NAS7.000991
NASA - JPL
SSIC No. 9661

FOSTER WHEELER ENVIRONMENTAL CORPORATION

FINAL

REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 2: POTENTIAL ON-SITE CONTAMINANT SOURCE AREAS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JET PROPULSION LABORATORY
4800 Oak Grove Drive
Pasadena, California 91109

VOLUME I

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AT THE

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November, 1999

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Chemicals and materials with a variety of contaminant properties are and have been utilized during the operational history of the site. The general types of materials used and produced include a variety of solvents, solid and liquid rocket propellants, cooling-tower chemicals, and chemical laboratory wastes. During the 1940s and 1950s, many buildings at JPL were constructed with a cesspool to dispose of liquid and solid sanitary wastes collected from drains and sinks within the building. These cesspools were designed to allow liquid wastes to seep into the surrounding soil. The present-day term for these subsurface disposal areas is "seepage pits." Some of the seepage pits may have received volatile organic compounds (VOCs) and other waste materials that are currently found in either the soil or the groundwater. In the late 1950s and early 1960s, a sanitary sewer system was installed and the use of the cesspools for waste disposal was discontinued.

In the 1980s, analyses of groundwater from three City of Pasadena water-supply wells (the Ventura Well, Well 52, and the Arroyo Well) located near JPL indicated concentrations of trichloroethene (TCE), tetrachloroethene (PCE) and carbon tetrachloride (CCl_4) above drinking water standards. Since this time, a number of investigations focusing on environmental issues have been conducted at JPL (see Section 1.3.3 below).

1.3.3 Previous Investigations Related to the Soil and Soil Vapor at JPL

Summaries of studies related to the geotechnical and environmental issues that occurred within OU-2 are included in this section. A more complete synopsis of historical studies, including those for groundwater, performed at JPL is presented in the RI/FS Work Plan (Ebasco, 1993a).

Geotechnical and environmental studies related to the potential on-site contaminant source areas include the following:

- LeRoy Crandall and Associates (1977a), Report of Subsurface Investigation, Overall Investigation of Geology, Soils and Seismic Hazard, Seismic Safety Plan, Jet Propulsion Laboratory Site.
- Agbabian Associates (1977), *Seismic Studies for the Jet Propulsion Laboratory Facilities, Part I, II, and III.*
- LeRoy Crandall and Associates (1977b), *Report of Fault Hazard Study, Jet Propulsion Laboratory.*
- LeRoy Crandall and Associates (1981), *Dewatering Well System, Building 150, Jet Propulsion Laboratory, Pasadena, California.*
- Richard C. Slade (1984), *Preliminary Hydrogeologic Assessment of Soil and Groundwater Monitoring, Jet Propulsion Laboratory, Pasadena, California.*
- Ebasco Services Incorporated (1988a and 1988b), *Preliminary Assessment Report for NASA-Jet Propulsion Laboratory* and *Site Inspection Report for NASA-Jet Propulsion Laboratory.*
- Ebasco Environmental (1990a), *Expanded Site Inspection Report for NASA-Jet Propulsion Laboratory.*

- Ebasco Environmental (1990b), *Supplemental Information to the Expanded Site Inspection Report on the NASA-Jet Propulsion Laboratory.*
- Jet Propulsion Laboratory (1990), Untitled set of memoranda, laboratory analyses, notes, sketches, and other correspondence associated with the removal of storm drain catch basin and associated impacted soil.
- Ebasco Environmental (1991), *(Draft) Remedial Investigation/Feasibility Study Work Plan for NASA-Jet Propulsion Laboratory.*
- Maness Environmental Services, Inc. (1992), *Environmental Site Investigation and Soil Remediation, Jet Propulsion Laboratory, Pasadena, California.*
- Ebasco Environmental (1993b), *Contaminant Source Research (1990 to Present)* in *Work Plan for Performing a Remedial Investigation/Feasibility Study at the NASA–Jet Propulsion Laboratory.*
- Ebasco Environmental (1993c), *Pre-RI Investigation* in *Work Plan for Performing a Remedial Investigation/Feasibility Study at the NASA–Jet Propulsion Laboratory.*
- U.S. Environmental Protection Agency (1993), *Aerial Photographic Analysis of the NASA Jet Propulsion Laboratory, Pasadena, California.*

Brief discussions of these studies are presented in the subsections that follow.

1.3.3.1 LeRoy Crandall and Associates (1977a), *Report of Subsurface Investigation, Overall Investigation of Geology, Soils and Seismic Hazard, Seismic Safety Plan, Jet Propulsion Laboratory*

This investigation was completed to identify the depth to crystalline basement rocks at JPL and to identify specific engineering and dynamic properties of soils at JPL for input into a seismic dynamic analysis to be performed later by Agbabian Associates (see Section 1.3.3.2).

During this study three borings were drilled at locations shown on Figure 1-3. Borings 1 and 3 were drilled to 100 feet below grade to provide information on the properties of the relatively shallow alluvium. Boring 2 was drilled to a depth of 680 feet below grade and encountered crystalline basement rocks at 635 feet below grade. All borings were drilled using mud rotary methods. Boring 2 was subsequently completed to 414 feet with 5-inch-diameter polyvinyl chloride (PVC) blank casing to allow a downhole seismic survey to be performed. Borings 1 and 3 were backfilled and abandoned after drilling.

Analyses performed on the undisturbed soil samples included moisture content, dry density, direct shear (to determine strength at various surcharge pressures), and particle-size distribution. The downhole seismic survey performed in Boring 2 evaluated propagation velocities of compressional and shear waves through the soils surrounding the boring. Data from this report that is useful for the current OU-2 RI include the descriptions and physical properties of the alluvium in Borings 1 and 3.

samples ranged between 4.7 in SB1-1-10 (soil boring SB1, 10-foot sample) to 8.1 in sample SB19-1-10Dup (soil boring SB19, 10-foot duplicate sample).

1.3.3.14 U.S. Environmental Protection Agency (1993), *Aerial Photographic Analysis of the NASA Jet Propulsion Laboratory, Pasadena, California*

A historical aerial photographic analysis of the Jet Propulsion Laboratory study area was conducted by the U.S. Environmental Protection Agency (EPA) using steroscopic pairs of selected aerial photographs spanning the period from 1941 through 1992 to identify potential waste-disposal units such as impoundments, trenches, and pits. The results of this analysis is summarized in the following paragraph taken from EPA's report:

> "The 1941 photograph revealed the study area, before the establishment of the Jet Propulsion Laboratory facilities, consisted of cultivated cropland, an equestrian park, and undeveloped rangeland. By 1946, Explorer Road was paved for vehicle access and several laboratory and test buildings had been constructed. Probable waste disposal structures including a pit, trench, and an impoundment were noted in the southeast portion of the facility adjacent to the Seco Arroyo in 1952; however, no waste disposal activity was noted at the pit, trench, or impoundment by 1964. These structures were not visible in 1972 due to the construction of a large parking lot. Additional construction of more laboratories and support buildings was observed throughout the facility on 1977, 1980, 1985, 1989, and 1992 photographs; however, no visible signs of leachate seepage, cesspool seepages, or seepages from waste disposal units were observed."

EPA (1993, Figure 5) identified a long, concrete-lined pool filled with liquid in the southeastern portion of the study area on a black and white photograph dated February 27, 1946, and that a dark-toned material (possibly sludge) was placed on the south side of the long pool.

EPA determined that the pool was possibly a test facility structure because of its close proximity to other laboratory buildings. In actuality, this water-filled structure was Building 45 and originally named "Towing Channel." In later years, the structure was referred to as "torpedo tube," "aerodynamics laboratory," and "impact laboratory." The primary initial use of the structure was for the research and development of guidance systems. The dark-toned area on the south side of Building 45 is due to vegetation that can be seen on the oblique, low altitude JPL photograph JB358G dated July 2, 1947 (Figure 1-22). Ground-covering vegetation, as well as circular tree-irrigation rings, can be seen on the slope south of the Towing Channel in Figure 1-17.

From a black and white aerial photograph dated August 15, 1952, EPA (1993, Figure 6) identified a circular impoundment, designated as Annotation G near the southeast portion of the study area. This graded depression in the Arroyo Seco is WP-1, which is discussed in Section 1.3.3.12 and shown in Figure 1-17.

Two trenches identified by the EPA (1993, Figure 7) on a black and white aerial photograph dated November 17, 1952, were designated as Annotations H and I during their analysis. It was suggested by the EPA that these two trenches, located in the southeast part of the study area adjacent to the Arroyo Seco, may represent waste-disposal activities. Since both trenches were outside the JPL boundary at the time the aerial photograph was taken and neither trench was part of the JPL's operations, historical information on their use and contents is not available. Based on the aerial photograph and the locations of significant monuments, it is believed that part of Annotation H and all of Annotation I is covered by the parking lot along the southeast boundary of the JPL facility. These two potential contaminant source areas (Annotations H and I) have been redesignated as Waste Pit Nos. WP-4 and WP-5, respectively, for the OU-2 RI, and their locations are shown in Figure 3-1, Section 3.0.

1.3.4 Additional Documents

Work conducted during the course of the RI for OU-2 began in 1994 and continued through 1998. The Work Plan for the OU-2 RI (Ebasco, 1993a) was originally presented in December 1993 as a document that addressed the work to be conducted under the RI and FS for all three operable units at JPL. As work progressed on the OU-2 RI, the Work Plan and the Field Sampling and Analysis Plan (FSAP) (Ebasco, 1993d) evolved to address additional sampling required to more accurately investigate contaminant sources and the nature and extent of contamination in on-site soil. Addenda to the Work Plan and FSAP were developed and approved to address supplemental investigations and include the following documents:

- *Draft Final "Part A" Addendum to the Work Plan for Performing a Remedial Investigation/Feasibility Study*, prepared for the National Aeronautics and Space Administration Jet Propulsion Laboratory, Pasadena, California, by Foster Wheeler Environmental Corporation, September 1996 (FWENC, 1996a).
- *Draft Final "Part B" Addendum to the Work Plan for Performing a Remedial Investigation/Feasibility Study*, prepared for the National Aeronautics and Space Administration Jet Propulsion Laboratory, Pasadensa, California, by Foster Wheeler Environmental Corporation, September 1996 (FWENC, 1996b).
- *Draft Final Addendum Number 2 to the Work Plan for Performing a Remedial Investigation/Feasibility Study*, prepared for the National Aeronautics and Space Administration Jet Propulsion Laboratory, Pasadensa, California, by Foster Wheeler Environmental Corporation, May 1998 (FWENC, 1998a).
- *Draft Final "Part A" to the Field Sampling and Analysis Plan (FSAP) for Performing a Remedial Investigation at Operable Unit 2: Potential On-Site Contaminant Source Areas*, prepared for the National Aeronautics and Space Administration Jet Propulsion Laboratory, Pasadensa, California, by Foster Wheeler Environmental Corporation, September 1996 (FWENC, 1996c).