux chamber results were below their health comparison values.

Air monitoring was conducted at eight monitoring stations around the perimeter of the waste-pit area—two on the north side, four on the south side (between the waste pits and the community); and one at both the east end and west end (45). For the first round of sampling that was conducted from August 30 through September 2, 1994, each location had wind-controlled VOC- and SVOC-samplers and a nondirectional hydrogen-sulfide sampler. This assured that air was collected by one set of VOC and SVOC samples when the wind was blowing from the waste pits toward that sampler. Another set of VOC and SVOC samplers at each location collected the air when it was not coming from the direction of the waste pits (i.e., when the air was blowing toward the pits). During this sampling effort, 48 samples were collected when the wind was

the direction of the waste pits, and 48 samples collected when the wind was not blowing from the waste pits. In 17 of the 48 pairs of matched samples, the concentrations of benzene in air coming from the waste pits exceeded those in air that was not coming off the waste pits. In 24 of the 48 matched pairs, the benzene concentrations in the air samples coming off the waste pit were lower than those of benzene coming from other directions. Seven of the matched pairs of samples had equal amounts of benzene. These data seem to indicate that emissions may be emanating from the waste pits, but these emissions do not play as large a role on air quality as other contamination sources.

During the second sampling event (September 6 – 9, 1994), ambient air samplers were nondirectional (45). During the second event, two additional locations were added to the sampling effort; i.e., two backyards along 204th Street (Table 12). CDHS reviewed these data in a health consultation released in 1996 (45). In that document, CDHS concluded that low levels of VOCs, SVOCs, and hydrogen sulfide were in the ambient air, and that the majority of the chemicals were at levels that were either below health comparison values or comparable to background levels in the Los Angeles area. Three contaminants (hydrogen sulfide, p-isopropylbenzene, and tetrachloroethylene) were measured at levels above health comparison values. Upon further examination, the estimated noncancer exposure levels were below health comparison values, thus noncancer health effects would not be expected from exposure to these contaminant levels in the air. Hydrogen sulfide and p-isopropyl benzene are not classified as carcinogens, thus, cancer effects are not expected. For tetrachloroethylene, the estimated cancer risk was very low increased risk.

Exposure From the Waste-Pit Area After It Was Capped

Summary: The responsible parties, as ordered by EPA, capped the waste pit area in 1999/2000. The cap eliminates any current or future exposure and emissions from the waste-pit area as long as the cap is maintained.

In 1999/2000, the responsible parties capped the waste pits with a Resource Conservation and Recovery Act (RCRA) cap. This is a multilayer cap that prevents 1) direct contact with the contaminants, 2) generation of wind-blown dust, and 3) rainwater runoff from washing through the pits and contaminated soil beneath them that carry contaminants into the groundwater. Thus, no current exposure to the waste material is occurring to a trespasser, a nearby resident, or a visitor to the neighborhood south of the site. The soil gas from beneath the waste pits will be collected and treated after the appropriate treatment technology has been selected, installed, and made operational. (See next section for a discussion of the public health hazard from the treatment system.)

Exposure to Soil Gas Captured From Under the Waste-Pit Cap and Released During Soil Gas Treatment

Summary: An aspect of the treatment strategy for the control of waste-pit contamination consists of a system installed below the waste pits that prevents chemicals from moving into the groundwater. This system "pulls" the VOCs in the soil beneath the waste material to the surface.

At the surface, the material needs to be treated to remove the contaminants in the soil gas. The choice of a treatment system for the soil gas is in progress. A resin adsorption technology was selected by EPA, and a pilot project using this technology was conducted in May and June 2003. CDHS recommends review of the pilot and full-scale treatment systems to ensure that they operate as designed and in a safe manner that does not adversely affect the nearby neighborhood. Based on possible air exposure to the soil gas pathway and the on-site indoor air pathway, CDHS determined that the site poses an indeterminate public health hazard in the future.

The soil below the waste pits and above the groundwater table is contaminated with SVOCs and VOCs. The responsible parties installed the waste-pit cap and a soil vapor extraction system in 1999.To prevent further spread of the contamination from the soil to the groundwater, the soil is treated to remove soil contamination. The treatment consists of a series of underground wells placed in the area around the waste pits, and a vacuum (soil-vapor-extraction treatment system). This system "pulls" the soil gas that has volatilized (evaporated) out of the contaminated soil, to the ground surface. The primary contaminants of concern are benzene and ethylbenzene in the soil gas. After these gases are brought to the surface, they need to be treated further to remove contamination.

Thermal oxidation was the soil gas treatment system that was originally selected by EPA and the responsible parties. Thermal oxidation, sometimes referred to as incineration, uses high temperatures to destroy the contaminants. The use of thermal oxidation has the potential to produce dioxins and furans. A great deal of concern in the community about the health impact of low levels of dioxins and furans led the community activist and residents from the community surrounding the Del Amo site to request that a different treatment system be used.

Through the Del Amo/Montrose Partnering Process described in the *Community Concerns* section, other soil gas treatment systems were evaluated. In particular, the group studied alternative technologies that use treatment and collection systems rather than thermal oxidation, which is considered to be less-acceptable environmentally.

The partner groups considered using the following types of technology:

- granular activated carbon collects the contaminants in carbon filters, and the carbon filters have to be treated on the site or off site;
- biofiltration uses bacteria to break down the contaminants;
- resin absorption collects the contaminants in synthetic resin filters, with the resin filters treated on the site or off site; and
- electrochemical oxidation uses a chemical reaction to break down the contaminants.

The partner group reviewed a variety of commercially available options using these technologies. As part of the review process, the partners evaluated whether each option was applicable to the Del Amo site, given the composition of the soil gas, the flow rate, and other issues related to the treatment technology. Of particular concern were the overall health and safety aspects of the process. For instance, does the process result in another form of

contamination (resin, charcoal), and, if so, how to treat or dispose of this material. Does the process use a highly combustible material that would need to be stored in large quantities near the waste pits? At the end of the review process, the partner group determined that the best choice was the resin absorption system that collects contaminants in synthetic resin filters that can be reactivated on site.

EPA took air-pollution impacts into account when it reviewed the available treatment methods. The agency identified applicable air-emission regulations promulgated by the South Coast Air Quality Management District (SCAQMD) that limit releases of carcinogenic air pollutants. The responsible parties and EPA contractors followed the air modeling methodologies prescribed by SCAQMD regulations to calculate emission levels released from the system that would be within the SCAQMD limits. Releases were limited to the amounts of chemicals that would cause an excess cancer risk less of 1 in 1 million persons in a receptor population living or working at the edge of the waste-pit area.

A pilot test project of the resin adsorption technology began in May 2003. During the pilot test project, the responsible parties performed a scale-up conceptual design of a full-scale resin adsorption system that meets required health-based emission limits specified in the SCAQMD regulations. The pilot test showed that 1) the resin was effective in removing the contaminants in the soil gas, 2) the resin could be successfully be cleaned for reuse, and 3) the captured desorbed material would have to be incinerated as there was no commercial interest in it. The costs to run the full-scale system were estimated to range from 8 million (EPA) to 12 million (responsible parties). In mid-2004, the responsible parties suggested using bioventing to treat the gas instead.further investigation into this option is continuing. CDHS recommends review of the pilot and full-scale treatment systems to assure that both operate as designed and in a safe manner, without adverse effects in the nearby neighborhood.

Indoor Air Exposure in the Residential Area South of the Site

Summary: It is theoretically possible that indoor air in occupied residences located south of the Del Amo site may be affected by contaminated groundwater flowing underneath the residences. CDHS estimates of indoor air levels of several VOCs indicate that the groundwater does not pose a public health hazard to residents living in this area. EPA sampled the indoor air of several residences along W. 204th Street in 1994, and did not find a health threat from the groundwater vapors.

Groundwater south of the site is contaminated. The uppermost water table is contaminated with VOCs and SVOCs. This water table flows underneath the houses and condominium complexes. In areas where the groundwater is close to the surface, VOCs can be "pulled" into buildings. This occurs when the contamination is close enough to the building that negative pressure within the building can, in a sense, "pull" the chemicals into the structure. Once inside the building, these gases can be inhaled.

Although soil gas can be an important source of indoor air contaminants, soil gas is only one of several contributors to total air contaminants found inside a building (35). Other sources include chemicals contained in the ambient (background) air, chemicals released into the building from structural components, building contents, and processes that use chemicals.

As described previously, the shallow contaminated-groundwater table in the Del Amo site area is about 47–70 feet bgs (3). In general, groundwater deeper than 30 feet bgs has not been found to affect indoor air quality of a building above it. However, the air quality impact can be evaluated using the modeling methodology described previously, so CDHS staff evaluated this pathway.

CDHS evaluated indoor air effects for two regions of the neighborhood south of the site located in the direction in which the groundwater plume is moving. These two areas of the groundwater plume differ somewhat in the types of contaminants and levels of these contaminants. The first region evaluated is located on the western side of the plume, near the northern end of Kenwood Avenue (Figure 4). The second region of the plume that was evaluated is on the eastern side of the plume in the area of Berendo Street. The first region generally has higher amounts of chlorobenzene compared to benzene; i.e., contamination due to the Montrose site rather than the Del Amo site. The second region of the plume has higher amounts of benzene than chlorobenzene. Moreover, other organic chemicals were detected in the groundwater in this part of the plume, such as vinyl chloride and naphthalene. It appears that this region may have other sources (Gardena Landfill #4) that are contributing to the groundwater contamination.

The results of the toxicological evaluation for indoor air exposure are shown in Table 13, including the exposure parameters and assumptions used in the evaluation. The cancer risk to the resident living on the west side of the neighborhood, in which groundwater is affecting indoor air quality, is 4 in 10 million—considered as no apparent increased cancer risk. The cancer risk to the resident living on the east side of the neighborhood from the groundwater affecting indoor air is 8 in 100 million—considered a no apparent increased cancer risk. None of the estimated indoor air concentrations exceed the noncancer health comparison values, indicating that noncancer health effects would not be expected to occur among residents living in houses built above the groundwater plume.

This information is supported by data from the 1994 EPA indoor air sampling conducted in 25 houses directly south of the waste pits. These houses were in the area offered buyouts by the responsible parties and were subsequently torn down. CDHS reviewed the indoor air sampling data in a health consultation published in 1995 (34). In summary, a wide variety of SVOCs and VOCs were detected in indoor air samples either at or below the Los Angeles County indoor air reference levels and/or below health comparison levels. At two locations, benzene levels were elevated, and the indoor air levels of tetrachloroethylene also were elevated. Tetrachloroethylene is not a groundwater contaminant in the area. EPA conducted further investigation of the elevated benzene levels. EPA staff removed an old stove in one house and several common household products in another house that were determined to be possible sources of benzene. The houses were retested, and the levels of benzene were much lower and within typical levels found in air in Los Angeles County.

Soil Exposure in the Residential Area South of the Site Before the Buyout

Summary: Based on soil investigations in and near the residential neighborhood south of the Del Amo site, exposure to adults and children to surface soils does not present a health risk related to Del Amo-related contaminants. DDT is not associated with activities at the Del Amo site; however, some soil in the neighborhood contained elevated levels of DDT. Several excavations have been carried out to remove DDT contamination. Arsenic and cadmium (metals) also are not related to activities at the Del Amo site; however, both have been detected in the residential area at levels exceeding those typically found in Western soils or health comparison values. Before the parcels of land were purchased from homeowners and regraded, other chemicals (primarily PAHs) were detected that could be related to the Del Amo site. A low increased cancer risk is associated with incidental ingestion of backyard soil in the area south of the Del Amo site

If contamination from the site has spread into soil in the neighborhood to the south, residents, visitors, and off-site workers could be exposed to that soil contamination in a variety of ways. Skin contact, inhalations of soil dust, and incidental soil ingestion are the likely exposure routes for contaminated soil. Incidental soil ingestion is likely if a person eats, drinks, smokes, or participates in recreational or occupational activities near soil containing contaminants. For residential yards and recreation areas, soil ingestion can be an important route of exposure, especially for children less than 6 years of age. Soil ingestion is greater for younger children because they tend to put their hands in their mouths more often.

On several occasions, surface (less than 6 inches) and shallow (1 – 3 ft) soil sampling has occurred in the neighborhood south of the Del Amo site. Several of the sampling efforts focused only on DDT and its breakdown products. In the following discussion, the sampling data will be presented and reviewed for those sampling efforts including compounds other than DDT in the analyses (Table 14).

In 1983, during excavation activities for waste pond 1A, soil samples were taken from zero to 1 foot bgs and 2 to 3 feet bgs from nine residential backyards across from the waste pits, as well as one sample from a yard located 2 miles further south which was sampled for background (6). The samples were analyzed for metals, VOCs, PAHs, base/neutral extractable and chlorinated pesticides. DDT and its breakdown products were detected in the soil, though not at levels that exceed the health comparison levels. No detectable concentrations of VOCs and SVOCs were reported. Selenium levels in all samples exceed typical western soil concentrations (33); however, the levels do not exceed the health comparison value. Arsenic and cadmium levels in two locations exceed background levels reported for soil in the western United States (33). The arsenic levels exceed the health comparison value for soil, but the cadmium concentrations do not exceed the health comparison value for soil.

In September 1993, in response to a recommendation for additional off-site soil sampling made in the previous PHA, consultants for the responsible parties took surface soil samples in the backyards and side yards and undeveloped land along Del Amo Boulevard to the south of the Del Amo site (7). They took 21 composited samples. The composites were drawn from the top 6

Del Amo site (7). They took 21 composited samples. The composites were drawn from the top 6 inches of soil from four subsamples taken from 3 feet in each direction from the point. Samples were analyzed for SVOCs, DDT and its breakdown products, and metals from a designated target list. Very low levels of several SVOCs were detected in nine of the samples (Table 14) Except for one detection of benzo(a)pyrene, the other SVOCs did not exceed their health comparison values. DDT was found at levels above health comparison values in several samples. Arsenic, cadmium, copper, lead, and zinc were found in some of the samples at levels exceeding typical background levels (33). Of these metals, the levels of arsenic, cadmium, and lead exceed the levels of health concern for soil.

Because of the DDT that was found in the 1993 surface testing, consultants for the responsible parties took additional surface soil samples from the yards of 1051 and 1055 204th Street in February 1994 (8). The samples were analyzed for pesticides and PCBs. No other chemicals except DDT were detected.

As a part of another study to delineate the extent of DDT contamination along 204th Street, EPA and their consultants collected subsurface soil on twenty-eight properties in June and July 1994 (9). They collected 232 subsurface soil samples from 51 locations. Samples were collected every 3 feet from the surface to approximately 18 feet down. No surface soil (less than 6 inches) samples were collected. In addition to DDT, 87 of the samples were analyzed for VOCs by radioassay in the field and 91 of the samples were sent to the laboratory for analysis of SVOCs and PCBs. No VOCs were detected. No other pesticides besides DDT and its breakdown products were detected in any of the shallow surface soil samples (3 ft or less). Three shallow surface-soil samples contained detectable levels of SVOCs. In one of the samples, benzo(a)anthrancene (0.20 ppm), benzo(a)pyrene (0.4 ppm) and benzo(b)fluoranthene (0.28 ppm) were detected at levels exceeding their health comparison values.

Consultants for EPA conducted additional subsurface soil testing during October 1995 to further delineate the subsurface soil contaminated with DDT at the following locations: behind 1051 and 1055 204th Street; in an area where metal slag was found; in the area between the 1043, 1041, and 1039 204th Street duplexes; and in the areas adjacent to the DDT-contaminated soil removal action conducted in 1994 (10). Soil samples were collected from 6 inches to 8.5 feet at 2-foot intervals. All soil samples were field tested for DDT. Some of the samples were sent to a laboratory for analysis of VOCs, SVOCs, pesticides, herbicides and metals. Thirty of the surface soil samples and 15 of the shallow subsurface (1.5-2.5 feet) soil samples were sent to the laboratory for metal analysis. Of these samples, only three surface soil samples and two shallow subsurface soil samples were analyzed for arsenic. Many of the surface and shallow subsurface samples had levels of cadmium, copper, lead, and zinc that exceed the typical background levels for Western soils (33); however, the levels of copper, lead, and zinc do not exceed their health comparison values. Two of the surface soil samples and one of the shallow subsurface soil samples had levels of cadmium that exceed the health comparison value. The five samples analyzed for arsenic were within typical levels for Western soils; however the levels exceed the health comparison value (33). Five surface soil samples and three shallow subsurface samples were analyzed for VOCs. Low levels of total VOCs (2.17 and 1.85 ppm) were detected in two of

the eight samples. Four surface and two shallow subsurface soil samples were analyzed for SVOCs, pesticides/PCBs, and herbicides. Except for DDT and its breakdown products, no other chemicals were detected in these six samples.

Taken together, these data suggest that DDT, arsenic (though not consistently elevated above typical Western soils), and cadmium should be considered contaminants of concern in the surface and subsurface soil. DDT is a contaminant of concern related to the Montrose site, *not* to the Del Amo site. Occasional detections have been made of lead, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene at levels above health comparison values. These chemicals also will be considered contaminants of concern for the site.

DDT removal actions took place at 1051 and 1055 204th Street in 1994 and 1995. These DDT-related removal actions did not include the removal of soil from some of the sampling locations in which arsenic, cadmium, and the other chemicals were found above health comparison values.

CDHS estimated the exposure for an adult and child who spend time gardening, playing, or doing some other activity in their backyards in the neighborhood south of Del Amo. It was assumed that the adults spent every day of the week for 52 weeks of the year for 30 years in their backyards. It was assumed that children spent every day from 6 months – 5 years of age, and from 5 – 12 years of age spent every weekend day in his/her backyard. The maximum concentrations of arsenic, cadmium, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene in surface soil (6 inches or fewer bgs) were used for the dose calculations of the backyard-activity exposure. CDHS assumed that the adult resident ingests 50 mg/day of soil and the child ingests 100 mg/day of soil, and that the entire contribution is from the backyard soil.

The estimated dose for adult residential exposure to soil in the backyard does not exceed the noncancer health comparison values for arsenic and cadmium. This means that noncancer health effects would not be expected to occur when an adult resident spends time in the backyard being exposed to maximum levels of chemicals of health concern in the soil. Similarly, a child playing in the backyard also would not be expected to experience any noncancer health effects from exposure to the soil.

A low increased cancer risk (2.8 in 10,000 persons) may exist for adults who have come into contact with soil containing the maximum levels of arsenic and PAHs in the soil on a routine basis for 30 years, and a low increased cancer risk (6.0 in 100,000) may exist for children under the same circumstances.

Residents south of the Del Amo waste pits accepted buyouts for their property and the houses were torn down. With no current residents, no current or future exposure exists for residents. The buyout area is to be a park (see next section for a discussion).

Soil Exposure in the Residential Area South of the Site After the Buyout

Summary: The responsible parties for the Del Amo site bought approximately 55 homes located south of the waste-pit area. These homes have been removed. The responsible parties graded the property in preparation for it to become a county park. As part of the grading, the responsible parties' contractors were directed by DTSC to collect the blue, lava-rock-like material that had been seen on the property by community members and to bury it at a depth of 3 – 5 feet bgs in the area of the planned basketball court. The blue, lava-rock-like material contains elevated levels of arsenic, lead, copper, and zinc. Several rounds of testing of the surface soil after the grading did not detect DDT or metals at levels that would pose a public health hazard. Slag material gathered by the Los Angeles County Department of Public Works contained some elevated levels of metals. Because nonnative material found in the surface soil has been found in some cases to contain elevated metals, and could become crushed into the surface soil or be handled by park visitors, CDHS recommends that the surface be graded to remove the nonnative material.

In the late 1990s, approximately 65 properties containing 55 houses (including the three properties that formerly contained elevated DDT levels in soil), were purchased by the Del Amo responsible parties (25). On the basis of input from a community advisory panel, the buyout area will be developed for a park. As part of the park development, some grading of the property was required. Before this grading occurred, community members identified several foreign materials in the surface soil in the future park area. In particular the community was concerned about a "blue, lava-rock-like material" and a "slag-like material." DTSC staff, accompanied by community members, examined the material and took samples for analysis at the laboratory. The slag-like material was found in the vicinity of 1041 and 1041½ 204th Street. The blue lava-rock-like material was found at 1005 West 204th Street. Analyses of the blue lava-rock-like material showed that it contained high levels of metals (arsenic, lead, copper, and zinc). The slag-like material did not contain elevated levels of metals.

During the grading that took place, the slag-like material was segregated and buried under 2 feet of non-slag-affected soils in the area where the proposed asphalt parking lot will be located (25). The blue, lava-rock-like material was hand consolidated under DTSC oversight and subsequently buried in a trench located 7 feet bgs in an area adjacent to the southern portion of the proposed basketball court. Development of the park required 1,650 cubic yards of nonexpansive import soil for fill dirt below the community center building foundation/slab and the satellite restroom-building slab (25). The imported soil was tested for environmental contaminants (metals, PCBs and pesticides, herbicides, total petroleum hydrocarbons (VOCs, SVOCs) before it was allowed to be used at the site.

To ensure that the surface soil was safe for use as a park, the responsible parties were asked to conduct post grading, surface-soil testing (25). Field testing was conducted for DDT. Eight

randomly preselected samples and two additional samples were sent to a laboratory for confirmation DDT analysis and for metals analysis (Table 15). No chemicals were detected at a level of health concern in the soil samples.

Before making the buyout area into a park, the Los Angeles County Department of Public Works conducted a site assessment of the property (46). The stated purpose of the site assessment was to ". . . identify subsurface conditions that may have been impacted by adverse environmental conditions at the site." Field sampling activity took place from November 9 – 13, 2001. The county drilled 19 soil borings, collecting samples starting at 5 feet bgs and then every 5 feet to the depth of interest. In the field, a photo ionization detector (PID) was used to determine the presence of any soil vapors in subsurface soil samples. The county collected water samples when groundwater was encountered during the boring (i.e., 7 of the 19 borings), collected slag material surface soil samples, composited like material into five different samples, and collected one shallow soil sample. The water and soil samples were submitted to a laboratory for analysis for total petroleum hydrocarbons, VOCs, metals, organochlorine pesticides, and organochlorine herbicides.

No organic chemicals were detected in most of the 135 samples collected from the 19 borings, and all the metals were within the range of typical background levels for the area (46). Total petroleum hydrocarbons were found in 29 of the 135 samples. Of those 29 samples containing total petroleum hydrocarbons, four had elevated levels of lead (2,420, 2,340, 410, and 433 ppm). Three of the 29 samples had elevated cadmium levels (23, 30.2 and 11.9 ppm). At depths of 45 – 50 feet, where water was encountered initially, 13 soil samples contained VOCs in addition to total petroleum hydrocarbons. The VOCs included 1,2-dichloroethane, naphthalene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, n-propylbenzene, trichloroethylene. DDT was detected in two samples (0.63 and 1.53 ppm total DDT).

Because the soil borings were taken at depths of 3 feet bgs and deeper, CDHS did not consider these data relevant to evaluating exposure of visitors to the park or park staff working on the landscape. Occasional digging in this area would not pose a health risk to a utility worker; however, such digging could bring this material to the surface where others could be exposed to it for longer periods of time.

County public works staff collected a near-surface soil sample at 1 foot bgs in the middle of the park (46). This sample did not contain any elevated metals, and no pesticides (including DDT) were detected.

County public works staff collected nonnative material collected from the surface and grouped the material into five samples, described as crystallized metal, metal blocks, granular brick, green glass, and metal pieces (46). These samples were analyzed for metals; the crystallized metal sample contained elevated arsenic (62.6 ppm). The metal block sample contained elevated nickel (1,430 ppm). All samples, except the granular brick, contained elevated levels of total chromium (517 – 2,030 ppm).

DTSC recommended to the county that additional soil sampling be conducted in the areas where the lead was detected at depths (3 – 5 feet) (46). In November 2002, the county and DTSC conducted lead surveillance and soil sampling around the four samples that had elevated lead levels in the previous sampling. The soil testing and sampling occurred from 0.5 feet (6 inches) to 3 feet bgs. DTSC collected 17 co-located samples. The samples were analyzed for 16 metals. The county collected 29 samples, and these were analyzed for lead. DTSC also conducted x-ray fluorescence screening for lead on 29 samples.

Using the x-ray fluorescence machine in the field, DTSC did not detect lead at levels above 168 ppm (46). Lead was detected in 8 of the 17 DTSC co-located samples, the concentrations ranged from 50 – 330 ppm. The Los Angeles County Department of Public Works detected lead at levels ranging from 3.8 – 450 ppm. DTSC toxicologists performed a risk appraisal of the lead concentrations and determined that the hazards posed by lead and other chemicals remaining in the soil are acceptable for use as a park or other recreational land use (79).

Based on these results, CDHS concludes that the surface soil does not pose a health concern for future workers or visitors (children and adults) after it is redeveloped into a park. Some nonnative material found in the surface soil has, in some cases, contained elevated levels of metals that might become crushed into the surface soil or be handled by park visitors. Therefore, CDHS recommends that the surface be regraded to remove the nonnative material.

Limitations of the Investigations Described in This Public Health Assessment

Limitations in the scope of an investigation and/or lack of sufficient data can be a source of uncertainty associated with any scientific investigation. It is the view of the authors of this document that the limitations and data gaps do not compromise the conclusions of this PHA. However, a variety of uncertainties must be taken into account when considering the strength of the conclusions and the recommendations made. The recommendations presented in this document in the *Public Health Action Plan* section are aimed at addressing the limitations.

Child Health Considerations

ATSDR recognizes that infants and children may be more sensitive than adults to environmental exposures. This sensitivity is a result of several factors: 1) Children may have greater exposures to environmental toxicants than adults because pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults; 2) Children play outdoors close to the ground which increases their exposure to toxicants in dust, soil, surface water, and in the ambient air; 3) Children have a tendency to put their hands in their mouths while playing, thereby exposing them to potentially contaminated soil particles at higher rates than adults (also, some children ingest nonfood items, such as soil, which is called *pica* behavior); 4) Children are shorter than adults, which means they can breathe dust, soil, and any vapors close to the ground; 5) Children grow and develop rapidly and can sustain permanent damage if toxic exposures occur during critical growth stages; and 6) Children and teenagers may disregard "No

Trespassing" signs and wander onto restricted locations. Because children depend on adults for risk identification and management decisions, CDHS and ATSDR are committed to evaluating their special interests at hazardous waste sites.

As described in the previous discussions, CDHS evaluated residential exposure, including childhood exposure, for residences south of the Del Amo site, for children who may attend daycare at a building located on the Del Amo site, and for children who might play in the buyout area if it becomes a park.

Conclusions

ATSDR requires that the site be assigned a hazard ranking based on exposure pathways, susceptibility of the population, and the likelihood the exposure could result in adverse health effects. We ranked the site on the basis of our evaluation of ten pathways of possible exposure related to the Del Amo site: three for the developed portion of the site, four related to the waste pits, and three specific to the neighborhood located south of the site. Based on this, CDHS determined that the site posed a public health hazard in the past, may pose a public health hazard now, and is an indeterminate public health hazard in the future. The following is a summary of the evaluation for each of these pathways.

- Based on available soil data in those exposed areas of the developed portion of the site, exposure to long-term workers, occasional workers, and a hypothetical population of children attending a daycare center does not present a public health hazard related to Del Amo-related contaminants. Limited surface and shallow soil sampling in the developed portion of the site (available at the time of the writing of the PHA) indicates that there are several chemicals not related to the Del Amo site (arsenic, DDT and Arochlors/total polychlorinated biphenyls [PCBs]) found at levels of health concern. For the long-term worker and occasional worker, these non-site-related chemicals pose an insignificant-to-slight increased cancer risk. The chemicals measured in the soil would not result in noncancer health effects for long-term workers, occasional workers, or children in the daycare. Since soil testing was only conducted in the exposed areas of the site, when a building is torn down or a parking lot removed, there is the potential for contaminated soil to be exposed.

- The groundwater under and around the Del Amo site is contaminated with various chemicals arising from the Del Amo and Montrose sites and other nearby sites. Currently no domestic, irrigation, or industrial wells pull water from the contaminated groundwater; therefore, no one has been exposed in the past or currently is being exposed through use of ground water as drinking water. If the groundwater is cleaned up or contained as planned, the contamination will not spread to the drinking water wells. Thus, there is no concern for future exposure from use of groundwater as drinking water.

- Indoor air in buildings on the developed portion of the site may be affected by VOCs in nearby contaminated soil or groundwater. CDHS estimates (from modeling indoor air impacts from contaminated soil) indicate that chemicals from beneath a building where LNAPL exists may contribute to a very low increased cancer risk. Moreover, there is a

possibility, although unlikely, of noncancer health effects for the long-term worker in that building. A hypothetical population of children attending a daycare might, although unlikely, experience noncancer health effects from breathing benzene in indoor air in a building located above LNAPL. Buildings in the developed portion of the site where no LNAPL is present are not expected to cause cancer or noncancer health impacts for the long-term worker, the occasional worker, or the child attending daycare. Many assumptions made in modeling this exposure may influence the validity of these findings. Sampling conducted in 13 buildings on the site, one of which was located above LNAPL, indicates that indoor air quality is similar to typical indoor air. On the basis of this exposure pathway, CDHS determined that the site may pose a public health hazard now and poses an indeterminate public health hazard for the future.

- On the basis of available data, direct contact with the contamination in the waste-pit area posed a public health hazard before it was capped in 1999/2000. The waste pits were covered with fill in the 1950s and fenced in the 1980s; however, there are reports that children played at the waste pits and that the waste material was visible on the surface of the pits. The waste material is high in PAHs and VOCs, most prominently naphthalene, benzo(a)pyrene, benzene, and ethylbenzene. Limited surface soil testing above the waste pits indicates that soil would not pose a public health hazard. However, if children directly handled the waste material on a frequent basis, it would have posed a public health hazard to children. The estimated exposures related to the contaminated waste material would result in a moderate increased cancer risk (5.9 in 1,000) to children who played with the waste on a fairly regular basis. These children could also have experienced noncancer health effects (changes in blood system components) related to benzene exposure. The waste pits are now capped, eliminating this exposure as long as the cap is maintained. On the basis of the evaluation of this pathway, CDHS determined that the Del Amo site posed a public health hazard in the past.

- Based on available data, emissions from contamination in the waste-pit area did not pose a public health hazard before it was capped. If the waste material is disturbed, VOCs (for example benzene and ethylbenzene) are released in large amounts. The undisturbed waste also emitted chemicals to the air through the fill material. However, air measurements taken around the waste pits before the cap was in place indicate that the waste-pit emissions did not significantly affect the air quality in the area.

- The responsible parties, as ordered by EPA, capped the waste-pit area in 1999/2000. This eliminates any current or future exposure and emissions from the waste-pits area as long as the cap is maintained.

- An aspect of the treatment strategy for the control of the waste-pit contamination consists of a system below the waste pits to keep chemicals from moving into the groundwater. This system pulls the volatile chemicals in the soil below the waste material to the surface. At the surface the material needs to be treated. The technology for treating the soil gas is in progress.

- It is theoretically possible that indoor air in buildings located in the residential area south of the Del Amo site may be affected by contaminated groundwater flowing underneath their homes. CDHS estimates of indoor air levels of several VOCs indicate that the groundwater does not pose a public health hazard to residents living south of the site. EPA sampled the indoor air of a few homes along W. 204th Street and determined that no health threat exists from the groundwater vapors.

- Based on soil investigations in and near the residential neighborhood south of the Del Amo site, exposure to adults and children to surface soils does not present a health risk from Del Amo-related contaminants. Some of the soil in the neighborhood contained elevated levels of DDT, and several excavations have been done to remove the DDT contamination. DDT is not associated with activities at the Del Amo site. Arsenic and cadmium have been detected at levels exceeding typical western soils and health comparison values. Arsenic and cadmium are not related to activities at the Del Amo site. There have also been detections of other chemicals (primarily PAHs) that could be related to the Del Amo site. A low increased cancer risk is associated with incidental ingestion of backyard soil in the area south of the Del Amo site before the parcels of land were purchased from homeowners and regraded.

- The responsible parties for the Del Amo site bought approximately 55 homes located south of the waste-pit area. These homes have been removed. The responsible parties graded the property in preparation for it to become a county park. As part of the grading, the responsible parties' contractors were directed by DTSC to collect the blue lava-rock-like material that community members had seen on the property and place it at a depth of 3 to 5 feet bgs in the area planned for a basketball court. This blue lava-rock-like material contains elevated levels of arsenic, lead, copper, and zinc. Testing of the surface soil after the grading did not detect DDT or metals at elevated levels, indicating that the surface soil does not pose a public health hazard. The county's recent subsurface sampling is not relevant to human health exposure, but the county also collected one surface soil sample that contained no detectable levels of pesticides and no elevated metals. Slag material gathered by the Los Angles County Department of Public Works contained some elevated levels of metals.

Recommendations

1. Ensure that the integrity of the cap over the waste-pit area is maintained. (EPA, DTSC, or local environmental agency)

2. Ensure that the fences in the waste-pit area are maintained to prevent trespassers from tampering with the soil vapor treatment system. (EPA)

3. Evaluate the health and safety aspects of the selected treatment system for the soil-gas-extraction system when it is implemented. (EPA, DTSC, local environmental agency, SCAQMD, or OEHHA)

4. Conduct soil sampling when parking lots or buildings are removed, constructed, or remodeled, or when any other major activity occurs on the developed portion of the site that will result in the exposure of soil. (EPA, county Public Works Department, city planning department, or some other local agency, responsible party, or land owner)

5. Conduct air sampling in buildings near LNAPL contamination. If LNAPL contamination is found at a level of health concern, eliminate or reduce the exposure. (EPA)

6. Ensure that future construction activities incorporate erosion-control and dust-mitigation mechanisms. (EPA, SCAQMD)

7. Remediate groundwater so that the contamination will not affect municipal wells in the future. (EPA)

8. Remove nonnative material from the soil surface before constructing the park. (Responsible party, Los Angeles County)

Public Health Action Plan

The Public Health Action Plan (PHAP) for this site contains a description of actions taken, to be taken, or under consideration for action by ATSDR and CDHS at and near the site. The purpose of the PHAP is to ensure that this PHA identifies public health hazards and provides a plan of action designed to mitigate and/or prevent adverse human health effects resulting from exposure to hazardous substances in the environment. CDHS and ATSDR will follow up on this plan to ensure that these actions are carried out.

Public Health Actions Currently Underway

1. EPA and the responsible parties are in the process of choosing a technology for treating the soil gas from the waste-pit cap area.

2. EPA is in the process of summarizing the site-characterization data for the developed portion of the site and issuing a risk assessment.

3. CDHS will continue to conduct public health assessment, community outreach, and health education activities related to both the Montrose and Del Amo sites.

Public Health Actions Completed

1. CDHS has conducted many public health assessment and health education activities related to the Del Amo and Montrose sites (see Appendix E).

2. Under EPA and DTSC oversight, the waste-pit area was capped with a RCRA-cap in 1999/2000.

3. Under EPA and DTSC oversight, wells for a soil-vapor-extraction system have been installed at the waste-pit area.

4. A 1999 EPA Record of Decision (ROD) was issued for groundwater clean-up activities; however, these activities have not been fully implemented yet.

5. As a part of the 1997 ROD for the waste-pit area, DTSC and EPA, in conjunction with the property owners, have placed deed restrictions on one of the two land parcels constituting the waste-pit area and are currently in the process of placing these restrictions on the second land parcel.

6. The responsible parties conducted additional soil sampling in the developed portion of the site during summer 2003; however, these data were not available for inclusion in this document.

Preparers of Report

Environmental and Health Effects Assessors

Marilyn C. Underwood, Ph.D., Chief
Site Assessment Section
Environmental Health Investigations Branch
California Department of Health Services

Community Relations Coordinator

Judy Lewis, R.N.
Community Participation Coordinator
Impact Assessment, Inc., contractor to
Environmental Health Investigations Branch
California Department of Health Services

ATSDR Regional Representatives, Region IX

Gwen Eng
Libby Levy
Regional Representatives

ATSDR Technical Project Officer

Tammie McRae, M.S.
Environmental Health Scientist
Division of Public Health Assessment and Consultation

Certification

This Public Health Assessment, **Del Amo Superfund Site, Near Torrance, California,** was prepared by the California Department of Health Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun.

Tammie McRae, M.S.
Technical Project Officer, Cooperative Agreement Team
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

The Division of Public Health Assessment and Consultation, ATDR, has reviewed this public health assessment and concurs with the findings.

for Roberta Erlwein
Cooperative Agreement Team Leader
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

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Appendix A—Glossary

Adverse Health Effect
A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR
The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Concentration
An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific-environment.

Cancer Risk
The potential for exposure to a contaminant to cause cancer in an individual or population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of the exposure. This approach is based on the assumption that there are no absolutely "safe" toxicity values for carcinogens. EPA and OEHHA have developed cancer slope factors for many carcinogens. A slope factor is an estimate of a chemical's carcinogenic potency, or potential, for causing cancer.

If adequate information about the level of exposure, frequency of exposure, and length of exposure to a particular carcinogen is available, an estimate of excess cancer risk associated with the exposure can be calculated using the slope factor for that carcinogen. Specifically, to obtain risk estimates, the estimated, chronic exposure dose (which is averaged over a lifetime or 70 years) is multiplied by the slope factor for that carcinogen.

Cancer risk is the likelihood or chance of getting cancer. We say "excess cancer risk" because we have a "background risk" of about one-in-four chances of getting cancer. In other words, in 1 million people, it is expected that 250,000 individuals would get cancer from a variety of causes. If we say that there is a "one-in-a-million" excess cancer risk from a given exposure to a contaminant, we mean that if 1 million people are exposed to a carcinogen at a certain concentration over their lifetime, then one cancer above the background chance, or the 250,001th cancer, may appear in those 1 million persons from that particular exposure. In order to take into account the uncertainties in the science, the risk numbers used are plausible upper limits of the actual risk based on conservative assumptions. In actuality, the risk is probably somewhat lower than calculated, and, in fact, may be zero.

CERCLA
See Comprehensive Environmental Response, Compensation, and Liability Act.

Completed Exposure Pathway
See Exposure Pathway.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA was put into place in 1980. It is also known as Superfund. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern
A belief or worry that chemicals in the environment might cause harm to people.

Concentration
How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant
See Environmental Contaminant.

Dermal Contact
A chemical getting onto your skin. (see Route of Exposure).

Dose
The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as the amount of substance(s) per body weight per day.

Dose / Response
The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration
The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant
A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Concentration, or what would be expected.

Environmental Media
Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

Environmental Media Evaluation Guide (EMEG)
EMEGs are media specific values developed by ATSDR to serve as an aid in selecting environmental contaminants that need to be further evaluated for potential health impacts. EMEGs are based on non-carcinogenic end-points and do not consider carcinogenic effects. EMEGs are based on the MRLs.

Exposure Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see Route of Exposure.)

Exposure Assessment
The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway
A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having five parts:
1. A Source of Contamination
2. Environmental Media and Transport Mechanism
3. Point of Exposure
4. Route of Exposure
5. Receptor Population

When all five parts of an exposure pathway are present, it is called a Completed Exposure Pathway

Groundwater
Water beneath the earth's surface that flows through soil and rock openings, and often serves as a source of drinking water.

Hazardous Waste
Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Maximum Contaminant Level (MCL)
The EPA has issued drinking water standards, or MCLs for more than 80 contaminants in drinking water. The MCLs are set based on known or anticipated adverse human health effects (which also account for sensitive subgroups, such as, children, pregnant women, the elderly, etc.), the ability of various technologies to remove the contaminant, their effectiveness, and cost of treatment. For cancer risk, EPA generally sets the MCLs at concentrations that will limit an individual risk of cancer from a contaminant to between 1 in 10,000 (low increased excess risk) to 1 in 1,000,000 (no apparent increased excess risk) over a lifetime . As for non-cancer effects, EPA estimates an exposure concentration, below which no adverse health effects are expected to occur.

Non-Cancer Evaluation ATSDR's Minimal Risk Level (MRL) and EPA's Reference Dose (RfD) and Reference Concentration (RfC), and OEHHA's Reference Exposure Level (REL)

The MRL, RfD, RfC, and REL are estimates of daily exposure to the human population (including sensitive subgroups), below which non-cancer adverse health effects are

unlikely to occur. The MRL, RfD, RfC, and REL only consider non-cancer effects. Because they are based only on information currently available, some uncertainty is always associated with the MRL, RfD, RfC, and REL. "Safety" factors are used to account for the uncertainty in our knowledge about their danger. The greater the uncertainty, the greater the "safety" factor and the lower the MRL, RfD, RfC, or REL.

When there is adequate information from animal or human studies, oral MRLs and RfDs are developed for the ingestion exposure pathway, whereas, inhalation MRLs, RfCs, and RELs are developed for the inhalation exposure pathway. A MRL, RfD, RfC, or REL is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse (non-carcinogenic) health effects over a specified duration of exposure. No toxicity values exist for exposure by skin contact. Separate non-cancer toxicity values are also developed for different durations of exposure. ATSDR develops MRLs are acute exposures (less than 14 days), intermediate exposures (from 15 to 364 days), and for chronic exposures (greater than 1 year). EPA develops RfDs and RfCs for acute exposures (less than 14 days), subchronic exposures (from 2 weeks to 7 years), and chronic exposures (greater than 7 years). OEHHA develops acute RELs for exposures lasting less than 24 hours and occurring no more frequently than monthly. OEHHA develops chronic RELs for exposures greater than 8 years. Both the oral MRL and RfD for ingestion are expressed in units of milligrams of contaminant per kilograms body weight per day (mg/kg/day). The inhalation MRL, RfC, and REL is expressed in units of mg/m^3.

Preliminary Remediation Goals (PRGs)

PRGs are developed by the EPA to estimate contaminant concentrations in the environmental media (soil, air, and water), both in residential and industrial settings, that are protective of humans, including sensitive groups, over a lifetime. PRGs were developed for both industrial and residential settings because of the different exposure parameters, such as, different exposure time frames (e.g., industrial setting: workers are exposed for 8 hours/day and 5 days/week vs. residential setting: families are exposed 24 hours/day and 7 days/week; and different "human" exposure points (e.g., industrial setting: healthy adult males vs. residential setting: males, females, young children, and infants), etc. Media concentrations less than the PRGs are unlikely to pose a health threat; whereas, concentrations exceeding a PRGS do not automatically determine that a health threat exists, but suggest that further evaluation is necessary.

NPL

The National Priorities List. (Which is part of Superfund.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

PHA

Public Health Assessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume
A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure
The place where someone can come into contact with a contaminated environmental medium (air, water, food, or soil). For examples, the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, contaminated soil used to grow fruits or vegetables, or the backyard area where someone might breathe contaminated air.

Population
A group of people living in a certain area; or the number of people in a certain area.

PRP
Potentially Responsible Party. A company, government or person that is responsible for causing the pollution at a hazardous waste site and/or expected to help pay for the cleanup of a site.

Public Health Assessment(s)
See PHA.

Public Health Hazard
The category is used in PAHS for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria
PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each is defined in the Glossary. The categories are:
1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Route of Exposure
The way a chemical can get into a person's body. There are three exposure routes:
1. breathing (also called inhalation),
2. eating or drinking (also called ingestion), and
3. getting something on the skin (also called dermal contact).

Semi-Volatile Organic Compound (SVOC)
A chemical compound that partially evaporates or changes from liquid to gas readily at room temperature.

Source (of Contamination)
The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an Exposure Pathway.

Special Populations
People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Superfund Site
See NPL.

Toxic
Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology
The study of the harmful effects of chemicals on humans or animals.

Urgent Public Health Hazard
This category is used in ATSDR's PHA documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

Volatile Organic Compound (VOC)
A chemical compound that evaporates (volatilizes) or changes from liquid to gas readily at room temperature.

Appendix B—Tables

Table 1. Environmental Releases in the Area Around the Del Amo Site, Near Torrance, California

Zip Code and Year	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988
90502*	29,370	52,230	52,912	62,362	50,400	28,851	10,662	73,942	169,658	534,917	622,746	619,609	468,651
	Methanol (32%-48%), styrene (6%-10%), glycol (10%-46%), methyl isobutyl ketone (4%-7%), toluene (1.7%-3%), xylenes (2%-31%).		Xylenes (50%-60%), toluene (2%-25%), styrene (6%-23%), glycol (7%-53%), methyl isobutyl ketone (3%-13%).					1,1,1-TCA (47%), PCE (40%), BTEX (2%), styrene (3%), glycol (5%).	PCE (57%), 1,1,1-TCA (21%), methylene chloride (18%), styrene (2%), glycol (1%).	1,1,1-TCA (12%-50%), methylene chloride (12%-38%), PCE (22%-42%), MEK (6%-13%), BTEX (8%-13%), styrene (~2.5%), glycol (1%-5%), chromium (<1%), lead cpds (<1%); caustics (<1%): HF, H_2NO_3, NaOH, H_2SO_4.		
90501	159	277	171	13,746	14,989	19,119	45,075	100,724	136,384	93,875	164,681	97,217	51,091
	Similar to 1995 – 1997, but much less quantity and no 1,1,1-TCA.			1,1,1-TCA (1995 only, 62%), n-butyl alcohol (11%-24%), naphthalene (16%-24%), 1,2,4-trimethylbenzene (start in 1996, 13%-15%), and cumene (start in 1996, 23%-24%), lead (<1%), copper cpds (<1%).			1,1,1-TCA (26%-70%), xylenes (8%-54%), Freon 113 (1990 only, 14%), acetone (in 1992 and 1993, 9%-12%), copper cpds (2%-7%), lead, HCl, MEK (1991 only, 3%), barium (1991 and 1992 only), chloromethane (1991 and 1992 only, 12%), n-butyl alcohol (start in 1991, 2%-9%), naphthalene (start in 1994, 9%), chromium (in 1993 and 1994 only, 1%).				1,1,1-TCA (40%-60%), Freon 113 (10%-21%), acetone (7%-17%), glycol ethers (1%-8%), copper (1%-3%). Less than 1%: asbestos (1988 only), lead, caustics (HCl, H_2NO_3, H_2PO_4, H_2SO_4). Add HCl in 1989 (23%), propylene (4%), and MEK (2%).	
90509†	1,118,079	1,920,952	1,166,936	971,137	1,042,806	794,645	748,192	717,326	604,559	659,316	450,966	528,635	409,297
	Ammonia (85%-90%). Less than 2%: propylene, BTEX, ethylene, naphthalene, MTBE, n-hexane, phenol, methane, metals (nickel and zinc compounds), HF.												

Source: Toxic Release Inventory (TRI) (31) Releases are presented in pounds of chemical released in that year.

* Douglas Aircraft Company's closure resulted in the large drop in emission release in 1991/1992.

† Mobil Oil Corporation Refinery is the major industry in this zip code.

1,1,1-TCA—1,1,1-trichloroethane; PCE—tetrachloroethylene; BTEX—benzene, toluene, ethylbenzene, xylenes; HCl—hydrochlororic acid; MEK—methyl ethyl ketone; HF—hydrofluoric acid; MTBE—methyl tertbutyl ether; H_2NO_3—nitric acid; H_2PO_4—phosphoric acid; H_2SO_4—sulfuric acid; NaOH—sodium hydroxide.

Table 2. Evaluation of Exposure Pathways, Del Amo Site, Near Torrance, California

Location	Type of Exposure Pathway	Primary Contaminants of Concern	Exposure Pathway Elements					Time	Conclusion
			Source	Media	Point of Exposure	Route of Exposure	Potentially Exposed Population		
Developed Area of Site	Soil	Arsenic, cadmium, Aroclor1260, total PCBs, BaP and other carcinogenic PAHs, benzene, ethylbenzene	Del Amo, Montrose, and other activities	Soil	Soil	Incidental ingestion, skin contact	Long-term on-site worker, occasional worker, child at day care	From ~1970s until now, future	Not currently a public health hazard from site-related contaminants. Potential future hazard if soil becomes exposed. Testing needed when covered soil is exposed.
	Groundwater if used as drinking water	BTEX	Del Amo, Montrose, and several other facilities	Groundwater	Drinking water	Ingestion, inhalation, skin contact	Residents, workers, other users of water	Past, present, future	Eliminated for past and current exposure. Potential future exposure if not cleaned up.
	Indoor air	BTEX, TCE, Styrene, PCE	Del Amo site activities	Soil gas coming from contaminated soil and groundwater	Indoor air	Inhalation	Long-term on-site worker, occasional worker, child at daycare	From 1970s (when development occurred) until now, future	Future public health hazard for buildings located over LNAPL. Indoor air testing recommended.
Waste Pits	Exposure to waste-pit contamination before pits were capped	PAHs, BTEX, VOCs, SVOCs	Del Amo waste pits	Soil Waste-material	Soil Waste-material	Incidental ingestion, skin contact	Trespasser	Before cap was placed over the pits	Public health hazard in the past.
	Exposure to emissions from waste pits before pits were capped	BTEX	Del Amo waste pits	Emissions from waste	Air	Inhalation	Nearby resident, trespasser	Before cap was placed over the pits	Not a public health hazard.

Table 2. Evaluation of Exposure Pathways, Del Amo Site, Near Torrance, California

Location	Type of Exposure Pathway	Primary Contaminants of Concern	Exposure Pathway Elements					Time	Conclusion
			Source	Media	Point of Exposure	Route of Exposure	Potentially Exposed Population		
Waste Pits	Exposure to waste-pit contamination after cap was placed	PAHs, BTEX, VOCs, SVOCs	Del Amo waste pits	Soil Waste-material	Soil Waste-material	Incidental ingestion, skin contact	Trespasser	After cap was placed over the pits	Not a public health hazard as long as cap is maintained.
	Releases from treatment of soil gas captured from under waste-pit cap	(Yet to be determined)	Del Amo waste pits, soil gas treatment system	Soil gas	To be determined	Inhalation, skin contact	Nearby resident	Future	Evaluate when treatment is operational.
Neighbor-hood area south of site	Indoor air exposure	BTEX	Del Amo, Montrose and several other facilities	Soil gas coming from contaminated groundwater	Indoor air	Inhalation	Nearby residents	Past, present, future	Not a public health hazard.
	Soil exposure before the grading occurred	DDT, arsenic, cadmium	Fill from Montrose site and other facilities	Soil	Surface soil	Incidental ingestion, skin contact	Residents	Past	Eliminated; no chemicals related to Del Amo at levels of health concern.
	Soil exposure after the grading occurred	Arsenic, lead, copper, zinc, nickel in non-native material	Del Amo site	Soil and nonnative materials found in the soil	Surface soil	Incidental ingestion, skin contact	Trespassers, park workers, park users	Present, future	Eliminated; no chemicals related to Del Amo at levels of health concern in soil. Nonnative material should be removed from accessible surface.

Acronyms used in table: BTEX—benzene, toluene, ethylbenzene, xylenes; DDT—dichlorodiphenyltrichloroethane; PAHs—polycyclic aromatic hydrocarbons; PCBs—polychlorinated biphenyls; SVOCs—semi-volatile organic compounds; BaP—benzo(a)pyrene; PCE—tetrachloroethylene; TCE—trichloroethylene; VOCs—volatile organic compounds.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#1 7351-31-17	NS	Very few samples composited with other parcels. Cadmium Chromium Manganese	NS	NS	-----	Not an area of manufacturing or storage
#2 7351-31-24 7351-31-25	Arsenic Cadmium DDT Arochlor PCBs PAHs	Cadmium DDT Arochlor PCBs PAHs	Toluene Xylenes 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Ethylbenzene Isopropylbenzene Tetrachloroethylene	NS	Toluene Xylenes 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Ethylbenzene Isopropylbenzene Tetrachloroethylene	
#3 7351-31-7 Sumitomo	NS	NS	3 samples on north end: Benzene Ethylbenzene Toluene	Benzene Methylene chloride Tetrachloroethylene Trichloroethylene 1,1-Dichloroethylene 1,1,1-Trichloroethane Cyclohexane Ethylbenzene Methyl ethyl ketone Styrene Toluene Xylenes	-----	Historically, tanks located in the area. Building is located on former tank area. Very little sampling.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#4 7351-31-8	NS	Cadmium Cyclohexane Chromium (Total) Copper 2-Hexanone Manganese Nickel Vandium	NS	NS	-----	Not an area of manufacturing or storage. No soil gas data. Some soil data.
#5 7351-33-17 WRC (Toyota-leases)	NS	NS	Benzene Toluene Dichlorobromomethane 2-Hexanone 1,2,3-Trimethylbenzene Methyl isobutyl ketone Xylenes Ethylbenzene Tetrachloroethylene Trichloroethylene	Benzene Methylene Chloride Tetrachloroethylene Trichloroethylene Toluene	-----	Manufacturing of butadiene during facility operation. Fair amount of data, but no metal analyses.
#6 7351-33-22 Hamilton Dutch Building	NS	NS	Benzene Toluene Ethylbenzene Xylenes	NS	Benzene Toluene Ethylbenzene Xylenes	Historical usage occurred in area. Non RI/FS sampling. Lots of soil gas sampling. Most samples analyzed for BTEX, very little other VOC analysis or high detection limits.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#7 7351-33-26	NS	NS	Benzene Cyclohexane	-----	Benzene Chloromethane Cyclohexane Freon 12 Freon 114	Storage tanks and pipelines on property when facility was in operation. LNAPL present in area. High detection limits for soil gas—bad data
#8 7351-33-27 Takechi USA, Inc.	NS	For VOCs only. No COCs	Benzene Cyclohexane 2-Hexanone	Benzene Tetrachloroethylene Toluene Styrene Xylenes Cyclohexane Methyl ethyl ketone 1,1-Dichloroethane 1,1-TCA Ethylbenzene	-----	Storage tanks and pipelines on property when facility was in operation. LNAPL present in area.
#9 7351-33-30 Currently Undeveloped	1 sample—a composite of 6 samples: Arsenic Cadmium Chromium Copper Manganese Vanadium Nickel DDT	NS	NS	NA	-----	Butadiene plant or fabrication plant were located in this area. Cooling towers also located in the area.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#10 7351-33-34 Currently Undeveloped	2 composite samples—from this parcel and two others: Arsenic Cadmium Chromium (Total) Copper Manganese Nickel Vanadium Zinc DDT Dieldrin	NS	Benzene Toluene Tetrachloroethylene	NA	Benzene Tetrachloroethylene Toluene	Pipelines cross the property.
#11 7351-33-37 Currently Undeveloped	2 composites—1 from this parcel and 2 others: Arsenic Cadmium Chromium Copper Manganese Nickel Vanadium Zinc Dieldrin DDT	NS	Benzene Tetrachloroethylene 1,2,4-Trimethylbenzene	NA	Benzene Tetrachloroethylene 1,2,4-Trimethylbenzene	Butadiene plant used to be located on parcel. Cooling towers located on parcel. High detection limits for BTEX in soil gas. Minimal other VOC analyses.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#12 7351-33-40 Currently Undeveloped	2 composite sample from this and other parcels: Arsenic Cadmium Chromium (Total) Copper Manganese Nickel Vanadium Zinc Dieldrin DDT	NS	2 Samples Benzene	NA	Benzene	Historical use of hazardous material. Pipelines crossed parcel. High detection limits for BTEX in soil gas.
#13 7351-33-900 Gas/Utility Right-of-Way	NS	NS	NS	NA	NA	Historically, a Department of Water and Power right-of-way. No facility activities in area.
#14 7351-34-39 Miller Fabrication	NS	NS	Benzene 4-Ethyl toluene Cyclohexane Xylenes Ethylbenzene Styrene Tetrachloroethylene	Benzene 1,1,1-Trichoroethane Ethylbenzene Methyl ethyl ketone Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes	-----	Historically, pipelines crossed property. High detection limits in soil gas.
#15 7351-34-41 Obie (Formerly F. Schaefer) Publications	NS	NS	Benzene Ethylbenzene Tetrachloroethylene Xylenes Toluene	Benzene Ethylbenzene Styrene Tetrachloroethylene Toluene Xylenes	-----	Historically, pipelines crossed property. Styrene finishing unit was located there.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#16 7351-34-43 Ace	NS	NS	Tetrachloroethylene 1,1,1-Trichloroethane Freon 11	1,1,1-Trichloroethane Benzene Chloroform Ethylbenzene Methyl ethyl ketone Styrene Tetrachloroethylene Toluene Xylenes	Tetrachloroethylene 1,1,1-Trichloroethane Freon 11	Historically, pipelines crossed parcel. Limited soil gas sampling.
#17 7351-34-45	NS	NS	Tetrachloroethylene 1,1,1-Trichloroethane 1,1-Dichloroethylene Freon 11 Acetone	NS	Tetrachloroethylene 1,1,1-Trichloroethane 1,1-Dichloroethylene Freon 11 Acetone	Historically, pipelines crossed the parcel. Limited soil gas sampling.
#18 7351-34-47 R. R. Donnelly Financial	NS	NS	Ethylbenzene Toluene Tetrachloroethylene Benzene 1,1,1-Trichloroethane	Benzene 1,1,1-Trichloroethane Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene Xylenes	-----	When facility was in operation, manufacturing activities like ethylbenzene production took place on the parcel. High detection limits for soil gas samples.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#19 7351-34-72	NS	1 single sample. 2 composites with other parcels: Cadmium Chromium (total) Copper Manganese Nickel Vanadium Zinc	Tetrachloroethylene	NS	Tetrachloroethylene	Historically, pipelines crossed parcel.
#20 7351-34-15 7351-34-50 7351-34-56 R. R. Donelly & Sons	NS	Arsenic Manganese Cadmium Chromium (total) N-Nitroso-dipenylamine	Ethylbenzene Styrene 1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene 2-Hexanone 4-Ethyl toluene Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene	1,1,1-Trichloroethane Benzene Chlorobenzene Cyclohexane Ethylbenzene Methyl ethyl ketone Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes	Ethylbenzene Styrene 1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene 2-Hexanone 4-Ethyl toluene Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene	Benzene, toluene, and other tanks located in parcel. LNAPL present in area.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#21 7351-34-52 Toyota	NS	NS	Tetrachloroethylene Benzene 4-Ethyl toluene Trichloroethylene 1,2,4-Trimethylbenzene	1,1,1-Trichloroethane Benzene Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes	Tetrachloroethylene Benzene 4-Ethyl toluene Trichloroethylene 1,2,4-Trimethylbenzene	When facility was in operation, manufacturing activities like ethylbenzene production took place on the parcel. High detection limits for soil gas sampling.
#22 7351-34-57 Coca Cola Building	NS	Limited sampling Benzene Ethylbenzene (no metals analysis)	Ethylbenzene Styrene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene Xylenes 2-Hexanone 4-Ethyl toluene Acetone Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene 1,2-Dichloroethane	Benzene (only analyzed for benzene, ethylbenzene, styrene, and toluene)	Ethylbenzene Styrene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene Xylenes 2-Hexanone 4-Ethyl toluene Acetone Chloroform Benzene 1,1,1-Trichloroethane Trichloroethylene 1,2,4-Trimethylbenzene 1,2-Dichloroethane	Several storage areas for styrene, benzene, ethylbenzene, and toluene located here.
#23 7351-34-58	NS	Limited sampling one boring - two depths No metals No COCs	Ethylbenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Benzene Trichloroethylene 1,2,4-Trimethylbenzene	NS	Ethylbenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Benzene Trichloroethylene 1,2,4-Trimethylbenzene	Storage tanks were located on this parcel.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#24 7351-34-69 Tri-Lite	NS	Nickel Chromium (total) Vanadium Arsenic	Ethylbenzene Styrene Xylenes Toluene Cyclohexane Tetrachloroethylene sec-Butyl benzene 4-Ethyl toluene Benzene 1,1,1-Trichloroethane Freon 114 Isopropyl benzene	1,1,1-Trichloroethane Benzene Chloroform Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene Toluene Trichloroethylene Xylenes	Ethylbenzene Styrene Xylenes Toluene Cyclohexane Tetrachloroethylene sec-Butyl benzene 4-Ethyl toluene Benzene 1,1,1-Trichloroethane Freon 114 Isopropyl benzene	Historically, pipeline crossed property. Styrene finishing unit located there. Considerable soil sampling conducted outside RI/FS, primarily for VOCs.
#25 7351-34-70	2 composites shared with another parcel: Arsenic Chromium (total) Cadmium Manganese Nickel DDT Benzo(a)anthracene Phenanthrene	Arsenic Chromium (total) Cadmium Nickel Manganese DDT	No COCs	NA	NA	Storage area was located in eastern portion when facility was in operation. High detection limits for soil gas.
#26 7351-34-73	NS	NS	Limited—3 samples. Ethylbenzene Styrene Toluene Cyclohexane Xylenes Benzene	NS	Ethylbenzene Styrene Toluene Cyclohexane Xylenes Benzene	Not much activity or storage on the parcel when facility was in operation. High detection limits for soil gas.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#27 7351-34-901	2 composites shared with another parcel: Arsenic Cadmium Chromium (total) Manganese Nickel Vanadium DDT Phenanthrene Acenaphthylene Benzo(a)anthracene 2-Methylnaphthalene	Arsenic Cadmium Chromium (total) Manganese Nickel Vanadium	No COCs	NA	Benzene Ethylbenzene Toluene Xylenes	Historically and currently, a Department of Water & Power right of way.
#28 Pacific Gateway	NS	2 samples for VOCs, SVOCs. 2 composite samples with other parcels—for PCBs / pesticides, metals. Manganese Nickel Cadmium Chromium	Ethylbenzene Styrene 1,3,5-Trimethylbenzene Toluene Tetrachloroethylene Xylenes 4-Ethyl toluene Acetone Chloroform Benzene 1,1,1-Trichloroethane Freon 11 Freon 12 Trichloroethylene	NA	NA	A street. Pipelines crossed the property in the past.
#29 Magellan Drive	NS	NS	Ethylbenzene Toluene Tetrachloroethylene Benzene	NA	NA	A street. Pipelines cross the parcel.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
#31 7351-31-18	NS	Limited sampling Cadmium Manganese Chromium (total)	1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Freon 11 Freon 12 Trichloroethylene 1,2,4-Trimethylbenzene	NS	1,4-Dichlorobenzene 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Freon 11 Freon 12 Trichloroethylene 1,2,4-Trimethylbenzene	Historically, a reactor building for synthetic rubber located on the parcel.
#31 7351-34-54	NS	Cadmium Manganese	No COCs	NS	-----	Little activity on property. Pipeline crossed parts of property.
#32 7351-34-66 Nippon Express	1 Surface soil for SVOC, PCBs / pesticides No COCs/No EDB	NS	5 shallow soil gas samples. 4 without complete VOC analysis. Carbon tetrachloride Chloroform	Benzene Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Toluene 1,1,1-Trichloroethane Xylenes	-----	Eastern Research Company was located in this parcel.
#33 7351-31-20 LAX Business Center	NS	NS	2 shallow soil gas samples. Only 1 had complete VOC analysis. No COCs	Benzene Cyclohexane Ethylbenzene Methyl ethyl ketone Methylene chloride Styrene Tetrachloroethylene 1,1,1-Trichloroethane Xylenes	-----	Laboratory and process building for synthetic rubber process located in this area.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
7351-31-800 7351-33-15 7351-33-20 7351-33-39 7351-34-21 7351-34-23 7351-34-24 7351-34-75 7351-34-64 7351-34-76 7351-34-67 7351-34-68	NS	NS	*Tetrachloroethylene* Freon113 1,1,1-Trichloroethane 1,1-Dichloroethylene Acetone Chloroform Dichlorobromomethane Freon 11 Ethylbenzene 1,3,5-Trimethylbenzene Toluene Cyclohexane 4-Ethyl toluene Benzene 1,2,4-Trimethylbenzene	NS	-----	Pipeline crossed these properties. Cooling towers were located in 7351-33-20 and 7351-33-39.
7351-34-65	NS	NS	5 shallow soil gas samples. 4 without complete VOC analysis. Freon 11 Freon 113	NS	-----	Some historical usage.
7351-33-9	NS	NS	12 shallow soil gas. 2 with complete VOC analysis. 1,3,5-Trimethylbenzene Tetrachloroethylene 4-Ethyl toluene Chloroform Benzene Acetonitrile Trichloroethylene 1,2,4-Trimethylbenzene	NS	-----	Unlined impoundments were located on this parcel.

Table 3. Summary of Chemicals Detected in the Parcels and Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California

Area of Concern; Parcel Numbers; Current Building Name	Surface Soil	Sub-Surface Soil	Shallow Soil Gas	Indoor Air (Sampling)	Indoor Air (Model)	Comments Sample Adequacy Historical Uses
7351-33-24 7351-33-23	NS	NS	1,4-Dichlorobenzene 1,3,5-Trimethylbenzene 4-Ethyl toluene Chloroform Benzene Chloromethane Chloroethane Acetonitrile 1,2,4-Trimethylbenzene	NS	-----	Wastewater treatment, oil skimmer, and other recovery operations occurred here.
7351-34-74	NS	NS	3 shallow. Only 1 with complete VOC analysis. 2-Hexanone 4-Ethyl toluene Benzene 1,1,1-Trichloroethane 1,2,4-Trimethylbenzene	NS	NS	Historical photos show some unidentifiable structure was located here.

Source: Draft baseline risk assessment report for the Del Amo site (30).
Acronyms used in table: DDT—dichlorodiphenyltrichloroethane; PAHs—polycyclic aromatic hydrocarbons; PCBs—polychlorinated biphenyls; VOCs—volatile organic compounds; NS—not sampled; COCs—chemicals of concern; NA—not applicable.

Table 4. Summary of Surface Soil* Data Collected from the Developed Portion of the Del Amo Site, Near Torrance, California—All Units (ppm)

Chemical Type	Chemical	Surface Soil		Health Comparison Value‡ (Source) Average Background (Bkgd) Concentration for Metals
		No. Detects / No. Samples	Concentration Range (Average†)	
Metal	Arsenic	15/15	2.6-49 (10.7)	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Metal	Barium	15/15	130-210	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Metal	Cadmium	15/15	6.3-9.1 (6.9)	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Metal	Chromium	15/15	18-290 (30.8)	80,000 (Child RMEG) Bkgd=23-1,579 (122)
Metal	Cobalt	15/15	6.8-12	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Metal	Copper	15/15	19-240 (60.9)	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)
Metal	Manganese	15/15	310-620	3,000 (Child RMEG) Bkgd=253-1,687 (646)
Metal	Nickel	15/15	12-59	1,000 (Child RMEG) Bkgd=9-509 (57)
Metal	Lead	15/15	5.6-200 (36.5)	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)
Metal	Vanadium	15/15	36-160	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Metal	Zinc	15/15	56-650	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)

Table 4. Summary of Surface Soil* Data Collected from the Developed Portion of the Del Amo Site, Near Torrance, California—All Units (ppm)

Chemical Type	Chemical	Surface Soil		Health Comparison Value‡ (Source) Average Background (Bkgd) Concentration for Metals
		No. Detects / No. Samples	Concentration Range (Average†)	
Pesticide	4,4'-DDD	12/15	0.0043-2.7 (0.24)	30 (Child RMEG)
Pesticide	4,4'-DDE	12/15	0.0056-2.2 (0.27)	30 (Child RMEG)
Pesticide	4,4'-DDT	14/15	0.022-9.1 (1.4)	1.0 (CREG)
Pesticide	Aroclor 1260	3/15	0.25-6.8	0.22 (CREG)
Pesticide	Dieldrin	3/15	<2-0.01	3 (Child Chronic EMEG) 0.04 (CREG)
Pesticide	Total PCB's	3/15	0.25-6.8 (0.84)	0.04 (CREG)
SVOC	2-Methylnaphthalene	0/15	<0.4	-
SVOC	Acenaphthene	1/15	<0.4-0.23	3,000 (Child RMEG)
SVOC	Acenaphthylene	1/15	<0.4-0.47	-
SVOC	Anthracene	1/15	<0.4-0.57	20,000 (Child RMEG)
SVOC	Benzo(a)anthracene	2/15	<0.4-0.31	0.01 (BAP-eq CREG)
SVOC	Benzo(a)pyrene	1/15	<0.4-0.43 (0.2)	0.1 (CREG)
SVOC	Benzo(b)fluoranthene	1/15	<0.4-0.87	0.01 (BAP-eq CREG)
SVOC	Benzoic acid	1/15	<2-9.3	200,000 (Child RMEG)
SVOC	Bis(2-ethylhexyl)phthalate	3/15	<0.3-0.77	35 (Residential PRG)
SVOC	Butylbenzylphthalate	2/15	<0.4-0.34	10,000 (Child RMEG)
SVOC	Chrysene	1/15	<0.4-1.1	10 (BAP-eq CREG)

Table 4. Summary of Surface Soil* Data Collected from the Developed Portion of the Del Amo Site, Near Torrance, California—All Units (ppm)

Chemical Type	Chemical	Surface Soil		Health Comparison Value‡ (Source) Average Background (Bkgd) Concentration for Metals
		No. Detects / No. Samples	Concentration Range (Average†)	
SVOC	Di-n-butylphthalate	1/15	<0.4-8.3	6,100 (Residential PRG)
SVOC	Fluoranthene	3/15	<0.4-0.24	2,000 (Child RMEG)
SVOC	Fluorene	1/15	<0.4-0.24	2,000 (Child RMEG)
SVOC	N-Nitrosodiphenylamine	0/15	<0.4	100 (CREG)
SVOC	Naphthalene	0/15	<0.4	1,000 (Child RMEG)
SVOC	Phenanthrene	4/15	<0.2-1	-
SVOC	Pyrene	5/15	<0.2-0.21	2,000 (Child RMEG)
VOC	1,2,4-Trimethylbenzene	0/5	<0.005	52 (Residential PRG)
VOC	1,2-Dichlorobenzene	0/5	<0.4	5,000 (Child RMEG)
VOC	1,3,5-Trimethylbenzene	0/5	<0.005	21 (Residential PRG)
VOC	1,4-Dichlorobenzene	0/5	<0.4	20,000 (Child Intermediate EMEG)
VOC	2-Hexanone	0/5	<0.05	-
VOC	Acetone	0/5	<0.05	5,000 (Child RMEG)
VOC	Benzene	0/5	<0.05	10 (CREG)
VOC	Cyclohexane	0/1	<0.001	140 (Residential PRG)
VOC	Ethyl benzene	0/5	<0.005	5,000 (Child RMEG)
VOC	Methyl isobutyl ketone (MIBK)	0/5	<0.05	790 (Residential PRG)

Table 4. Summary of Surface Soil* Data Collected from the Developed Portion of the Del Amo Site, Near Torrance, California—All Units (ppm)

Chemical Type	Chemical	Surface Soil		Health Comparison Value‡ (Source) Average Background (Bkgd) Concentration for Metals
		No. Detects / No. Samples	Concentration Range (Average†)	
VOC	Methylene chloride	0/5	<0.05	3,000 (Child Chronic EMEG) 90 (CREG)
VOC	Naphthalene	0/5	<0.4	1,000 (Child RMEG)
VOC	Styrene	0/5	<0.005	10,000 (Child RMEG)
VOC	Tetrachloroethene	1/5	<0.005-0.006	500 (Child RMEG) / 5.7 (Residential PRG)
VOC	Toluene	0/5	<0.005	10,000 (Child RMEG)
VOC	Xylenes (Total)	NA	NA	100,000 (Child RMEG)
VOC	m,p-Xylene	0/5	<0.01	30,000 (Child Intermediate EMEG)
VOC	n-Butylbenzene	1/5	<0.005-0.005	140 (Residential PRG)
VOC	n-Propylbenzene	0/5	<0.005	140 (Residential PRG)
VOC	o-Xylene	0/5	<0.005	-
VOC	p-Isopropyltoluene	0/5	<0.005	-
VOC	sec-Butylbenzene	0/5	<0.005	110 (Residential PRG)
VOC	tert-Butylbenzene	0/5	<0.05	130 (Residential PRG)

Source: Section 2, Pilot feasibility study, summary of RI/FS investigation and findings (5). Background metal concentrations were obtained from "Background concentrations of trace and major elements in California soils" (33).

* Surface soil = 0 – 6 inches below ground surface (bgs); † Average values given in parentheses for chemicals used in dose calculations, non-detects were assigned half the detection limit for calculation of average concentration values; ‡ Health comparison values: EMEG—Environmental Media Evaluation Guide; RMEG—Reference Dose Media Evaluation Guide; CREG—Cancer Risk Evaluation Guideline; PRG—preliminary remediation goal; BaP-eq—benzo(a)pyrene equivalent.

ppm—parts per million; VOC—volatile organic compound; SVOC—semi-volatile organic compound.

Table 5. Summary of the Health Evaluation from Exposure to Soil on the Developed Portion of the Del Amo Site, Near Torrance, California

Potentially Exposed Group	Type of Exposure	Noncancer	Cancer Health Effect
Long-term worker who digs in surface soil	Maximum Soil Concentration	None expected	4.0 in 100,000 Very low increased risk
	Average Soil Concentration	None expected	7.8 in 1 million No apparent increased risk
Occasional worker who digs into the subsurface soil	Maximum Soil Concentration	None expected	2.2 in 1 million No apparent increased risk
	Average Soil Concentration	None expected	4.4 in 10 million No apparent increased risk
Child attending daycare who plays on surface soil	Maximum Soil Concentration	Arsenic exposure-estimate exceeds health comparison value	-----
	Average Soil Concentration	None expected	-----

Source: Doses were calculated from the following information: maximum- and average-surface soil concentrations from Table 4 for certain chemicals. Equations for determination of dose are shown in U.S. Environmental Protection Agency (EPA) Risk Assessment Guidelines for Superfund. Long-term and occasional (short-term) worker weight: 70 kilograms (154 pounds). Child weight (13.5 kilograms or 30 pounds) was derived from the average of the 50th percentile of boys and girls ages 6 months to 5 years (EPA Exposure Factors Handbook) (47). The following were the duration assumed for exposure: 250 days per year for 25 years for the long-term worker; 14 days per year for 25 years for the short-term worker; and 250 days per year for 4.5 years for the child attending day-care. Incidental ingestion was assumed to be 100 milligrams soil per day for both worker populations and 200 milligrams per day for the child. The noncancer determination is based on a comparison of the estimated dose to the noncancer health comparison value for each chemical. For the long-term worker and child attending day-care, chronic health comparison values were used. For the short-term worker, acute or intermediate health comparison values were used, if available. If the estimated dose did not exceed the noncancer health comparison value, then the chemical was determined not to pose a health risk. Cancer risk is calculated by multiplying the estimated dose by the cancer slope factor derived by U.S. EPA or California Office of Environmental Health Hazard Assessment, and summing the risks from each carcinogen present in the soil. Noncancer health comparison values and cancer slope factors used in this evaluation are listed in Appendix F or here: copper—0.03 mg/kg/day (intermediate Minimal Risk Level) and 1,2,4-trimethylbenzene—0.05 mg/kg/day.

Table 6. Summary of Chemicals Detected Near the Del Amo Site and the Groundwater Units in Which Each Chemical Was Detected, Near Torrance, California

Compounds	Upper Bell-flower Aquitard	Middle Bell-flower B-sand Benzene Plume	Bell-flower C-sand		Gage Aquifer	Lynwood Aquifer
			Benzene Plume	Chloro-benzene Plume		
Acetone	X		X	X	X	
Total DDT*	X		X	X	X	
Total Hexachlorocyclohexanes	X		X	X		
sec-Butylbenzene		X				
Benzene	X	X	X	X	X	X
Carbon disulfide		X				
Carbon tetrachloride	X					
Chlorobenzene	X	X	X	X	X	X
Chloroform	X	X	X	X	X	
Dibromochloromethane		X				
1,2-Dichlorobenzene			X	X	X	
1,4-Dichlorobenzene			X	X	X	
1,1-Dichloroethane		X				
1,2-Dichloroethane	X	X	X	X	X	
1,1-Dichloroethylene		X				
cis 1,2-Dichloroethylene		X				
Ethylbenzene	X	X	X	X	X	
Methylene chloride	X	X				
Naphthalene		X				
Styrene		X				
Tetrachloroethylene	X	X	X	X	X	
Toluene	X	X	X	X	X	
Trichloroethylene	X	X	X	X		
1,2,4-Trimethylbenzene		X				
1,3,5-Trimethylbenzene		X				
Vinyl chloride		X				
Total Xylenes	X	X	X	X		
Arsenic		X				
Manganese		X				

Source: Groundwater remedial investigation report (final), Del Amo study area (3).

* DDT—dichlorodiphenyltrichloroethane

Table 7. California Department of Health Services Monitoring Frequency Guideline for Organic and Inorganic Chemicals in the West Basin Area, Del Amo Site, Near Torrance, California

Parameters To Be Sampled (Chemicals included in this analysis that are found in groundwater contamination near Del Amo and Montrose sites)	Monitoring Frequency
VOCs* that are regulated under Title 22 (Benzene, carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, ethyl benzene, methylene chloride, styrene, tetrachloroethylene, toluene, trichloroethylene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, vinyl chloride, xylenes)	VOCs, annually if none detected; Quarterly, if detected, but less than MCLs†; or Monthly, if detections are greater than MCLs.
SVOCs‡ that are regulated under Title 22	SVOCs every 5 years, if none detected; Quarterly, if detected, but less than MCLs; or Monthly, if detections are greater than MCLs.
Organic chemicals that are unregulated but monitoring is required	Naphthalene- monitored as required by federal government, 1987-1999. 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene sec-Butylbenzene Hexachlorocyclohexanes
Inorganic chemicals that are regulated under Title 22 (arsenic, manganese)	Once every 3 years

* VOC—volatile organic compounds
† MCL—Maximum Contaminant Level
‡ SVOCs—semi-volatile organic compounds

Table 8. Summary of Chemicals Detected in Shallow Soil Gas—Data Collected on the Developed Portion of the Del Amo Site, Near Torrance, California—All Units ($\mu g/m^3$)

Chemical	No. of Samples	No. of Detects	Frequency of Detection (%)	Minimum Concentration Detected	Maximum Concentration Detected	Mean Concentration
1,1,1-Trichloroethane	613	91	15	9.3	7,104	528.4
1,1,2,2-Tetrachloroethane	75	2	3	7.6	22.7	7,576*
1,1-Dichloroethane	403	1	0	113.4	113.4	768.4*
1,1-Dichloroethylene	612	6	1	3.5	6,103	429.3
1,2,4-Trichlorobenzene	75	1	1	28.3	28.3	13,830*
1,2,4-Trimethylbenzene	75	35	47	1.7	83,570	4,916
1,2-Dibromoethane (EDB)	303	2	1	2,3910	37,370	7,684
1,2-Dichlorobenzene	75	3	4	7.2	270,600	7,666
1,3,5-Trimethylbenzene	75	17	23	1.0	137.6	3,662*
1,4-Dichlorobenzene	158	5	3	6.0	222,500	3,432
2-Hexanone	75	6	8	11.1	163.9	6,985*
4-Ethyl toluene	74	29	39	5.9	63,910	6,268
Acetone	75	36	48	3.6	546.5	7,191*
Acetonitrile	328	7	2	18.4	184.5	2,433*
Benzene	875	209	24	0.6	13,000,000	88,940
Carbon tetrachloride	75	1	1	62.4	62.4	3,935*
Carbon disulfide	75	3	4	1.6	17.1	9,397*
Chloroethane	303	1	0	8.2	8.2	3,078*
Chloroform	495	17	3	13.1	7,787	554

Table 8. Summary of Chemicals Detected in Shallow Soil Gas—Data Collected on the Developed Portion of the Del Amo Site, Near Torrance, California—All Units ($\mu g/m^3$)

Chemical	No. of Samples	No. of Detects	Frequency of Detection (%)	Minimum Concentration Detected	Maximum Concentration Detected	Mean Concentration
Chloromethane	69	6	9	2.9	96.0	1,772*
Cyclohexane	669	58	9	12.4	11,360,000	58,840
Dichlorobromomethane	75	2	3	19.4	2,549,000	39,960
Ethanol	6	1	17	13.7	13.7	10,190*
Ethylbenzene	841	155	18	6.0	78,040,000	194,900
Freon 11	74	23	31	7.3	7,284	2,555
Freon 113	75	19	25	9.2	61,310	6,882
Freon 114	68	3	4	2.8	643.1	4,808*
Freon 12	56	7	13	1.7	1,930	4,170*
Heptane	6	3	50	1.8	4,508,000	949,400
Isopropanol	6	1	17	1.0	9,586	13,290
Methyl ethyl ketone (MEK)	479	13	3	7.0	144.5	897.8*
Methyl isobutyl ketone (MIBK)	75	2	3	12.3	110.4	5016*
Methylene chloride	571	3	1	5.6	6.6	583.7*
Styrene	841	67	8	6.0	8,082,000	11,300
Tetrachloroethylene	613	211	34	9.5	1,426,000	9,013
Tetrahydrofuran	6	0	0	N/A	N/A	15,950
Toluene	841	155	18	2.494	1,565,000	9,012
Trichloroethylene	612	67	11	18.22	2,872,000	9,159

Table 8. Summary of Chemicals Detected in Shallow Soil Gas—Data Collected on the Developed Portion of the Del Amo Site, Near Torrance, California—All Units ($\mu g/m^3$)

Chemical	No. of Samples	No. of Detects	Frequency of Detection (%)	Minimum Concentration Detected	Maximum Concentration Detected	Mean Concentration
Xylenes (Total)	297	51	17	6.5	186,400	2,140
cis-1,2-Dichloroethylene	496	1	0	6.0	6.0	502.7*
m,p-Xylene	6410	31	8	0.8	1,042,000	7,421*
n-Hexane	6	2	33	32,430	59,920	15,410
o-Xylene	6	2	33	1.0	320,800	54,270

Source: Draft baseline risk assessment report for the Del Amo site (30). Soil gas samples (approximately 900) were collected in places around the site where VOCs were stored, transported, or disposed. This table presents the shallow soil gas samples collected from 1 to 15 feet below ground surface (bgs). In the risk assessment from which the numbers in this table were taken, the mean was calculated by halving the detection limit for the non-detects. For some chemicals, the mean was reported as higher than the maximum because the detection limits for the non-detects were high. Those chemicals for which the mean is higher than the maximum are noted by an asterisk next to the mean. The soil gas samples were typically analyzed for the BTEX compounds, to a lesser extent for the common chlorinated solvent VOCs, and to a small extent (approximately 70 of the 900 samples) the samples were analyzed for the entire suite of VOCs. At times, the detection limits for the soil gas samples were very high, resulting in non-detections where there may have been chemicals present.

$\mu g/m^3$—milligrams per cubic meter

Table 9. Summary of Workplace Air Monitoring Study at the Del Amo Site, Near Torrance, California

Chemical	Indoor or Outdoor Air	No. of		Value (ppb)			Typical Concentrations Mean/Max (ppb)	Health Comparison Value (Source) (Values in ppb)
		Samples	Detections	Maximum	Minimum	Average		
Benzene	Indoor	121	116	38	0.38	3.75	13/97	0.03 (CREG) 4 (Intermediate MRL)
	Outdoor	39	35	5.2	0.185	1.76	7.1/25	
Chlorobenzene	Indoor	121	2	0.81	0.08	0.16	<0.23	13.5 (Ambient Air PRG)
	Outdoor	39	0	0.22	0.09	0.15	<0.23/0.11	
Chloroform	Indoor	121	3	0.8	0.08	0.16	1.4/12	20 (Chronic MRL) 50 (Intermediate MRL) 0.008 (CREG)
	Outdoor	39	1	0.25	0.09	0.16	0.47/75	
Cyclohexane	Indoor	121	55	60	0.4	3.03	NA	6,112 (Ambient Air PRG)
	Outdoor	39	14	5.5	0.45	1.55	NA	
1, 1-Dichloroethane	Indoor	121	1	0.63	0.08	0.16	NA	128 (Ambient Air PRG) 0.3 (Cal modified PRG)
	Outdoor	39	0	0.22	0.09	0.15	NA	
1,2-Dichloroethane	Indoor	121	0	0.24	0.08	0.15	<0.20/0.23	0.01 (CREG) 600 (Chronic MRL)
	Outdoor	39	0	0.22	0.09	0.15	NA	
1,1-Dichloroethylene	Indoor	121	1	0.61	0.08	0.16	<0.18	17.6 (Chronic REL) 0.005 (CREG) 20 (Chronic MRL)
	Outdoor	39	0	0.22	0.09	0.15	<0.18	
1,2-Dichloroethylene	Indoor	121	0	0.24	0.08	0.15	NA	200 (Intermediate MRL)
	Outdoor	39	0	0.22	0.09	0.15	NA	
1,2-Dibromoethane (EDB)	Indoor	121	0	0.23	0.18	0.21	NA	0.0065 (CREG)
	Outdoor	39	0	0.22	0.185	0.20	NA	
Ethylbenzene	Indoor	121	113	17	0.1	2.63	5.8/40	1,000 (Intermediate MRL)
	Outdoor	39	35	3.2	0.185	1.16	3.2/16	

Table 9. Summary of Workplace Air Monitoring Study at the Del Amo Site, Near Torrance, California

Chemical	Indoor or Outdoor Air	No. of		Value (ppb)			Typical Concentrations Mean/Max (ppb)	Health Comparison Value (Source) (Values in ppb)
		Samples	Detections	Maximum	Minimum	Average		
Methyl ethyl ketone	Indoor	121	86	230	0.5	16.25	NA	340 (RfC)
	Outdoor	39	24	13	0.18	2.87	NA	
Methylene chloride	Indoor	121	70	12	0.14	1.47	23.8/489	300 (Chronic & Intermediate MRL) 0.86 (CREG)
	Outdoor	39	13	2.5	0.135	0.49	NA	
Styrene	Indoor	121	94	15	0.095	1.42	2.9/23	60 (Chronic MRL)
	Outdoor	39	27	2.2	0.16	0.60	1.7/13	
Tetrachloroethylene	Indoor	121	86	11	0.16	1.28	6.8/53	40 (Chronic MRL) 0.49 (Ambient Air PRG)
	Outdoor	39	23	1.7	0.175	0.51	4.3/18	
Toluene	Indoor	121	121	85	0.59	12.41	NA	80 (Chronic MRL)
	Outdoor	39	37	14	07	5.41	NA	
1,1,1-Trichloroethane	Indoor	121	114	190	0.185	18.13	19/90	700 (Intermediate MRL)
	Outdoor	39	35	17	0.175	2.60	11/40	
Trichloroethylene	Indoor	121	32	10	0.08	0.48	1.2/15	100 (Intermediate MRL) 0.2 (Ambient Air PRG)
	Outdoor	39	4	1.3	0.09	0.21	0.22/1.6	
m,p-Xylene	Indoor	121	116	49	0.185	9.15	30/170	100 (Chronic MRL) 700 (Intermediate MRL) Both values for total Xylene
	Outdoor	39	38	12	0.47	4.22	18/90	
o-Xylene	Indoor	121	109	14	0.17	3.08	12/68	
	Outdoor	39	31	4	0.185	1.50	6.5/29	

Source: In 1994 and 1995, contractors for the responsible parties sampled the workplace air at twelve buildings in the developed portion of the site (5). Typical concentration data are from the Team Study and the Woodland Study (43, 44). These buildings were chosen because the building footprint is located over part of the former rubber plant VOC facility or the shallow soil gas samples collected within 25 feet of the building had indicated an "inhalation hazard to nearby indoor workers" (4). The contractors conducted air sampling on three occasions, once in the fall, winter, and spring. Three to six primary samples were collected at each building per sampling event. The number and location of sample collection points was varied on the basis of building size, layout, worker distribution, the location of former plant site, VOC facilities, and a preliminary "crack and crevice" screening survey for total organic vapor using field instruments. At least one sample per building per event was collected to allow comparison of data with local ambient conditions. Eight-hour-time integrated air samples were collected coinciding with the normal work day. Abbreviations and acronyms used in table: NA—not available; CREG—Cancer Risk Evaluation Guide; MRL—Minimal Risk Level; PRG—Preliminary Remediation Goal; REL—Reference Exposure Limit; ppb—parts per billion; RfC—Reference Concentration.

Table 10. Summary of the Health Evaluation from Exposure to the Indoor Air on the Developed Portion of the Del Amo Site, Near Torrance, California

Potentially Exposed Group		Noncancer Health Effects	Cancer Health Effects
Tract 7351-34-57 (Building located over LNAPL)	Long-term worker	None of the estimated air concentrations exceed their health comparison values.	1.2 in 100,000 Very low increased risk
	Short-term worker		6.3 in 10 million No apparent increased risk
	Child in daycare	The estimated concentration of benzene in indoor air exceeds its health comparison value.	-------
Tract 7351-34-15 Tract 7351-34-50 Tract 7351-34-56 (Building located near LNAPL)	Long-term worker	None of the estimated air concentrations exceed their health comparison values.	1.4 in 1 million No apparent increased risk
	Short-term worker		7.9 in 100 million No apparent increased risk
	Child in daycare		--------
Tract 7351-31-18 (Building not near a groundwater source)	Long-term worker	None of the estimated air concentrations exceed their health comparison values.	1.4 in 1 billion No apparent increased risk
	Short-term worker		8.0 in 100 billion No apparent increased risk
	Child in daycare		--------

The non-aqueous phase liquid (NAPL) advance model, as recommended by Environmental Protection Agency (EPA), was used to estimate the amount and risk from soil gas that would move from the light non-aqueous phase liquid (LNAPL) (groundwater) into the soil gas and then into the structure on Tract 7351-34-57 (38, 39). The soil column was assumed to be composed of three stratums and soil characteristics as described in the risk assessment. The LNAPL concentration (1,826 parts per million [ppm] in soil), the length, width, and height of the LNAPL were taken from the HRS Scoring Package. Fifty percent of the building was assumed to be located over the LNAPL based on data in the Groundwater Remedial Investigation Report. The Johnson and Ettinger soil gas advance model, as recommended by EPA, was used to estimate the amount and risk from the soil contamination beneath the structure into the structures located on the three tracts (37, 41). The vadose zone soil was input as SCL. Buildings were assumed not to have basements. Building dimensions (length and width) were estimated from maps. Height of the buildings was assumed to be 300 centimeters. The maximum soil gas concentrations taken from building-perimeter sampling (for soil gas modeling samples should be taken within the zone of influence of the building) were used, the soil gas values came from samples collected 6-7 feet below ground surface (bgs). The maximum concentrations of chemicals in the near building soil gas samples were used in the model. For the building on Tract 7351-34-57, the following soil gas samples were used in the model SGL0283, SGL0284, SGL0287, SGL0294, SGL0594, and SGL0615. For the building on Tracts 7351-34-15, 50, 56, the following soil gas samples were used in the model SGL0002, SGL0005, SGL0008, SGL0353, SGL0356, and SGL0357. For the building on Tract 7351-31-18, two soil gas samples (SGL0271 and SGL0558) were used in the model. Equations for determination of dose are shown in EPA's Risk Assessment Guidelines for Superfund. Long-term and occasional (short-term) worker weight: 70 kilograms (154 pounds). Child weight (13.5 kilograms or 30 pounds) was derived from the average of the 50th percentile of boys and girls aged 6 months to 5 years from EPA's Exposure Factors Handbook (47). The following were assumed for exposure duration: 250 days per year for 25 years for the long-term worker; 14 days per year for 25 years for the short-term worker and 250 days per year for 4.5 years for the child attending daycare. Inhalation rate was assumed to be 20 meters cubed per day (m^3/day) for the worker and the child's inhalation rate (7.2 m^3/day) was derived from the average of children from 0.5 to 5 years from EPA's Exposure Factors Handbook (47). The noncancer determination is based on a comparison of the estimated dose to the noncancer health comparison value for each chemical. If the indoor air concentration did not exceed the noncancer health comparison value than that the chemical was determined not to pose a health risk. Cancer risk is calculated by multiplying the estimated indoor air concentration by the unit risk factor derived by EPA or the California Office of Environmental Health Hazard Assessment (OEHHA), and summing the risks from each carcinogen present in the soil gas/LNAPL (groundwater). For the long-term worker and child attending day-care chronic health comparison values were used. For the short-term worker, acute or intermediate health comparison values were used if available. Noncancer health comparison values and cancer slope factors used in this evaluation are listed in Appendix F or here: chloroform (OEHHA inhalation unit risk = 5.3 x 10-6 (micrograms per meter cubed)$^{-1}$ [$\mu g/m^3$]$^{-1}$ and OEHHA chronic Reference Exposure Level = 300 $\mu g/m^3$); 1,1,1-trichloroethane (ATSDR intermediate Minimal Risk Level = 700 parts per billion [ppb]; 1,4-dichlorobenzene (EPA Reference Concentration [RfC] = 800 $\mu g/m^3$, Agency for Toxic Substances and Disease Registry (ATSDR) chronic Minimal Risk Level = 100 ppb and intermediate Minimal Risk Level = 200 ppb); acetone (EPA RfC = 13,000 $\mu g/m^3$); and 1,1,2,2-tetrachloroethane (ATSDR intermediate Minimal Risk Level = 400 ppb).

Table 11. Summary of Chemicals Detected in Two Surface Soil Composite Samples from the Waste-pit Area on the Del Amo Site, Near Torrance, California

Chemical Type	Chemical	Fill Soil Overlying		EPA Region IX Residential Soil PRG (ppm)	Health Comparison Value‡ (Source) Average Background (Bkgd) Concentration for Metals (ppm)
		Waste Pits (ppm)	Evaporation Ponds (ppm)		
SVOC	Acenaphthylene	0.81	0.78	NA	-
SVOC	2-Methylnaphthalene	0.63	0.7	NA	-
SVOC	Phenanthrene	0.58	0.43	NA	-
SVOC	Pyrene	0.4	0.48	100	2,000 (Child RMEG)
Pesticide	4,4'-DDD	0.12	0.12	1.9	30 (Child RMEG)
Pesticide	4,4'-DDE	0.14	0.067	1.3	30 (Child RMEG)
Pesticide	4,4'-DDT	1.5	0.2	1.3	1.0 (CREG)
Metal	Arsenic	9.2	7	0.38	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Metal	Barium	170	170	5,300	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Metal	Cadmium	6.2	6.7	9	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Metal	Chromium	56	35	210	80,000 (Child RMEG) Bkgd=23-1,579 (122)
Metal	Cobalt	12	12	4,600	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Metal	Copper	32	25	2,800	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)

Table 11. Summary of Chemicals Detected in Two Surface Soil Composite Samples from the Waste-pit Area on the Del Amo Site, Near Torrance, California

Chemical Type	Chemical	Fill Soil Overlying		EPA Region IX Residential Soil PRG (ppm)	Health Comparison Value‡ (Source) Average Background (Bkgd) Concentration for Metals (ppm)
		Waste Pits (ppm)	Evaporation Ponds (ppm)		
Metal	Lead	41	15	130	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)
Metal	Manganese	640	640	3,200	3,000 (Child RMEG) Bkgd=253-1,687 (646)
Metal	Nickel	21	17	150	1,000 (Child RMEG) Bkgd=9-509 (57)
Metal	Vanadium	48	47	540	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Metal	Zinc	120	88	23,000	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)

Source: As a part of the phase I remedial investigation, one composite sample was collected from the waste pits and one composite sample was collected from the evaporation ponds (23). Background soil data obtained from "Background concentrations of trace and major elements in California soils" (33). Specifically, three locations (SSL0017, SSL0018, and SSL0019) overlying the 2 series pits were sampled and combined into one composite sample and four locations (SSL0020, SSL0021, SSL0022, and SSL0023.) overlying the 1 series evaporation ponds were sampled and composited. The two samples were analyzed for SVOCs, pesticides/PCBs, metals, and cyanide.
Abbreviations and acronyms used in table: SVOC—semi-volatile organic compound; ppm—parts per million; RMEG—Reference Dose Media Evaluation Guide; CREG—Cancer Risk Evaluation Guide; EMEG—Environmental Media Evaluation Guide; DDT—dichlorodiphenyltrichloroethane; DDE—dichlorodiphenyldichloroethane; DDT—dichlorodiphenylchloroethane; PRG—Preliminary Remediation Goal; NA—not available.

Table 12. Summary of Ambient Air Contaminants Detected at the Waste-Pit Area and in Backyards on 204th Street, Del Amo Site, Near Torrance, California

Chemical	Level Measured in Air Near Waste Pits (ppb)	Level Measured in Air in Backyards (ppb)	SCAQMD's Maximum Background Levels (ppb)	Health Comparison Levels (ppb)	References for Health Comparison Levels
1,1,1-Trichloroethane	6.52	2.23	5.40	700	i-EMEG/MRL
1,2,4-Trimethylbenzene	2.8	2.4	NA	NA	-----
1,2-Dichlorobenzene	2.6	ND	0.40	34.64	PRG
1,3,5-Trimethylbenzene	0.82	0.7	NA	NA	-----
1,4-Dichlorobenzene	0.93	ND	0.40	200	i-EMEG/MRL
Benzene	3.2	2.8	5.50	0.03	CREG
Ethylbenzene	1.4	1.4	1.43	300	i-EMEG/MRL
Isopropylbenzene	4.9	0.8	NA	1.91	PRG
m,p-Xylene	8.3	5.4	2.4	300/40	a-EMEG/MRL
Methylene chloride	12	104.1	2.6	0.86	CREG
n-Propylbenzene	0.55	ND	NA	NA	-----
o-Xylene	2.9	1.29	16.50	400	a-EMEG/MRL
p-Isopropyl toluene	0.93	0.8	NA	NA	-----
Styrene	1.9	0.7	1.10	235	RfC
Tetrachloroethylene	2.3	8.3	2.00	0.29	CREG
Toluene	10	0.05	9.4	106.15	RfC
Naphthalene	0.12	0.05	NA	2	c-EMEG/MRL

Table 12. Summary of Ambient Air Contaminants Detected at the Waste-Pit Area and in Backyards on 204th Street, Del Amo Site, Near Torrance, California

Chemical	Level Measured in Air Near Waste Pits (ppb)	Level Measured in Air in Backyards (ppb)	SCAQMD's Maximum Background Levels (ppb)	Health Comparison Levels (ppb)	References for Health Comparison Levels
Acenapthalene	0.002	0.000097	NA	34.9	-----
Acenapthylene	0.006	0.00019	NA	NA	-----
Fluorene	0.002	0.00018	NA	22.1	PRG
Phenanthrene	0.002	0.00035	NA	NA	PRG
Anthracene	0.002	0.00014	NA	151	PRG
Fluoranthene	0.001	0.000033	NA	18.1	PRG
Pyrene	0.001	0.000031	NA	13.3	PRG

Source: Del Amo facility health consultation, potential health impacts due to the emissions from the waste pits (45).
Abbreviations and acronyms used in table: ppb—parts per billion ; ND—not detected; NA—not available; PRG—EPA Preliminary Remediation Goals; RfC—EPA Reference Concentration; CREG—ATSDR Cancer Risk Evaluation Guide for 1 x 10^{-6} excess cancer risk; a-EMEG/MRL—ATSDR Environmental Media Evaluation Guide/acute Minimal Risk Level; c-EMEG/MRL—ATSDR Environmental Media Evaluation Guide/chronic Minimal Risk Level; i-EMEG/MRL—ATSDR Environmental Media Evaluation Guide/intermediate Minimal Risk Level; SCAQMD—South Coast Air Quality Management District.

Table 13. Summary of the Health Evaluation From Exposure to the Indoor Air in the Neighborhood South of the Del Amo Site, Near Torrance, California

Potentially exposed group	Noncancer	Cancer
Residents on the western side (near Normandie Avenue)	None expected None of the estimated indoor air levels exceed health comparison values	4 in 10 million No apparent increased cancer risk
Residents on the eastern side (near Vermont Avenue)	None expected None of the estimated indoor air levels exceed health comparison values	8 in 100 million No apparent increased cancer risk

The revised Johnson and Ettinger groundwater screening model as adopted by EPA was used to estimate indoor air exposures in residences located south of the Del Amo site situated over contaminated groundwater plumes (48). For the residents living on the western side (near Normandie Avenue), monitoring well data for SWL0049 was used. For the residents on the eastern side (near Vermont Avenue), monitoring well data for SWL0057 was used. These wells were chosen for modeling because they are wells that have measurable levels of contamination in them and the wells are located in the neighborhood. Data were obtained from the Groundwater Remedial Investigation Report (3). Default values were used for the soil characteristics. Depth to groundwater = 1,435 cm or 47 feet. Building dimensions (length and width) were estimated from maps. Height of the buildings was assumed to be 300 cm. Equations for determination of dose are shown in EPA's Risk Assessment Guidelines for Superfund. The noncancer determination is based on a comparison of the estimated indoor air concentration to the chronic noncancer health comparison value (Minimal Risk Level (MRL), Reference Concentration (RfC) or Reference Exposure Level (REL) for each chemical). If the indoor air concentration did not exceed the noncancer health comparison value than that the chemical was determined not to pose a health risk. Cancer risk is calculated by multiplying the estimated indoor air concentration by the unit risk factor derived by EPA or OEHHA, and summing the risks from each carcinogen present in the groundwater. The resident's weight was assumed to be 70 kilograms (154 pounds) and inhalation rate was assumed to be 20 m^3/day. Noncancer health comparison values and cancer slope factors used in this evaluation are listed in Appendix F or here: chloroform (OEHHA inhalation unit risk = 5.3 x 10-6 $(\mu g/m^3)^{-1}$ and OEHHA chronic REL = 300 $\mu g/m^3$); 1,4-dichlorobenzene (EPA RfC = 800 $\mu g/m^3$, ATSDR chronic Minimal Risk Level = 100 ppb); 1,2-dichloroethane (EPA inhalation risk = 2.6 x 10-5 $(\mu g/m^3)^{-1}$ and ASTDR chronic Minimal Risk Level = 600 ppb); methylene chloride (EPA inhalation risk = 4.7 x 10-7 $(\mu g/m^3)^{-1}$ and ATSDR chronic and intermediate Minimal Risk Level = 300 ppb); and naphthalene (OEHHA chronic REL = 9 $\mu g/m^3$and ATSDR chronic MRL= 2 pp

Table 14. Summary of Surface and Near Surface Soil Data From the Neighborhood South of the Del Amo Site, Near Torrance, California

Year of Sampling	1983		1993	1995		Health Comparison Value (Source) Average Background (Bkgd) Concentration for Metals
Depth of Sample (bgs)	0-0.5 ft.	2-3 ft.	0-0.5ft.	0.5 ft.	2 ft.	
Number of Samples	9	9	21	66*	64†	
All VOCs	NA	NA	NA	<0.654-2.17	<0.144-1.85	-
Arsenic	4.5-19.4 (10.1)	8.16-12 (10.4)	2.5-14 (4.6)	3.23-9.37 (5.86)	3.39-3.8 (3.60)	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Barium	71.2-169 (117)	137-219 (160)	110-450 (195)	56.2-253 (133)	17-460 (129)	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Cadmium	0.91-6.67 (2.1)	1.22-2.12 (1.6)	1.5-29 (8.5)	0.85-30.2 (4.89)	0.15-881 (164)	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Chromium	8.83-51.4 (20.9)	16.8-47.7 (24.7)	22-210 (52)	15.7-24.6 (9.15)		80,000 (Child RMEG) Bkgd=23-1,579 (122)
Cobalt	6.19-19.7 (9.6)	8.42-10.7 (9.6)	8.9-16 (12)	0.74-24.6 (9.15)	2.93-156 (18.1)	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Copper	11.0-24.6 (19)	14.9-23.3 (17.7)	26-1,600 (141)	2.48-459 (95.5)	20.7-156 (68.6)	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)
Lead	20.7-88.1 (37.4)	13-28.2 (19.4)	54-450 (150)	9.5-2,280 (183)	6.0-392 (104)	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)
Nickel	5.08-24.0 (12.8)	10.4-23.0 (13.7)	15-570 (92)	12.4-585 (160)	15.2-345 (102)	1,000 (Child RMEG) Bkgd=9-509 (57)
Vanadium	NA	NA	33-71 (50)	23.8-137 (38.7)	6.3-84 (38)	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Zinc	38.4-135 (75.6)	41.4-58.1 (48.0)	140-1,600 (335)	69.3-1100 (266)	15.8-497 (138)	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)
All SVOCs	<5	<5	<0.2 (except for the ones indicated below	<1.46	<0.763	---

Table 14. Summary of Surface and Near Surface Soil Data From the Neighborhood South of the Del Amo Site, Near Torrance, California

Year of Sampling	1983		1993	1995		Health Comparison Value (Source) Average Background (Bkgd) Concentration for Metals
Depth of Sample (bgs)	0-0.5 ft.	2-3 ft.	0-0.5ft.	0.5 ft.	2 ft.	
Number of Samples	9	9	21	66*	64†	
Butylbenzylphthalate	<5	<5	0.30; 0.20; 0.21	NA	NA	10,000 (Child RMEG)
Bis(2-ethylhexyl)phthalate	<5	<5	0.35; 0.71; 0.61; 1.4	NA	NA	35 (Residential PRG)
Benzo(a)anthracene	<5	<5	0.24	NA	NA	0.01 (BAP-eq CREG)
Benzo(a)pyrene	<5	<5	0.2	NA	NA	0.1 (CREG)
Benzo(b)fluoranthene	<5	<5	0.28	NA	NA	0.01 (BAP-eq CREG)
Chrysene	<5	<5	0.37	NA	NA	10 (BAP-eq CREG)
Dimethylphthalate	<5	<5	0.25	NA	NA	100,000 (Residential PRG)
Phenanthrene	<5	<5	0.47; 0.22	NA	NA	---
Phenol	<5	<5	0.78; 0.31	NA	NA	30,000 (Child RMEG)
Di-n-butylphthalate	<5	<5	0.20	NA	NA	6,100 (Residential PRG)
Fluoranthene	<5	<5	0.27	NA	NA	2,000 (Child RMEG)
Di-n-octylphthalate	<5	<5	<5	NA	NA	1,200 (Residential PRG)
DDT (total)	0.035-1.7 (0.420)	0.003-0.218 (0.039)	1.04-111 (11.83)	<2.02-147 (3.49)	<0.219-70.5 (1.52)	30 (Child RMEG) 2 (CREG)

Source: Data obtained from a number of sources (6-10). Sampling data and background concentrations presented as ranges followed by the average in parentheses. Background soil data obtained from "Background concentrations of trace and major elements in California soils" (33). *There were 66 samples analyzed for DDT and not for the full suite of contaminants. For instance, only 30 surface (0.5 ft) samples were analyzed for most metals, five for VOCs, four for SVOCs, Pesticides/PCBs, and Herbicides. Only three samples were analyzed for arsenic and selenium. † There were 64 samples analyzed for DDT and not for the full suite of contaminants. For instance, only 15 samples were analyzed for most metals, three for VOCs, two for SVOCs, Pesticides/PCBs, and Herbicides. Only two samples were analyzed for arsenic and selenium.

Abbreviations and acronyms used in table: ft.—feet; bgs—below ground surface; EMEG—Environmental Media Evaluation Guide; CREG—Cancer Risk Evaluation Guide; RMEG—Reference Dose Evaluation Guide; PRG—Preliminary Remediation Guide; NA— not analyzed; VOCs—volatile organic compounds; BaP-eq—benzo(a)pyrene equivalent; SVOCs—semi-volatile organic compounds; DDT—dichlorodiphenyltrichloroethane.

Table 15. Post-Grading Soil Tests in Proposed Neighborhood Park South of the Del Amo Site, Near Torrance, California

Chemical	Concentration of Chemical (ppm) in Each Sample										Health Comparison Value (Source) Average Background (Bkgd) Concentration for Metals
	SS-31D	SS-35D	SS-30D	SS-16D	SS-21D	SS-29D	SS-18D	SS-17D	SS-5	SS-6	
Arsenic	3.5	4.8	4.1	5.8	4.7	4.2	6.4	5.4	5.1	5.1	20 (Child Chronic EMEG) 0.5 (CREG) Bkgd=0.6-11 (3.5)
Barium	130	170	230	190	170	130	130	200	160	170	4,000 (Child RMEG) Bkgd=133-1,400 (509)
Cadmium	ND	ND	ND	ND	ND	0.56	1.2	ND	ND	0.62	10 (Child EMEG) Bkgd=0.05-1.7 (0.36)
Chromium	20	22	25	33	27	19	57	26	25	31	80,000 (Child RMEG) Bkgd=23-1,579 (122)
Cobalt	8.4	11	11	12	13	9.1	11	11	12	12	500 (Child Intermediate EMEG) Bkgd=2.7-46.9 (14.9)
Copper	23	36	28	39	27	26	130	29	30	40	2,900 (Residential PRG) Bkgd=9.1-96.4 (28.7)
Lead	22	39	15	26	15	120	44	28	14	29	400 (Residential PRG) Bkgd=12.4-97.1 (23.9)
Nickel	17	20	20	39	21	18	76	21	24	39	1,000 (Child RMEG) Bkgd=9-509 (57)
Vanadium	39	44	52	55	51	35	53	50	50	50	200 (Child Intermediate EMEG) Bkgd=39-288 (112)
Zinc	99	190	76	88	74	160	110	120	78	110	20,000 (Child Chronic EMEG) Bkgd=88-236 (149)

Source: Environmental mitigation closure report, neighborhood park project (25). Background soil data obtained from "Background concentrations of trace and major elements in California soils" (33).

Abbreviations and acronyms used in the table: ppm—parts per million; EMEG—Environmental Media Evaluation Guide; CREG—Cancer Risk Evaluation Guide; RMEG—Reference Dose Media Evaluation Guide; PRG—Preliminary Remediation Goal.

Appendix C—Figures

Figure 1. Location of the Del Amo Site, Near Torrance, California
(Data Source: Dames and Moore Location Map)

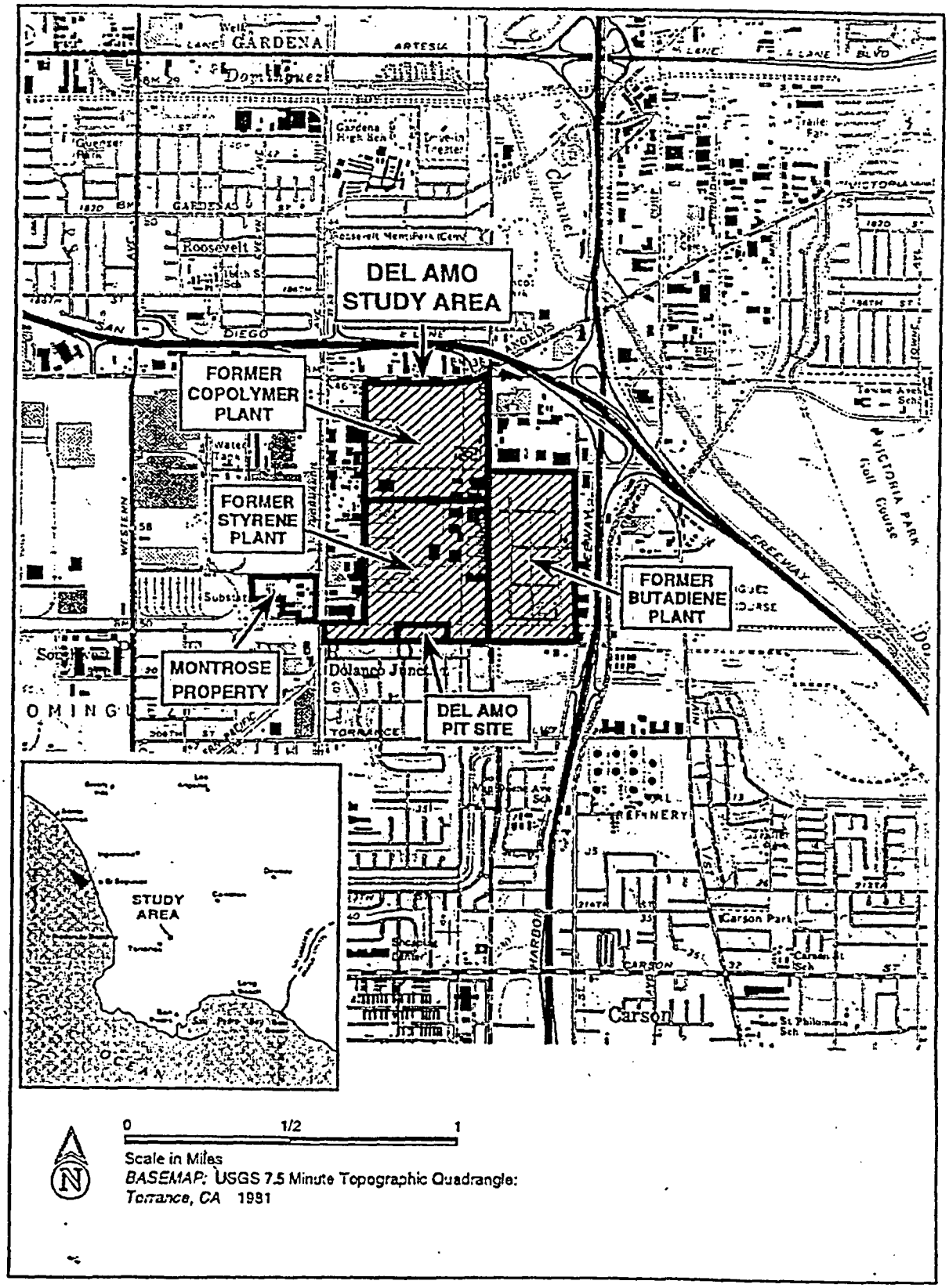
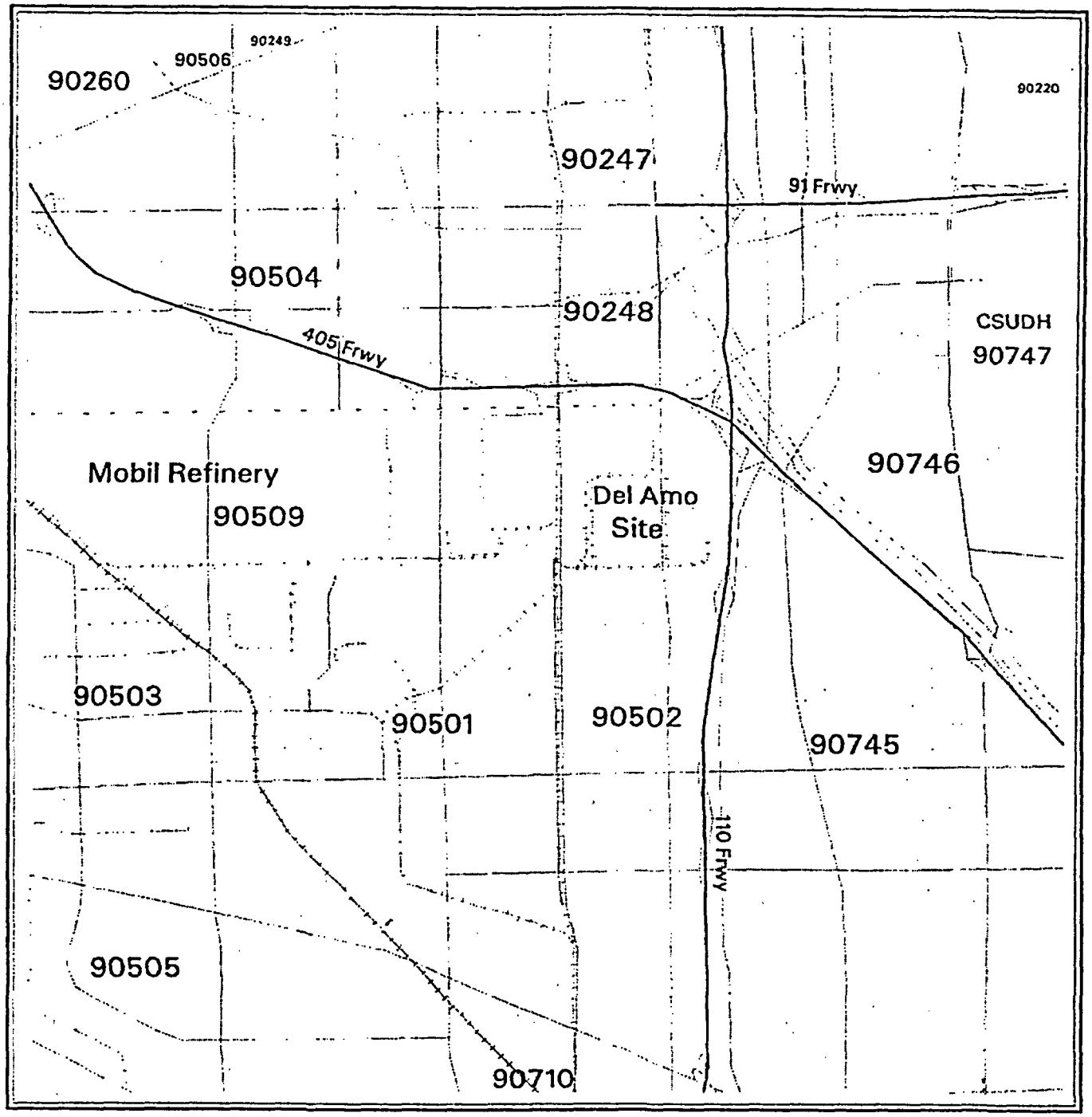


Figure 2. Del Amo Site, Near Torrance, California and Surrounding Zip Codes



1 inch = 3,750 ft = 0.71 miles

Figure 3. Exposure Areas of Potential Concern on the Del Amo Site, Near Torrance, California
(Data Source: URS Baseline Risk Assessment)

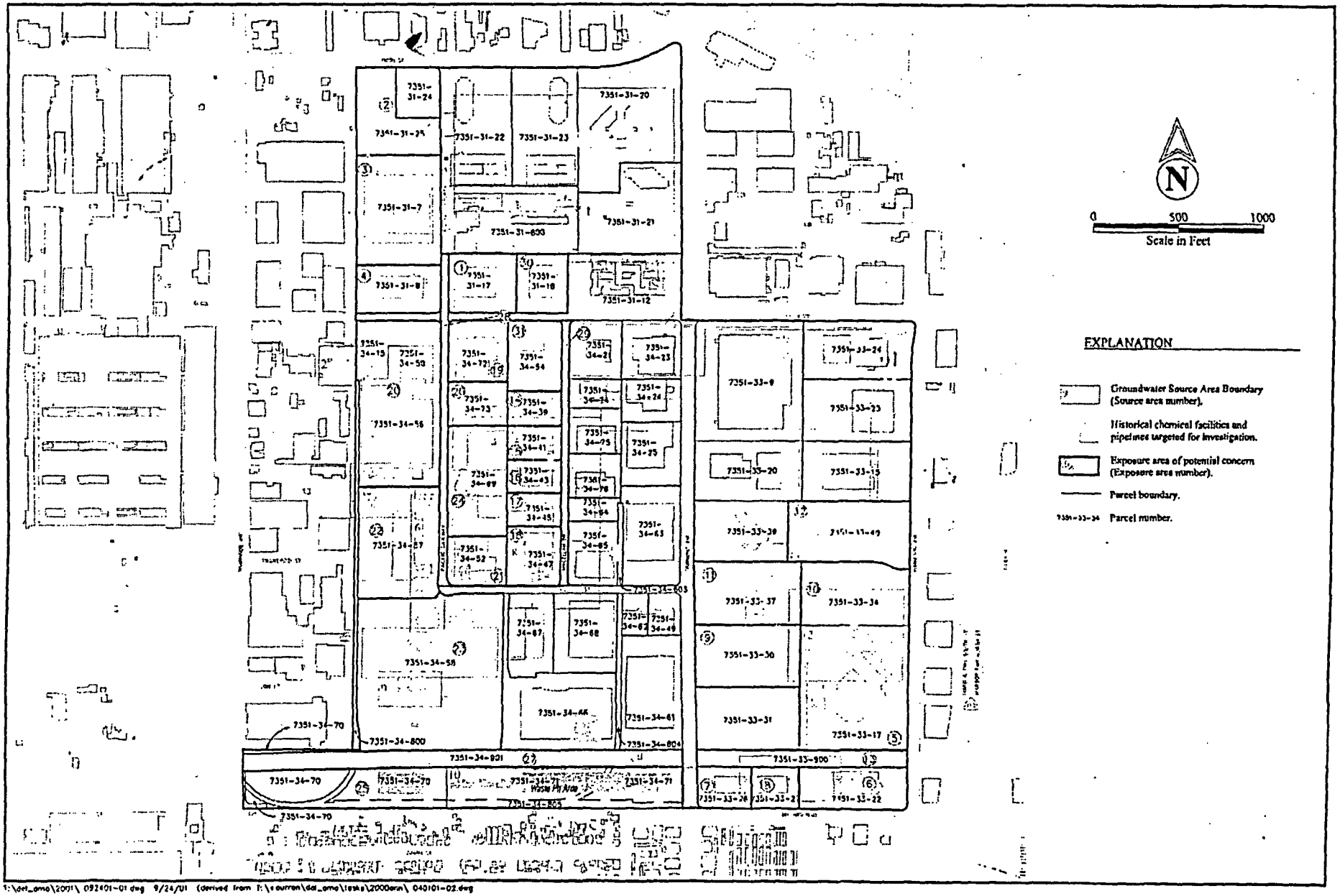


Figure 4. Benzene Groundwater Contamination in the Watertable Closest to the Surface, Del Amo Site, Near Torrance, California
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)

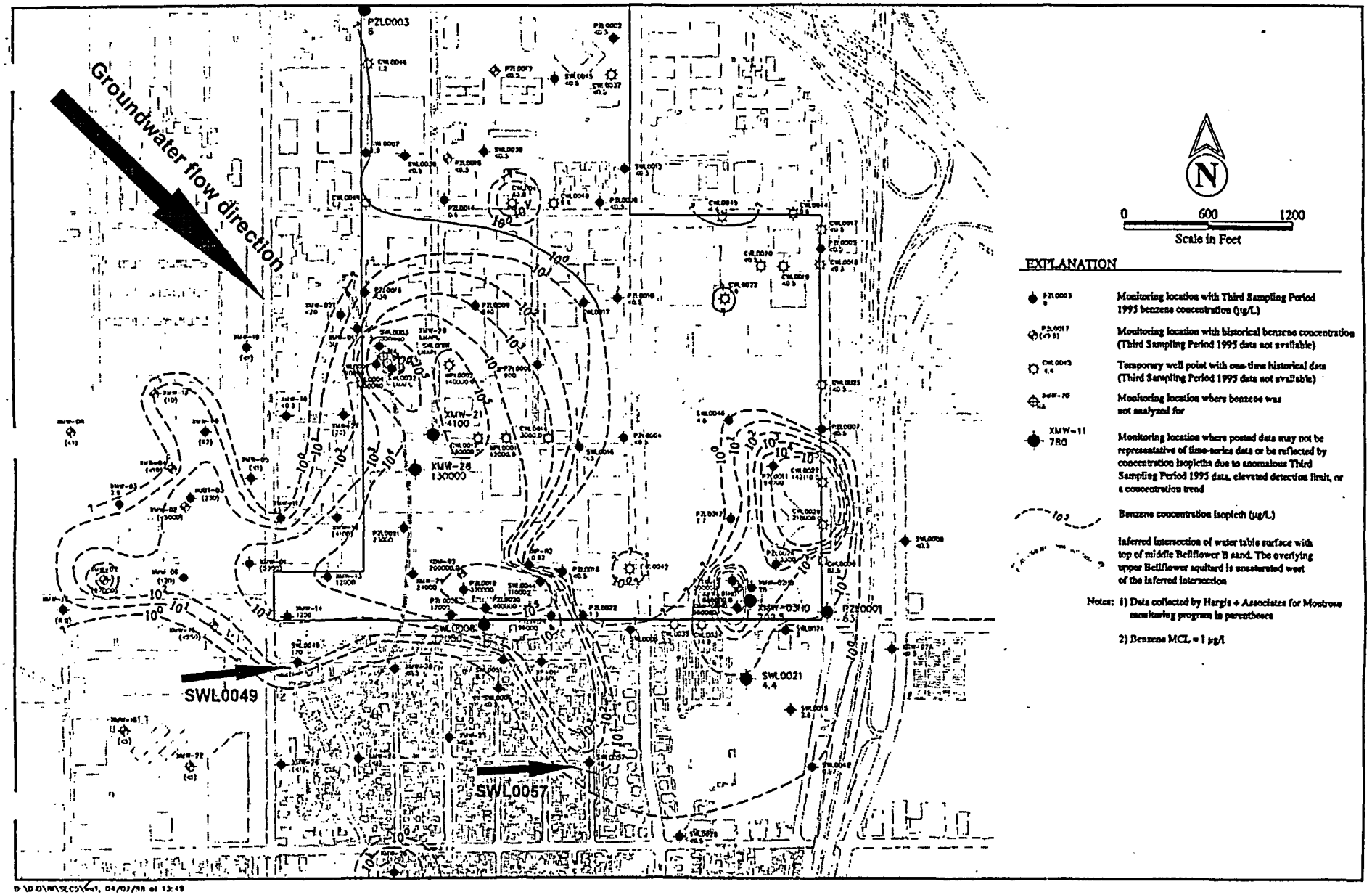


Figure 5. Locations of Groundwater Contamination Sources in Addition to the Del Amo Site, Near Torrance, California
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)

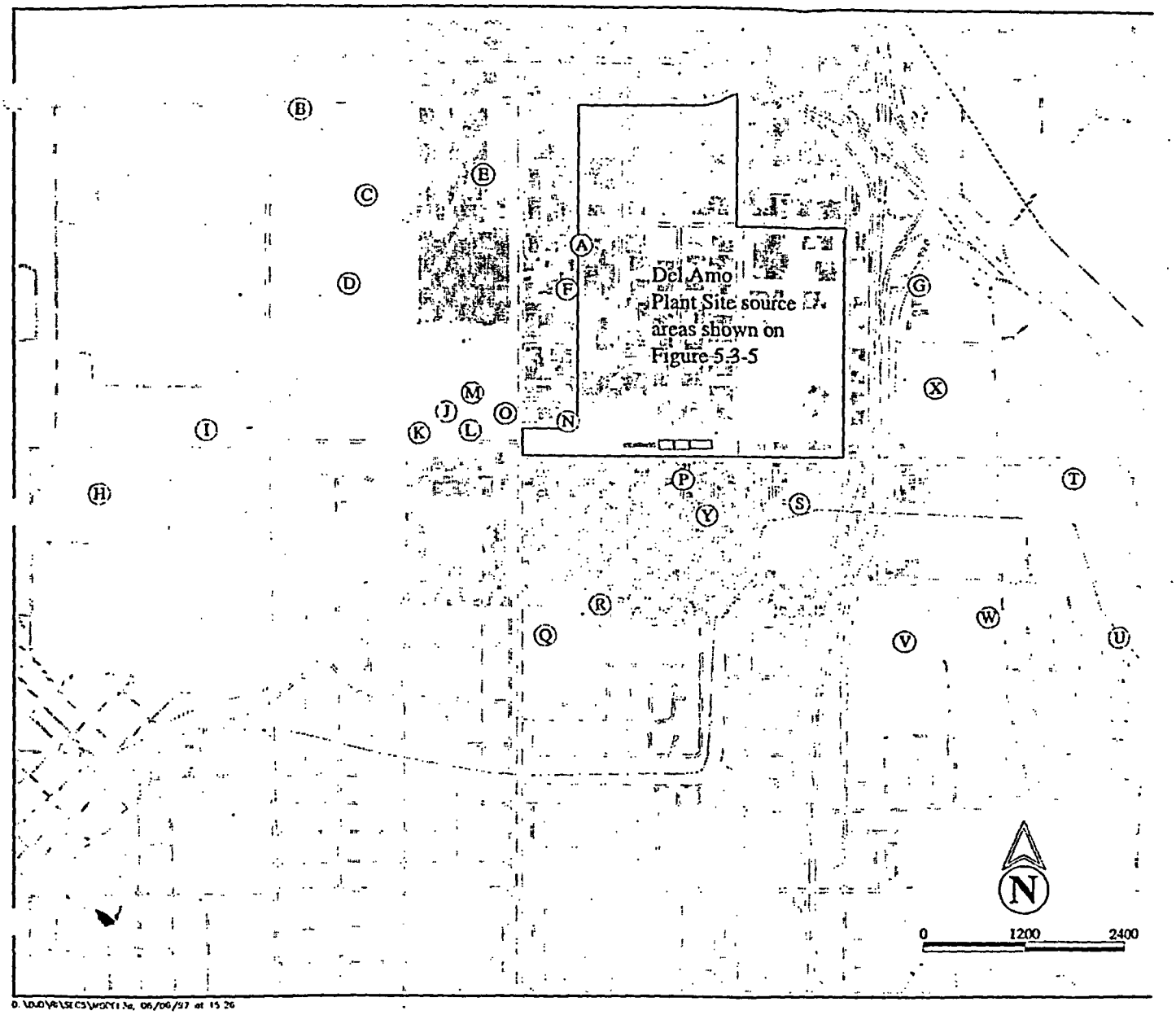


Figure 5. Locations of Groundwater Contamination Sources in Addition to the Del Amo Site, Near Torrance, California—Legend
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)

Source	Local Facility*	VOCs with Elevated Concentrations in Groundwater
A	Amoco/Del Amo (?)	TCE, PCE, chloroform
B	International Light Metals	TCE
C	International Light Metals/ McDonnell Douglas	TCE
D	International Light Metals	TCE, PCE, 1,1-DCE, 1,1-DCA
E	McDonnell Douglas	1,1-DCE, toluene, benzene, TCE, 1,1,1-TCA
F	Trico	1,1-DCA, TCE, PCE, vinyl chloride
G	Penske Truck Leasing	benzene
H	Mobil Oil Refinery	BTEX
I	Allied Signal	1,1-DCE, 1,1-DCA, 1,1,1-TCA, benzene
J	Jones Chemical	TCE, PCE, 1,1-DCE
K	XMW-07 LNAPL	BTEX, 1,1-DCA
L	Jones Chemical	TCE, PCE, benzene, 1,1-DCE, 1,1-DCA
M	Montrose	chlorobenzene, p-CBSA, chloroform
N	unknown	BTEX, TCE, 1,2-DCA, 1,2,4-trimethylbenzene
O	unknown	benzene
P	P-1 LNAPL Pipeline leakage?	benzene, naphthalene
Q	Azko	toluene
R	Arnco	BTEX, chlorobenzene, p-CBSA
S	Gardena Valley Landfill	benzene, PCE, TCE, vinyl chloride
T	Cal Compact Landfill	vinyl chloride, TCE, PCE, cis-1,2-DCE, benzene
U	Cal Compact Landfill	BTEX
V	Golden Eagle Refinery	BTEX
W	Golden Eagle Refinery	vinyl chloride, cis-1,2-DCE, TCE, PCE
X	Southwest Conservation Landfill	PCE, TCE, 1,1-DCA, vinyl chloride
Y	Boring SBL0102 LNAPL Pipeline leakage?	groundwater not tested

* Indicates only the name of the local facility at the time the analytical data was collected and does not necessarily reflect responsibility for the contamination present

Figure 6. Chlorobenzene Groundwater Contamination in the Watertable Closest to the Surface, Del Amo Site, Near Torrance, California (Data Source: Dames and Moore Groundwater Remedial Investigation Report)

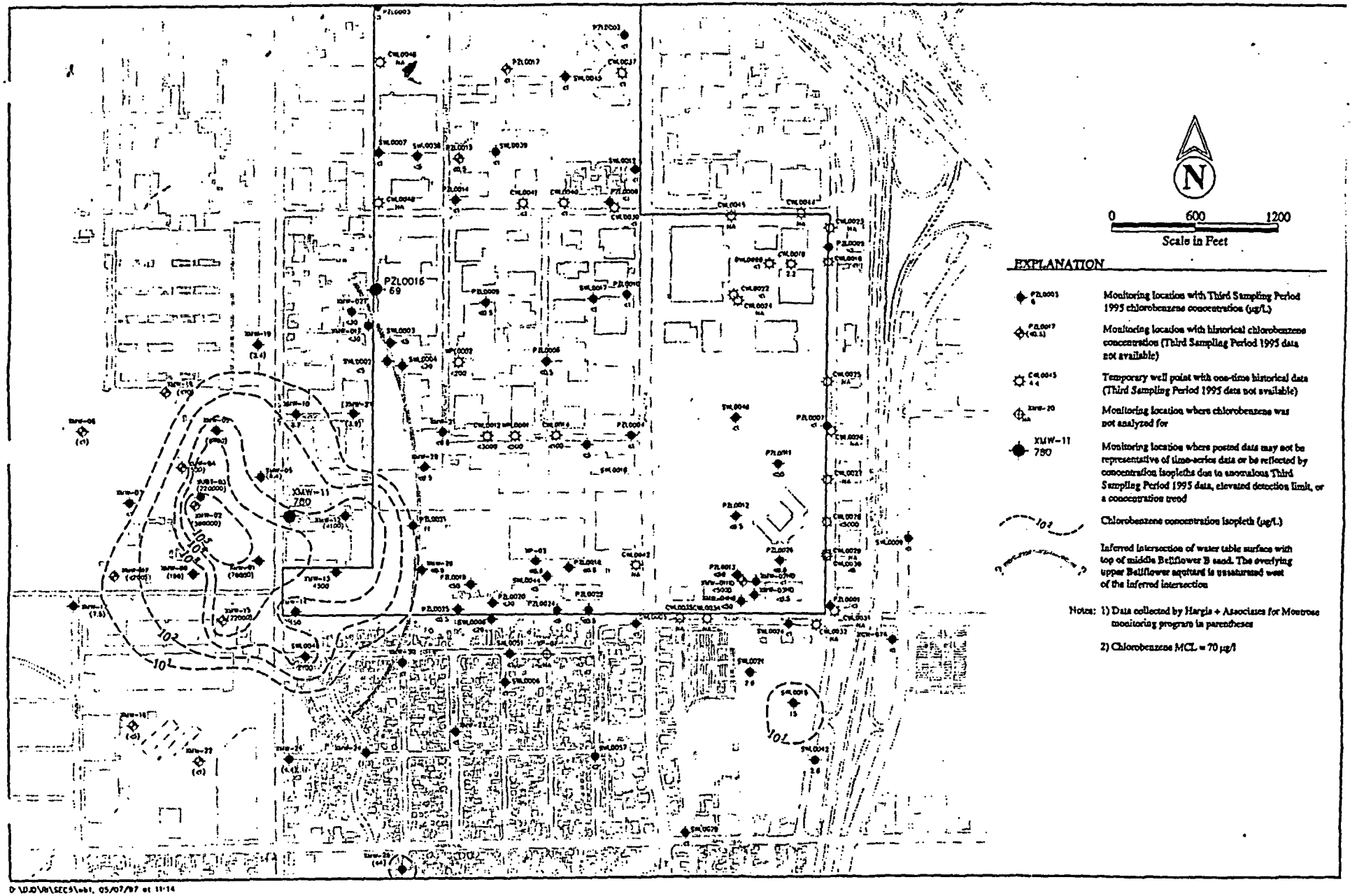
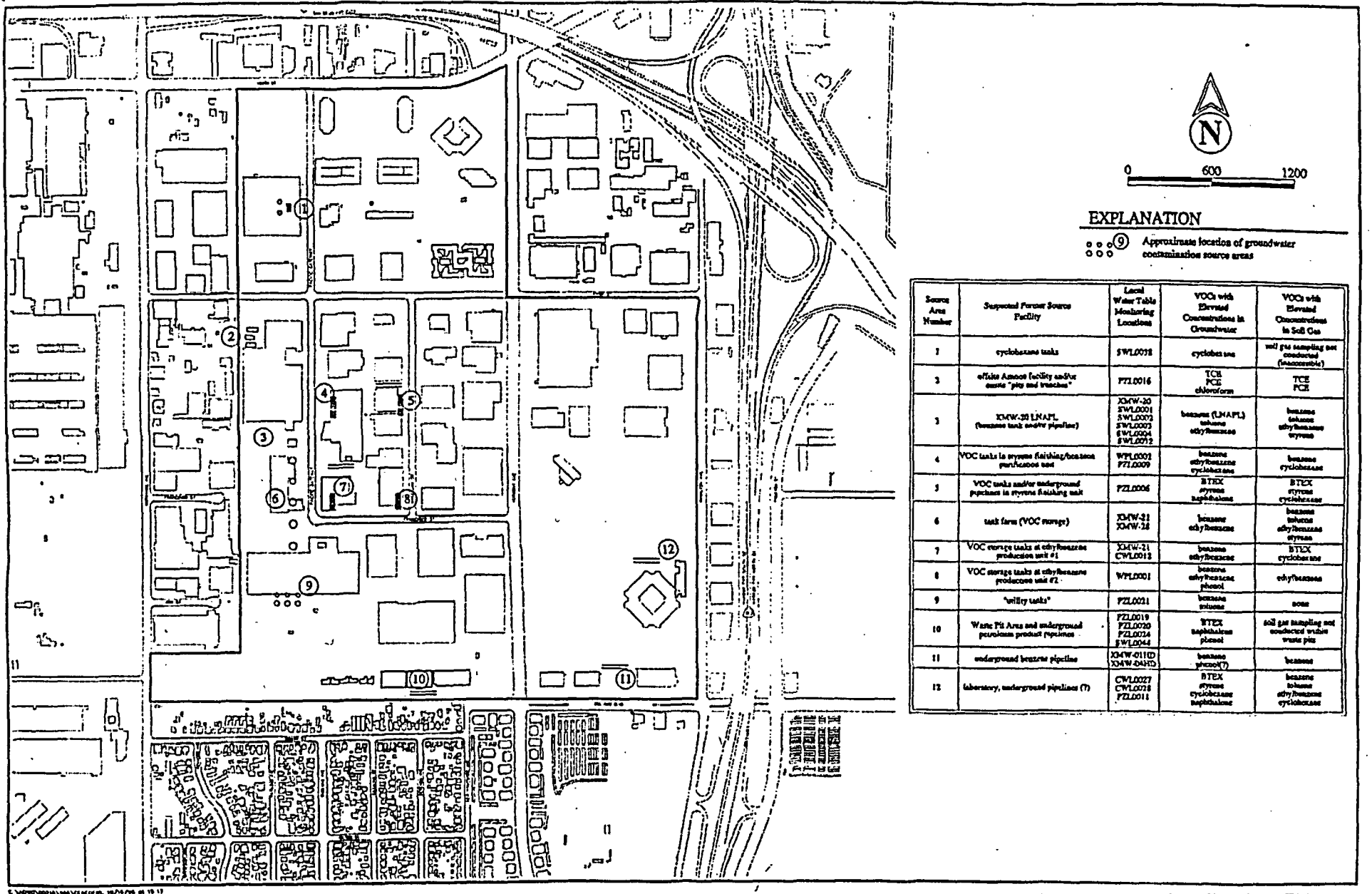


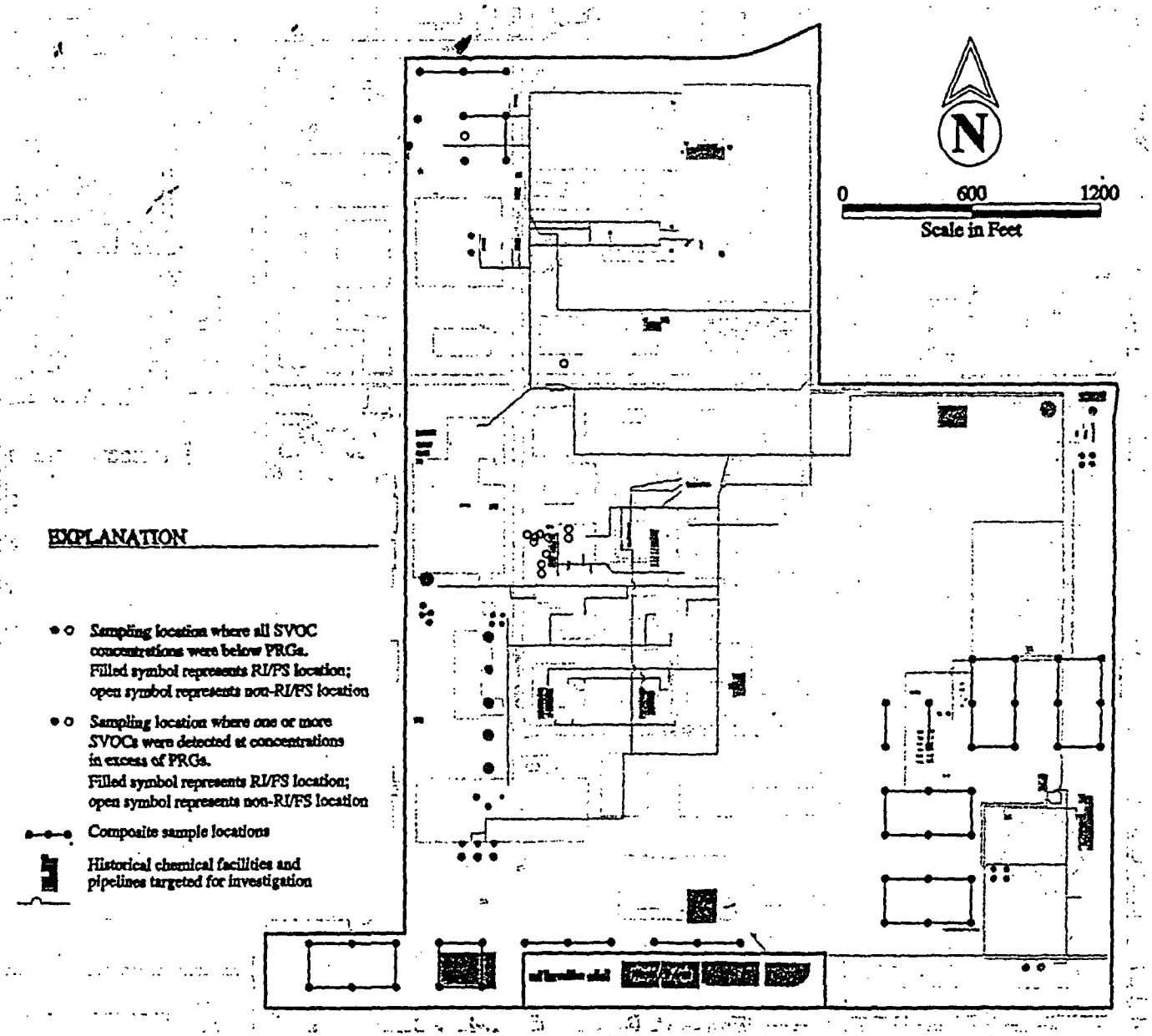
Figure 7. Locations of Source Areas for Groundwater Contamination on the Del Amo Site, Near Torrance, California
(Data Source: Dames and Moore Groundwater Remedial Investigation Report)



Source Area Number	Suspected Former Source Facility	Local Water Table Monitoring Locations	VOCs with Elevated Concentrations in Groundwater	VOCs with Elevated Concentrations in Soil Gas
1	cyclohexane tanks	SWL0038	cyclohexane	soil gas sampling not conducted (inaccessible)
2	offsite Amoco facility and/or waste "pits and trenches"	PZL0016	TCE PCE chloroform	TCE PCE
3	XMW-20 LNAPL (benzene tank and/or pipeline)	XMW-20 SWL0001 SWL0002 SWL0003 SWL0004 SWL0012	benzene (LNAPL) toluene ethylbenzene	benzene toluene ethylbenzene styrene
4	VOC tanks in styrene finishing/benzene purification unit	WPL0001 PZL0009	benzene ethylbenzene cyclohexane	benzene cyclohexane
5	VOC tanks and/or underground pipelines in styrene finishing unit	PZL0006	BTEX styrene naphthalene	BTEX styrene cyclohexane
6	tank farm (VOC storage)	XMW-21 XMW-28	benzene ethylbenzene	benzene toluene ethylbenzene styrene
7	VOC storage tanks at ethylbenzene production unit #1	XMW-21 CWL0012	benzene ethylbenzene	BTEX cyclohexane
8	VOC storage tanks at ethylbenzene production unit #2	WPL0001	benzene ethylbenzene phenol	ethylbenzene
9	"utility tanks"	PZL0021	benzene toluene	none
10	Waste Pit Area and underground petroleum product pipelines	PZL0019 PZL0020 PZL0024 SWL0044	BTEX naphthalene phenol	soil gas sampling not conducted within waste pits
11	underground benzene pipeline	XMW-01UD XMW-04HD	benzene phenol(?)	benzene
12	laboratory, underground pipelines (?)	CWL0027 CWL0028 PZL0011	BTEX styrene cyclohexane naphthalene	benzene toluene ethylbenzene cyclohexane

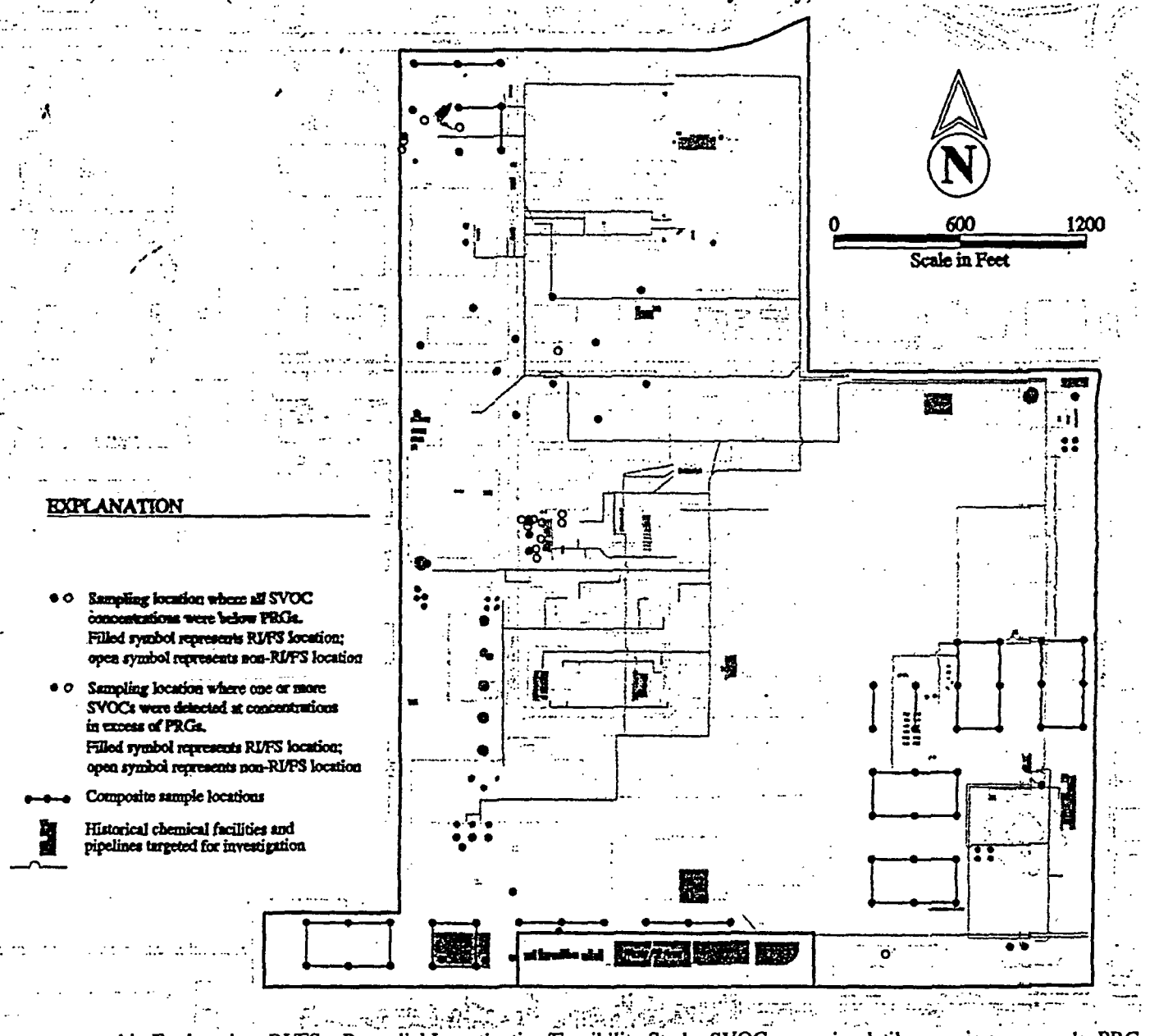
Acronyms used in Explanation: VOCs—volatile organic compounds; TCE—trichloroethylene; PCE—tetrachloroethylene; LNAPL—light non aqueous phase liquid; BTEX—benzene, toluene, ethyl benzene, and xylenes.

Figure 8. Locations of On-Site Surface Soil Samples Analyzed for Semi-Volatile Organic Compounds (SVOCs), Del Amo Site, Near Torrance, California (Data Source: Dames and Moore Pilot Feasibility Study)



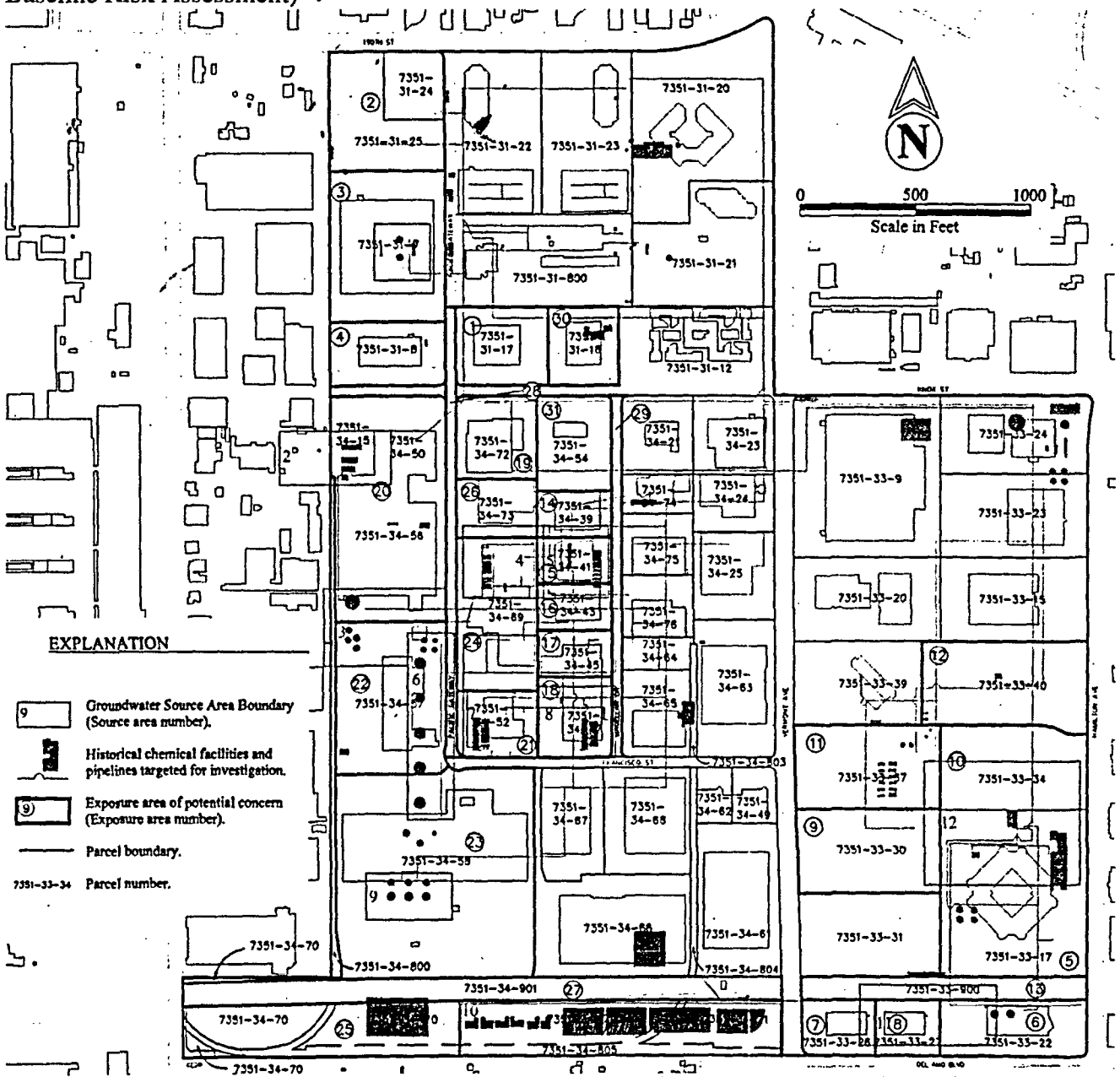
Acronyms used in Explanation: RI/FS—Remedial Investigation/Feasibility Study; SVOCs—semi-volatile organic compounds; PRGs—Preliminary Remediation Goals.

Figure 9. Locations of On-Site Shallow Soil Samples Analyzed for Semi-Volatile Organic Compounds (SVOCs), Del Amo Site, Near Torrance, California (Data Source: Dames and Moore Pilot Feasibility Study)



Acronyms used in Explanation: RI/FS—Remedial Investigation/Feasibility Study; SVOCs—semi-volatile organic compounds; PRGs—Preliminary Remediation Goals.

Figure 10. Locations and Results of Soil Gas Sampling Analyzed on the Del Amo Site, Near Torrance, California (Data Source: URS Baseline Risk Assessment)



Acronyms used in Explanation: RI/FS—Remedial Investigation/Feasibility Study; VOCs—volatile organic compounds.

Figure 11. Buildings on the Del Amo Site, Near Torrance, California, Where Indoor Air Sampling Was Conducted (Data Source: Dames and Moore Pilot Feasibility Study)

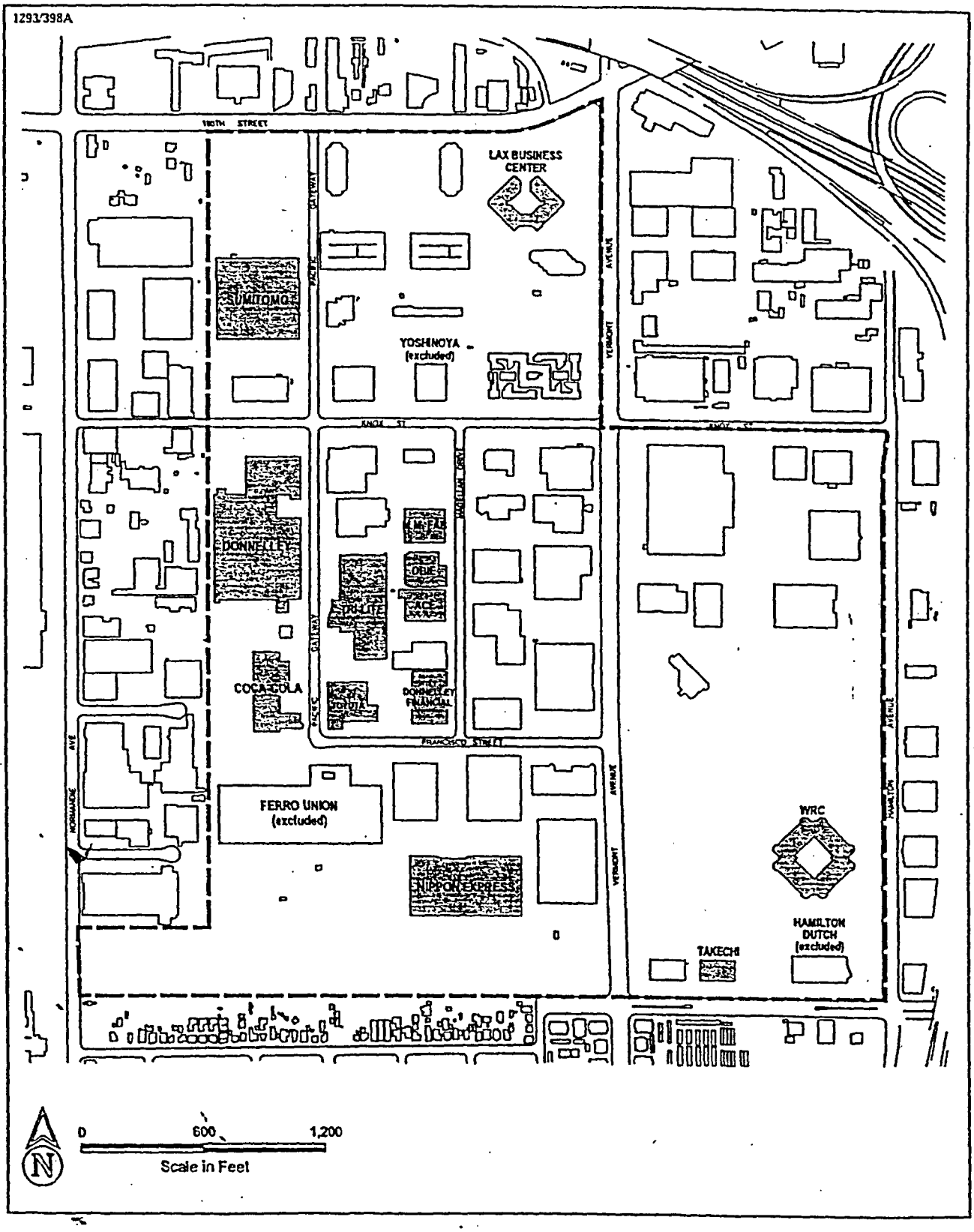
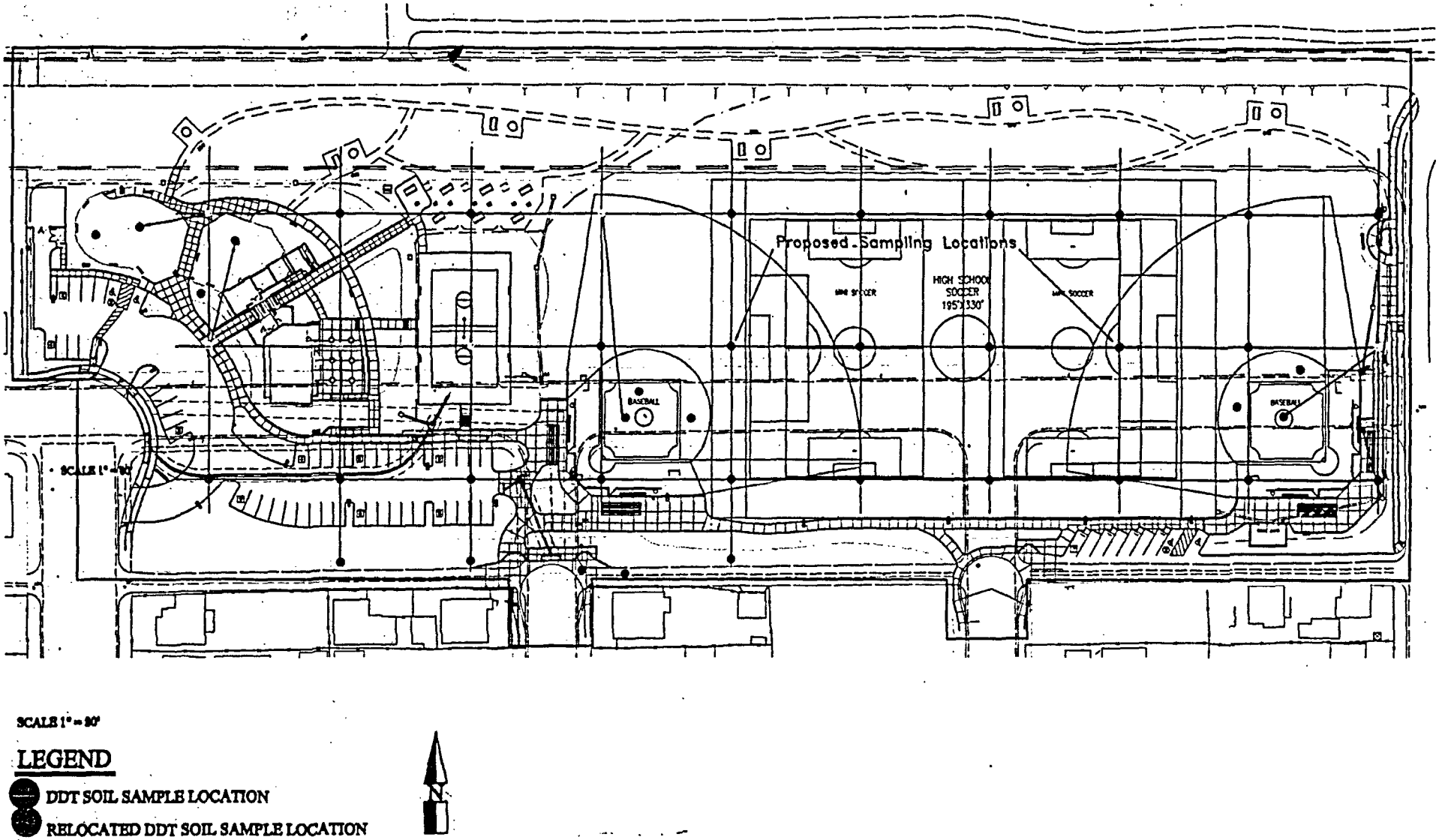


Figure 12. Future Layout of Community Park in Area South of the Del Amo Site, Near Torrance, California
(Data Source: C2REM. The Development of a Community Park. February 2000)



Appendix D—Status of the Recommendations Made in the Preliminary Public Health Assessment Dated January 12, 1994

In the public health assessment, CDHS reviews environmental and health data that was collected as of January 1, 1992 (26). The health assessment was shared in draft form with the regulatory agencies in July 1992. The Public Health Assessment was finalized on January 12, 1994. In the health assessment, CDHS made recommendations for additional data and for actions that are needed to reduce and eliminate exposure. In this appendix, we report on the status of the recommendations that were made in that health assessment.

CDHS/ATSDR Recommendations:

a. Improve current public access restrictions to the former waste disposal area through measures such as more secure gates and fences, and posting more signs in both English and Spanish.

Status: EPA ordered Shell (who hired Dames and Moore) to inspect and repair fences on a weekly basis as part of their continuing responsibilities to monitor the site.

b. Keep the unpaved Del Amo Boulevard clear of physical hazards.

Status: EPA took no action on this item because they have no jurisdiction in this area. CDHS is not aware of who might be the responsible agency for this recommendation

c. Evaluate the potential for soil gas migration underneath homes and businesses near the site.

Status: In August and September 1994 and January and February 1995, an environmental consulting firm, Dames and Moore (under contract with Shell Oil Company), conducted a soil gas investigation. This investigation was designed to determine if chemicals from the waste pits were migrating through the soil away from the waste pits and toward the residences located along West 204th Street. EPA's contractor, CH_2M Hill, provided oversight during this investigation. According to the results of the investigation, the levels of chemicals detected in the soil gas do not appear to pose an ambient air problem. For more a more detailed review of the data, see Del Amo Health Consultation *Potential Health Impact Due to the Emissions From the Waste Pits* (45).

d. Protect persons on and off the site during remediation from exposure to any dusts or vapors that may be released.

Status: According to EPA, all activities at the site will be performed in a manner that is protective of human health and the environment.

e. Provide on-site remedial workers with adequate protective equipment and training, in accordance with 29 CFR 1910.120, and follow appropriate National Institute for Occupational Safety and Health and Occupational Safety and Health Administration guidelines.

Status: EPA and the other regulatory agencies require their own employees and contractors as well as the responsible parties and their contractors to be properly trained for hazardous waste site work. Each entity is required by OSHA regulations to properly protect their workers from unacceptable exposures to hazardous substances.

f. Prevent further lateral and vertical migration of groundwater contaminants; maintain continuous monitoring of municipal wells in the area that may be potentially affected.

Status: A Record of Decision for the groundwater has been issued; implementation of the remedy is underway.

g. Implement institutional controls to prevent future use of contaminated aquifers for drinking water supplies until remediation has reduced contaminant concentrations to below levels of health concern.

Status: A Record of Decision for the groundwater has been issued; implementation of the remedy is underway.

h. Identify current users of private industrial wells in the area and determine whether water from these wells is contaminated.

Status: It is not clear if this has ever been done.

i. Implement deed and building restrictions to prevent future development on the site until contamination has been reduced to levels below health concern or until levels have been documented to exist at levels below health concern.

Status: The 1997 ROD for the waste pits selected deed restrictions as an element of the remedy, in order to prohibit residential use of the waste pits area, and to ensure any future commercial or industrial uses do not damage the remedy (a cap and a soil vapor extraction system). As long as the remedy is not impacted, EPA believes that future reuse of the land can occur without negative impact to the users. The remainder of the Del Amo site is still being studied and an assessment will be performed as to any unsafe exposures of potential future unsafe exposures and appropriate remedial actions will be prescribed. In the meantime, the majority of the site has been developed.

j. Collect additional groundwater data related to sources of contamination within the 280-acre site in order to supplement groundwater data available from other information sources in order to determine overall extent of groundwater contamination on and off the 280-acre site.

Status: Groundwater studies have been completed.

k. Assess the nature and extent of the floating layer in the shallow groundwater in the area of the 280-acre site through additional groundwater sampling and soil gas surveys; prevent further migration of the floating layer.

Status: According to EPA, the main contaminant, benzene (which is a light non-aqueous phase liquid, or a smeared LNAPL), has reached the B sand aquifer. The B sand aquifer is directly below the Upper Bellflower (dry) aquifer (the "shallowest" aquifer) and above the C sand, Lower Bellflower, Gage, Lynwood, and the Silverado aquifers (the deepest aquifer). The dissolved

plume has reached the Lower Bellflower aquifer. The other contaminants are ethylbenzene, naphthalene, chloroform, TCE, PCE, and para-chlorobenzosulfonic acid. The Silverado aquifer which is used for drinking water has not been impacted. Various remediation techniques are currently being investigated by EPA. EPA's goals are to: 1) isolate NAPL forever; 2) restore the groundwater outside the NAPL areas to drinking water standards; 3) contain the contaminants that cannot be remediated; and 3) evaluate removing the pure NAPL at a later date.

l. Conduct indoor air monitoring to assess the migration of soil gas from contaminated soil or groundwater through subsurface soil and into houses and other structures.

Status: In August and September 1994, EPA collected indoor air samples from the properties located on West 204th Street (see the Montrose Chemical Corporation Health Consultation, entitled *Health Impact of Contamination in Soil, Air, and Tap Water*, for a review of this data (34). The responsible parties conducted indoor air testing in buildings located on the developed portion of the Del Amo site (5). In 1996, contractors for the responsible parties sampled the workplace air at twelve buildings in the developed portion of the site (Table 9) (5). Benzene, ethyl benzene, styrene, toluene, 1,1,1-trichloroethane, and xylenes were detected in most of the building samples at levels that are fairly typical for indoor air (43, 44). These chemicals have been found in the soil, soil gas, and groundwater on the site, thus there could be some contribution from the contamination.

m. Conduct a soil gas survey during rainy and dry periods, in conjunction with additional soil and groundwater sampling for the 280-acre site in order to identify additional sources of contamination and to assess migration of soil gas from known sources, such as the waste disposal area, during rainy and dry periods.

Status: See status update for recommendation c.

n. Collect surface soil (0-3") samples from the 3.7 acre waste disposal area and other undeveloped areas of the 280 acre site, the unpaved Del Amo Boulevard, residential yards, and appropriate background locations for comparison in order to characterize adequately the extent and amount of site contamination that may exist on and off the site. If residential yard soil contains high levels of contaminants, home-grown vegetables and fruits and free-ranging chickens also need to be sampled for contaminants.

Status: The responsible parties with oversight from EPA and DSTC capped the waste pits by installing protective layers of materials over the pits, which prevents the waste from moving to the surface. Also, in order to prevent the migration of contaminants to the underlying groundwater, the contaminated soil beneath the pits will be cleaned using a soil vapor extraction unit that will extract contaminated vapors and treat them. The mechanism by which the vapors will be treated is now being discussed with the community and other agencies.

As part of a sampling effort to characterize potential releases from the Del Amo site, EPA collected shallow soil samples (0 – 6 inches) in October 1993 at 19 locations along W. 204th Street, between Normandie Avenue and New Hampshire Avenue (24). No chemicals associated with the Del Amo site were detected at levels of health concern; however, DDT was found in

two yards located along W. 204th Street at 32 ppm and 111 ppm. Subsequent sampling by EPA revealed an area along 204th Street, approximately six lots, that had been filled with material that included DDT. EPA carried out a removal action for this area in April and May 1994. Soil in the two yards containing DDT at greater than EPA's clean-up goal of 26 ppm was removed. For a more detailed review of the off-site soil sampling see the Montrose Public Health Assessment and the attached health consultations (49).

o. Collect surface and subsurface soil (greater than 3") data for the rest of the 280 acre site in order to assess the extent of soil contamination that may exist due to previous storage and handling operations associated with the former rubber manufacturing facilities (for instance storage tanks, pipelines, and waste sumps) or due to other present on-site sources (existing companies and businesses).

Status: Numerous soil and soil gas samples have been taken throughout the 280-acre site study area between 1993 and 1996 (5). This data was reviewed as a part of this health assessment.

p. Collect multiple background and site specific ambient air samples, with appropriate meteorological monitoring, to determine overall air quality in the area and to determine site specific air releases. Air samples to document releases from the site in an undisturbed state and a disturbed state (such as during soil borings or excavation activities) should be collected. Analyses should include information for organic and inorganic contaminant concentrations. An air model can also be used to determine dispersion of vapor releases via ambient air.

Status: The South Coast Air Quality Management District (SCAQMD) conducted ambient air quality testing and meteorological recording in the City of Torrance from September 29 through October 16, 1996 (50). The purpose of the study was to respond to CDHS's request for information about the overall air quality in the vicinity of Del Amo Boulevard, Vermont Street, and Normandie Street, and in the vicinity of the Del Amo Waste Pit. The SCAQMD sampled at four locations, two locations on the west side of the waste pits and two sites on the east side of the waste pits. All sampling locations were located greater than 400 feet away from the waste pits. SCAQMD did not sample a "background" location, for example, a station near the beach and thus upwind from all the stationary sources located in the Torrance area. Thirty-one samples were analyzed for 14 chlorinated volatile organic compounds (VOCs), benzene, ethylbenzene, toluene, xylenes, styrene, and 10 other aromatic hydrocarbons, and 2 cyclic and 43 aliphatic hydrocarbons related to ozone concerns. The report provided to CDHS did not contain data sheets or data tables for the chlorinated VOCs, only a summary table of the other data with no explanation of the sample numbers, and an inadequate presentation of data for comparison of most of the compounds detected.

The SCAQMD detected 5 of the 14 chlorinated VOCs. Carbon tetrachloride (0.17 ppb), trichloroethylene (0.3 ppb), and 1,1,1-trichloroethane (0.6 ppb) were detected in many of the 31 samples and at levels that were less than the average for the Los Angeles Basin air (0.17 ppb, 0.6 ppb, and 4.9 ppb, respectively) (50). Tetrachloroethylene was detected in 3 of 31 samples, at levels less than the basin average. Chloroform was measured in 6 of the 31 samples (0.4 to 1.8 ppb); each of the detections exceeded the basin average (0.23 ppb).

Benzene, ethyl benzene, toluene, xylenes, styrene, as well as the other aromatic hydrocarbons and the cyclic and aliphatic hydrocarbons were detected in many if not all the samples (50). The authors compared the average concentrations of benzene (1.8 ppb), toluene (5.7 ppb)and xylenes (3.8 ppb) to basin-wide data (2.4 ppb, 10.0 ppb, and 6 ppb, respectively); all were below the basin average. The data summary sheets for the non-chlorinated VOCs listed 54 other compounds that were detected; however, these chemical detections were not compared to basin-wide data.

The report concludes, "the concentrations of hydrocarbons found in the samples collected during this monitoring program were uniformly low, such that no specific directional correlation exists between the fluctuations in concentration level and wind velocity vectors. Peak concentrations are likely to derive from intermittent usage, mobile source concentrations, or isolated emissions, with equal probability" (50).

CDHS considers the study to be poorly documented in the report. In addition, several incorrect statements were attributed to staff of CDHS. For instance, "Dr. Underwood informed the District in October 1995, that public concerns over DDT contamination had been answered by EPA, and therefore request for sampling was no longer valid" and "Dr. Underwood requested, in place, of the definitive sampling suggested earlier, that background sampling be conducted in the area, to address concerns posed by the doctors assigned to the clinic" (50). CDHS was disappointed in the response to our request for air sampling as the sampling locations were not focused on the communities south of Montrose and Del Amo, no background sample was taken and the analysis did not include many of the compounds of that we had requested which had been based on the Toxic Release Inventories for nearby industries.

r. Collect data on particulate in indoor and ambient air samples. Use of an appropriate air model to determine fugitive dust emissions from contaminated soil, dispersion, and deposition may also be necessary.

Status: EPA reports that the surface soil has not been found to contain harmful concentrations of chemicals from the Del Amo facility therefore particulate data would not be helpful.

s. Collect house dust samples to determine if they contain site-related contaminants that could have migrated from the site.

Status: Dust sampling for chemicals related to the Del Amo site was never undertaken. A household dust sampling investigation was conducted in May 22-24, 1995, in order to obtain quantitative levels of DDT and its breakdown products, hexachlorocyclohexanes and their isomers in eighteen homes along West 204th Street (51, 52). DDT is not related to activities at the Del Amo site. Based on the household dust data reviewed, the levels of DDT do not appear to pose noncancer health concerns. The cancer risk of DDT ranged from no apparent increased cancer risk to a very low increased cancer risk. The levels of and hexachlorocyclohexanes and their isomers in all the samples analyzed were non-detect (i.e., below 1 ppm). For a more detailed review see Montrose Health Consultation- *Health Impact of Contaminants in Dust* II.

t. In coordination with other agencies, CDHS will provide ongoing community education in appropriate languages to the communities near the site about possible health effects from site-related contaminants and ways to prevent, cease or reduce exposures.

Status: Much of the outreach activity conducted by CDHS, EPA, and DTSC occurred in cooperation with the community and other agencies through the Outreach and Education Task Team of the Del Amo/Montrose Partnership. Though the partnership has ended, CDHS will continue to work with community and agencies to share exposure and health information.

u. When data become available to assess exposure levels, CDHS and ATSDR will reevaluate this site for indicated follow-up health actions.

Status: Since the publication on the Del Amo Facility Health Assessment, CDHS/ATSDR has reviewed, evaluated, and interpreted additional data as they became available. For example, four health consultations (which provide information on the following topics: soil, tap water, indoor air, household dust, and the waste pit) have been issued. CDHS has also commented on several work plans for site characterization and remediation activities. CDHS will continue to work closely with other governmental agencies and to review additional environmental data as they become available to ensure that the health and well being of the Del Amo and Montrose communities is protected.

Appendix E—CDHS/ATSDR Investigations of the Del Amo/Montrose Superfund Sites and Nearby Neighborhoods, 1983 – 2001

During a 15-year period, the California Department of Health Services (CDHS) and the Agency for Toxic Substances and Disease Registry (ATSDR) have conducted health investigations of the Del Amo/Montrose Superfund sites and surrounding neighborhoods. This appendix is a summary of our major findings and activities, and provides a chronology of the development of our understanding of these sites. At the end of the appendix is a complete list of CDHS/ATSDR publications related to Del Amo and Montrose sites.

The U. S. Environmental Protection Agency (EPA) first investigated DDT contamination related to the Montrose site in 1982 (53). ATSDR's involvement began in 1983, when it reviewed information from the Montrose site and made the following recommendations:

- Public access to contaminated areas should be restricted.
- Fishing and selling fish from contaminated waters should be restricted.
- More soil and air testing should be done.
- Cancer rates in the surrounding neighborhoods should be studied.

Several years later, ATSDR reviewed additional information on DDT-contaminated soil and dust from areas surrounding the Montrose site. In a 1988 health consultation on DDT in soil and dust, ATSDR found that neighborhood residents could be exposed by eating small amounts of DDT in soil and by breathing DDT in air, and recommended that action be taken to reduce the potential for such exposure (54).

CDHS first became involved at the Del Amo/Montrose sites in 1984, the year that Montrose was first nominated for EPA's National Priority List (NPL) of most hazardous waste sites (also known as Superfund). In response to community health complaints, CDFS conducted an epidemiological study to examine the health status of 2,500 people who were living near the sites at that time. The Del Amo-Montrose Health Effects Study (27), released in 1987 , found that:

- Residents of these neighborhoods did not experience higher rates of cancer, reproductive problems (miscarriage, stillbirth, low birth weight, and birth defects), or death.
- There were higher rates of liver disease in the area, which can be caused by exposure to organic chemicals such as DDT, a pesticide manufactured at the Montrose site. However, because liver disease was not associated with living near either site (residents with liver problems did not live closer to the waste sites than did other residents) it was not thought to be caused by the sites.
- There were increased rates of skin, eye, nose, and throat irritation as well as earaches, dizziness, and fatigue. These are symptoms often associated with airborne pollutants such as the volatile organic compounds present at the Del Amo site. Because these symptoms were greater near Del Amo, there is some evidence linking these health problems to that site. They could also have been caused by other pollution in the area.

Because residents who had moved away were not included in the study and those who did participate only lived in the neighborhood for an average of 6 years, this study could not answer questions about long-term effects. Some health effects, such as cancer, can take 15-20 years to develop; others, such as reproductive problems and reactions to irritants, may become apparent shortly after exposure. This study helps to understand these shorter-term effects.

The Montrose site was finally placed on the NPL in 1989. CDHS, now working under a cooperative agreement with ATSDR, conducted a Site Review and Update in August 1992, which was revised in August 1993 (55). This document reviewed all the information relevant to the possible public health impact of the Montrose site. Despite the protective measures EPA had taken in response to ATSDR's 1988 recommendations, CDHS concluded that there was still potential for exposure to DDT through contact with soil, dust, and fish. CDHS recommended that a full pubic health assessment be conducted when EPA finished its site investigations.

The Del Amo site was first proposed for the NPL in 1993. CDHS, again working under a cooperative agreement with ATSDR, began a public health investigation of this site. In February 1993, CDHS wrote and distributed a fact sheet in English and Spanish to the community called Your Health and the Del Amo Site, Findings From the Health Assessment, summarizing the major findings of the investigation (56). CDHS released the Del Amo Facility Preliminary Public Health Assessment (PHA) in January 1994 (26). The PHA:

- Reviewed three additional sources of information about cancer, reproductive problems, and deaths in the area. The conclusions were similar to the CDHS 1987 Health Effects Study. A study of cancer incidence from 1972 to 1982 found no overall increase in cancer risk in children or adults, and there was no pattern suggesting that cancers in the area were associated with the sites.
- Found that in the past, residents and workers had been exposed to volatile aromatic hydrocarbons (benzene and ethylbenzene) from Del Amo by breathing the air, and may have been exposed to polycyclic aromatic hydrocarbons (naphthalene, benzopyrene, phenanthrene, and chrysene) through skin contact and by eating small amounts in soil.
- Concluded there was not enough information to know what or how much people may have been exposed to, or if current or future exposures were possible.
- Recommended further testing of outdoor and indoor air, house dust, groundwater, soil gas, and surface soil on the site and in the surrounding neighborhood.

As a result of these recommendations, by September 1993 EPA had sampled surface soil at residential properties on 204th Street, bordering the Del Amo site. Unexpectedly, instead of finding contamination associated with Del Amo, they found DDT, a contaminant from the nearby Montrose site. It was soon discovered that DDT from the Montrose site had been used in fill material during development of the neighborhood. In a 1993 Health Consultation, Residential Backyard Soil Sample Review, CDHS found that DDT was present at levels of health concern in several yards and recommended additional sampling (24). In March 1994, CDHS wrote and distributed a fact sheet in English and Spanish called DDT In Your Environment, informing residents about ways that people may be exposed to DDT and possible health effects (57).
In April and May 1994, EPA removed some of the contaminated fill, during which the affected residents were temporarily relocated. During July, August and September 1994, EPA tested sub-surface soil, indoor air, tap water, and house dust in and around the affected homes for contaminants from both sites. CDHS reviewed EPA findings in three separate Health Consultations (Montrose Chemical Corporation Soil, Air and Tap Water, 5/95; Dust 5/95; and House Dust 12/95 (34, 51, 52) and concluded that:

- In 4 out of 28 yards tested, DDT was found in soil at levels of health concern; in two of these yards, benzopyrene was also at a level of health concern. These contaminants were found too deep beneath the ground to be considered actual health risks.

- Tap water did not appear to be contaminated.
- Indoor air in 2 of the 25 homes tested had higher than normal levels of benzene. Long-term exposure to high levels of benzene can cause leukemia. In this case, there were very low to low increased cancer risks depending on length of exposure (whether 9 or 30 years). Benzene in indoor air can come from many possible sources, and it is impossible to know whether or not this was related to the Del Amo site. (Note: EPA later discovered that the source of benzene in the home with highest levels was due to a malfunctioning stove).
- Indoor air in a third home had levels of tetrachloroethylene that could cause very low cancer risks if a person were exposed for 30 years. Although this is a contaminant present at Del Amo, its source in this home was not known.
- A sampling of dust in 20 homes found low levels of DDT were present in seven homes on or near the fill area. Exposure to these levels would not be expected to cause noncancer health problems. People exposed to the higher levels found (5 ppm to 8 ppm), would have a very low to low risk of developing cancer, depending on how long they were exposed (whether 9 or 30 years). At the highest level found (8 ppm) 30 years of exposure would result in a 1 in 92,000 increased risk of cancer in addition to the cancer risk from all other causes. This is considered to be a low increased risk.
- Many contaminants were detected about which not enough is known to be able to estimate risk.

Although CDHS did not recommend permanent relocation of residents on the basis of these findings, heightened community fears led to a buyout and the relocation of more than 60 families. The houses were torn down, the soil was cleaned or covered, and a park is being developed on the site of the former residences.

EPA planned to dispose of the DDT-contaminated fill by sending it to an incineration facility in Port Arthur, Texas. Because of the potential for incinerators to produce dioxin, members of the Del Amo/Montrose community were concerned that their toxic waste problems might be transferred to Port Arthur. In August 1998, ATSDR issued a Health Consultation on Incineration of DDT Contaminated Fill from Montrose Chemical Corporation and Del Amo (58). After reviewing information on the incinerator, stack emissions, and potential for exposure, ATSDR concluded that the Montrose fill material could be incinerated without posing a public health concern for residents of Port Arthur.

By now, attention had turned to potential DDT contamination in the neighborhood, but many residents were still concerned about air emissions from the Del Amo waste pits. In a health consultation on the Del Amo facility, *Potential Health Impact Due to Emissions From the Waste Pits*, released in November 1996, CDHS:

- Reviewed environmental testing of air on the surface of the waste pits, and of outdoor air and soil gas at the former waste disposal area and in the backyards of homes. This was done to find out whether chemicals were being released into the air at levels that could be harmful to the health of nearby residents.
- Found that the levels of chemicals in the soil gas were not high enough to cause a problem in indoor air.
- Concluded that the low levels of volatile and semi-volatile organic compounds (VOCs and SVOCs) and hydrogen sulfide in outdoor air were not high enough to cause noncancer health

problems. One contaminant with elevated levels, Tetrachloroethene, is carcinogenic. The estimated cancer risk from inhaling this chemical over a period of 30 years was considered to be very low.

- Found that there were eight chemicals about which not enough is known to be able to estimate risk.

One result of the 1993 discovery of DDT in the neighborhood was that ATSDR funded a three-year community health investigation by the University of California at Irvine. The Del Amo/Montrose Environmental Health Program was established to study the health problems of residents and to address their health concerns. Among other things, clinic physicians wanted to know what breast-feeding advice to give women whose blood had been tested for DDT. In February 1997, CDHS released a health consultation on *Infant Health Implications of Breast-feeding When Considering Maternal DDT Levels (59)*. This report:

- Reviewed the limited number of studies on the developmental effects of DDT and the relationship between DDT in the blood and in breast milk.
- Used these studies to develop guidelines advising whether or not to breast-fed, weighing the unknown potential harm from DDT against the known benefits of breast-feeding.
- Recommended that at 21 parts per billion (ppb) or greater of serum DDT, the mother should receive.
- Recommended that counseling be provided at the Environmental Health Program that focuses on the limited knowledge about the harmful effects of DDT in breast milk and the proven benefit that breast-feeding provides the child.
- Recommended that at 150 ppb of serum DDT, women should be advised not to breast-feed.

Another milestone was the formation of the Del Amo/Montrose Partnership in February 1997. Through the Partnership, members of the community, staff of the various government agencies involved at the site, political representatives, and other stakeholders hoped to develop a better understanding of issues and a coordinated approach to activities related to these sites.

In December 1999, the Del Amo/Montrose Community Environmental Health Program Final Report was released by the Center for Occupational and Environmental Health, University of California, Irvine (60). The report is a summary of the program which offered a range of environmental health services to the community, seeing 596 residents over a 2-year period. From the beginning, the lack of environmental monitoring in the area at the time made it difficult to know what the environmental exposures had been. Blood tests for DDT/DDE were offered because these measurements are an indication of how much DDT/DDE a person has been exposed to from all sources. Valid blood tests were obtained from 569 people. Participants were not tested for other site-related pollutants because there are no feasible tests that could measure past exposure to these chemicals. The final report contains a detailed description of the program's services, the population served, and the clinical findings.

Although the clinic program was not intended to be an epidemiological study, the clinical data was studied to see if there were any patterns suggesting that symptoms, diagnoses, or DDT levels might be associated with certain environmental exposures. There were no significant associations found between health outcomes, DDT levels, and known exposures to DDT in the neighborhood. In 1997, CDHS wrote and distributed a fact sheet in English and Spanish called Your Health and

the Montrose Site, informing residents about ways they may be exposed to DDT and how to prevent exposure (61). In March 1997, CDHS released a Montrose Chemical Corporation PHA (49), which included all of the findings related to the Montrose site up to that time, focusing on possible exposure pathways for contaminants at the site. In addition to findings that have already been mentioned, the PHA concluded that:

- DDT is the only site-related chemical to which community members may have been exposed at levels of health concern. DDT was carried off the site in the air, through surface water runoff, and in contaminated fill that was placed in a low-lying "hot spot" area. Additional sampling in the neighborhood was recommended to see if there were other areas with high concentrations of DDT.
- Residents may have been exposed to DDT in the past. It does not appear that such exposures would result in noncancer health effects, and potential increased lifetime cancer rates would be expected to be very low, if any.
- People may currently be exposed to DDT by breathing, eating, or touching contaminated soil, and by eating contaminated fruits, vegetables, chickens, eggs, or fish. Fruits and vegetables from the most contaminated area that were tested did not pose a health risk. Although chickens and chicken eggs from this area did contain DDT close to the FDA action levels, the exposures did not pose a health risk.
- DDT from Montrose caused substantial contamination of sediments, fish, and shellfish in the area around Palos Verdes, Long Beach Harbor and Los Angeles Harbor. Fish advisories describe which kinds of fish should be eaten in limited amounts. White Croaker from the above areas should not be eaten at all.
- There has been no exposure through drinking water, but steps must be taken to prevent future contamination of drinking water wells.

Investigators from the clinic requested more environmental testing from ATSDR to help them interpret the DDT blood test results of clinic participants. In July 1998, ATSDR released an Exposure Investigation (62). In this study:

- Thirty-three residents whose blood DDT levels were above 21 ppb agreed to have their yards, homes, and chicken eggs tested for DDT. This was done to see if DDT in their blood could be due to contamination in their homes or yards.
- ATSDR tested surface soil, indoor dust, surface wipe samples, and two chicken egg samples for DDT. Chickens were raised at only one of the participating households;
- The levels of DDT found in one yard were higher than the EPA removal action level for the site and could pose a health risk to children. The DDT levels in all the other yards and homes tested were not at levels that caused concern.
- The DDT levels found in both eggs were considered to pose a public health hazard if eaten on a regular basis.
- ATSDR recommended an expanded exposure investigation of home-raised chicken eggs in the neighborhood, as well as further soil sampling.

In May 1999, ATSDR released a second Exposure Investigation of home-raised chicken eggs (63). In this study:

- Thirty-two eggs and 11 soil samples were collected from 10 households in the Del Amo neighborhood. No households that raised chickens could be found in the Montrose neighborhood.

- All eggs tested contained some DDT. Five eggs collected from two households had DDT levels higher than the allowable level set by the FDA.
- Soil was found to be a significant source of DDT for chickens raised in the Del Amo area. Eggs from free-range chickens that peck the soil were compared to those from chickens kept in raised pens. The eggs with higher DDT levels all came from chickens that peck soil.
- Residents who regularly consume eggs from chickens raised on the ground in the Del Amo area may have very low increased cancer risks. Those who had eggs above the FDA action level were advised not to eat the eggs. Education was provided about safer chicken-raising practices and a medical evaluation at the clinic was offered.

In June 2000, CDHS wrote and distributed a fact sheet in English and Spanish called DDT and Chicken Eggs in the Del Amo/Montrose Neighborhood (64). It provides information about exposure to DDT from home-raised chickens, possible health effects, and how to reduce exposure through safer chicken-raising practices.

In the fall of 1999, EPA began further investigation into the off-site contamination from the Montrose site, to be completed in several phases. In June 1999, ATSDR released a Health Consultation Contingency Plan for the Del Amo/Montrose EPA Neighborhood Soil Sampling Event (65). This document outlined what the immediate response would be to protect public health if elevated levels of DDT were found in surface soil of residences in the neighborhood during Phase I sampling. The document listed three levels of DDT and recommended the appropriate actions to take at each level. In July 1999, CDHS released a health consultation, *Review of the Sampling and Analysis Plan for the Neighborhood Sampling Program*, which reviewed and commented on the EPA Phase I sampling plan (66).

The ATSDR contingency plan was modified by EPA for Phase II Sampling. In August 2000, CDHS produced a Health Consultation, Review of the Addendum to the Site-Specific Work Plan, Sampling and Analysis Plan, and Field Sampling Plan for the Phase II of the Del Amo and Montrose Neighborhood Sampling (67). This document contains CDHS comments on the Phase II sampling plan and it summarizes the findings of the 1999 Phase I sampling, in which EPA collected hundreds of soil samples and 40 fruit and vegetable samples and tested them for DDT and other chemicals. The findings were classified as follows:

- Investigation to find whether DDT in air settled to the ground and contaminated the soil. Surface soil from the Del Amo/Montrose neighborhood was compared to soil in six background areas in other neighborhoods. The levels in the background areas had slightly lower levels of DDT on average, but were very similar to most levels found in Del Amo/Montrose. No further sampling of this kind was planned.
- Investigation of storm-water runoff that flowed through neighborhood areas. Higher than normal levels of DDT were found along Kenwood Avenue in an area where there had been an unlined ditch. The yard of one house had levels of DDT that were a health concern, and EPA placed a temporary cover over the soils in that yard. Kenwood Avenue became the focus of sampling in Phase II.
- Investigation of possible fill areas. This sampling found no evidence of fill material in low-lying areas. Areas that had slightly higher than average levels of DDT were to be studied further in Phase II.

- Investigation of homegrown fruits and vegetables. No DDT was found in any produce grown in the neighborhood, but samples did not include root crops. There were plans to sample root crops in Phase II.

ATSDR/CDHS Del Amo/Montrose Publications:

- ATSDR Health Consultation, *Review of Montrose Site-Related Data,* 3/83
- *CDHS Del Amo-Montrose Health Effects Study,* 12/87
- ATSDR *Health Consultation on DDT in Soil and Dust,* 1/4/88
- CDHS Fact Sheet, *Your Health and the Del Amo Site, Findings From the Health Assessment,* (English and Spanish) 2/93
- CDHS/ATSDR *Montrose Site Review and Update,* 8/93
- CDHS/ATSDR Health Consultation, *Residential Backyard Soil Sample Review,* 11/10/93
- CDHS/ATSDR *Del Amo Facility Preliminary Public Health* Assessment, 1/12/94
- CDHS Fact Sheet, *DDT In Your Environment,* (English and Spanish) 3/94
- CDHS/ATSDR Health Consultation, *Health Impact of Contaminants in Dust, Del Amo/Montrose,* 5/95
- CDHS/ATSDR Health Consultation, *Health Impact of Contaminants in Soil, Air, and Tap Water, Del Amo/Montrose,* 5/95
- CDHS/ATSDR Health Consultation, *House Dust, Montrose Chemical Corporation,*12/95
- CDHS/ATSDR Health Consultation, *Del Amo Facility, Potential Health Impact Due to Emissions From the Waste Pits,* 11/20/96
- CDHS/ATSDR Health Consultation, *Infant Health Implications of Breast-feeding When Considering Maternal Serum DDT Levels, Montrose Chemical Corporation,* 2/20/97
- CDHS Fact Sheet, *Your Health and the Montrose Site,* (English and Spanish) Date?
- CDHS/ATSDR *Montrose Chemical Corporation Public Health Assessment,*3/13/97
- ATSDR *Exposure Investigation Del Amo (DDT in soil, dust, chicken eggs),*7/31/98
- ATSDR Health Consultation, *Incineration of DDT Contaminated Fill from Montrose Chemical and Del Amo at the Chemical Waste Management Inc. Landfill, Port Arthur, Texas,* 8/21/98
- ATSDR *Exposure Investigation Del Amo Facility (DDT in chicken eggs),* 5/27/99
- ATSDR Health Consultation. *Contingency Plan for Del Amo/Montrose EPA Neighborhood Soil Sampling Event,* 6/24/99
- CDHS/ATSDR Health Consultation, *Review of the Sampling and Analysis Plan for the Neighborhood Sampling Program, Montrose,* 7/6/99
- CDHS Fact Sheet, *DDT and Chicken Eggs in the Del Amo/Montrose Neighborhood,* (English and Spanish) 6/00
- CDHS/ATSDR Health Consultation, *Review of the Addendum to Site-Specific Work Plan, Sampling and Analysis Plan, and Field Sampling Plan for Phase II of DA/M Neighborhood Sampling, Montrose,* 8/9/00

ATSDR-Funded Project Publications:

- D. Baker, H. Yang. *The Del Amo/Montrose Community Environmental Health Program Final Report.* Center for Occupational and Environmental Health, University of California at Irvine. December 1999.

Appendix F—Brief Summaries About the Chemicals of Concern

Arsenic (68)

- Naturally-occurring chemical commonly found in surface soil and surface water.
- Long-term exposures of lower levels of arsenic through drinking water (170-800 ppb) can lead to a condition known as "blackfoot disease".
- Other effects include gastrointestinal irritation, and contact with skin can cause discoloration (hypo-or hyper-pigmentation), wart-like growths, and skin cancer.
- Acute oral MRL = 0.005 mg/kg/day (gastrointestinal effects in humans).
- Chronic oral MRL = 0.0003 mg/kg/day (dermal effects in humans).
- RfD = 0.0003 mg/kg/day (dermal effects in humans).
- EPA's cancer slope factor = 1.5 $(mg/kg/day)^{-1}$.
- Carcinogenicity: U.S. Environmental Protection Agency (EPA)—human carcinogen (due to its ability to cause skin cancer); U.S. Department of Health and Human Services (DHHS)—known human carcinogen; International Agency for Research on Cancer (IARC)—human carcinogen (sufficient human evidence).

Benzene (40)

- Naturally-occurring chemical, also in top 20 (by volume) of chemicals produced in the U.S.; used in a very wide range of products and industrial processes; found in environment as a result of both human and natural processes.
- Degrades relatively quickly in air, slowly in soil and water; does not bioaccumulate.
- Enters body through inhalation, ingestion, and dermal absorption.
- Adverse health effects due to intermediate or chronic exposures include disruption of blood production and possible reproductive problems in women.
- RfD = 0.004 mg/kg/day (decreased lymphocyte count in humans).
- RfC = 30 $\mu g/m^3$ (decreased lymphocyte count in humans).
- REL = 60 $\mu g/m^3$ (blood system, developmental and nervous system effects).
- Intermediate inhalation MRL = 4 ppb (13 $\mu g/m^3$) (neurological effects in mice).
- EPA oral slope factor = 5.5×10^{-2} $(mg/kg/day)^{-1}$.
- California Office of Environmental Health Hazard Assessment (OEHHA) inhalation unit risk = 2.9×10^{-5} $(\mu g/m^3)^{-1}$.
- USEPA inhalation unit risk = 7.8×10^{-6} $(\mu g/m^3)^{-1}$.
- Carcinogenicity: EPA—human carcinogen (due to its ability to cause leukemia); DHHS—known human carcinogen; IARC—human carcinogen (sufficient human evidence).

Cadmium (69)

- Naturally-occurring element (metal); also occurs as a result of industrial processes.
- Not usually found as a pure metal, but as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).
- Enters the body primarily through inhalation and ingestion; people are exposed to cadmium mostly from food and cigarette smoke.
- Inhalation of high levels of cadmium can severely damage the lungs and cause death.

- Chronic exposure (inhalation) to low levels can cause kidney (renal) damage.
- Chronic oral MRL = 0.0002 mg/kg/day (kidney damage in humans).
- OEHHA oral slope factor = 15 $(mg/kg/day)^{-1}$.
- Carcinogenicity: EPA—probable human carcinogen (limited human, sufficient animal evidence); DHHS—known human carcinogen; IARC—human carcinogen (sufficient human evidence).

Chlorobenzene (70)

- Naturally-occurring chemical; also synthetically produced.
- Used as a solvent and in production of other chemicals.
- Breaks down very quickly in water, relatively quickly in air, slowly in soil.
- Can enter body through inhalation, ingestion, or dermal absorption.
- Adverse health effects due to acute exposure include headaches, numbness, sleepiness, nausea, vomiting, and depression of nervous system function.
- Intermediate oral MRL = 0.4 mg/kg/day (liver effects in rats).
- RfD = 0.02 mg/kg/day (liver changes in dogs).
- REL = 1,000 $\mu g/m^3$ (alimentary, kidney, and reproductive system effects).
- Carcinogenicity: EPA—not classifiable; DHHS—not classified.

Dichlorodiphenyltrichloroethane (DDT) (71)

- Widely used pesticide in the U.S. for insects on agricultural crops from the 1940s, until it was banned in 1972; still used around the world to combat malaria and typhus.
- DDT and its breakdown products DDE and DDD last for a long time in the soil (greater than 30 years in some types of soil).
- Does not occur naturally in the environment.
- Based on prior use and the fact that it lasts so long in the soil, DDT and its breakdown products are found in most soils even in the Arctic and Antarctic even if they were not used there, i.e., there are background levels of DDT in most soils.
- Mainly gets into the body through the ingestion of food; can also get into the body by breathing DDT-contaminated air or by ingesting particles of soil to which the DDT is adhered.
- Animal studies show that long-term exposure can affect the liver; short-term exposure can affect reproduction; DDT breakdown products can affect the adrenal gland.
- Animal studies have shown that oral exposure to DDT can cause liver cancer.
- Acute oral MRL = 0.0005 mg/kg/day (neurodevelopmental effects in mice).
- Intermediate oral MRL = 0.0005 mg/kg/day (liver effects in rats).
- RfD = 0.0005 mg/kg/day (liver lesions in rats).
- Studies of DDT-exposed workers did not show increases in deaths or cancers.
- USEPA slope factor for DDT and DDE = 0.34 mg/kg/day
- USEPA oral slope factor for DDD = 0.24 mg/kg/day.
- Carcinogenicity: EPA—DDT, DDE, and DDD are probable human carcinogens (inadequate human, sufficient animal evidence); DHHS—DDT may reasonably be anticipated to be a

human carcinogen and DDE and DDD are not classified; IARC—DDT, DDE, and DDD are possible human carcinogens (limited human, less than sufficient animal evidence).

Ethylbenzene (72)

- Naturally-occurring chemical used in many products.
- Evaporates easily, does not dissolve readily in water; breaks down in air after a few days in presence smog and sunlight.
- Can be broken down in soil, can migrate down to groundwater.
- Can enter body through inhalation, ingestion, or dermal absorption.
- Adverse health effects in animals due to chronic exposure include the possibility of cancer.
- Intermediate inhalation MRL = 1,000 ppb (800 $\mu g/m^3$) (developmental effects in rats).
- RfC = 1,000 $\mu g/m^3$ (developmental effects in rats and rabbits).
- REL = 2,000 $\mu g/m^3$ (development, GI tract, liver, kidney, and endocrine).
- RfD = 0.1 mg/kg/day (liver and kidney effects in rats).
- Carcinogenicity: EPA—not classifiable; DHHS—not classified; IARC—possible human carcinogen (limited human, less than sufficient animal evidence).

Polychlorinated Biphenyls (PCBs) (73)

- Produced in the U.S. between 1933 – 1977 for use as coolants and lubricants.
- Mixtures of up to 209 individual chlorinated compounds (known as congeners).
- Though no longer manufactured, PCBs are still released during some industrial processes, from hazardous waste sites, illegal or improper disposal of industrial wastes, leaks from old electrical transformers containing PCBs, and burning of some wastes in incinerators.
- Food most common source of PCB uptake in the general population.
- Bioaccumulate in food chains and are stored in fatty tissues.
- Do not readily break down in the environment and may remain there for very long periods of time.
- Most common health effects are skin rashes and acne.
- Reproductive effects have been shown in women exposed to high levels of PCBs in the work place or from eating contaminated fish.
- High levels of PCBs may cause liver damage.
- Limited human (workers) and animal studies have shown an association with liver and biliary cancer.
- Intermediate MRL for Arochlor 1254 = 0.00003 mg/kg/day (developmental effects).
- Chronic MRL for Arochlor 1254 = 0.00002 mg/kg/day (immunological effects).
- Oral reference dose for Arochlor 1016 = 0.00007 mg/kg/day.
- Oral slope factor for total PCBs = 2 $(mg/kg/day)^{-1}$.
- Carcinogenicity: EPA—probable human carcinogens (inadequate human, sufficient animal evidence); DHHS—may reasonably be anticipated to be a human carcinogen; IARC—possible human carcinogen (limited human, sufficient animal evidence).

Polycyclic Aromatic Hydrocarbons (PAHs) (74)

- Group of chemicals (more than 100) formed during the incomplete burning of oil, coal wood, gas, garbage, or other organic substances like tobacco or charbroiled meat.
- Present throughout the environment and occur generally as mixtures, not individually.
- Exposed occurs from environmental sources such as air, water, and soil and from cigarette smoke and cooked food.
- Seventeen PAHs focused on in the literature based on available information, greater chance for exposure, and potentially the most harmful (acenaphthene, acenaphthylene, anthracene, benzo[a]pyrene, benzo[e]pyrene, chrysene, benz[a]anthracene, benzo[j]fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, fluorene, fluoranthene, indenol[1,2,3-c,d]pyrene, phenanthrene, pyrene, and dibenz[a,h]anthracene).
- Animal studies have shown effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. These effects have not been seen in people.
- Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).
- ATSDR intermediate oral MRL for anthracene = 10 mg/kg/day.
- RfD for anthracene = 0.3 mg/kg/day.
- OEHHA potency equivalent factors (PEF): benzo[a]pyrene index compound.
- OEHHA oral slope factor for benzo[a]pyrene = 12 $(mg/kg/day)^{-1}$.
- USEPA oral slope factor for benzo(a)pyrene = 7.3 $(mg/kg/day)^{-1}$.
- PAH mixtures containing benzo[a]pyrene, chrysene, benz[a]anthracene, benzo[a]fluoranthene, and dibenz[a,h]anthracene may reasonably be expected to be carcinogens.

Styrene (75)

- Synthetic chemical most commonly used in manufacture of various types of rubbers and plastics.
- Liquid at normal temperatures; evaporates easily; breaks down relatively quickly.
- Can enter body through inhalation, ingestion, or dermal absorption.
- Chronic inhalation MRL = 60 ppb (260 $\mu g/m^3$) (neurological effects).
- RfC = 1,000 $\mu g/m^3$ (central nervous system effects in humans).
- Chronic REL= 900 $\mu g/m^3$ (nervous system effects).
- Intermediate oral MRL = 0.2 mg/kg/day (liver effects).
- RfD = 0.2 mg/kg/day (hematological, liver effects in dogs).
- Carcinogenicity: EPA—possible human carcinogen (no human, limited animal evidence); DHHS—not classified; IARC—possible human carcinogen (limited human, less than sufficient animal evidence).

Tetrachloroethylene (PCE) (76)

- Synthetic chemical used as a dry cleaning fluid, a degreaser, and as a starting material for other products.

- Evaporates quickly; breaks down very slowly.
- Can travel easily through soils to reach groundwater.
- Most common way to enter body is inhalation, also ingestion if drinking water is contaminated.
- Adverse health effects due to chronic inhalation exposure possibly include reproductive effects in women.
- Chronic inhalation MRL = 40 ppb (270 $\mu g/m^3$) (neurological effects in humans).
- RfD = 0.01 mg/kg/day (liver effects in mice).
- High levels of exposure in animals may cause liver, kidney damage.
- OEHHA oral slope factor = 0.54 $(mg/kg/day)^{-1}$.
- OEHHA inhalation slope factor = 0.021 $(mg/kg/day)^{-1}$.
- OEHHA inhalation unit risk = 5.9×10^{-6} $(\mu g/m^3)^{-1}$.
- Carcinogenicity: EPA—carcinogenicity currently under review; DHHS—may reasonably be anticipated to be a human carcinogen; IARC—probable human carcinogen (limited human, sufficient animal evidence).

Toluene (77)

- Naturally-occurring chemical; also occurs as a result of industrial processes.
- Widely used solvent in many industrial processes and products.
- Enters body through ingestion, inhalation, or dermal absorption.
- Adverse health effects due to intermediate and chronic exposures include tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite.
- Chronic inhalation MRL = 0.08 ppm (0.30 mg/m^3) (neurological effects in humans).
- RfC = 400 $\mu g/m^3$ (neurological effects in humans).
- Chronic REL= 300 $\mu g/m^3$ (affects on nervous system, respiratory system, and development).
- Intermediate oral MRL = 0.02 mg/kg/day (neurological effects in mice).
- RfD = 0.2 mg/kg/day (increased organ weight in rats).
- Carcinogenicity: EPA—not classifiable; DHHS—not classified; IARC—not classifiable.

Trichloroethylene (TCE) (78)

- Synthetic chemical, liquid at room temperature; most commonly used as a degreaser, also used in some household products.
- Evaporates readily from surface soil, water; breaks down in air to form phosgene, a lung irritant; breaks down more slowly from deep soils, groundwater.
- Can enter body through inhalation, ingestion, or dermal absorption.
- Adverse health effects due to chronic exposure possibly include childhood leukemia, heart defects, and other birth defects.
- Acute inhalation MRL = 2,000 ppb (10,700 $\mu g/m^3$) (neurological effects in humans).
- Intermediate inhalation MRL = 100 ppb (540 $\mu g/m^3$) (neurological effects in rats).
- Chronic REL= 600 $\mu g/m^3$ (effects on the nervous system and eyes).
- Acute oral MRL = 0.2 mg/kg/day (developmental effects in mice).
- OEHHA oral slope factor = 0.013 $(mg/kg/day)^{-1}$.

- OEHHA inhalation slope factor = 0.007 $(mg/kg/day)^{-1}$.
- OEHHA inhalation unit risk = 2×10^{-6} $(\mu g/m^3)^{-1}$.
- Carcinogenicity: EPA—probable human carcinogen (inadequate human, sufficient animal evidence); DHHS—may reasonably be anticipated to be a human carcinogen; IARC—probable human carcinogen (limited human, sufficient animal evidence).

Xylenes (79)

- Naturally occurring chemical, also synthetically produced; used as a cleaning agent, solvent, paint thinner, and in other products.
- Evaporates easily; does not dissolve easily in water; breaks down slowly in soil or groundwater; breaks down relatively quickly in sunlight in air.
- Can enter body most commonly through inhalation, ingestion, or dermal absorption.
- Chronic inhalation MRL = 100 ppb (4,340 $\mu g/m^3$) (neurological effects in humans).
- RfC = 100 $\mu g/m^3$ (neurological effects in rats).
- Intermediate oral MRL = 0.2 mg/kg/day (blood effects in rats).
- RfD = 0.2 mg/kg/day (hyperactivity, decreased body weight, increased mortality in rats).
- Carcinogenicity: DHHS—not classified; IARC—not classifiable.

Appendix G—Fact Sheet Summarizing Public Comment Draft of Del Amo Public Health Assessment

The Del Amo Site: Public Health Assessment Recommendations and Findings

March 2003

Background

The Del Amo site is a hazardous waste site in western Los Angeles County, between the cities of Torrance and Carson. The harmful chemicals at Del Amo came from a company that was on the site. The company, which made synthetic rubber, opened in 1942 and closed in 1972. Most of the site has been made into an industrial park. Since 1983, residents and government agencies such as the California Department of Health Services (CDHS) and the U.S. EPA have been working together to make sure that chemicals on the site do not harm the health of the people who live and work near Del Amo.

When the rubber company was in operation, they dumped waste chemicals from the rubber making process into six waste pits and three shallow ponds. The largest amount of harmful chemicals on the site is in this waste pit area. The chemicals are in the soil and in the "soil gases" (gases in the spaces between the particles of soil). There is a fence around the waste pit area and the pits are covered with a "cap" to keep the waste from spreading and prevent people from coming into contact with the waste. The cap is made up of several layers of different materials, including a layer that contains pipes. The soil gases go through the pipes to a "soil gas treatment unit." The treatment unit removes the chemicals from the gases.

Fifty-five homes that were closest to the waste pit area were bought out during the clean up of the site. The soil around two of these homes had hazardous chemicals in it. These chemicals did not come from the Del Amo site. The chemicals have been removed, and this area may be made into a park.

The Public Health Assessment

CDHS conducted a public health assessment (PHA). A PHA includes an examination of the chemicals at a hazardous waste site and the area around it. A PHA is done to find out if the chemicals at a site could harm the health of people who live or work near the site. This fact sheet includes a summary of what we learned from the PHA and the recommendations we made, as well as information about comments or questions you may have about the PHA.

Recommendations

Although most of the areas on the Del Amo site do not pose a health risk, some areas may pose a slight health risk. Below are some of the recommendations CDHS made to the U.S. EPA and others to make sure that the chemicals do not cause health problems:

- Make sure that the cap over the waste pit area, and the fences around the soil gas treatment units, are in good condition. This will keep the chemicals from spreading, and prevent people from coming into contact with the waste, and make sure that the treatment unit is not damaged. (Ongoing.)
- Make sure that the method used to get rid of chemicals from the soil gas will not harm anyone's health.
- Test the air in buildings that are built over groundwater that has large amounts of chemicals in it to find out if harmful soil gas is getting in. (Some tests have been done, and more are underway.)
- Make sure that chemicals in the groundwater do not get into wells that are used to supply water to the public. (Planning has begun.)
- Make sure that harmful amounts of chemicals in the soil gas do not get into the air when there is construction.
- Make sure that as little dust as possible is made when more construction is done. Chemicals in the soil could be breathed in if there is dust. Also, when any buildings, parking lots or roads are dug up on the site, the soil that was underneath them should be tested to see if there are harmful amounts of chemicals.

Main Findings of the Del Amo Public Health Assessment

Soil Gas on the Del Amo Site

- Soil gas could get into some buildings on the Del Amo site. The buildings that could have this problem are ones that were built over soil and groundwater that have large amounts of harmful chemicals in it (see map). For example, some areas have very high levels of the chemical benzene. If you add small amounts of benzene to water, the benzene dissolves. If you add very large amounts to water, it does not dissolve. Instead, it stays separate, like oil and water. When this happens, the benzene (or other chemical) is called light non-aqueous phase liquid (LNAPL). Even though the contamination is far below the surface, harmful chemicals from LNAPL can get into the soil gas, and into the buildings, and may

cause health problems. The LNAPL was found under the waste pits and under some areas where the former rubber plant was located (north of Del Amo Blvd.) (see map).

Surface Soil Testing Where the Homes Were Bought Out (Future Park)

- The surface soil in this area was tested before the homes were bought out. The tests found only very small amounts of chemicals from the Del Amo site. These small amounts would not be harmful to anyone's health. The homes next to the soil gas processing area were bought out so that the construction of the cap could happen as quickly and efficiently as possible. The people responsible for building the cap decided that it was best to move residents away from the site.
- Now that the two homes where DDT was found have been cleaned up, the levels of other hazardous chemicals in the surface soil (like arsenic and lead) are too low to harm anyone's health.

Drinking water:

- Some of the groundwater under and around the Del Amo site has harmful chemicals in it. This groudwater is far from the drinking water wells.
- There are no wells that get water from the contaminated groundwater. This means that chemicals in the groundwater at Del Amo are not in any water used by people or businesses.
- There are three water companies that operate 14 drinking water wells within four miles of the site: California Water Service Company, Southern California Water Company, and the City of Torrance Water Department. The water from these companies is tested to make sure that it is safe to drink.

Waste pit area before it was capped:

- The waste material in the pits was covered with dirt and other material as far back as the 1950s. A fence was built around the pits in the 1980s. However, residents said that when they were children, they played at the waste sites and they saw waste material on the ground. If children played with the waste material often, they would have a slightly higher chance of getting cancer and other health problems.
- CDHS does not expect that breathing the air in the waste pit area before it was capped would cause health problems.

Past Activities

The PHA looked at information from past activities. The following activities were carried out to address community concerns and to find out if the chemicals from the site have affected the health of the community:

- A study of the health of community members was done in the late 1980s. The study and review indicated that residents living near the Del Amo site did not have higher than expected rates of cancer, miscarriage or other reproductive problems, or death. Although there were higher rates of liver disease, residents who had this health problem d'd not live closer to the site than residents without liver problems. Therefore, the liver problems were not thought to be related to the chemicals on the site. The study also found higher than expected rates of skin, eye, nose, and throat irritation as well as earaches, dizziness, and fatigue. People who had these health problems lived closer to Del Amo than people who did not have these health problems. Therefore, chemicals on the site could have caused these health problems, or they could have been caused by other sources of contamination (such as nearby industry or vehicle exhaust) in the area.
- The University of California at Irvine developed a two-year program, the Del Amo/Montrose Community Environmental Health Program. The program offered a range of diagnostic health services to 596 residents living near the Del Amo site. The services included blood tests for DDT, and a variety of other medical tests and health questionnaires to find out about health problems that could have been caused by contact with chemicals from the Del Amo and Montrose sites. Although this was not a health study, the investigators did look for patterns of health problems among the people who participated in the program. They found that people in the neighborhood did not seem to have health problems related to the Del Amo site.

Public Comment Period

This fact sheet contains some of the main findings of the public health assessment. CDHS invites you to read the complete report, which is available at the Torrance Civic Center Library, 3031 Torrance Blvd., Torrance. The public comment period is from March 28 to April 30, 2003. Please send your comments or questions about the public health assessment report in writing to:

Tivo Rojas
California Department of Health Services
Environmental Health Investigations Branch
1515 Clay Street, Suite 1700
Oakland, CA 94612

If you have any questions about the public comment period, please contact Tivo Rojas at (510) 622-4500 or at trojas@dhs.ca.gov.

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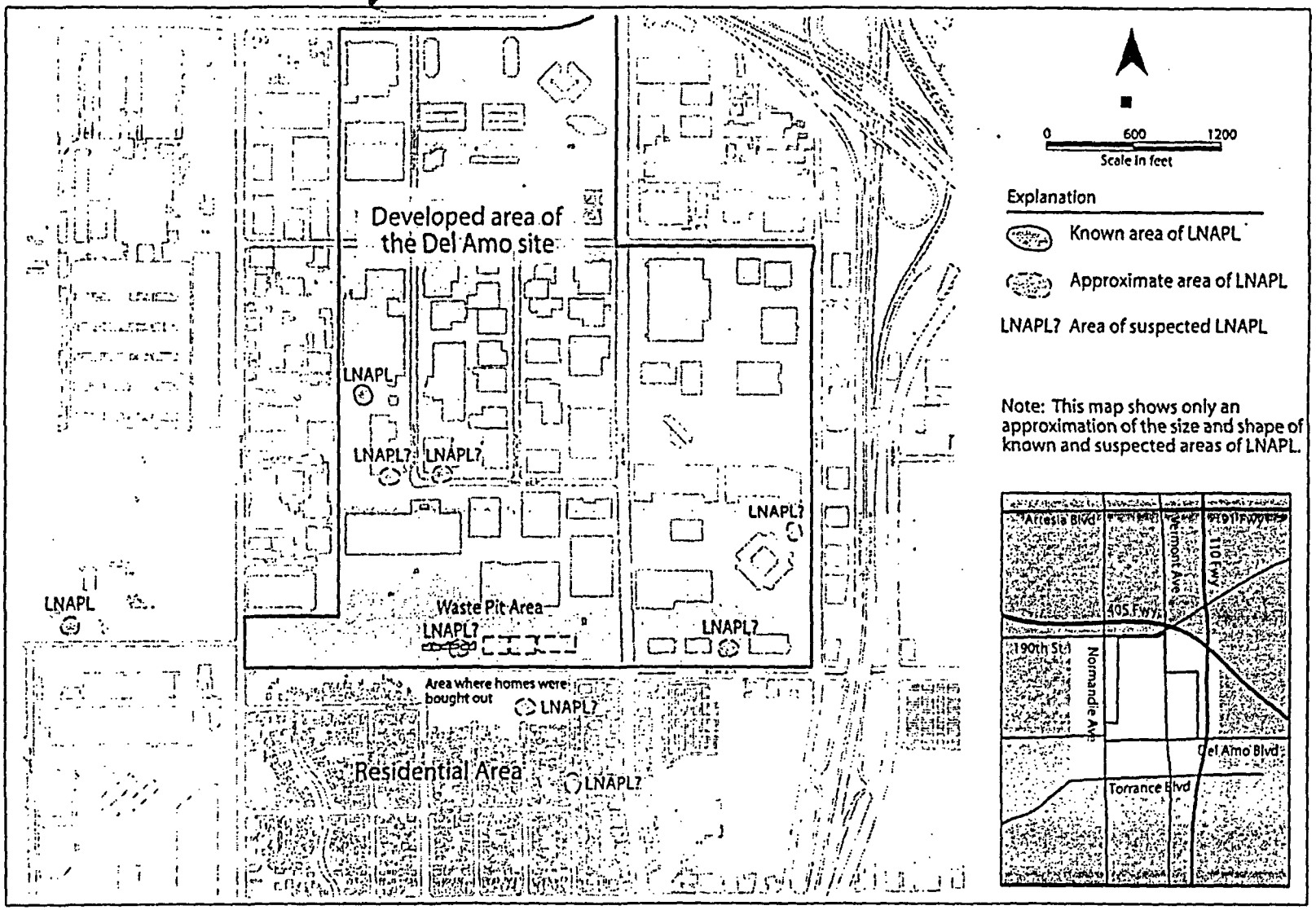
Del Amo Site and Surrounding Area



Source: Dames & Moore

Appendix H—Public Comments and Responses from the California Department of Health Services

On May 8, 2003, this Public Health Assessment (PHA) for the Del Amo site was released in draft for public comment. The comment period was scheduled to end June 7, 2003, but at the request of a community group, the California Department of Health Services (CDHS) extended the public comment period to August 3, 2003.

As part of the release of this PHA, CDHS prepared a fact sheet that provides a summary of the PHA (see Appendix G). This fact sheet was mailed to 2,000 addresses, including those located south of the site and to commercial addresses located on the developed portion of the Del Amo site. The PHA was placed in several libraries in the area for public review and comment. The fact sheet and the PHA were mailed to more than 300 addresses from the CDFS mailing list for the Del Amo site. This list contains residents and former residents of the nearby neighborhood, other community stakeholders, civic and political interested parties, and government agencies. The PHA and fact sheet are available on the CDHS web site at www.cdhs.ca.gov/ps/deodc/ehib.

CDHS received four sets of comments from each of the following groups: Del Amo Action Committee (DAAC), U.S. Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), and Shell Oil Company (representing the responsible parties). The comments are provided in the following pages. Comments about typographical errors are excluded. When appropriate, a response from CDHS is provided in bold face type.

Comments from Del Amo Action Committee

Thank you for the comment period extension and the opportunity to comment on this public health assessment - exposure pathway analysis, on the Del Amo Superfund Site. We are submitting comments generated by our technical advisor, followed by specific point-by-point comments generated by our director.

In general, this PHA does a good job at making accurate conclusions about the Del Amo Waste Pits and characterizing the potential exposure pathways from this Superfund site. However, the concomitant exposure from the nearby Montrose site is not identified as an ongoing risk to the residents of the nearby areas. Exposures to DDT levels that are of concern are most likely occurring during backyard gardening, exposure to house dust, consumption of homegrown produce and chickens and their eggs, and during lactation.

The vapor intrusion pathway is correctly identified as an exposure pathway from the Del Amo site. However, the potential for vapor intrusion into nearby residences was not identified as a potential exposure pathway to contaminants. The Independent Reviewers identified the Del Amo Waste Pits as a source of contamination that they thought posed a health risk to the community in their report. Clearly, air borne emissions from the waste pits also pose an exposure pathway of concern. Some of this may be mitigated by the vapor recovery system that is being designed, but it is not clear if this system will capture all the vapors since it is only installed in the waste pit area and cannot be expected to capture vapors in the surrounding soils.

CDHS response: In this PHA, we evaluated the possibility that contaminated groundwater flowing beneath the houses in the neighborhood could affect the indoor air. CDHS estimates of indoor air levels indicate that the groundwater does not pose a public health hazard to residents living south of the site. CDHS did not evaluate the horizontal movement of underground vapors from the waste pits into nearby homes. This is because the soil-gas data collected around the pits did not indicate that this was occurring when the waste pits were not covered. Now the waste pits are covered so the gases cannot escape out the top. For that reason, a soil gas system is in place under the cap.

The finding of PCBs, benzene and ethylbenzene in the developed portion of the Del Amo site also presents serious public policy issues. First, how could this land have been redeveloped without adequate site characterization? Second, how does this redevelopment affect potential exposures? And third, how do the liabilities at the site play out with new owners; i.e., who will ultimately pay for the cleanup of this contamination if the land use changes or if regulatory agencies determine it needs to be cleaned up due to the potential for exposures in a future use? The PHA does say, "If paving or a building is removed or constructed, it is possible that chemicals may be present in the surface and shallow soil which could then pose a health hazard. ...we would recommend further testing in those areas where soil has not been tested when and if the soil is exposed." This begs the question of what should be done to eliminate exposure to these soils and what types of restrictions should be placed on the site to eliminate this exposure scenario.

It would be helpful if the information in this PHA could be summarized in a tabular form. Each pathway and the contaminants of concerns and whether or not they are a current or future exposure problem would be the relevant sections of the table.

CDHS response: Table 2 has all of the pathways and all the elements of each pathway presented in it.

Again, this PHA presents a lot of good information for the community, but it sometimes is lacking in clarity and direction to the relevant regulatory agencies as to what current and future mitigations need to occur to prevent exposure.

Specific Point by Point Comments and Questions are in italics and referenced sections are identified by page and "quotations".

Summary, Page 1, the first paragraph explains the reason for the Public Health Assessment. The name Public Health Assessment is misleading. Often communities believe the intention of this document is to assess their health or the health of the community. It would be very helpful to supplement the title with, "Exposure Pathway Analysis"; this will help by not setting the document up for an immediate failure in the view of communities being impacted by these sites. If this were adopted for all PHA's, we believe the Department of Health Services would see a visible change in the perception of this type of document in the communities it serves.

CDHS response: We agree that the name is misleading to the community and that the emphasis of most PHAs is exposure pathway analysis. In this document and others, community concerns and health outcome data are also discussed.

Summary, Page 1, "The groundwater contamination is mixed with contamination from the nearby Montrose Superfund site, on the western edge of the Del Amo plume, and from a few smaller facilities." Should indicate plume direction. Include the names of the smaller facilities and chemicals of concern.

CDHS response: This information is presented in the background section of the text or in Figure 4. In the interest of brevity, this information was not placed in the summary.

Summary, Page 1, "In this PHA, there will be separate discussions of the health hazard posed by the developed part of the site, the waste pits, the groundwater contamination, and possible offsite exposures." If offsite exposures include the adjacent community, it should clearly state so.

CDHS response: The text was revised to make this clearer.

Summary, Page 1, "In this reexamination of the site..." Does reexamination mean, a) 1992 and beyond work done in the community or b) in this PHA?

CDHS response: The text was revised to make this clearer.

Page 3, "However, air measurements taken around the waste pits indicate the waste pit emissions do not significantly affect the air quality in the area when undisturbed." Our area air quality is already really bad. Need to compare emissions with average air quality, not just our toxic soup airways at this site.

CDHS response: We agree that the air quality in the neighborhood needs examination. To that end, CDHS requested the assistance of the South Coast Air Quality Management District (SCAQMD) to conduct air sampling in the neighborhood. Their sampling effort and findings are described in Appendix D, item p.

Page 3, "This eliminates any current or future exposure and emissions from the waste pits at the site." What about vapors escaping from the sides?

CDHS response: We did not evaluate the horizontal movement of underground vapors from the waste pits into the nearby homes. The soil-gas data collected around the pits did not indicate that this occurred when the waste pits were not covered. Now the waste pits are covered so the gases cannot escape from the top. For that reason, a soil gas system is in place under the cap.

Page 3, "Arsenic and cadmium are not related to activities at the Del Amo site. There have also been detections of other chemicals (primarily PAHs) that could be related to the Del Amo site." If arsenic and cadmium are harming the community or have the potential to harm the community at the levels that are being detected it should be clearly stated. What is being recommended as a followup to these chemicals and what are the names of these chemicals?

CDHS response: The comment is about a summary bullet in the Summary section. The pathway is further described in the pathway evaluation section. Namely, CDHS estimated the exposure for an adult and child who spend time gardening, playing, or doing some other activity in their backyards in the neighborhood south of Del Amo. We assumed the adults spent every day of the week for 52 weeks of the year for 30 years in their backyards. For children, we assumed that they spent every day from 6 months to 5 years of age, and from 5 to 12 years of age we assumed they spent every weekend day in the backyard. The maximum concentrations of arsenic, cadmium, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene in surface soil (6 inches or fewer below ground surface [bgs]) were used to calculate the exposure dose for backyard activity exposure. CDHS assumed that the adult resident ingests 50 mg/day of soil and the child ingests 100 mg/day of soil, and that the entire contribution is from the backyard soil.

The estimated dose for adult residential exposure to soil in the backyard does not exceed the noncancer health comparison values for arsenic and cadmium which means that noncancer health effects would not have been expected to occur when an adult resident spends time in area in the backyard being exposed to the maximum levels of chemicals of concern in the soil. Similarly, a child playing in the backyard would also not be expected to experience any noncancer health effects from exposure to the soil.

A low increased cancer risk (2.8 in 10,000) may exist for adults who have come into contact with soil containing the maximally measured levels of arsenic and PAHs in the soil on a routine basis for 30 years and a low increased cancer risk (6.0 in 100,000) may exist for children.

Since these homes were part of the buyout no further action is required to reduce or eliminate exposure.

Page 7, "The waste pits consist of three evaporation ponds (1A-3A) and six disposal pits (2A-2F). There are 7 (seven) unlined pits. C2REM created a 7th pit on the north side of pit 2B; we believe that was the location. Both vegetation from the site and waste seeps that were encountered in preparation for the cap were placed in this newly created unlined pit. It should be recorded on maps for future referral to waste locations, just like the metal slag burial sites. As well, the description should be evaporation ponds (1A - 1C).

CDHS response: We corrected the text to read 1A-1C. We added text to the background section about the additional material that was placed under the cap.

Page 9, "Funds were appropriated by the state legislature to help build the park." This funding is believed to have rolled back into the budget due to the CA budget crisis.

CDHS response: The text has been changed to reflect this.

Page 9, "The DDT-related investigations and cleanup will not be discussed in this health assessment because they are not related to activities of the Del Amo facility". Two points here, one is that there is DDT in the Del Amo waste pits according to data reviewed for this PHA and therefore should be evaluated. The second point is that cumulative impacts need to be discussed and explored in public health assessments. In many instances these two sites are inseparable. Maybe a special section could be used for such an analysis.

CDHS response: CDHS evaluated DDT-data when available for samples relevant to Del Amo activities, see Tables 2, 3 4, 11, and 14. We also took DDT into account when calculating doses for on-site exposure (Table 5). The data for DDT in the waste pits are presented in Table 11. CDHS did not pursue an analysis of the DDT found in the community south of the Del Amo site that was found to be related to the Montrose site.

Page 11-12, "Toxic Release Inventory (TRI) Search" It is good to see this section looking at other impacts in the community. These types of impacts need to be evaluated with a critical eye looking specifically at environmental justice impacts and susceptible populations.

Page 17, referencing the summary section in the beginning of exposure pathway sections. We like the up front summary in these sections. It would appear to be helpful for many types of readers.

Page 18, "Therefore, there is potential for future exposure to soil contamination if excavation activities occur at the Del Amo site without safety and engineering controls". Who will be in charge of placing these controls in place and who will be responsible to follow up on this recommendation? DAAC has observed various types of construction on this site, from railroad spur maintenance, to digging a trench for a new irrigation system, to a company digging a huge pit inside their building to place a large piece of machinery at a level workers can operate it. No one, except DAAC, that we know of has ever even approached workers in the field to check to see if they have been informed about the areas hazards. Every single time we have done so we have been told they were not aware of any additional safety measures needed to perform their job. So just talking about safety and engineering controls is just that, talk - if no one seriously puts together a plan with a specific process in place. DAAC requests that whom ever is in charge of protecting public health at this site make sure such a plan is put in place.

CDHS response: The South Coast Air Quality Management District (SCAQMD) has responsibility for oversight on air releases. As long as it is a Superfund site or undergoing 5-year review, EPA or its designated agency would also have responsibility for what goes on at the site.

Page 19, "These chemicals are not considered related to the Del Amo site but to some other activities that occurred on the site in recent times." This document should be straightforward and not vague. What other activities?

CDHS response: The text has been modified.

Page 26, "Private parties have conducted indoor air sampling (40); however, we concentrated on the data gathered with oversight by U.S. EPA". Why? All data should be seriously considered or excluded if flawed. If data is considered flawed a reason for this conclusion should be clearly stated.

CDHS response: CDHS tried to review and include as much data that were available. In the case of the indoor air data, we were more comfortable presenting the data gathered under EPA's oversight.

"Summary - Exposure to the Waste Material and Surface Soil Around the Waste Pit Area Before It Was Capped". What follow up has been done with these reports? It is assumed that this information was gathered by the ATSDR clinic effort and therefore contact information on these individuals should be available. DAAC recommends that a formal effort be made to contact these individuals and notify them of these conclusions; which would seem to be extremely important to anyone engaged in proactive healthcare activities.

CDHS response: As a part of the clinic visit, information was gathered about the person's experience with the two sites, Montrose and Del Amo. We assume the individual's who played at the waste pit would have volunteered this information when they were asked. The clinic staffs were trained by CDHS staff about the exposure issues related to the two sites. There is no plan to identify, track, and notify the individuals who did play at the waste pits.

Page 27, "The waste pits consist of three evaporation ponds (1A, 1B & 1C) and six disposal pits (2A-2F) (22)." Refer to Page 7 comment on this subject. There are 7 (seven) unlined pits. C2REM created a 7th pit on the north side of pit 2B; we believe that was the location. Vegetation from the site and waste seeps that were encountered in preparation for the cap were place in this newly created unlined pit. It should be recorded on maps for future referral to waste locations, just like the metal slag burial sites.

CDFS response: The material encountered during the grading was buried near the disposal pits, and covered by the cap. This information was added the background section of the PHA (page 8).

Page 28, "The cancer risk to the child trespasser who is exposed to the maximally contaminated waste material in the pit 1F is 1 in 10,000, this is considered a low increased cancer risk" Using the term "child trespasser" is a derogatory term and should be removed, really the villain here is the contamination not curious children?

Page 28 & 29, "If the waste material had been disturbed, VOC's (for example benzene and ethyl benzene) would be released in large amounts. Even the undisturbed waste emitted chemicals to the air through the fill material. However, air measurements taken around the waste pits indicated the waste pit emission did not significantly affect the air quality in the area." What about the trucks that were driving over pit 2B causing it to sink in the middle. This was discovered July 14, 1994 and Shell soon had gravel placed over pit 2B and the area clearly marked for future truck traffic, which then would go between pits 2B & 2C. Therefore, significant releases must have occurred when these seeps oozed up to the surface on several occasions that we know of and probably many times that went undocumented.

CDHS response: If activities occurred that disturbed the waste material than the release of VOCs could have occurred. Such releases are not documented and thus were not evaluated.

Page 29, "The data also suggested that the emissions could be approximately 10 times greater from the disposal pits than from the waste pits." Please clarify, disposal pits are the waste pits or were the disposal pits referring to the evaporation ponds?

CDHS response: The text has been corrected.

Page 30, "This eliminates any current or future exposure and emissions from the waste pits at the site." A caps life expectancy is not set in stone. How old is the oldest cap that has been put into place on a superfund site? This cap has already required some soil replaced due to burrowing activities by rodents and it is only 3 years old.

CDHS response: Based on your comment and others, we have modified the concluding statement to reflect that the effectiveness of the cap is dependent on maintaining the cap.

Page 36, "The residents south of the Del Amo waste pits were bought out of their property, so there is no current or future exposure for residents." This is a misleading statement. There are still residential areas directly to the south of the pits!

CDHS response: As a result of buyout, there are no residences on the property where the soil sampling was conducted, directly south of the waste pits area. Since there was no

material related to the Del Amo site found on the property closest to the site, we would conclude that residents farther away would also not be getting exposed to chemicals that migrated via surface-water runoff or aerial dispersion.

Page 36, "Slag material gathered by the county contained some elevated metals, this material should be removed before the park is created." DAAC requests that a specific correspondence on this recommendation be prepared and sent out by DHS to all parties impacted by the buyout area on 204th street, including the Del Amo Action Committee. Our new address is: Del Amo Action Committee 1536 W. 25th Street, #440, San Pedro, CA 90732; we seem to have been left off the last several communications on this issue.

CDHS response: As the information has been made available to CDHS from the county or DTSC, we have made it available to DAAC.

Page 37 "...contained the elevated DDT levels, were bought by ... (24)." The word "the" is misleading and should be removed; other areas with highly elevated levels of DDT were detected in the community and on Kenwood Ave. Being perfectly honest there are quite probably other areas in the community with highly elevated DDT levels, which have yet to be identified.

CDHS response: We agree that "the" is not needed and have removed it.

Page 39, Conclusions, "Based on this, CDHS determined that the site posed a health hazard in the past, poses a health hazard now, and is an indeterminate health hazard in the future." We do not disagree with the conclusion but are confused by it. Our comprehension of this PHA as we reviewed it, seemed to be leading to a conclusion that risks were really just either non existent or too small to be concerned with. It seems the reader of this PHA would find it hard to reach the opinion stated in the conclusion quoted above. This is a problem. The document should be crystal clear as to all gaps in data, hazards posed to humans (including susceptible population risks, like to our Latino population), cumulative risks from all know sources and chemical synergism of chemicals involved. Recommendations should be concrete and identify what is needed to rectify the current hazards and make damn sure everyone is as safe as possible in the future, including workers and the near by communities.

CDHS response: Based on your response and others, we have introduced the conclusion category language (health hazard) in the summaries and evaluations of the various exposure pathways. Hopefully this will make it more clear how we arrived at these conclusions.

Page 41, "Arsenic and cadmium have been detected at levels exceeding typical western soils and health comparison values. Arsenic and cadmium are not related to activities at the Del Amo site. There have also been detections of other chemicals that could be related to the Del Amo site." What other chemicals? What exactly is it that you are saying here?

CDHS response: We are referring to PAHs, and we have added this to the bullet.

Appendix E, Page 131, "Found that in the past, residents and workers had been exposed to volatile aromatic hydrocarbons (benzene and ethylbenzene) from Del Amo by breathing the air and may have been exposed to polycyclic aromatic hydrocarbons (naphthalene, benzopyrene, phenanthrene, and chrysene) through skin contact and by eating small amounts in soil;" What are the dates considered "past"?

CDHS response: The information that is being quoted is from a summary of the previous Del Amo PHA. The air and soil pathway mentioned in the comment refers to exposure before the waste pits were covered to some extent in 1951, and to a greater extent in 1965.

Page 132, "These contaminants were found too deep beneath the ground to be considered actual health risks;" How deep and what basis is used to make this determination?

CDHS response: The information that is being quoted is from a health consultation written by CDHS staff and finalized in 1995. Soil data that is reviewed for health implications came from 1.0 to 3.0 feet below ground surface (bgs) and 3.75 to 5.0 feet bgs. In the document the authors state, "ingestion and dermal doses were not calculated because the contaminants were detected in subsurface soil samples."

Page 132, "...(Note: U.S. EPA later discovered that the source of benzene in the home with highest levels was due to a malfunction stove)." This is a questionable statement in our opinion; no proof of this was ever presented. This home also was closest to the mother load of pure DDT buried adjacently to the pits and also one of the closer homes to the source of the groundwater plume of benzene.

CDHS response: Staff at EPA reported that the local gas and electric company was contacted and they identified a problem and fixed it. EPA also reported that subsequent testing showed that the benzene problem did not exist.

Page 134, "Although chickens and chicken eggs from this area did contain DDT close to the FDA action levels, the exposures did not pose a health risk." This is an inaccurate statement. No level of DDT is safe and all of the eggs collected from this area contained DDT, many of them were over the FDA action level.

CDHS response: The information that is being quoted is from a fact sheet that summarized the Montrose PHA that was released as a final in 1997. The egg sampling that had been conducted at that time did not indicate a health risk. Additional sampling of backyard chicken eggs has been conducted since that time and indeed, has indicated a health concern. At the time the report was released, it was an accurate statement. (The documents that summarize that information are also summarized in the appendix.)

Page 135, "Education was provided about safer chicken-raising practices and a medical evaluation at the clinic was offered." Education outreach petered out when you and then another staff person left CDHS and this outreach was and still is left to the community to figure out and fund.

CDHS response: We know it is hard to reach to residents who have backyard chicken eggs one time and there is a need to continue to reach the older residents as well as new ones that may have come into the area. To the extent possible with our current resources and other demands, we will continue to identify ways to work with DAAC and the community to keep the outreach going.

Page 135 & 136, "In June, 1999, ATSDR released a Health Consultation Contingency Plan for the Del Amo/Montrose EPA Neighborhood Soil Sampling event (61)." The yard of one house had levels of DDT that were a health concern, and EPA placed a temporary cover over the soils in that yard. The contingency plan was not followed when it was needed the most. This situation was not dealt with in an expeditious manor. EPA had to be continually nagged by DAAC and the partners. In the future agencies that are mandated to protect the public ought to try much harder to carry out this mission even if they are not the lead agency at the site.

CDHS response: CDHS reviewed and approved of the measures put forth in the ATSDR contingency plan health consultation. As CDHS understands it, EPA also reviewed and approved it. CDHS was not able to oversee the soil sampling events but assumed that the contingency plan was followed. In discussions with EPA later on, we became aware that the plan was followed to the extent it could be followed but that there were deviations from the protocol that ATSDR put forth.

Page 135 & 136, "No DDT was found in any produce grown in the neighborhoods, but samples did not include root crops." This is not a true statement for two reasons. One, most of the fruit and vegetable samples collected rotted before any testing could be preformed and two, the radishes EPA planted showed DDT when sampled. Even though EPA attributes this to dust blowing in the wind, no proof of this has ever been presented. Many of the vegetables collected and sampled at 1055 204th Street contained DDT and DDE as well. Even though in this section it is specified that this was an effort during U.S. EPA's phase II sampling it is misleading and makes one believe this is not a completed exposure pathway, if one did not know any better.

CDHS response: The information that is being quoted is from a health consultation written by CDHS staff and finalized in 2000. The vegetable data was collected as a part of EPA's Phase I neighborhood sampling. We are aware that some of the vegetable and fruit samples were not analyzed because of rotting problems. Of the over 40 samples that were analyzed, only one sample had detectable levels (cabbage at 2.0 ppb). For Phase II sampling, EPA planted and tried to grow radishes at more than 10 homes in the neighborhood. After harvesting radishes from four homes, the radishes were sent for analysis. DDT and DDE were detected in all of the samples, but the laboratory later reported it did not wash the vegetables before analyzing them. (A letter from the laboratory confirms this). DDT and DDE might have been on the outer (red) layer of the

radishes, but the radishes might have been washed before they were eaten; therefore, these data are not helpful for human health interpretation. Finally, the vegetables, collected at 1055 204th Street in 1993 (reported on in the Montrose PHA) did contain low levels of DDT and DDE. However, the chemicals were not at levels of health concern. People may eat fruits and vegetables grown in their backyards, because the data that have been collected to date does not indicate a public health hazard.

Thank you again for the opportunity to comment on the Del Amo waste pits Public Health Assessment. It seems to be generally one of the better PHA's we have reviewed. DAAC looks forward to working with you to ensure the needs of this community are put in the forefront and a strong voice of advocacy is heard. If you have any questions or would like to discus any of our questions or comments further please do not hesitate to call us.

U.S. Environmental Protection Agency Comments

Summary, Page 1, last paragraph, 1st sentence (also see conclusions, page 39, 1st paragraph, 3rd sentence): The sentence states that the site poses a health hazard now. EPA believes that the statement is stronger than the available data and discussion in the body of the PHA can support. Edit the sentence to state that the site poses a potential health hazard now.

CDHS response: The five categories of public health hazard that ATSDR uses are the following:
1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

These are terms that the ATSDR and EPA have agreed to use. There is no "potential" public health hazard category. Because 1) the current public health hazard is based on modeling of indoor air impacts from subsurface contamination in the LNAPL areas, and 2) because the current public health hazard is not based on actual data, the text has been modified to read "may" pose a public health hazard now.

Page 4, last asterisk (*): The last sentence of the paragraph states that the slag material found in the "buy-out" area should be removed before a park is created. This recommendation was not included in the previous PHA draft, and the report provided no rationale for the new recommendation. EPA disagrees that the slag material should be removed before a park is created. The slag material would pose no adverse health impacts park users because the slag is buried beneath the top soil, and the slag is a solid mass that does not affect the metal content of surrounding soil. No exposure pathway would exist from which the metals within the slag would enter people's bodies. Finally, it should be noted that there are several hundred tons of the slag material within the buy-out area, and excavation and disposal of the slag would be a large and costly undertaking.

CDHS response: As reported on page 38, the county collected slag material from the surface of the soil, grouped the material into five different groups, and sampled each group for metals. The crystallized metal sample contained elevated arsenic. The metal block sample contained elevated nickel. The recommendation arises from these findings, namely, to remove the slag material during grading of the surface especially in areas where the soil will remain exposed. We did not mean to imply that this removal should occur for the subsurface. The text has been modified in several places to make this clear.

Page 5, Background section, 1st paragraph, 2nd sentence: The sentence states that the CDHS will determine whether health effects are likely to occur because of exposure to site contaminants. This statement seems to imply that the PHA can predict health outcomes for individuals, which is incorrect. Edit the sentence to state that CDHS will determine whether health effects may occur.

CDHS response: Semantics and use of language are very complex. We did not mean to imply that we could predict health outcomes for individuals by using the phrasing we did. The text was changed.

Site Description and History, 9th sentence: The sentence states that the (waste pits) area is currently double fenced. This is incorrect; there is currently only one fence surrounding the waste pits property itself. Revise the sentence to correct this point.

CDHS response: Text was revised.

Surface Soil or Near Surface Soil Exposure in the Developed Portion of the Site, Page 18, 1st paragraph, 2nd sentence. The sentence states that no soil cleanup has ever occurred in the developed portion of the site. This is incorrect; a property owner conducted a removal action in an area in the northwest corner of the site that encompasses two parcels (parcel no. 7351-31-24 and 31-25). The owner removed all shallow soil where concentrations of contaminants exceeded EPA's PRGs. Revise this sentence to reflect the clarification.

CDHS response: CDHS reviewed records previously made available by EPA and have no record of this removal. However, the text has been edited based on this comment.

Page 18, 2nd paragraph,: The statements in this paragraph regarding the surface and near surface soil sampling at the site would have been true up until November 2002. In November, EPA and the PRPs initiated new soil matrix sampling activities that targeted locations of former rubber plant facilities with the potential for having released hazardous substances. These sampling activities are still underway at this time.

CDHS response: We are glad to hear that additional soil sampling is planned or underway. We will add this information to the PHA's *Public Health Action Plan.*

Indoor Air Exposure in the Developed Portion of the Site, Page 24, 3rd paragraph, 4th sentence:

This sentence states that the Responsible Parties did not sample the soil gas near buildings. This is incorrect; there were many locations across the site where the soil gas sampling was conducted immediately adjacent to existing buildings. Specifically, soil gas samples were taken adjacent to buildings on the following parcels: 7351-31-18, 31-27, 31-29, 31-30, 7351-33-9, 33-15, 33-17, 33-23, 33-27, 7351-34-23, 34-41, 34-47, 34-56, 34-57, 34-66, 34-67, 34-69, 34-72, 34-75, and 34-76.

Furthermore, on page 26 of the PHA, in the first full paragraph, it is stated that DHS used soil gas data that appeared to have been drawn close to the building foundations. All data provided to DHS for this PHA had been data gathered by the Responsible Parties. This paragraph acknowledges that the Responsible Parties did sample the soil gas near the buildings, which contradicts the aforementioned statement. Revise the sentence accordingly.

CDHS response: The text was changed on page 24 to reflect this information.

Exposure to Air Emissions from the Waste Pits Area Before It Was Capped, Page 30, 2nd full paragraph, last sentence: The sentence describes the noncancer exposure levels for the three contaminants found at concentrations above health comparison values. However, the sentence could cause a reader to wonder about cancer effects. Please clarify for readers whether the contaminants being described are carcinogens or not.

CDHS response: The comment refers to a part of the PHA where we are summarizing findings of a health consultation that was written by CDHS. In that health consultation, the cancer risk was assessed. This information was added to the summary in the PHA.

Exposure to Releases from the Treatment of Soil Gas Captured from under the Waste Pit Cap, Page 31, *Summary* section, last sentence: The sentence recommends that the potential health impact of the soil gas treatment strategy be evaluated before a selection is made. EPA has performed this action. In evaluating potential health impacts of vapor treatment systems, EPA identified applicable air emission regulations (promulgated by Air Quality Management District (SCAQMD) that limit releases of carcinogenic air pollutants. The Responsible Parties and EPA contractors followed the air modeling methodologies, prescribed by the regulations, to calculate the releases that would be allowed from our system. The releases would be limited to the amount of chemicals that would cause less than an excess cancer risk of one in one million to a receptor living or working at the edge of the Waste Pits Area. During the pilot test project for the resin adsorption technology (currently underway), the Responsible Parties will be performing a scale-up conceptual design of a full-scale resin adsorption system that meets the required health-based emission limit specified by the regulations.

CDHS response: This section, the Recommendations and the Public Health Action sections have been revised based on this recent work.

Soil Exposure in the Residential Area South of the Site After the Buyout , Page 36, *Summary* section, last paragraph, and Page 38, 4th full paragraph, 2nd sentence: A recommendation is stated in these two locations that all slag material should be removed before the park is created. However, this section of the report provides no justification for this recommendation. EPA disagrees that the slag material should be removed before a park is created.

This report states, on page 37, in the 1st paragraph, last sentence, that "The slag-like material did not contain elevated levels of metals," referring to sampling and analysis conducted by DTSC. The report further states, in the ensuing paragraph, that "the slag-like material was segregated and buried under 2 feet of non-slag impacted soils where the proposed asphalt parking lot will be located." The report then describes sampling and analysis conducted by the County (page 38, 3rd complete paragraph) that found elevated arsenic and nickel in some of the slag-like samples.

As stated in EPA's comment #1, EPA believes the slag material would pose no adverse health impacts to park users because the slag is buried beneath the top soil, and the slag is a solid mass that does not affect the metal content of surrounding soil. No exposure pathway would exist from which the metals within the slag would enter people's bodies. Finally, it should be noted that there are several hundred tons of the slag material within the buy-out area, and excavation and disposal of the slag would be a large and costly undertaking. DTSC also has stated that it believes no further clean-up action is needed for this property to be used as a park.

CDHS response: The recommendation arises from the county's findings that are described on page 38 and in your comment. We have modified the recommendation so it states to remove nonnative material during grading of the surface especially in areas where the soil will remain exposed. We did not mean to imply that this removal should occur for the subsurface. The text has been modified in several places to make this clear.

Page 37, 1st paragraph, 1st sentence: This sentence, which starts on page 36, states that 65 properties, including the properties that contained the elevated DDT levels, were bought by the Del Amo Responsible Party. This sentence can be misleading. The soil with elevated DDT levels was removed from the properties prior to purchase by the Del Amo Responsible Party. Edit the sentence as follows to clarify this item: *". . . 55 homes including the properties that had contained the elevated DDT levels, were bought . . . ."*

CDHS response: We have modified the text based on another comment from another entity.

Recommendations for Further Actions, Page 41, #3: Regarding evaluating the health and safety issues for the soil gas treatment system, as stated in Comment #8, EPA and the Responsible Parties have addressed this concern already.

CDHS response: We have updated this and other similar statements in the document.

Page 41, #5: This recommendation is to conduct soil sampling whenever parking lots or buildings are removed, constructed, remodeled, or some other activity occurs that will result in

the exposure of soil to the developed portion of the site. EPA agrees that it is possible that such sampling would be necessary on at least some parcels. However, such sampling may not be necessary on all parcels.

CDHS response: It is not clear from the comment how the need for such sampling would be determined. CDHS would be interested in reviewing the criteria for determining the need for additional sampling. In the absence of such criteria, we have not changed the recommendation.

Page 41, #7: This recommendation is to conduct air sampling in buildings near where LNAPL and soil contamination exists. The first sentence states that this sampling will ensure that the soil gas pathway is not a major contributor to the indoor air quality in the buildings. This statement is illogical. Sampling alone does not ensure that soil gas will not contribute significantly to the indoor air quality in the nearby buildings. Air sampling in buildings, at properly selected locations, could help determine whether soil gases are entering buildings and contributing to any adverse indoor air conditions. Edit the sentence to clarify this point.

The first sentence recommends air sampling in buildings near LNAPL and soil contamination. However, this PHA determined that the potential for a slight increased cancer risk from soil gases infiltrating buildings existed only in buildings located near LNAPL. Therefore, the recommendation to conduct such air sampling in buildings that are merely near soil contamination (without NAPL present) is not justified. Revise the recommendation to address this point.

The second sentence recommends that additional indoor air testing be done while manipulating buildings' heating and cooling (HVAC) systems so as to maximize soil gas influx during measurements. The third sentence recommends that if contamination is found at a level of health concern, then the exposure should be eliminated or reduced. However, sampling the indoor air while manipulating a building's HVAC system would not tell U.S. if workers would really be exposed when the system is operating normally. Such sampling would merely tell U.S. that a potential exposure exists. However, we already know from modeling that the pathway potentially exists, so monitoring in this manner would not provide enable U.S. to reach any new conclusions. Furthermore, if chemicals were detected at levels of health concern, one could not conclude that the chemicals were related to the Superfund site. This PHA stated this point earlier. Chemicals related to the Del Amo Superfund site can have other common indoor sources in buildings; the chemicals are not unique to the Superfund site. EPA is not authorized to expend Superfund resources to address indoor air pollution from sources not related to a Superfund site.

CDHS response: The text has been edited; the recommendation was intended to apply only to buildings near LNAPL contamination. On the basis of EPA's comments on the previous draft, CDHS added specificity to the type of air sampling recommendation. Now, EPA is disagreeing with the specifics of our request. Since we would prefer to keep the recommendation clear and simple, we have edited the recommendation. When additional air sampling is conducted, CDHS will be available to review the workplan.

Public Health Actions Completed, Page 42, #3: The sentence states that a soil vapor extraction (SVE) system has been installed at the waste pits. Actually, the whole SVE system has not yet been installed. Only the extraction wells have been installed - not the blowers or the vapor treatment unit. Edit the sentence as follows to reflect this clarification: *"Under U.S. EPA and DTSC's oversight, wells for a soil vapor extraction system ~~has~~ have been installed at the waste pits."*

CDHS response: CDHS appreciates the update and the suggested language. The text has been edited.

Page 42, #5: The sentence indicates that U.S. EPA placed deed restrictions on the two land parcels constituting the waste pits area. This statement contains some somewhat misleading and incorrect aspects. First, only one of the parcels has had the deed restrictions implemented to date. The second parcel is still in the process of having the deed restriction implemented. Second, U.S. EPA alone did not place deed restrictions on the property; such an action is actually implemented by DTSC and the property owner, with U.S. EPA as a cosignatory. Correct these items by editing the sentence as follows: "As a part of the 1997 ROD, DTSC and U.S. EPA, in conjunction with the property owners, have placed deed restrictions on one of the two land parcels constituting the waste pits area, and are currently in the process of placing the restrictions on the second land parcel."

CDHS response: CDHS appreciates the update and the suggested language. The text has been edited.

Comments from the California Department of Toxic Substances Control

The Department of Toxic Substances Control (DTSC) has reviewed the above referenced Public Health Assessment Report (PHA), dated April 4, 2003, and received April 7, 2003. The PHA was authored by the State of California, Department of Health Services (DHS). DTSC previously provided comments on the Initial Release of this document in a letter dated May 20, 2002. Attached are DTSC's Human and Ecological Risk Division (HERD) comments on the Public Comment Release, contained in two memorandum. The additional following comments are provided for your review.

General Comments

The main body of the document does a good job at assessing approximately 15 years worth of data. The summary and conclusion sections do not seem to reflect the same data. For instance the summary and conclusion sections state that the site posed a public health hazard in the past, poses a health hazard now, and is an indeterminate health hazard in the future. However, the text and corresponding tables (i.e. Table 2) do not reflect this same conclusion. This could lead those who only read the summary and conclusion sections to a different conclusion than those who read the entire report.

Specific Comments

Page 3-4, Last bullet of summary: This bullet is addressed by DTSC's HERD memorandum (see next set of comments). Additionally, the County, with DTSC oversight, conducted additional surface soil investigations for lead. Copies of comments and memorandum were forwarded to CDHS. The County is currently putting together it's final report on it's findings.

CDHS response: On December 17, 2003, DTSC approved the data in the county report about their testing in the future park area. In this report, additional soil testing for lead was presented. This data has been added to this report.

Page 9, Off-site Investigations, 3rd paragraph: It is DTSC's understanding that state funding that had been appropriated was lost because it was not used by a specified date.

CDHS response: The text was deleted that referred to the state funding.

Page 11, Land Use. Correct the last paragraph to read that the Mobil Refinery is located to the "west", not the "east". Also, correct to read the "Gardena" landfill, not Gardenia. The McDonnell Douglas site was a Water Board lead site as it consisted of mostly groundwater contamination.

CDHS response: The text related to the Mobil Refinery and the Gardena landfill has been modified. We did not assign responsibility in the text for oversight for the nearby hazardous waste sites; therefore, we did not make any text changes based on the last comment.

Page 19: The top of the page is rather confusing: It lists primary chemicals of concern (COCs) as arsenic, DDT, Arochlor 1260, benzene, and ethylbenzene. It then lists nine chemicals found, "but not consistently at levels above health comparison values". Then it states that "*most of the chemicals found at levels of health concern in the soil are related to activities at the Del Amo site*". It is then followed by exceptions to this, which include DDT, Arochlor 1260, and arsenic. Of the COCs, three of the five are excluded. It is unclear if the comment related to "most of the chemicals" is speaking of the COCs, or of the other nine compounds listed.

CDHS response: The text has been modified to make the points more clearly.

Table 4, Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site, Metals data: Soils data in this table was divided into 0-6 inches, and 6 inches to 3 feet below ground surface. Many of the resulting upper-most concentration ranges are the same. The data collection during the EPA-lead investigation was generally segregated into surface soil sampling (zero to 1 foot depth), and shallow soil (zero to 15 foot depth, which includes surface soil subset) investigation areas. Therefore, it is unclear how the data ranges were segregated for this table.

CDHS response: A mistake was made in entering the data for shallow soil into Table 4. Since we chose to emphasize the surface soil data in the dose calculations, we have removed the shallow-soil data from Table 4 to remove the duplication of data.

Table 4, VOC data section: It does not appear that "averages" are provided in the range of concentration column. Additionally, it is confusing how the ranges are listed from high to low, rather than the reverse (i.e. <400-0.097).

CDHS response: We chose to revise Table 4 and provide the average values for only those chemicals that were included in the dose calculations. The ranges that the reader finds confusing are meant to show the high detection limits for those compounds.

Table 8: For 1,3-Butadiene and 1, 4-Dioxane the table lists no hits, no detections, with "N/A" for minimum and maximum concentrations detected, but then shows an 11, 960 mean. Please clarify. The mean concentration for 1,1-Dichloroethane also does not make sense. Additionally, include what "N/A" means in the table.

CDHS response: We took this table from a table in the Baseline Risk Assessment (draft) for the Del Amo site, Table 4 in that document. This document had been reviewed by DTSC and the reason that a chemical might not have been detected but a mean calculated for it was based on a high detection limit for the non-detects. However, since the table was created to show what was detected in the shallow soil gas, several chemicals (i.e., 1,3-butadiene, 1,4-dioxane, and 1,1-dichloroethane) were removed even though they were not detected in the soil.

The Human and Ecological Risk Division (HERD) has provided toxicological support for this Site for the Department of Toxic Substances Control (DTSC) since 1998. The HERD reviewed the initial release of a public health assessment for the Del Amo property dated May 9, 2002.

General Comments

General Comment 1. In a letter dated December 11, 2002, the CDHS responded to comments on the initial release of the public health assessment that were contained in the HERD memorandum of May 9, 2002. All HERD comments were satisfactorily addressed by revising, correcting or adding text and/or figures and tables.

General Comment 2. Nowhere in this document are the equations presented used to calculate the doses for the evaluated exposure pathways, the resulting cancer risk or expectation of noncancer adverse health effects. The HERD recommends that the equations be presented in an appendix to this report, in the glossary, and/or as footnotes to the tables where dose, noncancer effects, and cancer risk are presented (Tables 5, 10, 13).

CDHS response: We have referenced the document where the equations are presented.

General Comment 3. The toxicity criteria used to calculate risk or noncancer effects presented in this document are not explicitly identified. The HERD recommends that the chemical profiles presented in Appendix F – Brief Summaries About the Chemicals of Concern be revised and expanded using a standard format that contains information with respect to each chemical's occurrence and toxicity, all the Agency for Toxic substances and Disease Registry (ATSDR) guidance levels (cancer risk evaluation guideline [CREG], environmental media evaluation guide [EMEG], and minimal risk level [MRL]), used in this document as comparators, and the toxicity criteria used to calculate the potential for the chemical concentrations to cause adverse health effects (reference doses, MRLs and cancer slope factors). Each chemical profiled should be identified as associated with the Del Amo or Montrose sites.

CDHS response: The toxicity criteria used to evaluate noncancer and cancer effects were added to the footnotes for the tables or Appendix F.

General Comment 4: In Tables 5, 10, and 13, and in the text, summaries of the health evaluation are presented. The noncancer health effects are described as "none expected" or "... exceeds health comparison value". The cancer evaluations are described as "low", "very low increased risk" or "no apparent increased risk". These terms need to be clearly defined. For example, health comparison value(s) should be defined, and the risk levels dividing "no apparent" from "very low", and "very low" from "low" increased risk should be given. These definitions should be presented as footnotes to the tables and in the glossary.

CDHS response: This information was added to the footnotes to those three tables.

Specific Comments

Page 3, second bullet: This bullet should be revised to state that the cap "eliminates any current or future exposure and emissions from the waste pits at the site *provided that the cap continues to be maintained as it is now".*

CDHS response: Similar wording was added to this bulleted item and in other places in the text where that statement occurs.

Page 3, fifth bullet: This bullet states that Del Amo-related contaminants do not present a health risk to nearby residents but goes on to discuss the dichlorodiphenyltrichloroethane (DDT) measured in the neighborhood. A sentence should be added that this chemical comes from the Montrose site.

CDHS response: Similar wording was added to this bullet and to other places in the text where that statement occurs.

Page 11, Land Use: A) In the first paragraph, it is stated that some of the parcels within the Del Amo site apparently have permits that will allow live/work spaces. These parcels should be identified. B) In the sixth paragraph, the location of the Jones Chemical Company vis-à-

vis the Del Amo site should be given. In the same paragraph, the Mobil refinery is located to the west of the site, not to the east, as stated. The landfill is the Gardena landfill, not the Gardenia landfill.

CDHS response: Two tracts have neighborhood/office commercial planning zone designations (Tract 7351-31-24 and 7351-33-45 (has former tract designation 7351-3337 on figures in this PHA). The land uses for neighborhood/office commercial land include live/work spaces. This information has been added to the text. The other edits were also made in the text.

Page 12, Toxic Release Inventory (TRI) Search: In the third paragraph, it is stated that the Mobil refinery accounts for the majority of the air releases in zip code 90509, and the reader is referred to Figure 2. Since Figure 2 does not include the north designation, a sentence should be added to the text stating that the Mobil refinery is west of the Del Amo site.

CDHS response: A north designation was added to Figure 2.

Page 24, Indoor Air Exposure in the Developed Portion of the Site: A) At the top of the page, it is stated that "if you take samples of indoor air, you are probably not going to be able to evaluate whether the soil or groundwater contamination is affecting the indoor air". An explanation should precede this sentence saying that many chemicals commonly found in indoor air from off-gassing of furniture, carpeting, marking pens, etc., are the same chemicals that have been detected in the soil and groundwater at the site. B) In the third paragraph, it is stated that eleven source areas have been identified by the responsible parties and EPA, and the reader is referred to Figure 3. Figure 3 has many more than eleven source areas. The statement should be corrected or clarified.

CDHS response: A) A statement was added to that section to explain the source of chemicals in Indoor Air. B) Figure 3 is a rather complex map from the URS Corporation *Baseline Risk Assessment.* It shows 31 Exposure Areas of Potential Concern as well as 11 source areas.

Page 33, Indoor Air Exposure in the Residential Area South of the Site: Indoor air sampling data for homes south of the waste pits were compared to "Los Angeles indoor air reference levels" and health comparison levels. A brief description of both comparators should be included in the text. A citation should be provided for the Los Angeles levels.

CDHS response: Health comparison values are generally described in the introductory paragraphs to the *Environmental Contamination/Pathways Analysis/Toxicological Implications* Section and in the glossary in Appendix A. The document we cited for the conclusion about the indoor air sampling conducted in 1994 cited a letter from EPA for the indoor air comparisons.

Page 33, Soil Exposure in the Residential Area South of the Site Before the Buyout, Summary; and Page 41, Conclusions, first bullet: Since the presence of DDT in soils is discussed in the summary, this chemical should be included in the concluding statement that "DDT, arsenic and cadmium are not related to activities at the Del Amo site".

CDHS response: Text was added to both locations.

Page 68 and 69, Appendix B – Tables, Table 3 Summary of Chemicals of Concern in the Parcels: The title of the table is mislabeled. "Concerns" should be "Concern". It is stated in this table that Parcel 7351-33-34 is currently undeveloped. However, Figure 3 of the draft baseline health risk assessment indicates a building on the parcel. Similarly, Parcel 7351-33-37 may also now be developed, according to Figure 3. Please check and correct, if necessary.

CDHS response: The table title was corrected. CDHS examined Figure 3 of the draft baseline risk assessment and did not find a building indicated on Tracts 7351-33-34 or 7351-33-37.

Page 78, Appendix B – Tables, Table 3 Summary of Chemicals of Concern in the Parcels.

CDHS response: This was based on the parcel that it appeared to be a right-of-way on the Figures in the baseline risk assessment; however, on reexamination and discussions with EPA, we have removed this statement as the property could be developed in the future.

Page 85, Appendix B – Tables, Table 3 Summary of Chemicals of Concern in the Parcels ... : The statement for Parcel 7351-34-74 that "something historical located here" is not adequate and should be revised to identify the historical structure(s).

CDHS response: The text was revised.

Pages 94 to 96, Appendix B – Tables, Table 8 Summary of Shallow Soil Gas Data Collected on the Developed Portion of the Del Amo Site: A footnote should be added to this table to explain the derivation of the mean concentration values for those chemicals that were not detected.

CDHS response: The mean was taken from the Baseline Risk Assessment report (draft) for the Del Amo site (30), so we have added text as a footnote to Table 8 to reflect what the authors of the risk assessment did to calculate the mean.

Page 99, Appendix B – Tables, Table 10 Summary of the Health Evaluation from Exposure to the Indoor Air on the Developed Portion of the Del Amo Site: The three parcels evaluated and listed here should be further described. That is, it should be stated that Parcel 7351-34-57 is located over LNAPL; Parcel 7351-34-15, 50, 56 is near LNAPL, and Parcel 7351-31-18 is not over a groundwater source area.

CDHS response: Text was added to Table 10.

Page 115, Appendix C – Figures, Figure 5 Locations of Groundwater Contamination Sources ...: The designation "K" is used twice to identify two separate sources. In addition, the Jones Chemical facility is listed twice as sources "J" and "L". Please check and correct.

CDHS response: Jones Chemical is the source for two separate plumes (marked as J and L in Figure 5).

Page 125, Appendix D – Status of the Recommendations made in the Preliminary Public Health Assessment dated January 12, 1994; Item I: In this item, it is recommended that deed and building restrictions be implemented to prevent future development on "the site" until the contamination has been reduced. In the discussion of the status of this item, it is clear that "the site" referred to in this item is the waste pits. Therefore, the text of Item I should be revised to make clear that this recommendation refers only to the waste pits area.

CDHS response: The recommendation in the previous Del Amo Health Assessment was referring to the entire Del Amo site not just the waste pits area. No changes were made to the text.

Page 127, Appendix D – Status of the Recommendations made in the Preliminary Public Health Assessment dated January 12, 1994; Item p: In this item, it is recommended that ambient air samples be taken to evaluate overall air quality in the area. Although it is stated in the status of this recommendation that the Southern California Air Quality Management District (SCAQMD) conducted an air quality monitoring investigation in Torrance, the results of this investigation is not presented. It should be stated here whether the results were ever reviewed, and a short summary of the investigation should be provided.

CDHS response: A short summary and some commentary on the air district report was added to Appendix D.

Page 127, Appendix D – Status of Recommendations made in the Preliminary Public Health Assessment dated January 12, 1994; Item s: It is recommended in this item that house dust samples be collected to determine if site-related contaminants could have migrated indoors. It should be restated in the status of this item that DDT, the contaminant discussed, is not related to the Del Amo site.

CDHS response: Text was added.

Conclusions

This document strives successfully to bring together the results or status of the many studies that have been performed for this site and adjoining sites, as these studies relate to identified public health issues. However, deficiencies remain as discussed in the comments above.

Comments from Shell Oil Company

Comments on the subject draft report are submitted for your consideration on behalf of the Del Amo Respondents (hereafter, the Respondents), Shell Oil Company and the Dow Chemical Company. Our letter is organized into the following three sections: Background, General Comments, and Specific Comments.

Background

For the past 11 years the Respondents have been engaged in performing a Remedial Investigation and Feasibility Study (RI/FS) at the Del Amo site (hereafter, the site) pursuant to an Administrative Order of Consent (AOC) issued to the Respondents by the U.S. Environmental Protection Agency (U.S. EPA). The California Department of Toxic Substances Control (DTSC) cosigned the AOC with U.S. EPA; and accordingly, all RI/FS work by the Respondents has been performed with oversight from both U.S. EPA and DTSC. Among other things, the Respondents have been responsible for collecting virtually all of the environmental data (including air, soil, soil gas, and groundwater data) in support of the Del Amo RI/FS and subsequent remedial design (RD) and remedial action (RA) work. The Respondents currently maintain a large relational database that contains all environmental data collected at the site for both RI/FS and RD purposes. To date, the Respondents have worked closely and cooperatively with U.S. EPA and DTSC, and contributed to the successful completion of the following RI/FS, RD and RA project milestones:

1. Focused FS and Baseline Risk Assessment addressing the waste pits area of the site (1996);
2. Record of Decision (ROD) addressing the waste pits area (1997);
3. Final Remedial Design for the waste pits area (1999);
4. Construction of most components of U.S. EPA's selected remedy for the waste pits area (2000);
5. Participation in a pilot test to evaluate an alternate SVE treatment option for possible application at the waste pits area (currently ongoing);
6. Final RI Report for Groundwater (1998);
7. Final FS Report for Groundwater (1998);
8. ROD for Groundwater (1999); and,
9. Preparation of Draft Baseline Risk Assessment for Soils and LNAPL (2001).

In addition, the Respondents are currently engaged in activities, under the AOC, leading to the preparation of RI, FS and Final Risk Assessment Reports for Soils and NAPL. Work is also ongoing relating and leading to RD and RA for U.S. EPA's selected groundwater remedy.

During the past 11 years the Respondents have worked closely, not only with U.S. EPA and DTSC, but also with the owners of the 67 commercial and industrial properties (and their tenants) located within the 280-acre area formerly occupied by the synthetic rubber plant complex. We have worked closely with these property owners and tenants in order

to coordinate the sampling and field investigative activities required under the AOC, and also to periodically keep these important stakeholders informed about the status and findings of the ongoing investigations. In addition, the Respondents have supported U.S. EPA in a variety of ways in the agency's public outreach and education activities about the RI/FS and RD activities during the past 11 years since the AOC was issued.

General Comments

The Respondents are very concerned that certain statements made primarily in the Summary and Conclusions sections of the subject report are both: 1) unsupported by CDHS' own analysis presented in the body of the report and 2) alarmist to a broad public lay audience that is, first and foremost, interested in simply knowing if there is evidence to suggest that it is not safe to work at this site, or to go home to their residences in areas adjacent to the site. The specific statements in the report that are of concern in this regard imply that CDHS believes that the site is not a safe environment for present land uses and may not be safe in the future. Concern is also raised by the conclusion that the site may not have been safe in the past.

If CDHS believes this to be the case, then evidence and/or analysis providing the supporting basis for these conclusions needs to be added to the report. As discussed further below, under specific comments, the report currently lacks such supporting evidence, and in fact presents analyses and conclusions to the contrary. If, on the other hand, CDHS does not intend to convey the impression that the site is, was, or may be unsafe for workers and the public, then the current text should be modified to better reflect CDHS' intended meaning- Additional detail about this issue is presented below under Specific Comments.

CDHS response: Please see responses to specific comments below.

Another general problem with the report is that nowhere is the purpose of the report described in clear and unambiguous terms. For example, in both the Summary and Background sections, details are provided about the past operations of a synthetic rubber plant complex from 1942 to 1972. In these sections, the reader is left with the clear impression that the focus of the report is the contamination that is associated with past operations at the former rubber plant, and the health hazard at the site that is associated with this contamination. If this is the case, then references to contaminants and associated health hazards from contaminants that are believed to have originated from sources other than the former rubber plant complex, such as DDT, Arochlors, PCBs, arsenic, cadmium, blue lava rock and slag should be removed from the report.

On the other hand, if the purpose of the PHA is to identify and analyze contaminants and health hazards that are associated with the multitude of sources (past and present) in this long-time industrial and residential area, then a more thorough and balanced description is needed of past and present operations at other local contributors to contamination in and around the Del Amo site. If the report continues to identify risks attributed to

chemical materials that are not associated with the former rubber plant complex, then it should also provide enough history to explain to the reader the connection between those materials and their sources.

CDHS response: In evaluating the health implications for a site, ATSDR's policy is to include all chemicals that may be identified in the environmental sampling not just the site-related ones. Thus, CDHS evaluated the data without regard for the source. CDHS did not expand on the DDT problems found in the area from the nearby Montrose site.

Specific Comments

Page 1, Summary, last paragraph, the text reads: "In this reexamination of the site, CDHS determined that the site posed a health hazard in the past, poses a health hazard now, and is an indeterminate health hazard in the future. This conclusion is based on CDHS's evaluation of nine pathways of possible exposure related to the Del Amo site: two for the developed portion of the site, four related to the waste pits, and three specific to the neighborhood located south of the site." As stated above, adequate support for this statement is not found in the report, and in fact, conclusions from the evaluation of exposure pathways that are presented elsewhere in the report appear to be in direct conflict with this conclusion. Examples from the report are provided below.

Regarding the portion of the conclusion addressing *the present* health hazard posed by the site: The results of this pathways analysis are summarized in the bullets following the above excerpt on pages 2 through 4 of the report, and are further summarized in Table 2, Evaluation of Exposure Pathways (Appendix B). Examination of Table 2 reveals that for present exposures, all but one of the exposure pathways evaluated were either determined by CDHS to not represent a public health hazard or were eliminated because "chemicals related to Del Amo" are not present at levels of health concern. The single pathway that is flagged in Table 2 as representing a public health hazard for present exposures is the indoor air exposure pathway for buildings in the developed area of the site that are "located over LNAPL."

Details about CDHS' analysis and results of this indoor air exposure pathway are presented in the section of the report. Indoor Air Exposure in the Developed Portion of the Site, on pages 23 through 26. In summarizing the results of the analysis on page 23 the authors state:"CDHS estimates of indoor air impacts from contaminated soil using modeling indicate that chemicals coming from beneath the building in areas where there is LNAPL may contribute to a very low increased cancer risk and a possibility though unlikely of noncancer health effects for the long-term worker in the building. A child attending daycare could but is also unlikely to experience noncancer health effects from these estimated levels of exposure to benzene from the LNAPL. For those buildings in

the developed portion of the site where there is no LNAPL, cancer or noncancer health impacts are not expected for the long-term worker, the occasional worker, or the child attending daycare."

The authors go on to note: "There are many assumptions in modeling this exposure that may influence the validity of these findings. Sampling conducted in 13 buildings on-site, including a building over the LNAPL contamination, indicate that indoor air quality is similar to typical indoor air." We suggest that the above findings and conclusions do not provide sufficient basis for CDHS to conclude that "the site poses a health hazard now," and therefore this conclusion should be removed or appropriately modified in the final report. Table 2 should also be appropriately modified. Surely a finding based on modeling results that contaminants "may contribute to a very low increased cancer risk" for the long-term worker (later quantified as 1.7 in 100,000 on page 25 of the PHA, and as 1.2 in 100,000 in Table 10 of Appendix B), and the finding that a child attending daycare "could but is also unlikely to experience noncancer health effects" do not alone provide sufficient basis to conclude that the site currently represents a public health hazard.

Regarding potential exposures to a child attending daycare, the estimated benzene indoor air concentration from the modeling was 4.41 ppb which is just slightly above the comparison value used of 4 ppb. The conclusion on page 25 is that "noncancer health effects like changes in neurological function are not very likely based on the level of exposure that we estimated from the modeling." This finding also does not support the conclusion that "the site poses a health hazard now."

Finally, we suggest that adequate support for this conclusion is lacking elsewhere in the report, particularly in light of the observations noted on pages 23 and 26, that actual measured concentrations of contaminants in 13 buildings on the site "are typical of indoor air," and that "if the contamination is affecting indoor air quality it does not appear to play such a large role that the overall quality of the air is affected above typical ranges."

CDHS Response: CDHS identified a completed pathway (breathing indoor air in buildings located over LNAPL contamination) at a level of long-term health concern. This is ATSDR's definition of a public health hazard. This determination was made on the basis of modeling data because the sampling data was insufficient. The responsible parties and their consultants often use modeling to "predict" if contamination is not spreading or if it will never reach a neighborhood. Because modeling includes the use of assumptions, the resulting data are predictions rather than absolute.

Regarding the portion of the conclusion *addressing future* health hazard posed by the site: Referring again to Table 2 (Appendix B), it is apparent that of the nine pathways evaluated, only two were determined by CDHS to either represent a public health hazard in the future (the indoor air pathway on the developed portion of the site), or require

farther evaluation after certain U.S. EPA decisions are made in the future (the waste pits area pathway dealing with any releases from the final selected SVE treatment system).

Our comments above regarding the indoor air pathway apply here to the future receptors as well. The authors suggest that the report does not provide sufficient support to conclude that the indoor air pathway represents a public health hazard in the future, and, consequently, the relevant text in the Summary and the Conclusions sections of the report (as well as in Table 2) should be removed and/or revised appropriately.

CDHS response: For future exposures, CDHS identified the indoor air pathway as the primary one to base the indeterminate health hazard category. As elaborated on in our previous responses, this is the appropriate conclusion at this time. As the commenter points out, there are other concerns related to possible future exposures to the site; e.g., health and safety of the resin absorption treatment for the soil vapor at the waste pits, soil exposure on the developed site when soil is uncovered, and the need to clean up the groundwater before it affects municipal drinking water wells.

Regarding potential future emissions from the SVE treatment facility eventually constructed at the waste pits area, we note that U.S. EPA has already performed an analysis of potential health impacts of vapor treatment systems that might be applied at the waste pits area. In addition, the Respondents have performed air modeling of treatment system emissions, in accordance with the South Coast Air Quality Management District (SCAQMD) regulations, and calculated the allowable releases from the system. It is our understanding that emissions from whatever treatment system is eventually selected by U.S. EPA will be limited to the amount of chemicals that would cause less than 1 in 1 million excess cancer risk to a receptor living or working in the vicinity of the waste pits area. Consequently, we suggest that CDHS should be in a position to eliminate the current uncertainty that is reflected in the draft PHA regarding this pathway.

CDHS response: The sections of this PHA that describe this issue (i.e., the *Recommendations* and the *Public Health Action Plan* sections), have been revised on the basis of EPA's analysis of the allowable air releases, and to reflect recent work with the soil vapor treatment system.

Regarding the portion of the conclusion *addressing past* health hazard posed by the site: Referring again to Table 2 (Appendix B), it is apparent that of the nine exposure pathways evaluated only two were determined by CDHS to represent a public health hazard in the past. These are: 1) the indoor air pathway on the developed portion of the site since the early 1970s, and 2) exposure to a trespasser via ingestion and skin contact at the waste pits area before the cap was placed over the pits.

Our comments above regarding the indoor air pathway apply here to the past receptors as well. We suggest that the report does not provide sufficient support to conclude that the

indoor air pathway represented a public health hazard in the past, and consequently, the relevant text in the Summary and the Conclusions sections of the report as well as Table 2 should be removed and/or appropriately revised.

The suggestion that ingestion and skin exposures to a trespasser at the waste pits area in the past constituted a health hazard is speculative and unsupported, and the conclusion should be deleted from the report.

On page 2, last paragraph, the assertion that children playing on the pit site "could also have experienced noncancer health effects related to benzene exposure" is speculative and not supported by the facts and findings from the 1984-1987 survey of 1038 adults and 450 children who lived in the neighborhood immediately to the south of the Del Amo site. That survey, the "Del Amo-Montrose Health Effects Study," (CDHS December 1987) identified only skin, eye, nose and throat irritation, earaches, dizziness and fatigue as health complaints associated with living near the Del Amo site and the Montrose and Jones chemical sites. While preparing the study in 1986, the investigators conceded the report was a screening and not a rigorous study of health effects, and that because a good exposure profile was not available, odor and proximity to site were used as surrogates. But there was no report of unusual occurrences of any noncancer illness among children that could be attributed to playing on the pit site.

On page 3, first sentence: The PHA includes the statement that "if children directly handled the waste material on a frequent basis, it would have posed a health hazard to children." On page 27 the waste material is described as "clay-like sludge or black tar." Assuming that the tar material somehow oozed to the surface where children might have encountered it in earlier years, it is not clear what evidence or scientific basis CDHS used for concluding that this material, when exposed to air, posed the kinds of hazards to health that are postulated in the PHA. We suggest that evidence to support this conclusion is lacking, particularly in light of the fact, as is noted on page 28 of the PHA, that "there were no site-associated contaminants in the surface soil" (at the waste pits area), and also the very low VOC emissions into air that were documented at the waste pits area before it was capped (see Final Report Ambient Air, Surface Flux, and Soil Gas Characterization, Del Amo Waste Pit Area, by CH2M Hill, January 26, 1996).

In addition to the residents interviewed in the neighborhood south of the Del Amo site, a similar number (949 adults and 521 children) were interviewed in the neighborhood south of the Montrose/Jones chemical sites. Also interviewed was a control group outside the Del Amo and Montrose neighborhoods. The PHA does not explain why the children in the "Del Amo neighborhood" would have been more likely to play on the pit site than children in the "Montrose neighborhood".

On page 27, Summary: The suggestion in the fifth sentence that children played daily or, as suggested on page 28, played five times per week for ten years with hazardous waste materials from the pit site is unverified, uncorroborated by the interviews of hundreds of children conducted from 1984-1987, and contrary to experience. It is also a significant extension of the

statement on page 28, fourth paragraph, that "CDHS staff have heard from residents that children used to play in and around the waste pit area before it was fenced in 1981, and even after that when the fence was broken." In this respect, U.S. EPA's "Draft Final Guidelines for Carcinogen Risk Assessment" (March, 2003), notes on page 100 that "Children's behavior may lead to relatively high but intermittent exposures. This pattern of exposure, 'one that gradually declines over the developmental period and which remains relatively constant thereafter' is not accounted for in the LADD model" (ELSI, 1992).

In other words, children do not do the same thing every day or from year to year. And the pattern of exposure declines as children grow older. CDHS' assumptions noted above about the frequency and duration of past exposures at the waste pits area cannot be justified as conservative. In light of all of the above, we suggest that CDHS delete speculative and unsupportable conclusions about past public health hazards at the waste pits area of the site.

CDHS response: CDHS identified the indoor pathway as the primary basis for the determination of the health hazard category in the future. As elaborated on in our previous responses, this is the appropriate conclusion for that pathway.

CDHS identified exposure to the waste material as a health hazard in the past. The comment makes several points about this pathway determination to which we will respond:

- **The *Del Amo-Montrose Health Effects Study* did not include a question asking whether a person went onto the waste-pit area and played with the material. Thus, the study could not and did not evaluate this exposure.**

- **The dose estimates were based on incidental ingestion of the material. We did not attempt to quantify the inhalation exposure that might have occurred when children/people may have disturbed the waste. Furthermore, this comment cites air data gathered when the material was covered, which is not relevant to possible inhalation exposures from someone disturbing the material when playing with it.**

- **The determination of health hazard is based on children/people interacting with the waste material and not the surface soil. In fact, we evaluated the cover/fill material and found it did not pose a health hazard.**

- **Children typically will explore their nearby surroundings. In the case of the children living near the Del Amo waste pits, it is not unrealistic for one to assume that children would go onto this property and explore it. Perhaps children from the Montrose/Jones Chemical neighborhood would as well. Children would probably find the "clay-like sludge or black tar" very appealing and want to play with it. Beyond our reasonable assumptions, people have reported to us that children went onto the site and played with the waste material.**

- **It is hard to accurately quantify exposures. CDHS used appropriate assumptions to estimate the risks, and determined that the waste material does pose a health hazard.**

Regarding the following statement made on page 19, second paragraph:"Most of the chemicals found at levels of health concern in the soil are related to activities at the Del Amo site." It is not clear what CDHS means by the language "related to activities at the Del Amo site." If CDHS intended to assert (as a reasonable reader would assume) that the chemicals found at levels of concern are related to past operations of the former synthetic rubber plant, then the sentence is not reconcilable with other information presented on page 19. For example, in the first paragraph on page 19 the following sentence appears: "The primary chemicals of concern are arsenic, DDT, Arochlor 1260, benzene, and ethylbenzene." In paragraphs 3,4 and 5 on page 19, DDT, Arochlor 1260 and total PCBs, and arsenic are respectively identified as not being related to the Del Amo site. Consequently, the above-quoted sentence in the second paragraph should be rewritten as: "Of the five chemicals identified above as being the primary chemicals of concern at the Del Amo site only two, benzene and ethylbenzene, are related to past operations of the former synthetic rubber plant complex." The second sentence of the second paragraph should also be deleted.

CDHS response: The text has been modified to make it consistent.

In addition, on page 35 where residential exposures prior to the buyout are discussed, reference is made to three chemicals that should be considered contaminants of concern, DDT, arsenic and cadmium, yet reference is only made to DDT not being related to the Del Amo site. Arsenic should be included as not related to the Del Amo site on page 35, to be consistent with the statement made on page 19.

CDHS response: The text has been modified for clarity.

Regarding the following statements made respectively on pages 4,36, and 38. Page 4, paragraph 1, last sentence, and page 36, paragraph 5, last sentence: "Slag material gathered by the county contained some elevated metals, this material should be removed before the park is created." Page 38, paragraph 2, sentence 2:"Occasional digging into this area would not pose a health risk to a utility worker; however, such digging could bring this material to the surface where others could be exposed to it for longer periods of time." Page 38, paragraph 4, last sentence: "All slag material should be removed before the park is created."

U.S. EPA and DTSC have evaluated the environmental sampling and testing performed in the area of the proposed park, including analyses of the slag material, and, as documented in various correspondence, have concluded that there is no evidence to suggest that the sampled materials represent a health hazard to future users of the park. m their respective evaluations of the testing results, both agencies have concluded that "No Further Action" is required for the area to be used as a park. Additionally, as currently conceived, the park would require no digging except for planting or removing landscaping. Currently, contract language is being drafted that would limit the depth of digging/planting allowed by Parks and Recreation staff upon transfer of the property. These and other references to slag material should be updated to reflect both DTSC's

and EPA's previous evaluations. DTSC's February 28, 2003 letter "recommends no further action at this property for its use as a park or other recreational use." U.S. EPA's August 21, 2001 letter states: "subsequent clean-up actions by EPA succeeded in removing the contaminated soil from this property that could potentially cause a threat to human health or the environment" and "EPA has no reason to believe, based on data from our investigations, that the subject property is not suitable for use as a park."

CDHS response: CDHS is pleased to learn that restrictions will be placed on activities within the park that could bring subsurface material to the surface. The recommendation was meant to apply to clearing the surface soil of nonnative debris, especially in areas where the soil will be exposed. The text has been modified to reflect this.

Regarding Data Summary Tables, including

- Table 4, Summary of Surface and Shallow Soil Data Collected from the Developed Portion of the Del Amo Site;

- Table 8, Summary of Shallow Soil Gas Data Collected on the Developed Portion of the Del Amo Site; and

- Table 9, Summary of Workplace Air Monitoring Study at the Del Amo Site.

There appear to be a variety of problems with how site data are presented in these data tables. For example, in Table 4 data are summarized incorrectly for both Surface and Shallow Soil. The depth ranges indicated for both surface and shallow soils do not reconcile with the numbers of samples and concentration ranges known to exist within the Del Amo project database that is being maintained by the Respondents. Another issue is revealed by noting that for most contaminants, the upper end of the concentration range for surface soil is the same value recorded for the upper end of the concentration range for shallow soil. An example of a problem with Table 8 is that no explanation is provided for what most readers will assume is an obvious error in reporting; that is, a mean concentration value that falls outside of the range between the minimum and maximum concentrations detected. On Table 9 factual errors are noted in the text provided at the bottom of the table. The details of the Workplace Air Monitoring Program are fully documented in the publicly-available project deliverable: *Workplace Air Monitoring Program Report, Del Amo Study Area,* by URS Corporation, dated November 16, 2001. This report should also be the source for any data summary tables included for these data in the PHA. There are additional issues we have noted that should be resolved in the data tables. In the interest of including all project data in appropriately referenced data summary tables, the Respondents would be happy to work directly with CDHS to understand the format of presentation that you are trying to achieve in these tables, and to generate the desired tables for you directly from the project's currently updated database.

CDHS Response: A mistake was made in entering the shallow soil data into Table 4. Sin we chose to emphasize the surface soil data in the dose calculations, we have removed th shallow soil data from Table 4 to remove the duplicative data.

The numbers in Table 8 were taken directly from Baseline risk assessment report (draft) for the Del Amo site written by URS Corporation, consultants to Shell Oil Company (30) We assumed you have previously reviewed the data in a document for which you had responsibility. However, we can explain why URS Corporation had mean values higher than the maximum values and had mean values when there were no detections. In both cases, it relates to the issue of detection levels for the non-detects. These were taken into account when calculating the mean by using half the detection limits for non-detects. Sin some samples had fairly high non-detects, this means that for some chemicals the mean value was higher than the maximum value. This would also result in a mean value to be calculated, even though no chemicals were detected. Since the table was designed to show those chemicals that were detected, we have removed those chemicals for which there wei no detections.

Table 9: We appreciate the offer to assist in getting a good table. What is ironic is that Table 9 in the PHA is almost an exact duplicate of Table 16 in the document you refer us to, "Workplace Air Monitoring Program Report, Del Amo Study Area, by URS Corporation, dated November 16, 2001". This report was commissioned by Shell Oil Company (CDHS chose to present only the data for chemicals that were detected, wherea Table 16 in the workplace air report reflects additional chemicals that were not detected.) In other words, we have already used the document you cited.

In Conclusion: In light of all of the issues identified in our comments, the Respondents respectfully suggest that CDHS consider revising the PHA, and reissuing it as a Revised Draft for public comment.

Regarding the broad conclusions in the report, we are very concerned about terms such as "health hazard" and "indeterminate health hazard" that are really technical jargon and likely to be read and interpreted differently by the community than intended by the authors of the PHA. Based on our comments, we suggest that CDHS consider rephrasing the broad conclusions in th Summary and Conclusion sections of the report to convey a message that is more accurate and less open to possible misinterpretation by the audience. We suggest that the gist of a defensible conclusion is that *the site might have posed a health hazard in the past, does not pose a health hazard now (under present conditions, uses and controls), but could pose a health hazard in the future if site conditions, uses or activities are altered without proper attention to safety.* This approach would be more consistent, for example, with the statement on page 17 as to surface soil and near surface soil, that "when a building is torn down or a parking lot removed, there is a potential/or contaminated soil to be exposed."

During our review we have noted additional consistency issues, errors in fact, and grammatical problems that we have not included or attempted to resolve in this comment letter. However, in

the interest of disseminating the most accurate, understandable and defensible information to the public regarding the ongoing investigations and remedial activities at the Del Amo site, the Respondents are ready to assist you in any reasonable way that we can.

CDHS response: Since there is no new data that influences changes in the critical conclusions and recommendations of the document, CDHS does not support the need for reissuing a draft. CDHS has edited the text to make clearer what information provided the basis for the health hazard determinations. Lastly, CDHS contacted Shell concerning additional consistency issues, errors in fact and grammar, and the few items identified had already been corrected.

Thank you for the opportunity to review and provide you with our comments on the draft PHA, and for your consideration of our suggestions.