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**INITIAL SUBSURFACE  
ENVIRONMENTAL INVESTIGATION**

at  
Exxon Station 7-8932  
1790 Marina Boulevard  
San Leandro, California

For Exxon Company, U.S.A.

**INTRODUCTION**

Exxon Company, U.S.A. (Exxon) contracted with RESNA Industries (RESNA) to perform an initial subsurface environmental investigation at Exxon Station 7-8932 located at 1790 Marina Boulevard in San Leandro, California. The purpose of this investigation was to evaluate the presence of gasoline hydrocarbons in the subsurface soil and groundwater in the vicinity of existing underground gasoline-storage tanks (USTs) and service islands, and to evaluate the presence of petroleum hydrocarbons, halogenated volatile compounds (HVCs), and metals in the subsurface soil and groundwater in the vicinity of the existing used-oil UST, as part of Exxon's standard procedure for an initial subsurface investigation. Work performed for this investigation included:

- Drilling six soil borings (B-1 through B-6)
- Collecting soil samples from the borings
- Constructing six 4-inch inner-diameter groundwater monitoring wells (MW-1 through MW-6) in borings B-1 through B-6
- Surveying the well locations and elevations
- Developing and sampling monitoring wells MW-1 through MW-6
- Submitting soil and groundwater samples for laboratory analysis
- Preparing this report of results and conclusions

The field work for this investigation was performed in accordance with RESNA's field protocol (Appendix A), the Site Safety Plan (RESNA, August 11, 1993), and Exxon's work scope for an "Initial Subsurface Investigation". At the request of Exxon, RESNA did not perform a survey of sensitive receptors in the vicinity of the site for this investigation.

## SITE DESCRIPTION AND BACKGROUND

### General

The site is located on the northern corner of the intersection of Marina Boulevard and Merced Street in the City of San Leandro, Alameda County, California, as shown on the Site Vicinity Map (Plate 1). The site is a former Exxon service station equipped with one station building and three service islands. According to information provided by Exxon, USTs beneath the site include one 9,940-gallon, one 8,000-gallon, and one 6,000-gallon single-walled, steel gasoline USTs, and one 1,000-gallon, single-walled, steel used-oil UST. The locations of the USTs, service islands, and other pertinent onsite features are shown on the Generalized Site Plan (Plate 2).

The site is a nearly flat, predominantly asphalt-covered lot at an elevation of approximately 25 feet above mean sea level (msl). The site is bounded by Merced Street to the southwest, Marina Boulevard to the southeast, an office complex to the northwest, and commercial stores to the northeast. The area surrounding the site is primarily commercial development.

### Geology and Hydrogeology

The subject site is within the East Bay Plain, located in the west-central portion of the San Leandro Cone (Hickenbottom and Muir, 1988). Helley and Lajoie (1979) mapped the earth materials underlying the site area as Quaternary bay mud deposits composed primarily of dark plastic clay and silty clay rich in organic material. The site is located approximately 1-¼ miles north of the Estudillo Canal, approximately 1-½ miles northeast of Milford Landing on the eastern shoreline of the San Francisco Bay, and approximately 2-½ miles north of the San Lorenzo Creek (which has been channelized in a concrete aqueduct in this area). The active Hayward Fault is situated approximately 2½ miles east of the site.

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The subject site is located on the East Bay Plain, an area of generally low relief lying between the San Francisco Bay to the west and the hills of the Diablo Range to the east. The eastern boundary of the plain in the San Leandro area is marked by the active Hayward Fault, which is located along the base of the Diablo Range escarpment. The Hayward Fault is a well recognized groundwater barrier which locally influences groundwater flow near the base of the hills (Maslonkowski, 1984).

The East Bay Plain is underlain by about 1,000 feet of unconsolidated Quaternary sediments, consisting mostly of sand and silt deposited by alluvial systems, and clay and silt deposited in shoreline and estuarine environments. The alluvial deposits consist of large coalescing fans (cones) formed by debris transported by streams and creeks that drained from the Diablo Range (Hickenbottom and Muir, 1988). The soils in the vicinity of the subject site have been mapped as younger alluvium deposits of The San Leandro Cone (Maslonkowski, 1984) and consist of unconsolidated clay, silt, sand and gravel (Helley and Lajoie, 1979).

Recharge to the groundwater in the area occurs mainly as a result of direct precipitation that falls on the plain and the adjacent hills. Water reaches the groundwater reservoir through seepage from streams, infiltration through the soil, and subsurface inflow from adjacent areas and bedrock units.

## FIELD WORK

### Drilling

A well construction permit was acquired from the Alameda County Flood Control and Water Conservation District (ACFCWCD) Zone 7, prior to drilling. A copy of the permit is included in Appendix B, Well Construction Permit. To check the soil boring locations for the presence of underground utilities prior to drilling, RESNA pre-marked the exploratory boring locations, contacted Underground Service Alert (USA), and contracted with Cruz Brothers, a subsurface locator.

Six borings (B-1 through B-6) were drilled August 12 and 13, 1993, to evaluate the presence of gasoline hydrocarbons in the subsurface soil in the vicinity of the existing gasoline USTs and the service islands, and to evaluate the presence of petroleum hydrocarbons and HVCs in the subsurface soil in the vicinity of the used-oil UST. The locations of borings B-1 through B-6 are shown on Plate 2. A summary of the field procedures used by RESNA are included in Appendix A. To estimate the inferred groundwater downgradient direction beneath the site, prior to exploration, RESNA reviewed the United States Geological Survey 7.5-minute quadrangle San Leandro, California topographic map (USGS, 1980). The inferred downgradient direction was found to be to the south-southwest. The following criteria was used to locate the borings B-1 through B-6:

- Boring B-1 was located in the vicinity of the used-oil UST to evaluate the potential presence of petroleum hydrocarbons and HVCs in the soil near the used-oil UST;
- Boring B-2 was located approximately 3 feet south of existing gasoline USTs to evaluate the potential presence of gasoline hydrocarbons in the soil in the topographically inferred downgradient direction of the gasoline USTs;
- Boring B-3 was located in the vicinity of the southeastern service islands to evaluate the potential presence of gasoline hydrocarbons in the soil in the topographically inferred downgradient direction of these service islands;
- Boring B-4 was located in the vicinity of the western service islands to evaluate the potential presence of gasoline hydrocarbons in the soil in the topographically inferred downgradient direction of the service islands;
- Boring B-5 was located in the vicinity of the topographically inferred downgradient property line; and,
- Boring B-6 was located in the vicinity of the topographically inferred upgradient property line.

### Soil Sampling and Description

The borings were drilled to depths ranging from 19½ to 21 feet and soil samples were collected at intervals of approximately five feet or less, beginning at the 5-foot-depth interval. Soil samples were screened in the field for the presence of petroleum hydrocarbons using a photoionization Organic Vapor Meter (OVM). Samples were described using the Unified Soil Classification System (see Plate 3, Unified Soil Classification System and Symbol Key, and Plates 4 through 9, Logs of Borings).

Subsurface materials encountered in borings B-1 through B-6 consist primarily of sandy silt to silty clay, interbedded with a sandy gravel to gravelly sand layer (see Logs of Borings, Plates 4 through 9, and Geologic Cross Sections A-A' and B-B', Plate 10). Locations of Geologic Cross Sections are shown on Plate 2.

Soil stratigraphy beneath the site consists of an upper unit of coarse sandy gravel baserock underlain by four native soil units. The upper-most soil unit was predominantly unsaturated, fine grained, and consisted of a thin layer of silty clay between the depths of approximately 2 and 4 feet, which was in turn underlain by a sandy silt layer to depths of about 7 feet. Beneath this upper unit, an unsaturated coarse grained unit was encountered between depths of about 7 and 12 feet, that consisted of sandy gravel to gravelly sands. This unit was underlain by a fine grained water-bearing unit of sandy silt to silty clay that contained wet rootholes and small sand lenses between depths of 12 and 19½ feet. Beneath this fine-grained unit, at depths between 18 feet and the bottom of the borings, an unsaturated confining silty clay unit was encountered.

Subjective evidence of hydrocarbons in the soil was noted and recorded on the boring logs of B-1 through B-6 during drilling. Field OVM readings of samples from borings B-1 and B-3 through B-6 were nondetectable. Field OVM readings of samples, from boring B-2 ranged from 3.6 ppm at 10½ feet to 6.4 ppm at 14 feet. The OVM readings are listed on the boring logs in the column labeled PID, and are considered an approximate magnitude of petroleum hydrocarbons present in the soil.

### Stockpile Soil Sampling

During drilling, soil cuttings from the borings were stockpiled onsite pending disposal. Soils were placed on and covered with 6 millimeter visquene. Four soil samples were collected from the soil stockpile on August 13, 1993. A description of the sampling protocol is included Appendix A.

### Groundwater Monitoring Well Construction

Groundwater monitoring wells MW-1 through MW-6 were constructed in borings B-1 through B-6, respectively. The wells were completed with 4-inch inner-diameter, Schedule 40, polyvinyl chloride (PVC) casing. Well casings were set in the wells to depths of 17½ to 19½ feet below ground surface. The screened casings for the monitoring wells were constructed with 4-inch inner-diameter, 0.020 inch machine-slotted PVC set from the total depth of the wells to approximately 9½ feet in well MW-4, 13½ feet in well MW-2, and to approximately 7 feet in wells MW-1, MW-3, MW-5, and MW-6. Monterey Sand #3 was used as filter pack material installed to approximately 1 foot above the well screen. Blank PVC casing was set from the top of the screened casing to within a few inches below the ground surface (see Plates 4 through 9 for monitoring well construction details).

### Groundwater Monitoring Well Development

Groundwater monitoring wells MW-1 through MW-6 were developed on August 16, 1993, by surge block and bailing techniques until water being removed from the wells was found to be relatively free of sediments. The turbidity in each of the wells remained above 200 NTUs (nephelometric turbidity units). Appendix C contains well development data which includes time, gallons removed, and turbidity data. Field procedures employed by RESNA are included in Appendix A.

### Groundwater Level Measurements and Sampling

Quarterly monitoring and sampling was performed on August 19, 1993, in accordance with protocol in Appendix A. Depth-to-water (DTW) levels and subjective analyses data are summarized in Table 1.

### SITE SURVEY

On August 18, 1993, the site and locations and elevations of the wells were surveyed by Ron Archer Civil Engineer, Inc., of Pleasanton, California, a licensed land surveyor. The results of this survey are included in Appendix D, Wellhead Survey.

### LABORATORY METHODS

#### Soil Samples

Soil samples from soil borings B-1 through B-6 were submitted to PACE Incorporated (PACE), a state-certified laboratory (Certification No. 1282) located in Novato, California, for laboratory analyses for the gasoline constituents benzene, toluene, ethylbenzene, and total xylenes (BTEX), and total petroleum hydrocarbons as gasoline (TPHg) using modified Environmental Protection Agency (EPA) Methods 5030/8015/8020. Additionally, soil samples from boring B-1, in the vicinity of the used-oil tank, were submitted for laboratory analysis for total petroleum hydrocarbons as diesel (TPHd) using modified EPA Methods 3550/8015, total oil and grease (TOG) using Standard Method 5520, halogenated volatile compounds (HVCs) using modified EPA Method 8010, and metals cadmium, chromium, lead, zinc, and nickel using EPA Methods 6010/200.7. Soil samples that tested positive for TPHg were analyzed for lead using EPA Method 6010/200.7, ICP. These soil samples were selected for laboratory analyses based on:

- areas where the presence of petroleum hydrocarbons were suspected; and

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- five-foot intervals and/or change in stratigraphic unit as recommended by the ACDEH for definition of petroleum hydrocarbons in soil.

### Stockpile Soil Samples

On August 14, 1993, four soil samples were collected from the stockpile, and sent to Pace for compositing and analyses for TPHg and BTEX using modified EPA Methods 5030/8015/8020, TPHd using modified EPA Methods 3550/8015, TOG using Standard Method 5520, volatile organic compounds (VOCs) using EPA Method 8240, CAM metals (see report of laboratory analysis for methods), cyanide reactivity using EPA Solid Waste Method SW846 7.3.3.2, sulfide reactivity using EPA Solid Waste Method SW846 7.3.4.1, corrosivity using EPA Method 9040, and ignitability using modified EPA Method 1010.

### Water Samples

The groundwater samples from the monitoring wells were submitted under Chain of Custody Record to PACE and analyzed for the gasoline constituents BTEX and TPHg using EPA Methods 5030/8020/8015. Samples from well MW-1 were also analyzed for TPHd using modified EPA Methods 3510/8015, TOG using Standard Method 5520, and HVCs using modified EPA Method 8010.

## FIELD RESULTS

### Groundwater Gradient Evaluation

Groundwater elevations were calculated for each well by subtracting the DTW measurements from the surveyed elevation of the wellhead. The elevations from groundwater monitoring wells MW-1, and MW-3 through MW-6, were used to evaluate a groundwater gradient and flow direction. Monitoring well MW-4 was not used in the gradient evaluation due to an anomalously high groundwater elevation possibly due to the proximity of the tank backfill. DTW measurements, wellhead elevations, and groundwater elevations are presented in Table 1.



The groundwater gradient as interpreted from the DTW data was approximately 0.002 with a flow direction to the south. This gradient is generally consistent the topographically inferred flow direction for this site. The evaluated groundwater gradient is shown on Plate 11, Groundwater Gradient Map.

## LABORATORY RESULTS

### Soil Analyses

Results of laboratory analyses of soil samples are summarized in Table 2, Results of Laboratory Analysis of Soil Samples. Copies of laboratory reports and Chain of Custody documents for soil samples obtained during this investigation are included in Appendix E.

Laboratory analyses reports of soil samples from borings B-1 through B-6 indicate:

- concentrations of TPHg and BTEX were not detected at the laboratory method detection limits (MDLs) of 1.0 ppm and 0.005 ppm, respectively, in borings B-1 through B-6. Sample S-14-B2 collected from 14 feet in boring B-2 contained a concentration of 1.4 ppm TPHg.
- concentrations of chromium, nickel, and zinc were detected in boring B-1 at depths of 5½ feet, 10½ feet, 15½ feet, and 20½ feet, and a concentration of lead was detected at 15½ feet. Concentrations ranged from 23 ppm to 66 ppm. These concentrations are below the Total Threshold Limit Concentration (TTLCs).
- concentrations of TOG were detected in boring B-1 at depths of 15½ feet (57 ppm) and 20½ feet (63 ppm).
- concentrations of lead (12 ppm) was detected in boring B-2 at a depth of 14 feet.

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### Stockpile Soil Analyses

Laboratory analytical results of the composited soil sample from the stockpile indicted concentrations of BTEX, TPHg, VOCs, and organic lead were not detected at their respective laboratory MDLs. CAM metals were not detected at their respective laboratory MDLs, except for 0.05 ppm arsenic, 4.2 ppm barium, 0.30 ppm cobalt, 0.16 ppm copper, 0.58 ppm lead, 0.61 ppm nickel, 0.16 ppm vanadium, and 0.42 ppm zinc. Laboratory analytical results indicated a concentration of 340 ppm TOG, 7.7 pH, <0.5 ppm reactive cyanide, >60°C flash point, and <1.0 ppm reactive sulfide.

### Water Analyses

Results of laboratory analyses of groundwater samples are summarized in Table 3, Results of Laboratory Analyses of Groundwater Samples, on Plate 12, TPHg Concentrations in Groundwater, and on Plate 13, Benzene Concentrations in Groundwater. Copies of laboratory reports and Chain of Custody documents for water samples obtained during this investigation are included in Appendix E.

Laboratory analytical results of water samples from monitoring wells MW-1 through MW-6 indicate that:

- TPHg was not detected at the laboratory MDL (50 ppb) in wells MW-1, MW-4, and MW-5. TPHg was detected in wells MW-2, MW-3, and MW-6 and ranged from 55 ppb (MW-3) to 200 ppb (MW-2);
- concentrations of benzene were not detected at the laboratory MDL (0.5 ppb) in wells MW-3, MW-4, and MW-5. Benzene was detected in wells MW-1, MW-2, and MW-6, and ranged from 0.5 ppb (MW-1) to 5.0 ppb (MW-2). Concentrations were greater than the current California Department of Health Services Maximum Contaminant Level (MCL) of 1.0 ppb in wells MW-2 and MW-6;

- concentrations of the other purgeable gasoline constituents (toluene, ethylbenzene, and total xylenes) in wells MW-1 through MW-6 either ranged from 0.6 ppb to 18 ppb or were not detected at the laboratory MDL (0.5 ppb);
- TPHd was not detected at the laboratory MDL (50 ppb) in well MW-1; and,
- HVCs were not detected at their respective laboratory MDLs in well MW-1.

### CONCLUSIONS

Based on the results of this site investigation, RESNA concludes the following:

- Subsurface soils do not appear to have been impacted by gasoline hydrocarbons in the vicinity of the service islands or the former used-oil UST. Concentrations of TPHg (1.4 ppm) have impacted the soils in the vicinity of the gasoline USTs.
- Subsurface soils in the vicinity of the used-oil UST do not appear to have been impacted by diesel hydrocarbons. Concentrations of TOG have impacted the soils in the vicinity of the used-oil UST at depths of 15½ (57 ppm) and 20½ (63 ppm) feet.
- Gasoline hydrocarbons in soil appear to have been laterally delineated to less than 1.0 ppm onsite to the north (B-1 and B-6), south (B-5), southwest (B-4), and southeast (B-3).
- Gasoline hydrocarbons in soil appear to have been vertically delineated to less than 1 ppm to a depth of 19 feet in the vicinity of the former gasoline USTs (B-2).
- Gasoline hydrocarbons (TPHg) and benzene concentrations in groundwater have been delineated to less than 50 ppb and 1.0

ppb, respectively, beneath the southern (MW-5) and southwestern (MW-4) (downgradient) portions of the site.

- Groundwater was encountered between depths of approximately 9½ and 14½ feet, with a static water level of between about 11½ and 12½ feet. The groundwater gradient was approximately 0.002 with a flow direction to the south.

### LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological practice in California at the time this investigation was performed. This investigation was conducted solely for the purpose of evaluating the presence of gasoline hydrocarbons in the subsurface soil in the vicinity of existing underground gasoline-storage tanks (USTs) and service islands, and to evaluate the presence of petroleum hydrocarbons, halogenated volatile compounds (HVCs), and metals in the subsurface soil and groundwater in the vicinity of the existing used-oil UST beneath the site. No soil engineering or geotechnical references are implied or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. This report has been prepared solely for Exxon Company, U.S.A. and any reliance on this report by third parties shall be at such party's sole risk.

**REFERENCES CITED**

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