

HEALTH CONSULTATION

**ASSESSMENT OF POSSIBLE EXPOSURE AT THE FAIRCHILD DRIVE
SIGN CONSTRUCTION SITE, MOUNTAIN VIEW, CA**

May 26, 1999

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

STATEMENT OF ISSUE

The Environmental Health Investigations Branch (EHIB), within the California Department of Health Services (CDHS), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), is conducting investigations of an on-the-job exposure to environmental contaminants at a sign construction site. This specific health consultation was requested by the United States Environmental Protection Agency (USEPA). The investigations for this site do not involve children's health issues nor do they involve community concerns or demographics.

BACKGROUND

ATSDR and CDHS were asked, by the USEPA (letter from Eugenia Chow, dated 9-1-98; Appendix A) to evaluate a possible exposure to an employee of Devcon Construction Inc. The suspected exposure occurred at 313 Fairchild Drive, Mountain View, CA, on February 17, 1998. This site is adjacent to the Middlefield-Ellis-Whisman Superfund Site, and is located approximately 35 miles south of San Francisco, CA. A supervisor's report indicated the employee became sick while working on a sign construction project. The employee noticed a chemical odor, felt dizzy and disoriented, and had a headache after working at the construction site (work began at approximately 10:30 a.m.). Similar symptoms occurred when the employee returned to the work site after lunch.

The Cohen Group, an environmental health and safety contractor for Devcon Construction, Inc., arrived to investigate at approximately 12:30 p.m. It was raining, when the contractor arrived, and it was muddy at the site. It began raining heavily at approximately 1:00 p.m. and continued until the contractor finished their work, at approximately 2:00 p.m. The contractor noticed an odor at the site, and measured the organic vapors, (the airborne, or volatile organic chemicals) using an organic vapor meter (OVM) (a Foxboro OVM 128 instrument). According to the contractor, the instrument was calibrated and used as recommended by the manufacturer. The OVM readings indicated the volatile organic compounds (VOC) were "at typical background levels". It should be noted that the instrument detects and quantifies total organic chemicals.

As measured on 2-17-98, the background VOC level was 0.5 ppm (measured in the contractor parking lot area; limit of detection for the instrument is approximately 0.2 ppm). The typical background levels, derived from historical sampling at the site, range between 1-2 ppm (under relatively dry conditions). The OVM readings obtained at the sign construction site were described as "at typical background levels". Included in the contractor's report was a note that the VOC levels were likely higher during the morning hours versus the early afternoon (sampling with the OVM occurred from approximately 1:00 -2:00 p.m.). In addition, the contractor mentioned that the employee was not known to have made contact with the contaminated soil, and presumed that any exposure was through inhalation.

The contractor also took surface soil samples in the area of the sign construction work on February 17, 1998. The surface soil sampling consisted of four samples: two that contained an "oily, yellowish" material that was on the ground near the work site; and two surface soil samples from "recently turned over" soil directly under the sign construction project. The soil samples were analyzed at an independent laboratory that used USEPA certified methods for analyses of organochlorine pesticides, volatile organic compounds, and semivolatile organic compounds. The positive results of those tests are provided in Table 1.

Soil Contaminants and Their Characteristics

Tetrachloroethene is a solvent used in the dry cleaning industry, is also used in a variety of industrial processes. Toluene, 1,2,4-trimethylbenzene, and xylenes are also used in industrial processes, and as components of automotive gasoline. Because xylenes and toluene are gasoline components, they are commonly found at sites where fuel has been spilled. All of these contaminants are considered volatile organic chemicals. As such, it is reasonable to expect that at least some of these contaminants, if present in the surface soil, would volatilize into the surrounding air. It follows that inhalation of those contaminants is possible.

DDD and DDE are breakdown products of the pesticide DDT (dichlorodiphenyltrichloroethane), and are not considered volatile compounds. Likewise, the phthalate contaminant, a component of most plastics, is nonvolatile at ambient temperatures. These contaminants are not likely to be inhaled, but can enter the body through ingestion or through contact with skin. However, the contractor's report mentions that the employee was not working directly in the contaminated soil, thus ingestion and dermal exposure routes are unlikely.

DISCUSSION

Pathways Analysis

The impact of environmental contaminants on human health can be evaluated by exposure assessment investigations. The exposure assessments evaluate the mechanisms, or exposure pathways, by which humans come into contact with the contaminants. As defined by the ATSDR, an exposure pathway contains five elements. The five elements are: 1) a source of the contamination; 2) a means by which the environmental contaminant is transported; 3) a location at which humans can come into contact with the contaminant; 4) a route by which the contaminant comes into contact with or enters the body; and 5) a person(s) that receives the contaminant, often called the "receptor population".

Given the range of possibilities for environmental contamination, none, a few, or all of the exposure pathway components may exist at any particular site. Therefore, exposure pathways are described, based on the number of components that exist, as completed, potential, or eliminated. A completed exposure pathway contains all five of the pathway components. A potential exposure pathway has one or more of the components absent, but the pathway may be

completed at some point in the future. An eliminated exposure pathway has one or more components missing, and those missing components will not exist in the future.

The CDHS has identified one exposure pathway at the Fairchild Drive sign construction site. The exposure pathway is derived from a receptor, the construction worker, who was exposed to contaminants in the surface soil. The pathway involves contaminants that are the likely result of spills and releases of fuels and solvents. The point of exposure is the job site, where the worker was exposed to the contaminants through inhalation of the volatile compounds. An exposure involving ingestion was not evaluated due to the unlikely nature of such an exposure in an adult. Table 2 provides a summary of the exposure pathway.

Use of Comparison Values

Evaluation of the health effects associated with exposures to contaminants is accomplished by comparing the concentration of a contaminant to values known as “comparison values”. Since this investigation involves an “industrial exposure”, the most appropriate comparison values are the limits that have been established by various agencies to protect employees in the work place. The most commonly used work place protection limits are established by: the National Institute for Occupational Safety and Health (NIOSH); the Occupational Safety and Health Administration (OSHA); and the American Conference of Governmental Industrial Hygienists (ACGIH). For the purpose of this health consultation, the workplace limits are used as the primary comparison values. In addition, values established by the USEPA are used as comparison values. The following material provides a general description of comparison values and the rationale for their use.

Comparison values allow for a general screening of contaminants found at sites under investigation. These comparison values allow an investigator to quickly sort the contaminants into groups that are either: not likely to cause health effects, or contaminants that should be evaluated further. If the contaminant levels are less than the comparison values, then an adverse health effect is not likely, and that contaminant is not considered further. On the other hand, if the contaminant concentration exceeds the comparison value, the contaminant is considered a contaminant of concern, and a more rigorous toxicological evaluation is necessary.

PUBLIC HEALTH IMPLICATIONS

Evaluation of Completed Toxicological Exposure Pathway

Ideally, assessment of an inhalation exposure would consider the concentration of air contaminants at the time of the exposure. In this case, there are no quantitative data that define the air contaminants at the time of the exposure. However, based on available information, an estimate of the VOC concentration range can be made.

Both the employee and the contractors noted that “odors” were detected. The human olfactory

detection limit for the VOCs found in the soil are in the range of 0.1 ppm for each of toluene, xylene and 1,2,4-trimethylbenzene; and approximately 5 ppm for tetrachloroethene (1-4). Because several individuals detected the odors at the site, it is reasonable to conclude that the “lowest estimate” of the airborne VOC concentrations is approximately 0.1 ppm.

The contractors measured the site VOCs, (in the afternoon) at several locations “Background” was measured in the contractor’s parking lot at approximately 0.5 ppm, and the VOC at the sign construction work site was approximately 1-2 ppm. When considering the olfactory threshold information and the data from the OVM, a reasonable estimation of the airborne VOC concentrations is approximately 0.1-2 ppm. It should be noted that VOC levels measured at the site represent total organics, and therefore the estimates include all components of any mixture of organic contaminants at the site.

For the exposure assessment considered in this health assessment, “worst case” estimates are intentionally used. The “worst case” VOC concentration estimate is used because it will permit the most rigorous evaluation of the contaminants, and therefore ensure that any possible adverse health effect associated with a contaminant will be revealed. If, when using the worst case estimate, we find that no harmful health effects are expected, we can be reasonably confident that no health hazard exists. With the intention of using a worst case estimate of the VOC concentrations, 2 ppm (the highest background VOC level generally found at the site), was selected as the estimate of the VOC concentrations at the sign construction site. Comparisons using the worst case estimate of the site VOC levels and various workplace regulatory levels are presented in Table 3.

The data in Table 3 suggest that, the estimated airborne VOC concentrations were at least 10 times lower than any of the limits that regulate on-the-job exposures. Therefore the estimated VOC concentrations at the site do not exceed the limits that have been designed to provide workplace protection.

A limitation in the data evaluated for this health consultation is the lack of data that define the airborne contaminant concentrations during the morning work period. However, it is known that the soil at the site is the source of the VOCs. Furthermore, it is likely that the extent of any inhalation exposure is related to the concentration of the VOCs in the soil. Therefore, because of the limitations with the information describing the airborne contaminants, it is also reasonable to examine soil contaminants, and to consider those data in the construction of the health consultation.

The site investigations revealed that surface soil VOC concentrations ranged from 0.12–0.26 ppm. A listing of the soil contaminants found at the Fairchild Drive Sign Construction Site and Preliminary Remediation Goal (the PRG values produced by the USEPA) values are provided in Table 3.

With the comparisons of the data in Table 4, it should be noted that all contaminant

concentrations found in the soil at the sign construction site are at least 80 times lower than the comparison values. Since none of the contaminants found at the exposure point exceed any of the soil comparison values, no adverse health effects are likely to be associated with exposure to the soil contaminants.

The second round of soil testing, conducted approximately one month later, did not find any of the original VOCs. However, trichloroethene was detected in several samples with the highest level at 0.037 ppm. This concentration of trichloroethene is more than 150 times below the soil comparison value (PRG value for the USEPA) of 6 ppm. Therefore the trichloroethene found on the 3-20-98 sampling date is not likely to cause any adverse health effects.

Additional Comments

The analyses using work place comparison values and related information indicate that the air and soil contaminants, at the levels measured at the site, are not likely to cause adverse health effects. Additional evidence that supports that conclusion is discussed below. However there are several limitations associated with the data evaluated. Those limitations are also discussed below.

Supporting Evidence

A number of literature reports indicate that acute exposures to the compounds found in the soil at the Fairchild site can cause headache and dizziness. However, the symptoms are generally experienced when exposed to higher concentrations of VOC than the concentrations measured at the Fairchild Sign Construction Site (see references 2-4 for general information and reference 5 for reviews of the literature). Under laboratory tests in which humans were exposed to toluene or xylene or tetrachloroethene, noticeable symptoms associated with the solvent exposures were first experienced as VOC concentrations approach 100 ppm or higher (2-5; no data available for 1,2,4-trimethylbenzene). This evidence suggests that exposure to VOCs at concentrations higher than 100 ppm may elicit a symptomatic response to the contaminants. A comparison of the symptomatic response levels (approximately 100 ppm) versus the measured VOC levels at the site (1-2 ppm), leads to the conclusion that the VOC concentrations measured at the site are not likely to cause adverse health effects. In fact the estimated airborne VOC levels at the Fairchild Sign Construction Site were at least 50 times lower than the levels known to be associated with the early symptoms of exposures to VOCs.

Limitations with the Data Evaluated

The air sampling, using the OVM, was conducted in the afternoon, approximately 3 hours after the possible morning exposure. The fact that all of the air measurements were made at least several hours after the possible exposure interjects an element of uncertainty into the conclusions drawn from these investigations. However, the estimated range of VOC concentrations (0.1-2 ppm), is consistent with the available data from the afternoon sampling. That is, the 0.1-2 ppm

estimate for VOC concentrations is consistent with what is known about typical human olfactory sensitivity, the OVM sensitivity, and the readings obtained using the OVM.

The OVM measures total organics in the sampled air. The instrument can not provide information regarding the relative amount of a particular compound nor can it provide the number of different compounds present in the sampled air. This limitation is relevant for this investigation because information involving "total organics" can not be used to distinguish between site related contaminants versus contaminants originating from other sources. For instance, while it is expected that the VOCs found in the soil would be present in the air sampled by the OVM, it is also likely that components of the exhaust from automobiles on Fairchild Drive or other nearby streets may have contributed to the "total organics" measured by the OVM. Therefore, the information obtained with the OVM may over estimate the site-derived contaminants. In addition, the OVM readings can not provide information that is useful in assessing questions related to the presence or absence of solvent mixtures.

The presence of several contaminants at the site raises the possibility that any exposure may have involved a mixture of VOCs. While there are reports of laboratory human exposures to solvent mixtures (5), these studies do not generally render conclusions that are easily adaptable to the exposure assessment scenarios investigated for this health consultation. Therefore in must be recognized that the evidence evaluated for this health consultation can not eliminate the possibility that exposure to a mixture of VOCs may elicit an unusual response.

An unusual response by an extremely sensitive person is a possibility for most environmental or workplace exposures. The data evaluated for this health consultation can not eliminate the possibility that an extremely sensitive person may experience a hypersensitive reaction to the VOCs found at the site.

CONCLUSIONS

The data available for this Health Consultation indicate that a completed exposure pathway existed at the Fairchild Drive Sigh Construction Site. The pathway involved the inhalation of volatile organic chemicals (tetrachloroethene, toluene, xylenes, and 1,2,4-trimethylbenzene) by a worker at the site. Measurements of the airborne and soil contaminants found at the site indicate that the contaminants exist at levels that are below all regulatory limits established for protection of employees at the workplace. Comparisons using the estimated site contaminant concentrations versus VOC concentrations known to produce symptoms in humans, support the conclusion that the on-site contaminants are not likely to cause symptoms of solvent exposure. Based on the review and analysis of the available data, the Fairchild Drive Sign Construction Site poses no apparent public health hazard to workers near the site where the VOCs were measured.

An obvious limitation of this investigation is the lack of data that defines the airborne contaminants at the time of the initial exposure. Due to other limitations with the available data, the information evaluated in this health consultation can not eliminate several possibilities.

These possibilities include adverse health effects associated with exposure to a solvent mixture at the site, and the possibility of an unusual response to the contaminants by an extremely sensitive person.

PUBLIC HEALTH ACTIONS AND RECOMMENDATIONS

Actions Completed

Construct a Health Consultation describing the investigations and the analyses of the available data.

Recommendations for Further Actions

Communicate findings of the health consultation to the USEPA and other interested stakeholders.

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CERTIFICATION

This Fairchild Health Consultation 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 health assessment was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation, and concurs with its findings.

Richard E. Gillig, M.C.P.
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REFERENCES

1. Verschueren, K. 1983. Handbook of Environmental Data on Organic Chemicals, Van Nostrand Reinhold, Melbourne, Australia.
2. Toxicological Profile for Toluene. 1994. Agency for Toxic Substances and Disease Registry.
3. Toxicological Profile for Xylenes. 1995. Agency for Toxic Substances and Disease Registry.
4. Toxicological Profile for Tetrachloroethylene. 1995. Agency for Toxic Substances and Disease Registry.
5. Arlien-Soborg, P. 1992. Toluene (Chapter 3) in: Solvent Neurotoxicity. CRC Press, Boca Raton, FL.

Appendix A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX

Date: September 1, 1998

Subject: 313 Fairchild Drive, Mountain View, CA
Middlefield-Ellis-Whisman Site

From: Eugenia Chow, Remedial Project Manager *EC*

To: Bill Nelson, ATSDR

As I mentioned in my voicemail, I have attached documents related to a possible exposure by a construction worker at the above referenced site. Please review the soil sampling results and let me know what your thoughts are on the possible health impacts. The construction worker's name is John Link, but I don't have his address or phone number. The attorney who called on his behalf informed me that Mr. Link has not been able to return to work and that he was having neurological problems which he believed were related to the incident. The attorney's name is:

Rich Ross
400 Capital Mall, Suite 900
Sacramento, CA 95814-4407
(916) 449-3908

Thanks for your assistance.

Table 1. Soil Sample Descriptions and Contaminants Found at the Fairchild Drive Sign Construction Site.

Sample and Description	Contaminants Found (concentration)
Surface Soil containing oily residue	tetrachlorethene (0.17 ppm) toluene (0.23 ppm) 1,2,4-trimethylbenzene (0.12 ppm) total xylenes (0.26 ppm)
Surface Soil recently turned under	4,4'-DDD (0.18 ppm) 4,4'DDE (0.16 ppm)

Table 2. Summary of Exposure Pathway Elements for the Fairchild Drive Sign Construction Site.

Source	Environmental Media	Point of Exposure	Route of Exposure	Receptor
Solvent and Fuel Spills	Air	Work Site	Inhalation	Worker

Table 3. Estimated Volatile Organic Contaminant Concentrations at the Fairchild Drive Sign Construction Site Compared to Values Established for Workplace Protection of Employees.

Contaminant ¹	Estimated Air VOC Concentration ²	Workplace Protection Values		
		NIOSH ³	OSHA ⁴	ACGIH ⁵
tetrachloroethene	2		100	25
toluene	2	100		50
1,2,4-trimethylbenzene	2	25		25
total xylenes	2	100		100

1. All data are ppm.
2. Estimates selected as a “worst case estimate”; values shown are the highest organic vapor meter readings on the day of the site investigation.
3. NIOSH = concentrations used for workplace protection. These are established by the National Institute for Occupational Safety and Health and are the Recommended Exposure Limits (time weighted average).
4. OSHA = concentrations used for workplace protection. These are established by the Occupational Safety and Health Administration, and are the Permissible Exposure Limits (time weighted averages).
5. ACGIH = concentrations used for workplace protection. These are established by the American Conference of Governmental Industrial Hygienists and are the Threshold Limit Values (time weighted average).

Table 4. Contaminant Concentrations and Soil Comparison Values for the Fairchild Drive Sign Construction Site.

Contaminant ¹	Soil Concentration Found	Soil Comparison Value
		PRG ²
tetrachloroethene	0.170	16
toluene	0.230	520
1,2,4-trimethylbenzene	0.120	170
total xylenes	0.260	210 ³
4,4'-DDD	0.18	19
4,4'-DDE	0.16	13
bis(2-ethylhexyl)phthalate	0.820	100,000

1. All data are ppm
2. PRG = preliminary remediation goals for industrial sites; values established by the USEPA
3. Value is the lowest for any of the xylene isomers.

Moffit Field
Naval Air Station

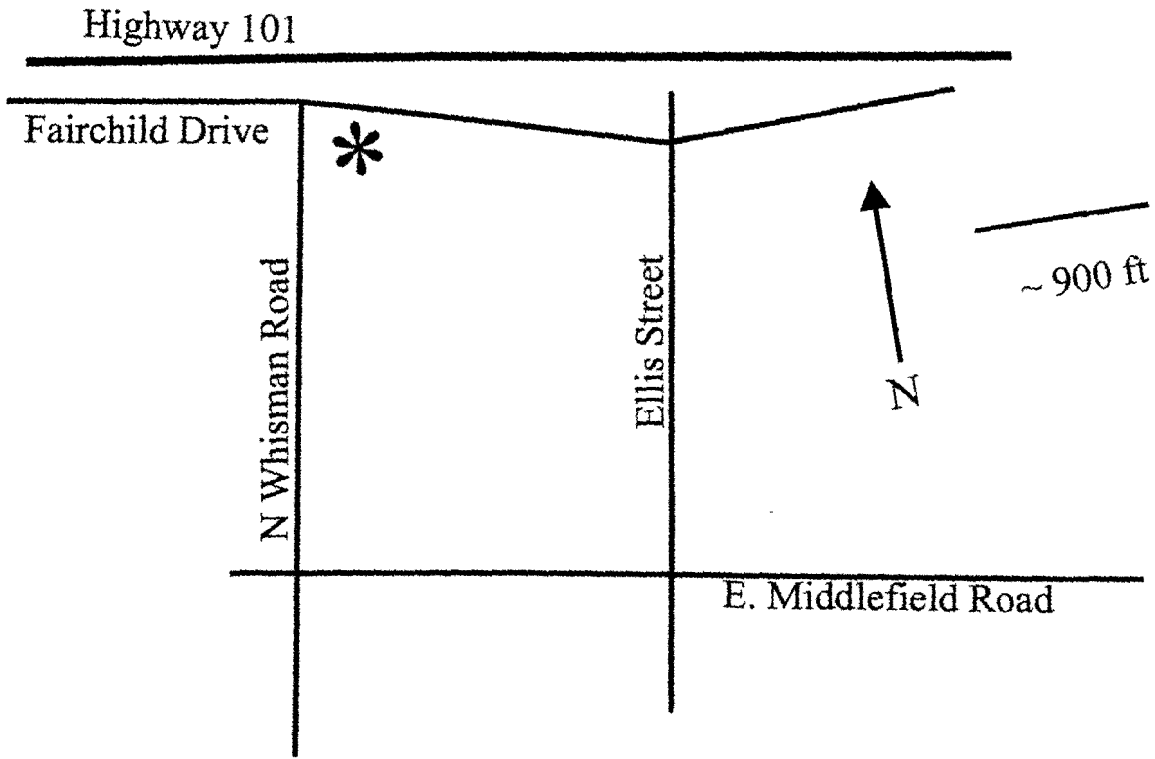


Figure 1. Map Illustrating the Approximate Location of the 313 Fairchild Drive Sign Construction Site.