APPENDIX H

An Evaluation of Solvent Leaks Associated with the City of Sunnyvale Sewer System

H.1 City of Sunnyvale Sewer System

The city of Sunnyvale lies in northern Santa Clara County, in the medial and distal portions of the Stevens Creek fan, and in the Basin interior. The city obtains 90 percent of its water from treated surface-water sources; 10 percent is supplied by groundwater. Depth to groundwater ranges from greater than 100 feet at the southern edge of the city to 15 feet at the Central Expressway. Figure 28 presents geographic and groundwater features of the city of Sunnyvale. North of the Central Expressway, groundwater is less than 15 feet below ground at most locations. North of the rail line, many wells penetrating the lower aquifer are artesian, and north of the Central Expressway, nearly all wells penetrating the lower zone are artesian.

In an analysis of shallow groundwater sensitivity to surface contamination conducted by the Santa Clara Valley Water District using EPA's "DRASTIC" methodology, Sunnyvale's aquifers ranged from "low" sensitivity to "medium high," with the less-vulnerable zones lying in the southern half of Sunnyvale, and the more vulnerable zones lying in the shallow groundwater zone in the northern half of the city (Pierno, 1999).

The Sunnyvale sewer system is primarily a residential sanitary sewer system, but also includes five commercial lines serving commercial and industrial facilities. A majority of the sewer system is fewer than 50 years old. Construction details usable in ascertaining the physical potential for exfiltration were not obtained for this evaluation. In the shallow groundwater zone, infiltration is known to occur to a limited extent.

Sunnyvale is home to a large number of high-tech industries, including manufacturers of computer chips, printed circuit boards, and related products. There are also several chemical companies and metal-plating shops in Sunnyvale. To ensure safety from fire and explosion, these industries were required to store solvents in underground tanks. Solvent tanks leaked to soil and groundwater at many installations, resulting in a substantial number of releases in Sunnyvale. The S.F. Regional Board's database of Spills, Leaks, Investigation, and Cleanup (SLICs) lists 119 cases in Sunnyvale as of 2001. The high incidence of solvent use and spills in Sunnyvale suggests an increased potential for past illegal or unregulated discharge to sewers.

Sunnyvale's Industrial Pretreatment Program. The former manager of Sunnyvale's pretreatment program, Rosanna Lacarra, was interviewed in June 2000 to learn the extent to which illegal discharges are now or have previously been a problem. Through this discussion, the following aspects of Sunnyvale's program and the dry-cleaner issue were explained.

- All dry cleaners in Sunnyvale are required to be zero discharge. These facilities are self-contained. In the past, there were three ways that solvent waste was generated from dry cleaners: from condensate (water and perchloroethene vapor condensate collected in a bucket and often dumped to sinks and drains), from exchanging the perchloroethene in the system, and from exchanging the solids accumulated on filters. All of these wastes were presumably manifested and disposed of appropriately, as verified by Sunnyvale's pretreatment program. In the 1970s and earlier, direct discharge of dry-cleaner wastes to the sewer was legal and commonplace.
- Not all dry cleaners in Sunnyvale perform the dry-cleaning process on-site; several dry cleaners take the work to another location outside of Sunnyvale.
- There are no centralized dry cleaners, such as large industrial uniform cleaning facilities, in Sunnyvale, nor do staff members recall any in the past.
- In 1992 and 1993, Sunnyvale's pretreatment inspectors conducted an intensive review of dry cleaners' activities, beyond routine inspections, and concluded that all were in compliance and

none were discharging. One facility had installed a pilot treatment system to handle condensate rather than changing out equipment so it could become self-contained. Inspectors verified that the system worked properly.

- Today, the city's Industrial Pretreatment Program inspects significant industrial users annually, and requires a Solvents Management Plan for facilities using solvents on-site. City pretreatment staff experienced with these facilities contend that significant industrial users are unlikely to be the source of the influent concentrations of solvents (Gallo, 2000).

Lacarra made the city's Industrial Pretreatment Program reports available for review. From a brief review of the reports and further discussion with Lacarra, the following features of Sunnyvale's program history are evident.

- Sunnyvale has aggressively pursued industrial discharge to the sewer system for as long as staff there can recall (all joined the city after 1990). The following examples obtained from reports confirm a history of proactive enforcement.
- In 1985, six industries were referred to the city attorney for prosecution; court action on one case resulted in a 10-day jail term.
- In 1986, the Sunnyvale Pretreatment Program led an interagency committee managing groundwater treatment issues and developing criteria to permit discharge from groundwater treatment systems, aquifer pump tests, etc.
- In 1987, routine sampling efforts produced 1,307 samples.
- In 1987, of 71 industrial dischargers, 57 achieved consistent compliance, seven were found to be in violation of federal regulations, two were referred to the city attorney, legal action was pending on four, and monetary penalties were assessed on one.
- In the 1986-87 fiscal year, $393,211 was budgeted for the pretreatment program, including 13,542 inspector hours. In 1987-88, $412,000 was budgeted.
- Sunnyvale does not routinely sample and analyze for VOCs in trunk lines and laterals. VOCs are sampled and analyzed quarterly on influent. This is because the VOC concentrations on influent are well below the local limit for total toxic organics established for its facility. VOC concentrations have typically ranged from non-detect at reporting limits of five parts per billion (ppb) or less to approximately 10 ppb, while the local limit is one part per million (i.e., 1,000 ppb). Sunnyvale does routinely sample trunk lines and laterals for metals, which in the South Bay present a greater permit-compliance challenge.
- Sunnyvale has an Incident Response Plan in place, and staff is trained to implement this plan. Because the Sunnyvale Water Pollution Control Plant is staffed 24 hours a day, seven days a week, any large release of solvents bearing a distinct odor would alert operators, and the Incident Response Plan would be implemented. Inspectors would work their way up trunk lines and laterals sampling manholes with GasTechs and PIDs to locate the source.
- Sunnyvale has had ample capacity, and aggressive identification of infiltration and inflow problems has not been a priority. Plans are nevertheless being made to assess the magnitude of these problems in light of increased daily flows. A rough estimate of infiltration is considered to be 3 to 5 percent of daily flow, which today may mean up to 900,000 gallons per day. At the Sunnyvale landfill, adjacent to the Water Pollution Control Plant, significant infiltration into the main trunk line creates a sufficient cone of depression to capture groundwater from beneath the 90-acre landfill.
- The Sunnyvale sewer system is considerably newer than San Jose's, due to the relatively recent boom in development Sunnyvale experienced in the 1960s and 1970s. There have been relatively few structural problems with the system.

H.2 Implications of Influent Concentrations

A cursory review of current and past data for HVOCs detected on influent sewage was performed. Data from a few years was reviewed to get a general sense of the extent to which these parameters are monitored. HVOC concentrations on influent were reviewed on a few reports, and their implications were discussed with Lacarra. Before embarking on a more comprehensive data collection and compilation effort, a framework must be developed for using the data and arriving at meaningful interpretations. In a somewhat random sampling, the following values provide a sense of the relative historical presence of solvents in the Sunnyvale sewer system.

Table 1. Selected Historical HVOC Influent Concentrations At Sunnyvale Water Pollution Control Plant

Year	Compound	Influent Conc.	Dry Season Flow, Million Gallons per Day	Mass and Volume per Day	Pounds per Year
1999	TCE, PCE, 1,1,1-TCA	all nd	18 mgd	-	-
1998	TCE	6 ug/l	17.4 mgd	0.87 lb; 0.27 l	317
1994	PCE	nd	~15 mgd	-	-
1986	TCE	17	11 mgd	1.5 lbs; 0.46 l	547 lbs/yr
	PCE	40		3.7 lb; 1.03 l	1,350 lbs/yr
	1,1,1-TCA	28		2.6 lb; 0.87 l	949 lbs/yr

Assumptions: Concentrations are for dry season flow; storm season flow does not increase mass discharged and can be ignored; mass of solvents arriving at POTW in vapor form or adsorbed to solids not accounted for; dry season daily flows are estimated.

There are at least three possible interpretations to the influent concentrations. These are:

- **Direct Discharge Scenario.** An illegal discharge of concentrated solvents is causing the resulting influent concentration.
- **Infiltration Scenario.** Sewer lines in the northern half of Sunnyvale are likely to be at or below the water table, allowing infiltration where loose joints, holes, or other avenues exist. There are numerous large solvent plumes in Sunnyvale. Where sewer lines in which infiltration occurs intercept these plumes, contaminated groundwater may be entering the system and contributing the solvents.
- **Background Scenario.** The influent concentrations may represent the sum of all discharges in the system. Instead of a single discharger illegally dumping a large quantity of solvent, many dischargers may contribute small amounts. Homeowners may be a source of solvent discharge, particularly in older homes equipped with garage sinks. Home auto-maintenance work, home dry cleaning, leather conditioning, stain removal, pesticide disposal, hobbyists, home auto and other specialty painting, and other sources of solvents may contribute a background level similar to that observed in 1998. Home-based service businesses for which equipment is maintained and cleaned in the home, such as painting, exterminating, and janitorial services may also be contributors of solvents to the sewer system. Conscientious homeowners wanting to properly dispose of household hazardous waste should follow container instructions before rinsing contents into home drains and discarding containers in the trash.

The city of Sunnyvale encourages its residents to dispose of their household hazardous waste properly through an intensive public outreach program and conducts monthly household hazardous waste collection events at a facility adjacent to the Sunnyvale Water Pollution Control Plant. The participation rate for Sunnyvale residents is currently about 5 percent, compared to a 3 percent countywide participation rate (Bowers, 2001). In 1999-2000, approximately 900,000 pounds of household hazardous waste was collected throughout Santa Clara County. Households tend to participate on an as-needed

basis, typically when moving, so a 3 percent participation rate does not imply that the balance of households are mishandling their hazardous waste. Nevertheless, some solvents may enter the sewer system through container rinsing, parts washing, and direct dumping.

Of these three scenarios, the largest quantities of solvents can be expected from the point-source scenario. This scenario is also the least likely threat today, due to the well-run permitting and inspection program implemented by the Sunnyvale Pretreatment Program. To the extent that point sources may have been a past issue, this scenario represents a possible continued threat to groundwater for the following reasons:

- Pure-phase solvent discharged to the sewer system is much denser than water; consequently, it sinks to the bottom of the sewer main, settling at sags or pooling at lift stations, and escaping at joints.
- It is likely that a few gallons of pure-phase solvent discharged to the sewer may escape notice by operators at the Water Pollution Control Plant because it would be retained in sags or escape through joints, so it would not arrive at the POTW headworks. Only a soluble fraction would be carried to the headworks. Because the city's National Pollutant Discharge Elimination System (NPDES) permit requirements call for only semi-annual influent monitoring for VOCs, a discharge event may escape notice if peak concentrations of soluble solvents are flushed out between sampling events.

The above interpretation of the possible threat to groundwater is entirely speculative; no direct evidence was encountered to substantiate these scenarios. To determine whether this speculation is reasonable, it would be useful to obtain several case histories from other POTWs in which documented pure-phase solvent releases have been observed to be retained in the sewer mains, and to find out what the corresponding dissolved phase concentrations were at the influent sampling point. The city of Davis experienced an apparent illegal discharge of dry cleaning solvent to the sewer system, which resulted in groundwater contamination. However, perchloroethylene was not detected in wastewater influent (Hanzo, 2001).

The infiltration scenario represents removal of solvents from groundwater. For at least one plume, the sewer system substitutes for an engineered remedial action. VOCs imparted to groundwater at the adjacent Sunnyvale Landfill by landfill gas and leachate are captured by groundwater infiltration into the sewer and headworks. Where sewer mains are entirely below the water table, substantial inflow at faulty joints can be expected. At least some of the numerous solvent plumes in Sunnyvale can also be expected to be intercepted or redirected by sewer mains. In areas of shallow groundwater (north of the Central Expressway), sewer mains may act to redirect plumes by conducting flow in the sand and gravel backfill.

The background scenario represents a continued potential source and threat to groundwater, and is also the most difficult to address. In addition to the city's aggressive Industrial Pretreatment Program, the city operates an active outreach program with a full-time public education specialist conducting programs throughout the year to increase public awareness about the need to restrict inappropriate wastes from the sewer.

Absent better evidence, all three sources can be assumed to play a role. The trend of decreasing concentrations of HVOCs in influent can probably be attributed to improved education, permitting, and enforcement, along with dilution, exfiltration, biodegradation, improved industrial practices, and awareness of the consequences of mishandling solvents.