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PUBLIC HEALTH ASSESSMENT

EL TORO MARINE CORPS AIR STATION SANTA ANA, ORANGE COUNTY, CALIFORNIA

SUMMARY

El Toro Marine Corps Air Station is in Orange County, California, near the city of Irvine. The Marine Corps established El Toro in 1943, and it currently serves as the center for marine aviation operations on the Pacific Coast. The facility occupies 4700 acres comprising hangars, flightline areas, maintenance areas, fueling facilities, a clinic, housing areas, and a golf course. Portions of land on El Toro Marine Corps Air Station are leased to private companies for nursery and agriculture use, e.g., growing oranges, strawberries, and asparagus.

El Toro Marine Corps Air Station was proposed for listing on EPA's [National Priorities List](#) (NPL) in 1989 because past operations and disposal practices contaminated local groundwater. In 1990, El Toro Marine Corps Air Station was listed on the NPL.

ATSDR has categorized the El Toro Marine Corps Air Station as an [indeterminate public health hazard](#) due to the limited data available from on-station [media](#) that would indicate whether or not humans are being exposed to levels of [contaminants](#) expected to cause adverse health effects.

Off-station groundwater data have been collected by the Orange County Water District since 1985 when routine monitoring detected trichloroethylene in irrigation wells less than one-half mile from the El Toro Marine Corps Air Station boundary.

Agricultural farm workers and well operators are exposed to contaminants in groundwater through unintentional [ingestion](#) of contaminated groundwater, [dermal](#) contact with contaminated groundwater, and [inhalation](#) of aerosolized groundwater contaminants. Based on the evaluation of current groundwater data, contaminants detected in groundwater both on station and off station do not pose a health [hazard](#) to those workers.

Future [exposure](#) could occur through two potable water wells that are located 10 miles downgradient of the contaminant [plume](#). At the current rate of contaminant migration, those wells will be affected in one and a half to five years. The Orange County Water District has developed plans for additional groundwater treatment to prevent additional wells from becoming contaminated.

Based on records review and personnel interviews, El Toro Marine Corps Air Station has identified 22 on-station sites for further investigation, which will include the sampling of soil, soil gas, groundwater, surface water and sediment.

At this time, data from the three extraction wells and the soil gas and [ambient](#) air at the landfills are the only data available from on-station areas. However, comprehensive sampling is currently underway, by the Marine Corps.

ATSDR's Health Activities Recommendation Panel (HARP) has determined that based on the evaluation of available data and on current site conditions at the El Toro Marine Corps Air Station, follow-up [public health actions](#) are not being considered at this time. As more data become available, ATSDR will evaluate the data to determine if follow-up public health actions are indicated for the community near the station.

BACKGROUND

A. Station Description and History

Station Description

El Toro Marine Corps Air Station (MCAS) is within an unincorporated area of Orange County, California, one-half mile east of the city of Irvine, eight miles southeast of the city of Santa Ana, and 12 miles northeast of the city of Laguna Beach on the Pacific Coast. The Department of the Navy's Marine Corps began construction of the air station on 2319 acres of land. An additional 2379 acres were acquired between 1944 and 1977 to bring MCAS to its present size of 4741 acres. Contained on MCAS are flightlines, hangars, maintenance shops, a hospital, a clinic, housing areas, schools, a golf course, and office buildings. MCAS leases portions of land to private companies for nursery and agriculture use, e.g., growing oranges, strawberries, and asparagus.

MCAS operates a jet air station and provides services and materiel to support aviation activities for the Marine Corps and Navy on the West Coast. Operations include equipment maintenance and testing requiring the use of fuels, oils, solvents, and other hazardous materials. Past storage, handling, use, and disposal practices have led to [environmental contamination](#). The U.S. Environmental Protection Agency (EPA) placed MCAS on the National Priorities List (NPL) in 1990 because of the detection of trichloroethylene (TCE) in irrigation wells outside the station boundaries and in monitoring wells inside the station boundaries.

Based on information gathered from record reviews and from employee interviews, MCAS identified 22 areas for Remedial Investigation and Feasibility Study (RI/FS). The Marine Corps will perform the RI/FS which will characterize the extent of environmental contamination and evaluate various clean-up methods. These 22 areas are grouped into three operable units (OUs).

Operable Unit 1 (OU-1) also referred to as Site 18 - Regional Groundwater Volatile Organic Compound (VOC) Investigation is the overall contaminated groundwater investigation. This investigation includes a groundwater contamination plume at the western portion of MCAS, which extends off-station three miles to the northwest. Operable Unit 2 (OU-2) consists of four landfills and a petroleum disposal area which are the suspected sources of groundwater contamination [\(1\)](#). Operable Unit 3 (OU-3) is made up of the remaining sixteen sites which include PCB spill areas, Fire Training areas, Battery Disposal areas, and others.

An Operable Unit 4 (OU-4) has been designated to address the abandoned wastewater treatment plant receiving lines, plus additional sites identified during a RCRA (Resource Conservation and Recovery Act of 1978) Facility Assessment Confirmation Study for future inclusion into the RI/FS program. The Confirmation Study includes the investigation of on-station abandoned storage tanks and sites previously identified by the Regional Water Quality Control Board [\(2\)](#).

Because data collected from Operable Unit 1, Site 18 - Regional Groundwater VOC Investigation, are the only complete quantitative data available at this time for MCAS, this public health assessment will focus on that area. However, when further data become available on the 21 on-station sites, ATSDR will evaluate the data to identify any public health hazards.

For purposes of clarity in this public health assessment, the term "station" refers to the El Toro Marine Corps Air Station and the term "site" refers to the potentially contaminated source areas within the station.

[Table 1](#) lists the 22 identified sites, operable units, and suspected contaminants at each site. Areas in OU 2-3 are further described in [Appendix A](#).

Operable Unit - 1

Site 18 - Regional Groundwater Volatile Organic Chemical (VOC) Investigation (OU-1)

The groundwater contaminant plume is at the western section of MCAS and continues off station 3 miles in a northwesterly direction (see [Figure 1](#), page 5). The plume has been identified in several permeable zones which occur between 200 to 450 feet below the ground surface. Contaminants detected include the VOCs: carbon tetrachloride, chloroform, tetrachloroethylene, TCE, and dichloroethylene. Nitrates-N, aluminum and manganese were also detected in the groundwater. Monitoring wells have been installed on-station by the Marine Corps and off-station by Orange County Water District to monitor the contaminant plume. The source(s) for the groundwater contamination are currently under investigation. Groundwater treatment is being conducted off-station by Orange County Water District and on-station by the Marine Corps to reduce the [concentrations](#) of VOCs.



[Figure 1. MCAS El Toro](#)

Table 1:		
Suspected Contaminants at El Toro Marine Corps Air Station		
Operable Unit	Site Number	Suspected Contaminants
OU-1	18	Heavy metals, red and white phosphorus, nitroamines, TCE, PCE, DCE, toluene, chlorobenzene, nitrate TDS, and selenium
OU-2	2	General categories of construction debris, municipal wastes, batteries, waste oils, hydraulic fluids, paint residues, transformers, and waste solvents
	3	Burnt waste, metals, incinerator ash, solvents, paint residues, hydraulic fluids, engine coolants, construction debris, oily wastes, municipal solid wastes, and various inert solid wastes
	5	Burnt waste, municipal solid waste, unspecified fuels, oils, solvents/cleaning fluids, scrap metals, and paint residues
	10	Waste oils, antifreeze, hydraulic/transmission fluids, and various solvents
	17	Domestic waste, cooking grease, oils and fuels from sumps, empty drums, and other unknown materials

OU-3	1	FS smoke (sulfur trioxide chlorosulfonic acid), low-level radioactive material, metals, nitrated toluene/sulfates, and waste from FS smoke disposal
	4	Ferrocene, hydrocarbon carrier solution and oily wastes
	6	JP-5 fuel and waste lubricant oils
	7	JP-5 fuel and waste oils
	8	Various scrap/salvage materials and PCBs
	9	JP-5 fuel, aviation gasoline, and other waste oils
	11	PCBs
	12	Sludge from secondary wastewater treatment, heavy metals (Silver, Arsenic, Cadmium, Copper, Mercury, Lead, Selenium, and Zinc), pesticides, and hydrocarbons
	13	Crankcase oils, metals, and PCBs
	14	Battery acid, paints, lead, and other priority metals, waste oils, methylene chloride, and phenols
	15	Diesel fuel
	16	JP-5 fuel, leaded aviation gasoline, hydraulic fluid, waste oils, napalm, white phosphorus, and magnesium phosphate
	19	JP-5 fuel
	20	Kerosene, waste oils, and heavy metals
	21	Drums containing chemicals
22	Fuel	

Source: Brown and Caldwell, 1986. Marine Corps Air Station, El Toro, Installation Restoration Program, Draft Final Remedial Investigation and Feasibility Study Work Plan, 28 April 1991.

History

Since 1980, the Marine Corps has been investigating and cleaning past hazardous waste disposal sites on Marine Corps installations through the Installation Restoration Program (IRP). The Naval Facilities Engineering Command manages the technical aspects of the IRP. The goals of the IRP include the identification and cleanup of areas contaminated by the release of hazardous substances into the environment. The IRP addresses cleanup of contamination resulting from past, not current disposal operations. The IRP's initial steps are to identify potentially contaminated sites, evaluate the extent of contamination, and determine the need for remedial actions (2). Waste generated from current operations is regulated by EPA's Resource Conservation and Recovery Act (RCRA) Program.

The first study identifying potential sources of contamination at MCAS was the Initial Assessment Study (IAS), begun in 1985 by Navy contractors, Brown and Caldwell Engineers. At the completion of the study, 17 potential source areas were identified. Although sampling was not conducted, recommendations for future sampling locations and analytical parameters were made (3).

Concurrent with the IAS, the Orange County Water District discovered TCE contamination in two off-station agricultural wells downgradient of MCAS boundary. That discovery launched a program of in-depth investigations to characterize the extent and source of the groundwater contamination (4).

In 1987, the Navy contracted James M. Montgomery Engineers, Inc., to review the previous work by Brown and Caldwell and to produce a Site Inspection Plan of Action. While that study was underway, the Marine Corps prepared a supplemental plan to address off-station TCE contamination. The Plan of Action, completed in August 1988, recommended 19 areas for further study including Site 18 - Regional Groundwater VOC Investigation which would address the off-station contaminant plume (3).

A Perimeter Study Investigation (PSI) was initiated in 1988 by the Navy contractor, James M. Montgomery Engineers, Inc., in response to concerns expressed by the Regional Water Quality Control Board that MCAS was a possible source of a VOC groundwater contamination plume that extended three miles off station. The PSI results indicated that VOCs were present in the shallow groundwater along the southwestern boundary of the facility prompting the Marine Corps to install an interim pump and treatment system to treat approximately 10 gallons of groundwater per minute (gpm) from three extraction wells (3).

The RI/FS Work Plan and associated documents for MCAS were initiated in 1989. During the investigation conducted for the compilation of the RI/FS Work Plan, MCAS added three additional sites to the 19 previously identified sites bringing to 22 the total number of sites to be investigated.

In March 1990, the Marine Corps completed an off-station Remedial Investigation Work Plan. It included recommendations for monitoring well installation and it served as a starting point for the Regional Groundwater VOC Investigation currently being conducted under the RI/FS Program (3).

The Orange County Water District implemented a VOC groundwater treatment operation to reduce off-station groundwater contamination. It began operating in 1990 at a rate of 700 gpm with a maximum capacity of 1200 gpm (5).

B. Site Visit

ATSDR staff conducted a site visit on March 21-25, 1991. They were accompanied by representative of Southwestern Naval Facilities Engineering Command and MCAS. During the site visit, all of the sites (excluding Site 18 - Regional Groundwater VOC Investigation) were visited. ATSDR representatives observed the following from the tour of sites.

- The station is surrounded by a six-foot chain-link fence with guards at every gate. Only authorized personnel are permitted access to the station.
- Within the station, certain high security areas are patrolled, and entry is strictly regulated.
- Access to the sites was found to be restricted, usually by six-foot chain-link fence topped with barbed-wire, by patrol, or by both. However, Site 17 - Communication Station Landfill, which is located at the base of a steep incline, had no fence to restrict access.
- Site 17 may represent a physical hazard since many large household appliances (i.e., refrigerators, freezers, etc.) were seen exposed in the landfill area, providing a potential for children to get trapped and suffocate. Access to the site is not prohibited, but there was no evidence of activity in the landfill area. Children were seen walking down an adjacent hill.
- MCAS leases portions of land to private companies for nursery use, and agriculture use, e.g., growing oranges, strawberries, and asparagus. Past land leases included use for quarry mining.

ATSDR interviewed the Joint Public Affairs staff, the Station Industrial Hygienist, the Station Occupational Medicine physician, and the Community Planning and Liaison staff to identify any on-station or off-station community health concerns.

ATSDR personnel attended a Technical Review Committee Meeting and made contacts with representatives from Orange County Water District, Orange County Health Care Agency, CH2M Hill Contractors, California Department of Health Services, Orange County Environmental Management Agency, EPA, and The Irvine Company.

C. Demographics, Land Use and Natural Resources Use

On-Station Demographics

Bachelor housing is provided for 3250 marines in barracks on the main facility of El Toro Marine Corps Air Station. Family housing for 1256 marines and 4000 dependents is provided in housing facilities on the east side of Irvine Boulevard.

There are 2950 military personnel who work at the facility, but live off station. MCAS employs 1750 civilian personnel, with the majority of personnel living in the towns of Lake Forest (El Toro), Irvine, Santa Ana, and Anaheim, California, between one mile and ten miles from MCAS (6).

Off-Station Demographics

Previously known as the community of El Toro, the area now called the city of Lake Forest is less than one-half mile from the southeastern boundary of MCAS. Its estimated 1990 population was 62,685. The population break-down consists of 94.2 percent Caucasian, 7.0 percent Hispanic, 4.1 percent Asian/Pacific Islander, 1.1 percent African-American, and 0.6 percent American Indian. There are 16,508 persons less than 18 years old, and 46,177 persons 18 years and older. The median education is 13.9 years of school. The median household income is \$40,411 compared to the median household income of all of Orange County of \$40,248. Approximately 48 percent of the households earn more than \$50,000 per year. An estimated 71 percent of

employed residents work in "white-collar" jobs, 18 percent in "blue-collar" jobs, 10 percent in services, and less than 1 percent in agriculture and fishing. The 1990 unemployment rate was 3.1 percent (2).

The city of Irvine, located in central Orange County, less than one mile west of MCAS, covers 43.6 square miles and has a total population of 102,418 with a median age of 29.8 years. There are 29,445 persons less than 18 years old, 65,129 persons between 18 and 60 years old, and 7844 persons over 60 years old. Approximately 74 percent of the city's population is Caucasian, 18 percent Asian/Pacific Islander, 6.3 percent Hispanic, 1.7 percent African-American, 0.19 percent American Indian, and 0.11 percent other (7). The median education is 14.4 years with 34.7 percent of all residents being college graduates. Over 19 percent of the population falls into the \$75,000 and above annual income range. There was an estimated four percent unemployment rate in 1990.

Most of the farms near MCAS employ migrant workers who have moved to the U.S. from Mexico. Migrant farm workers are not enumerated separately in the 1990 Census, and no other estimates of the migrant population for MCAS area are currently available.

Land Use

MCAS is situated in a semi-urban, agricultural area of Southern California. The majority of the land immediately surrounding MCAS is used to raise oranges, strawberries, asparagus, and other agricultural crops. Portions of the station are leased for nursery use and agriculture use. The University of California, Irvine, has an agricultural field station directly north of MCAS. Located just northeast of the MCAS is a large nursery where fruit trees are grown. Until 10 years ago, the entire area surrounding MCAS was agricultural land; since then, urbanization has brought development closer to MCAS. New housing developments lie about one-half mile to the northeast of Site 1. About one-half mile northwest of the MCAS boundary are the main residential areas of the city of Irvine. The land farther north and northeast of MCAS in the Santa Ana Mountains and the San Joaquin Hills remains essentially undeveloped (2).

Another residential area is located less than one mile from the southeastern border of the station. The area directly southeast of the station boundary is a small, recently developed industrial complex, containing offices and warehouses.

Within the Irvine Unified School District, there are 19 elementary schools, four middle schools and four high schools. One of the elementary schools is on MCAS less than one mile from Sites 3 and 4.

Natural Resources Use

Groundwater

Groundwater in the surrounding area of MCAS is primarily used for irrigation of agricultural and greenbelt areas (i.e., parkways and parks that encircle the local communities). Municipal wells are located west of Newport Boulevard, eight miles west of MCAS. Municipal wells are used as drinking water sources for 45,000 people (8).

Drinking water is supplied to MCAS and the surrounding area from Irvine Water District and Orange County Water District. The water is blended with water obtained from the Colorado River.

As the demand for water has increased, the need for additional water sources has necessitated the evaluation of local groundwater as a potential drinking water source. Since June 1990, the Orange County Water District has operated a VOC groundwater treatment facility that treats 700 gallons of contaminated groundwater per minute. The treated water is discharged into the reclaimed water line where it is used for non-potable agricultural and

greenbelt irrigation in areas in and around the city of Irvine. Future water development plans call for expanding the remediation/treatment system, and using the treated water for drinking (5).

Surface Water

Surface drainage in the vicinity of MCAS flows to the southwest, following the slope of the land perpendicular to the trend of the Santa Ana Mountains (4). Off-station drainage from the hills to the northeast and upgradient irrigated farmlands combine with on-station runoff generated from the extensive paved surfaces at the station, and flows into four main drainage channels: Marshburn Channel, Borrego Canyon Wash, Agua Chinon Wash, and Bee Canyon Wash (see Figure 1). Three of these drainage channels: Borrego Canyon Wash, Agua Chinon Wash, and Bee Canyon Wash have continuous flow, from natural washes that originate in the Santa Ana Mountains (4).

Marshburn Channel is a lined drainage channel that runs along the northwestern boundary of MCAS and receives runoff from the western part of the facility. The channel flows into San Diego Creek less than one mile northwest of Bee Canyon Wash.

Southernmost of these channels is the Borrego Canyon Wash, gravel lined channel that flows along the southeast boundary of MCAS. Borrego Canyon Wash crosses the southern corner of the station, and joins Agua Chinon Wash about one-quarter of a mile from the station boundary.

Agua Chinon Wash and Bee Canyon Wash descend from the Santa Ana Mountains through MCAS. They submerge into culverts as they approach the flightline area, then emerge just past the flightline area.

Agua Chinon Wash flows into San Diego Creek just east of the intersection of the San Diego and Laguna Freeways, approximately one mile downstream of its intersection with Borrego Canyon Wash. Bee Canyon Wash flows into San Diego Creek about 1500 feet north of Agua Chinon Wash.

San Diego Creek receives continuous flow from the run-off of the Borrego Canyon Wash, Agua Chinon Wash, Bee Canyon Wash, and the paved Marshburn Channel. Approximately 5 miles downstream from MCAS, the San Diego Creek runs through a recreational area consisting of hiking, biking, and equestrian trails as it makes its way to Newport Bay. Newport Bay is a major recreational area used for swimming and fishing.

D. Health Outcome Data

Health outcome data or health effects data are collected from cancer or tumor registry databases and birth defects data provided by the state and local health agencies, and any site-specific health studies that may have been performed.

ATSDR conducts a review of health outcome data if completed exposure pathways have been identified; if the toxicologic evaluation shows the likelihood of health outcomes; and if the community near the site has health concerns.

The State of California maintains a cancer registry from 1988. Orange County has maintained complete tumor registry data since 1984. Other health data bases maintained by California State include Birth Defects Registry, and an Alzheimer Disease Registry.

COMMUNITY HEALTH CONCERNS

Community health concerns are collected from logs kept by Navy Public Affairs Office, EPA's Community Relations representative, and state and local health and environmental agencies.

ATSDR representatives spoke with MCAS medical officers and with the Public Affairs Officer, state, city, and county health officers as well as a member of the El Toro Community Association in order to identify community health concerns. No community health concerns were identified from those discussions.