ASSESSMENT OF TOTAL PETROLEUM HYDROCARBON (TPH) RELEASE AT THE AC TRANSIT SITE, 1100 SEMINARY AVENUE, OAKLAND - RISK ANALYSIS

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Introduction

Recent developments and approaches toward investigating environmental pollution emphasize the quantification of the risk involved caused by a particular release based on relevant geohydrologic characteristics and contaminant parameters (1, 3, 4). Risk analysis associates a certain risk with site characteristics (site sensitivity) and environmental stress (contamination severity). Such analysis is particularly useful when a priority among several sites is being sought. Risk analysis has a relative rather than an absolute accuracy since the model is relatively qualitative and contains several uncertainties. This approach was used to rank more than 100 contaminated sites in the Santa Clara Groundwater Basin in a study commissioned by the U.S. EPA (1, 2). It resulted in dividing the sites into two groups: those that required ongoing (OG) action, i.e., further investigation and remediation; and those sites (22) for which no action (NA) was considered necessary. This report follows the same analytical methodology in assessing the risk associated with TPH release(s) at the Seminary Ave. site. The location of the site is presented in Figure 1.

Background Information

Construction of a new building at the AC Transit location required removal of five underground tanks present on the property that contained diesel fuel and gasoline. In September 1986, soil samples collected next to the tanks were analyzed for TPH; four out of seven samples were contaminated, with the highest value of 13,000 ppm located inside the vault. This led to the conclusion that the tanks or the associated piping systems were leaking and that the vault was not preventing TPH dispersion away from the tanks. Removal of the tanks in January 1987 confirmed the presence of leak(s). This prompted a geohydrologic investigative program with the immediate purpose of locating a construction site on the property free of contaminants. Construction over a clean site will achieve a dual goal: safe working conditions for the construction crew and assurance that the construction site will not be disputed as a contaminated site subsequent to construction.

The geohydrologic data, acquired during January through April 1987 and introduced as Appendix I of this report, resulted in the definition of a contamination pattern on the property that allowed repositioning the new building away from the main contaminant dispersion pattern. Thus, the primary scope of the geohydrologic investigation, namely that associated with the newly planned construction, was achieved. The report of this work was contained in a letter dated April 13, 1987 and is presented as Appendix II. One of the conclusions of Appendix II is that <u>there is</u> contamination on the Seminary Ave. site apart from the construction site.

Separate from its impact in terms of identifying a clean construction site, the geohydrologic and geochemical investigations (Appendix I) were aimed at characterizing the contamination and understanding its extent. Subsequent sections of this report address this issue.

FIGURE 1 AC Transit location. Arrow indicates dominant groundwater flow direction

The identified soils and subsurface water characteristics are used in this report as a measure of environmental vulnerability to the identified contaminants, using the Santa Clara Methodology (1, 2). This is a measure of site sensitivity. During the geohydrologic program, soil and water samples were collected and analyzed. These data defined, when assembled according to the Method, the model's second term: contamination severity. Appendix III presents a short description of the 15 elements that make up site sensitivity and the 9 elements that make up contamination severity.

In the subsequent two sections, we present the assigned point values for each one of the 24 factors considered and required by the risk analysis model, with explanatory arguments for the assigned values.

Site Sensitivity

Factor 1 - Assigned point value = 2. Figure 1 shows the location of the AC Transit site in a square roughly 3 x 3 miles. The positions of 8 neighboring wells are identified together with the general direction of the groundwater movement. It shows there is no public well located downgradient of the site. Consequently, a value equal to 0 could be assigned. To be conservative, the value assigned was 2.

Factor 2 - Assigned point value = 2. Figure 1 and Table 1, which is a list of wells, indicate that the nearest public well is located at 7825 San Leandro Street, 0.7 mile southeast of the AC Transit site. A point value of 2 corresponds to this distance.

Factor 3 - Assigned point value = 2. Since no private well is present downgradient, a value equal to 0 could be assigned. Conservatively the value assigned was 2.

Factor 4 - Assigned point value = 5.5. Since no clear definition of this factor is available, the assigned value was equal to the average for the 22 Santa Clara NA sites.

Factors 5, 6, and 7 - Assigned point value for each = 2. The actual deserved point value for each should equal zero since no wells are present downgradient of site.

Factor 8 - Assigned point value = 7.9. This value corresponds to a depth to shallow groundwater of 8 feet.

Factor 9 - Assigned point value = 0. This value is appropriate since no well for potable groundwater is located downgradient of the site.

Factor 10 - Assigned point value = 1.1. The well located at 919 81st Avenue supplies water from 400 feet. The value of 1.1 corresponds to this depth.

TABLE 1

Wells Around AC Transit Site
(1100 Seminary Avenue)

Well Number	Street Address	Well Use	Original Yield (gpm)	Total Well Depth (ft)
2S/3W 8G1	499 High Street	Industrial No longer in use	Unknown	610
2S/3W 8Q1	4701 San Leandro St.	Industrial No longer in use	85	756
2S/3W 9K1	2232 Seminary Ave.	Irrigational No longer in use	Unknown	102
2S/3W 15N1	919 81st Ave.	Industrial Cooling and washing	Unknown	400
2S/3W 15N2	1001 81st Ave.	Irrigational No longer in use	Unknown	128
2S/3W 16D1	1175 57th Ave.	Industrial No longer in use	250	1025
2S/3W 16G1	1034 66th Ave.	Industrial No longer in use	Unknown	71
2S/3W 16R1	7825 San Leandro St.	Industrial Cooling water	1000	510

Factor 11 - Assigned point value = 2.6. Data collected for the first 20 feet indicate a soil material with an overall permeability most likely below 5.10^{-7} cm.s^{-1} ($1.42.10^{-3}$feet/day). Since no data were available for the soil at 20-50 feet, we assumed the highest boundary for the "silt, clay mixtures" (Table II-3, in 205J), 10^{-2} feet/day. This results in a "travel time" of 5,000 days, i.e., a point value of 2.6.

Factor 12 - Assigned point value = 3. Because of the proximity of San Francisco Bay and because potential contaminants are intercepted at a shallow depth by subsurface waters, the relevance of deeper layers' permeability is questionable in the case of the Seminary Ave. site. Thus, conservatively 60% of maximum point value is assigned.

Factor 13 - Assigned point value = 3. Same explanation as for Factor 12.

Factor 14 - Assigned point value = 4. The subsurface shallow and localized water cannot sustain steep gradients for long periods. The value of 4 corresponds to a gradient equal to 0.8%.

Factor 14a - Assigned point value = 5. The information gathered does not indicate the presence of cross-contaminating conduits. Conservatively, the middle of the scale value is assigned.

Unlike the calculation procedure outlined in the 205J document (1), where for most factors a range rather than a point value was assigned (as a reflection of uncertainty in estimation), we deliberately have chosen a point value; this by no means reflects an increased confidence in our estimates. Thus our point value is nothing more than the middle point of a range for the particular factor.

The summation of the point values assigned for factors 1 through 14a produces a value equal to 44.1. In comparison, the 22 NA (no action) sites in the Santa Clara Groundwater Basin produced an average site sensitivity parameter equal to 65.1 when the same middle-of-the-range point for each factor is calculated. Compared to the 22 NA sites in Santa Clara, the Seminary Ave. site has almost the lowest sensitivity grade; only one out of 22 sites had a lower grade (is a less troublesome site) than the Seminary Ave. site. Figure 2 presents the average Santa Clara NA values and the Seminary Ave. values. It is clear that the site is a better site than most of the 22 NA sites of Santa Clara County because of the proximity of the Bay, and the lack of private wells downgradient of the site. It is also a better site because no potable water and no superficial usable groundwater is encountered around it.

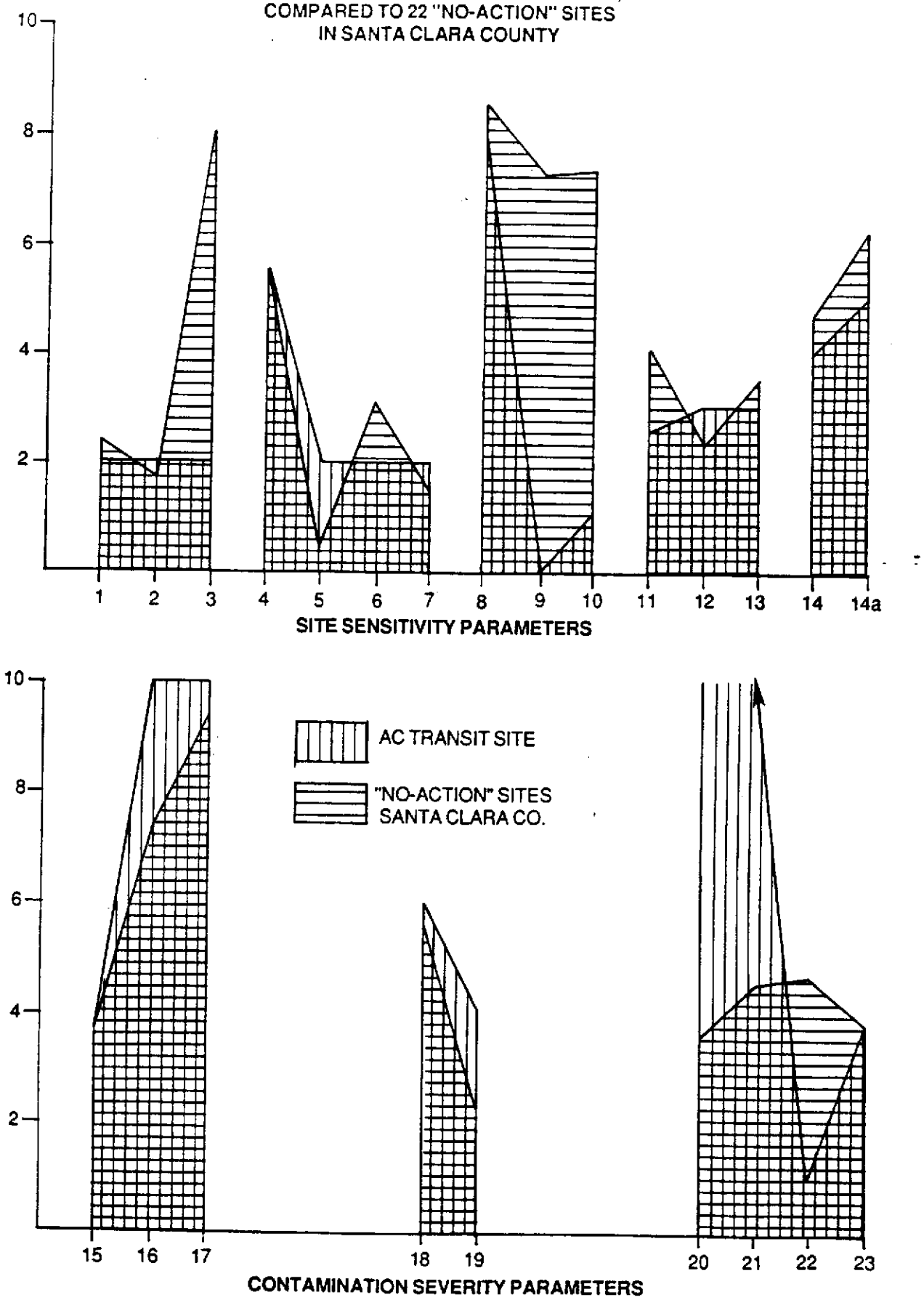
Contamination Severity

Soil and water chemical analyses results are collected and included in this report as Appendix IV. A summary of these data is presented in Table II-1 of Appendix II.

Factor 15: Assigned point value = 3. This value corresponds to the LD50 - humans characteristic for benzene and equal to 130 mg/kg.

FIGURE 2

SITE SENSITIVITY AND CONTAMINATION SEVERITY
AT A.C. TRANSIT, 1100 SEMINARY AVE.,
COMPARED TO 22 "NO-ACTION" SITES
IN SANTA CLARA COUNTY



Factor 16: Assigned point value = 10. Benzene is a carcinogen thus a maximum point value is assigned.

Factor 17: Assigned point value = 10. Both benzene and toluene are mutagenic, thus a maximum point value is assigned.

Factor 18: Assigned point value = 6. Among the four contaminants identified at the site, benzene (a nonpolar molecule), is the least prone for sorption.

Factor 19: Assigned point value = 4. This value corresponds to the bioaccumulation of ethyl benzene and possibly xylene.

Factor 20: Assigned point value = 20. Since in one case xylene isomers in excess of 20 $mg.L^{-1}$ were determined, a maximum value of 20 is possibly assigned.

Factor 21: Assigned point value = 10. This is an average value between a maximum of 20 and zero because the only contaminants found in soil was TPH. No traces of benzene, ethyl benzene, toluene, or xylene were found in the soil.

Factor 22: Assigned point value = 1. Assuming a contamination spread of 0.2 miles, a point value equal to 1 is appropriate.

Factor 23: Assigned point value = 4. There are four contaminants identified at the site, consequently the point value of 4.

The summation of all nine point values, which together represent the severity of the contamination episode at AC Transit, amounts to a value equal to 68.0. The average severity term calculated for the 22 Santa Clara-NA sites is equal to 45.0 and the severity term for the 73 "on-going-action" sites is equal to 64.3. Figure 2, introduced earlier, indicates that the two critical factors in the severity term are factors 20 and 21, the actual contamination magnitude in groundwater and soil, respectively. For factor 20 we assigned a maximum value (equal to 20) based on one single determination equal to 20 $mg.L^{-1}$ for xylene isomers. However, the inclusion of the Seminary Ave. site in the same group as "on-going-action" Santa Clara sites, which may seem to be suggested by the high severity term, is not justified for several reasons:

1. Among the 73 Santa Clara sites for which action is required, there are 26 (35.6%) for which the groundwater contamination (factor 20) is assigned the maximum grade, 20, the same grade assigned by us to the Seminary Ave. site. While the groundwater at the site is contaminated in excess of 1 ppm with 4 chemical species, the 26 Santa Clara sites are in average characterized by 9 incidents of contamination in excess of 1 ppm, more than twice compared to the Seminary Ave. site. The model does not make this distinction.

2. Two-thirds of the Santa Clara sites for which further action is required are contaminated with 10 or more chemical species. At the site, there are four chemicals of interest. This figure is close to the average number found for the 22 Santa Clara sites, 3.8, for which "no-action" is required. Clearly the Seminary Ave. site belongs in the same group with "no action" sites.

3. Although a contamination plume was not thoroughly mapped, the chemical distribution data seem to indicate a relatively localized contamination. This is most likely the result of a limited petroleum product discharge and certainly a consequence of a good (self-confined) geohydrologic environment.

Conclusions

1. Detailed soil descriptions introduced on several plates of Appendix I indicate the presence at the site of a predominantly fine soil material with an estimated hydraulic conductivity below 5.10^{-7} $cm.s^{-1}$. Transfer of fluid contaminants through such a soil is sensibly restricted.

2. Interlayered with the fine soil is a coarser material that may conduct contaminants and enhance their dispersion in the environment. However, the proportion of such lenses (conduits) is limited.

3. The site soils characteristically have a high degree of water saturation; this fact coupled with the low density of petroleum products limits the downward percolation of fuel contaminants. They will move, however, horizontally by a mechanism explained in Appendix I.

4. Favorable features are the lack of potable use of water and the general absence of any wells in a direction downgradient of the site.

5. The proximity to the San Francisco Bay with its frequent tides and the low elevation of the site result in a fluctuating depth of the capillary fringe in the soil. When a fuel contaminant is already released in the subsurface -- which is the case at the site -- the variable elevation of the groundwater seems to favor further dispersion of the contaminant.

6. Following a grading system used to prioritize contaminated sites in the Santa Clara Groundwater Basin, a relatively risk "contamination severity" term was calculated. This score was caused primarily by a single determination equal to 20 ppm xylene isomers in one groundwater sample.

7. In terms of compounded toxicity, soil sorption and bioaccumulation characteristics, two out of the only four chemical species identified at the site (xylene and ethyl benzene) rank first and second (i.e. they are the least toxic) in a group of 19 compounds investigated in the Santa Clara project (phthalate esters not included) (1, 2).

8. Analyzed soil samples did not reveal any fuel components except TPH.

9. No traces of 1,1 - Dichloroethane, 1,1 - Dichloroethylene, 1,1,1 - Trichloroethane, Trichloroethylene, Trichloromethane, Methylene Chloride, or Vinyl Chloride were found in any of the tested water samples. This proves that the fuel is the sole primary contaminant since all four identified compounds (xylene, ethyl benzene, toluene, and benzene) are fuel constituents.

10. The combination of favorable site hydrology, minimal water use and limited contamination suggest that the "no-action" alternative should be given serious consideration.

REFERENCES

1. Assessment of Contamination from Leaks of Hazardous Materials in the Santa Clara Valley Groundwater Basin, (205J Report), 1985. University of California, Berkeley - SEEHRL, n. 85-6.

2. Assessment of Contamination from Leaks of Hazardous Materials in the Santa Clara Valley Groundwater Basin, (205J Report), Technical Appendix: Chemical Summaries, 1985, University of California, Berkeley - SEEHRL, n. 85-8.

3. Guidelines for Addressing Fuel Leaks, 1985. California Regional Water Quality Control Board.

4. Newill, Vaun A., 1987. Keynote Address at the Thirteenth Annual Research Symposium U.S. EPA "Land Disposal, Remedial Action, Incineration and Treatment of Hazardous Waste", Cincinnati, OH.