DATE

TO: Alameda Co. DHS

FROM: Newman Planning Associates

Hazardous Materials ... Cilellus site

... the basis for our discussion

Lisa Newman

If you have questions about this transmission, please call:

Fax Phone: (415) 492-9569

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35C

16 May 1991

Ms. Gaye Quinn, Planning Director
City of Emeryville
2200 Powell Street, 12th Floor
Emeryville, California 9460[illegible]

Re: Review of [illegible] Remediation Plans for East Baybridge Site

Dear Gaye:

In the course of preparing [illegible] section of the East Baybridge [illegible] plans for the site. Under contract [illegible], [illegible] prepared a plan for the majority of the site. Under separate contract, Aqua Resources prepared a remediation plan for the Ransome site. We have significant concern about use of the plans (particularly the Aqua Resources plan), in their current forms, for the EIR.

To explain our concerns, we have prepared the enclosed review of the two plans. To allow readers unfamiliar with the site contamination to understand our review, the memorandum includes a relatively extensive introduction, providing details about contamination on the site and its potential human health effects. In summary, we have identified potential deficiencies in both plans, which leads us to question the adequacy of the plans as a basis for [illegible] environmental review. As you may be aware, a recent court decision (Oro Fino Gold Mining Corporation v. County of El Dorado) found a CEQA document inadequate because it was based on an inadequate reclamation plan (the contents of which are similar to a remediation plan).

On the basis of this case and our review of the project remediation plans, we are concerned about the legal adequacy of the EIR. Robin Donoghue study the implications of the Oro Fino case for this analysis. Altering the remediation plans, which we believe may be necessary, could take some time, potentially delaying the EIR schedule.

If you have any questions about this issue, please call Dr. Kelly Moran, supervisor of ESA's Hazardous Materials group, at 896-5900.

Sincerely,

Michael Rice

Michael Rice
Managing Associate

cc: Lisa Newman
Robin Donoghue

/lpg

Environmental Science Associates, Inc.
[illegible]

ESA

EAST BAYBRIDGE EMERYVILLE
SUMMARY AND EVALUATION OF SITE REMEDIATION PLANS

BACKGROUND

Certain chemical and physical properties of a substance may cause it to be considered hazardous. As defined in the California Code of Regulations (CCR), Title 22, Section 66084, a "hazardous material" is a substance that poses a substantial hazard to human health or the environment when improperly handled, stored, disposed, or otherwise managed. A "hazardous waste" is any hazardous material that is abandoned, discarded, or in storage prior to recycling. For example, soil that is excavated from a site containing hazardous materials would be a hazardous waste if it exceeded specific CCR Title 22 criteria./1/

The East Baybridge project site has a history of heavy industrial and commercial use, dating from before the turn of the century. Storage, use, and disposal of hazardous materials have resulted in contamination of soils and groundwater at the site. Remediation of the project site is required as part of the project; without remediation, development of the project site would result in disturbance of hazardous wastes that might pose a threat to site workers, project occupants, or the public.

The Alameda County Health Care Services Agency, Department of Environmental Health, Hazardous Materials Division, oversees cleanup of contaminated soil at hazardous waste sites in the county. For the East Baybridge project, the first step in remediation planning was a series of site investigations carried out by consultants.

In early 1989, Kaldveer Associates performed a Preliminary Environmental Assessment of the East Baybridge project site./2,3,4/ The scope of work included a site reconnaissance, interviews with property owners, and review of public agency records. Kaldveer reported that historic patterns of site utilization suggest the likelihood of soil and groundwater contamination in the project area, and recommended that soil and groundwater testing be done. In late 1989, Kennedy/Jenks/Chilton did a Baseline Environmental Assessment for the Ransome Company portion of the project site (a property on Hollis Street, at the northern boundary of the project area)./5/ That study found extensive ground surface staining and other visible evidence of environmental impairment at the Ransome site. Collection of soil and groundwater samples was recommended.

The most comprehensive study of the project site was carried out by Levine-Fricke, who examined available reports and related documents describing conditions at the project site, and then followed up with a site investigation that included sampling and analysis of soils and groundwater. The findings were reported in a comprehensive, two-phase Environmental Investigation report that identified and quantified widespread contamination of soils and groundwater at the project site./6/

On the basis of information gathered in the site investigations -- principally the Levine-Fricke report -- site remediation plans were prepared. The site investigation reports and the consultants' recommendations for site remediation have been submitted to the Alameda County Department of Environmental Health (DEH) for review. Because groundwater is present at the site, the San Francisco Bay Regional Water Quality Control Board (RWQCB) must also review the site investigation report and remediation plans. The California Department of Health Services (DHS) may also take an interest in the soil contamination aspects of the remediation. Both DEH and RWQCB have approval authority over site cleanup activities and can specify additional or stricter remediation measures beyond those originally proposed.

RESULTS OF SITE INVESTIGATIONS

Soil and groundwater samples collected during the site investigations were found to be contaminated with a variety of chemicals; the type and distribution of contaminants found was not unexpected, given the historic site uses.

Unless otherwise noted, information in this section is summarized from the Levine-Fricke report./6/ Details of locations and concentrations of contaminants can be found in that report. Principal results of the sampling program are summarized in the paragraphs that follow. (Sampling locations that showed the highest measured levels of contaminants are given in parentheses.) For ease of reference, the L-shaped project site is divided into three "quadrants" -- Area A, Area B, and Area C. Area A is the southeast portion of the site; Area B is the northeast portion; and Area C is the northwest portion.

AREA A

Groundwater in an area roughly 200 feet wide and 1,200 feet long in Area A was contaminated with volatile halogenated solvents, including 1,1-dichloroethylene, 1,1,1-trichloroethane, and 1,1-dichloroethane. Solvent vapors also were detected at several soil sampling locations in this area.

Soil was contaminated with waste oil hydrocarbons at a number of sampling locations in Area A. The highest value measured was 7,400 mg/kg.

An area estimated to be 20 feet square lying south of the Clipper building site contained lead exceeding 1,000 mg/kg in concentration.

AREA B

The Ransome Company yard in the northwestern sector was extensively stained with oil, reportedly due to disposing lubricating oils and diesel directly on the ground. Upwelling "tar boils" as large as three feet in diameter were visible on the property./5/

The Ransome Company yard was found to have soils contaminated with a variety of compounds, including waste oil; the gasoline components benzene, toluene, xylenes and ethylbenzene; polynuclear aromatic hydrocarbons; and oil & grease.

Groundwater at the Ransome property was contaminated with gasoline and gasoline components, diesel, and waste oil.

Soil samples taken along the rail tracks north of the LDS warehouse were contaminated with waste oil.

A localized area near the rail tracks off Hollis Street in Area B contained concentrations of polychlorinated biphenyls in shallow soils ranging up to 7.3 mg/kg.

AREA C

Elevated concentrations of lead and zinc were found in the yard of the M&N site in shallow soils covering an area about 10 feet square. California regulations consider soil with a concentration of 1,000 mg/kg of lead to be a hazardous waste./7/ The highest concentration of lead measured in soils at the site was 8,800 mg/kg. California regulations consider soil having a zinc concentration greater than 5,000 mg/kg to be a hazardous waste./7/ Zinc contamination at the project site was not widespread but the single elevated zinc concentration detected was 47,100 mg/kg.

Areas in the vicinity of the M&N building site and near the tracks were contaminated with waste oil.

Two soil sampling locations near the M&N warehouse contained low levels of volatile organic compounds, including toluene.

Petroleum hydrocarbons were detected in shallow soils and perched groundwater at several sampling locations along the rail tracks near the Bashland property.

Groundwater in the area along the tracks north of the Bay Area Warehouse was contaminated with six volatile halogenated solvents, most notably trichloroethylene, 1,2-dichloroethylene, and vinyl chloride. Toluene was also detected at one location in this area.

To summarize, principal contaminants detected in samples collected at the site included chlorinated organic solvents in soil, groundwater, and soil gas; petroleum hydrocarbons from waste oil, gasoline, and diesel in soils and groundwater; the aromatic gasoline components benzene, toluene, xylenes, and ethylbenzene in soils; and metals lead and zinc, polynuclear aromatic hydrocarbons, and polychlorinated biphenyls in scattered soil samples.

POTENTIAL HEALTH THREATS

Properties that relate to potential health threats of the contaminants found at the project site are discussed briefly below.

CHLORINATED ORGANIC SOLVENTS

All three areas of the site exhibited contamination of soil, groundwater, or soil gas from chlorinated solvents. The most prevalent and/or elevated contaminants included 1,1-dichloroethane, 1,1-dichloroethylene, 1,2-dichloroethylene, 1,1,1-trichloroethane, trichloroethylene and vinyl chloride. All of these compounds are man-made contaminants, mobile in the environment, and unequivocal indicators of industrial pollution. Sources of chlorinated organic solvents are likely spills or tank leaks from common use as industrial process chemicals, solvents, and degreasers. All are toxic in the environment and produce symptoms such as respiratory irritation, nausea, and intoxication. Routes of exposure include inhalation and skin contact. Chronic exposure often causes liver and kidney damage. At least two chlorinated solvents -- trichloroethylene and vinyl chloride -- are carcinogens./8/

PETROLEUM HYDROCARBONS

Petroleum contamination results from spills or leaks of fuels such as gasoline, diesel, or waste oil, or from spillage or improper disposal of oils, grease, tar, or asphalt. The most common source of petroleum contamination is leaking underground storage tanks (USTs). Several USTs are known to have been present on the site, and other undocumented USTs that would be a threat to site workers might also be present. Fuels such as gasoline and diesel are flammable and would pose a potential fire hazard if present in storage containers or at high concentration in soil. Hydrocarbon vapors also irritate the eyes and respiratory system. A leaking UST could pose additional threats to groundwater resources and the environment. Cleanup criteria are site specific and variable, but the Regional Water Quality Control Board generally requires cleanup of petroleum hydrocarbons found at concentrations above 100 mg/kg for this type of site./9/ Stricter standards might apply, depending on potential uses of the groundwater.

BENZENE, TOLUENE, XYLENES, AND ETHYLBENZENE (BTXE)

These organic liquids are components of gasoline and other petroleum products, and are used as reagents or solvents in many industrial processes. The presence of BTXE compounds in soil or groundwater always indicates serious contamination and is often evidence of a UST leak. BTXE compounds are volatile, highly flammable, and toxic. The primary route of exposure is inhalation of vapors. Toxic effects include headaches, dizziness, nausea, and irritation of eyes and mucous membranes. Of the four, benzene is considered the most hazardous because it is known to cause cancer./8/ As summarized in the setting, the Ransome Company yard had the most serious BTXE contamination. The most likely sources of contamination at the project site would be spillage from industrial applications or leakage from storage tanks.

LEAD

Lead, a heavy metal, is a widespread environmental toxin. Lead has many metallurgical and other applications in industry, such as use in piping, tanks, solder, glass, and batteries; in the past it was used widely as a component of paints and gasoline. Routes of exposure include inhalation and ingestion of lead-contaminated particulates or dust, and skin and eye contact. Symptoms of lead poisoning include fatigue, sleep disturbance, headache, muscle aches, digestive upset, abdominal pain, and loss of appetite. Lead poisoning is chronic and becomes more severe as lead builds up in body tissues and bones. Long-term effects include anemia, loss of strength, kidney damage, and serious disorders of the central nervous system. Severe cases of chronic lead poisoning can result in delirium, coma, and death. Some lead compounds are carcinogens./8/ The lead levels seen in soils at the project site could have come from any number of sources. Areas of contamination were very localized.

ZINC

Zinc is a heavy metal that is an essential trace nutrient but toxic at high concentrations. Zinc has many industrial uses. Routes of exposure include inhalation and ingestion of zinc-contaminated particulates or dust, and skin and eye contact. Symptoms of zinc toxicity include dermatitis, eye irritation, and respiratory upset upon acute exposure. Unlike lead, zinc does not appear to build up in the body with chronic effects. At least one zinc salt, zinc chromate, is a carcinogen, but the carcinogenic effect appears to be due to the chromium ion rather than the zinc./8/

POLYNUCLEAR AROMATIC HYDROCARBONS (PNAs)

PNAs are a group of closely related organic compounds having chemical structures made up of two or more associated aromatic rings. All PNA compounds are toxic, and several are carcinogenic. PNAs are components of products such as creosote and asphalt that contain complex mixtures of hydrocarbons. They are also produced as by-products when petroleum compounds are incompletely burned, and occur naturally as products of plant biosynthesis. Routes of exposure are inhalation and ingestion of contaminated particulates. Acute toxicity does not appear to be a characteristic of PNAs, but several of the compounds are known to cause cancer./8/

POLYCHLORINATED BIPHENYLS (PCBs)

Polychlorinated biphenyls are a closely related group of organic compounds that were widely used commercially as electrical insulators. The source of PCBs at the site could be electrical cables, condensers, or transformers, or trace contaminants in light oils that might have been spread as herbicides. PCB vapors cause severe irritation of the eyes and lungs, and can cause severe injuries even at low concentrations. PCBs are insoluble and non-volatile, but accumulate in the food chain. They are readily stored and transmitted in fatty tissues. Chronic exposure can cause acne, jaundice, vomiting, liver damage, and fatigue. PCBs are carcinogens, damage fetuses, and can cause birth defects and stillbirths. They are combustible and produce toxic gases when burned, including trace amounts of very highly toxic dioxins. The greatest hazard from PCBs appears to be long-term concentration in the food chain, which leads to chronic exposure./8/

SITE REMEDIATION PLANS AND ESA COMMENTS

*The site investigation identified hazardous waste contamination at the project site. Remediation of both soils and groundwater is required, and remediation of contaminated areas is an integral aspect of the project. Site remediation will be guided by Site Remediation plans prepared specifically for this project. Such plans generally include, at minimum, the following: proposed methods of treating hazardous soils in a manner that would render them nonhazardous or otherwise protect public health and safety; plans for final disposal of soils, treated or otherwise; plans for cleaning up contaminated groundwater; and plans for handling, testing, treating, and disposing of groundwater during dewatering.

Two formal site remediation plans -- one by Levine-Fricke and one by Aqua Resources, Inc. -- have been prepared to address different areas of the project site. The remediation plan prepared by Levine-Fricke applies to all contaminated areas of the project site <u>except</u> the Ransome Company parcel./10/ The plan prepared by Aqua Resources, Inc. addresses contamination at the Ransome site only./11/ The Levine-Fricke plan excludes the Ransome site. The two remediation plans are discussed separately, below. ESA's comments on the plans are presented as a part of the discussion. The comments, offering our opinions, based on currently available information are in bold.

LEVINE-FRICKE PLAN

The Levine-Fricke plan proposed a comprehensive cleanup program using remediation methods specific to the types of contaminants present at the property. Proposed cleanup methods are summarized as follows:/10/

<u>Lead and zinc</u>

Because of their related chemical properties, these two metals would be handled in similar ways. Soils contaminated with lead or zinc would be excavated and hauled off site for disposal in a Class 1 landfill. Proposed cleanup goals are 1,000 mg/kg for lead and 5,000 mg/kg for zinc; these concentrations are identical to the California Total Threshold Limit Concentrations for lead and zinc -- concentrations above which the soil would be considered a hazardous waste by the state./7/ Provisions for treatability studies and waste pre-treatment at the disposal site are included in the plan. Levine-Fricke estimated that approximately 550-650 cubic yards of lead-contaminated soil in Area A would require remediation, while approximately 50 cubic yards of lead- and zinc-contaminated soil would be cleaned up in Area C. Confirmatory soil testing would be done to assure that all contaminated soil was removed. **Levine-Fricke does not indicate, however, if metal extractability tests (the California Soluble Threshold Limit Concentration and/or the Federal Toxic Characteristic Leaching Procedure) would be run on soil samples, or how soils exceeding the regulatory limits based on those tests would be handled. Hazardous waste guidelines based on the extractability tests are considerably lower than the cleanup goals for metals proposed by Levine-Fricke.**

Polychlorinated biphenyls

Soil contaminated with PCBs would be excavated and disposed of at a class I landfill. The PCB-contaminated soil appeared to be associated with a visibly oil-stained spot in Area B. Approximately 450-650 cubic yards of soil were estimated to require remediation. The proposed cleanup goal for PCBs was set at 1.0 mg/kg, a conservative level equivalent to one-tenth of federal cleanup guidelines for PCB cleanup in residential areas (10 mg/kg)./10/ **This cleanup goal would appear to be realistic because the state guideline for cleanup of carcinogens in soils is the same value -- 10 mg/kg.** As with the cleanup plan for lead and zinc, remediation of PCB contamination would include soil pre-testing and confirmatory testing to assure that cleanup goals had been reached.

Polynuclear aromatic compounds (PNAs)

Levine-Fricke does not propose cleanup of PNA compounds at the project site; the highest concentrations of PNAs were found at the Ransome property, outside the area covered by Levine-Fricke's remediation plan. **More importantly, a cleanup program for PNAs does not appear to be necessary at the project site because the highest values measured were below state cleanup guidelines for PNAs in soil. DHS guidelines specify 10 mg/kg and 100 mg/kg to be cleanup levels for carcinogenic and non-carcinogenic PNAs, respectively./12/ PNA levels measured at the non-Ransome portion of the site did not exceed those standards./6/**

Petroleum hydrocarbons in perched groundwater and associated soil

In the perched groundwater zone in Area C, contaminated soils and contaminated groundwater would be remediated together as a unit. Shallow soils and perched groundwater tainted with petroleum hydrocarbons would be excavated from the contaminated area and disposed at a landfill that would accept it. Hydrocarbon analysis of deeper water from the well indicated that the underlying groundwater does not appear to have been affected by the upper contaminated zone, which is estimated to be about 4 feet in depth. Although the near-surface contamination appears to be fully contained by the geologic formation (e.g. "perched" groundwater sits atop an impermeable layer of soil that isolates it from deeper groundwater), remediation at this location is necessary to ensure that groundwater quality beneath the soil/water contaminated layer would not be affected in the future. **No specific cleanup goal for soil hydrocarbons was mentioned in the remediation plan, but it was implied that soils containing more than 500 mg/kg -- along with all water associated with the soil -- would be removed. The RWQCB often requires more stringent cleanup goals for petroleum hydrocarbons. A cleanup level of 100 mg/kg might be imposed in light of the proximity of this property to San Francisco Bay and the fact that residential site use is planned./13/ It is important that the RWQCB concurs with Levine-Fricke's approach and approves the proposed cleanup goals before remediation proceeds. The County Department of Environmental Health must also be agree with the planned approach.** Approximately 200 cubic yards of saturated soil would be remediated. Pre-testing and confirmatory sampling would be done to provide assurance that remediation goals were met.

Petroleum hydrocarbons in soil

With the exception of the perched groundwater zone discussed above, oil-contaminated soil in Areas A and C would be contained on site by capping with a low-permeability seal such as asphalt pavement or a building foundation. Containment of the petroleum contamination in Area A would be monitored by a groundwater testing program. Groundwater samples would be collected semiannually from existing wells in the vicinity of hydrocarbon-affected soils in Area A; the water samples would be analyzed for total petroleum hydrocarbons. **The reservations expressed above regarding remediation of the perched groundwater zone apply to remediation of hydrocarbon contamination in soil as well. The proposed plan might not be approved because of inadequate cleanup goals. In this case, several of the soil samples tested had concentrations of petroleum hydrocarbons reaching several thousand milligrams per kilogram, levels that arguably should be cleaned up. Perhaps bioremediation could be applied in these areas, as is proposed for the Ransome site (discussed below).**

Volatile organic compounds in groundwater

The remediation plan for groundwater focused on Area A, where the major plume of groundwater contaminants was identified. Groundwater affected by volatile organic compounds would be contained on the site with a shallow groundwater collection trench placed downgradient of the contaminated water. The trench would be installed along Hollis Street, on the site boundary south of Yerba Buena Avenue. The plan calls for water captured in the collection trench to be treated on site to remove the volatile contaminants. Treatment methods under consideration include air stripping, liquid-phase carbon adsorptio[n] or photolysis with chemical oxidation. After the volatiles are removed, the treated water would be released to a nearby storm drain under NPDES permit, or discharged to the EBMUD wastewat[er] treatment facility. A groundwater monitoring program would be implemented to monitor and evaluate the effectiveness of the collection trench [syste]m. **This complex and comprehensive plan appears to be well-designed to rem[ove] volatile contaminants, but as with all groundwater remediation plans, t[he RWQCB] must approve the methods proposed. (ESA lacks engineering expertise [to] [illegible] particular remediation techniques, but they are well known methods that addr[ess] specific contaminant problems.) For remediation by air stripping, approval by the BAAQMD would also be needed.**

In addition, a well located on the northern site boundary in Area C would be monitored quarterly for at least one year to assess if the concentrations of volatile organic compounds at this location are changing. No remediation at this location was proposed; Levine-Fricke notes that the VOCs in Area C groundwater appear to be coming from an off-site source. **The RWQCB must approve this strategy -- it might require additional action.**

Timing

Soil remediation under the Levine-Fricke program could be completed in approximately five months from the start of cleanup. It was estimated that groundwater remediation would require approximately fourteen months. **These time frames seems reasonable.**

RESOURCES INC. PLAN

The Aqua Resources remediation plan for the Ransome property concentrated on remediation of petroleum hydrocarbons in soils, including the contaminants diesel, waste oil, gasoline, and BTXE. Two cleanup programs were presented; one for the higher molecular weight hydrocarbons, and the other for the lighter compounds./11/

Diesel and waste oil

Soils contaminated with diesel and/or waste oil would be treated by bioremediation, either on the site or at an off-site location Aqua Resources estimated that roughly 1,500 cubic yards of soil would require treatment.

Gasoline and BTXE

Soils contaminated with gasoline and the gasoline components BTXE would be remediated by aeration and reuse on site as fill. It was estimated that 4,900 cubic yards of material would require treatment by the aeration method of choice. Bioremediation has been used successfully at sites contaminated with petroleum hydrocarbons, and is likely to work at this site, if done properly. For bioremediation to succeed, both the types of contaminants and the environmental conditions must be suitable. The contaminants must be potentially biodegradable, the chemicals must not be toxic enough to interfere with microbial action, the organisms must be able to achieve the remediation goals, and the nutrient medium must be suitable for growth. Laboratory and pilot programs are often necessary before suitable conditions are obtained. When bioremediation is applied to a contaminated site, confirmation testing (which is not specifically discussed in the report) is very important because no soil actually leaves the property.

For petroleum hydrocarbons in groundwater at the Ransome property, no remediation plan was proposed. Aqua Resources feels that groundwater remediation is not necessary at the Ransome Company property because no free petroleum product was observed in the monitor wells and because the concentrations of hydrocarbons measured are in the part per billion range (although they were above the levels that require mandatory reporting to the RWQCB). On the basis of that information, Aqua Resources judged that the petroleum hydrocarbon concentration in groundwater at the Ransome site was not severe enough to require remediation. However, a water sampling program to monitor the effectiveness of soil remediation at the site on groundwater quality was recommended as part of the remediation plan. It is possible that the Aqua Resources remediation plan will not be satisfactory to the RWQCB.

Remediation plans should also specify that all USTs at the project site would be removed as part of the project. Risks associated with closure of USTs would be minimized by following proper procedures for UST cleaning and removal. In the project area, both the Oakland Fire Department and Department of Environmental Health supervise UST removals to enforce enactment of appropriate safety procedures

and soil sampling and testing provisions. Removal of tanks would need to be done under the guidance of those agencies.

SUMMARY OF ESA COMMENTS

On the basis of the above information, we have concern that the remediation plans are not adequate, and will not provide adequate basis for the environmental review. To ensure the adequacy of the EIR, it is important that it consider all potential impacts related to remediation. If the EIR is based on inadequate plans, we could wind up in a situation similar to that in the Oro Fino case.

While we have noted a few potential problems with the Levine-Fricke proposal, minor modifications to it may provide enough resolution to proceed with the EIR process and ens... appropriate consideration of all related impacts.

In contrast, we are extremely concerned about the potential inadequacy of the Aqua Resources plan for the Ransome site. This plan may require major revision to meet agency requirements. It is likely that revisions would introduce new environmental impacts that would not occur under the current proposal.

Another problem is that the two site assessments and remediation plans are independent documents, which do not provide an overall view of the site contamination. While this is not a major issue for soil contamination, it presents some difficulties when evaluating the groundwater remediation plans. Because groundwater migrates slowly across the site to San Francisco Bay, it is possible that contamination identified at the Ransome site could migrate to other portions of the property. Depending on the rate and direction of migration, it is possible that the Levine-Fricke groundwater remediation activities could partially abate the Ransome site contamination (however, because no active groundwater pumping is proposed, any reduction in contamination is likely to be minimal). Revised remediation plans (particularly the Levine-Fricke plan) should include consideration of the effects of the adjoining site contamination and remediation plans on the subject property.

NOTES

/1/ Under state law, hazardous properties are grouped into four general categories: toxic, ignitable, corrosive, and reactive.

Toxic Substances may cause short-term or long-lasting health effects, ranging from temporary effects to permanent disability, or even death. For example, such substances can cause disorientation, acute allergic reactions, asphyxiation, skin irritation or other health effects if human exposure exceeds certain levels (the level depends on the substance involved). Carcinogens (substances known to cause cancer) are a special class of toxic substances. Examples of toxic substances include benzene, which is a component of gasoline and a suspected carcinogen, and methylene chloride, a common laboratory solvent.

Ignitable substances are hazardous because of their ability to burn. Gasoline, hexane and natural gas are examples of ignitable substances.

Corrosive materials can cause severe burns or damage materials; these include strong acids and bases, such as lye or sulfuric (battery) acid.

Reactive materials may cause explosions or generate toxic gases. Explosives, pure sodium or potassium metal (which react violently with water), and cyanide are examples of reactive materials.

/2/ Kaldveer Associates, Preliminary Environmental Assessment, Santa Fe R&D Development, Emeryville, California, February 2, 1989.

/3/ Kaldveer Associates, Preliminary Environmental Assessment, Phase II, for Santa Fe R&D Development, Emeryville, California, April 19, 1989.

/4/ Kaldveer Associates, Summary of Findings: Preliminary Environmental Assessments, Phases I and II, for Santa Fe R&D Yerba Buena Avenue and Hollis Street, Emeryville and Oakland, California, May 1, 1989.

/5/ Kennedy/Jenks/Chilton, Baseline Environment Assessment Report, prepared fo[illegible] Ransome Company, October 1989.

/6/ Levine-Fricke, Phase I and Phase II Environmental Investigation Yerba Buena Project Site, Emeryville, California, prepared for Catellus Development Corporation, San Francisco, California, October 26, 1990.

/7/ California Code of Regulations, Title 22, Article 11, Section 66699, "Persistent and Bioaccumulative Toxic Substances."

/8/ Marshall Sittig, Handbook of Toxic and Hazardous Chemicals and Carcinogens, Second Edition, Noyes Publications, Park Ridge, New Jersey, 1985, pp. 118-119, 739-742.

/9/ For soil contaminated by petroleum products, cleanup guidelines are flexible and site specific. In the project site, the cleanup standard would probably be either 100 mg/kg or 1,000 mg/kg for hydrocarbons. Refer to the Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure, State of California Leaking Underground Fuel Tank Task Force, May 1988, updated February 1989.

/10/ Levine-Fricke, Site Remedial Plan: Yerba Buena Project Site, Emeryville and Oakland, California, prepared for Catellus Development Corporation, February 11, 1991.

/11/ Aqua Resources, Inc., Remedial Investigation and Closure Plan for Former Corporation Yard Site, 4030 Hollis Street, Emeryville, California, submitted to

Alameda County Health Care Services Agency, Department of Environmental; Health, Division of Hazardous Materials, January 16, 1991.

/12/ Bufton, Beth, Toxic Substances Control Division, California Department of Health Services, telephone conversation, January 12, 1990.

/13/ For remediation associated with USTs, the RWQCB has required cleanup to levels as low as detection limits (1 mg/kg or less) as part of its non-degradation policy for surface and ground waters. For disposal, the RWQCB considers materials containing between 100 and 1,000 mg/kg of petroleum hydrocarbons to be "designated" wastes, restricting disposal to certain specified landfills. The RWQCB considers soils containing more than 1,000 mg/kg of petroleum hydrocarbons to be hazardous wastes. (These designations were explained by Steven R. Ritchie, San Francisco Bay RWQCB, in a memorandum to DHS on June 1, 1987.) In ESA's experience, cleanup levels of 100 mg/kg and "no detectible quantity" of petroleum hydrocarbons have been applied at various Bay Area sites in recent years. The RWQCB determines an appropriate cleanup level for each site on the basis of site-specific factors, such as proximity to groundwater and possibility of migration to the Bay.

According to Cynthia Chapman of DEH, Alameda County generally uses a petroleum hydrocarbon cleanup standard of 100 mg/kg in the Emeryville/Oakland area; this standard is based on DEH interpretation of RWQCB guidelines (telephone conversation, May 8, 1991).