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MCAS EL TORO
SSIC # 5090.3

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SUBJECT: Contract N68711-89-D-9296
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Jacobs Document Control #CLE-C01-01F018-B6-0002
Contract Task Order #0018, Final Summary Report
Marine Corps Air Station El Toro, Santa Ana, California

Dear Mr. Padro:

Enclosed please find five copies of the Jacobs Final Summary Report for the Marine Corps Air Station El Toro. This Final Summary Report was prepared in response to Section C, Task 2, of the Scope of Work for Contract Task Order #0018. The Final Summary Report has been revised to address review comments received from the Remedial Project Manager (RPM) on 7 May 1990. The Final Summary Report summarizes the current situation as reported by others, identifies data deficiencies, and will facilitate the development of the Remedial Investigation/ Feasibility Study Work Plan.

Please contact Ed Rogan at 714/250-5500 or Phil Stassi at 619/453-9091 to arrange any necessary meetings to discuss this submittal. We are available to meet with you immediately upon your receipt of this document.

Sincerely,

Edward J. Rogan

Philip J. Stassi
CLEAN Program Manager

Edward J. Rogan
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UNITED STATES NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST DIVISION
COMPREHENSIVE LONG TERM ENVIRONMENTAL ACTION NAVY (CLEAN)

NAVY CLEAN PROGRAM

FINAL SUMMARY REPORT - CTO #0018

COMPREHENSIVE WORK PLAN FOR REMEDIAL
INVESTIGATION/FEASIBILITY STUDY AT THE
MARINE CORPS AIR STATION EL TORO
SANTA ANA, CALIFORNIA
DOCUMENT CONTROL NO. CLE-C01-01F018-B6-0002
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1.0 INTRODUCTION

1.1 Contractual Authority

This Final Summary Report was prepared in partial fulfillment of Contract Task Order (CTO) #0018 under the Comprehensive Long Term Environmental Action Navy (CLEAN) Contract Number N68711-89-D-9296 for Naval Facilities Engineering Command, Southwest Division. The technical approach and scope of this report were developed in consultation with Larry Nuzum, Remedial Project Manager (RPM), and conform to the requirements specified in the Implementation Plan (IP) for this CTO dated 7 February 1990 and as revised and resubmitted on 20 March 1990.

1.2 Purpose and Scope

This Final Summary Report indexes work undertaken to date at the Marine Corps Air Station (MCAS), El Toro, California, with respect to Installation Restoration (IR) Program and other pertinent investigations. The purpose of this document is to:

- Summarize existing information that is available in the files without unnecessarily duplicating the detail available in the referenced reports.
- Provide the RPM with a concise document that lists the views and interpretations of report authors on the physical setting and history of the site with regard to hazardous waste management.
- Provide CLEAN investigators with an historical summary of the previous investigations and correspondence that are available.
- Identify the sites that have been assessed by others to be addressed under the Remedial Investigation/Feasibility Study (RI/FS) process.

Specifically, the report lists each of the disposal sites that have been proposed for investigation under the RI/FS and the rationale for their inclusion. The final list of sites to be included under the RI/FS will be determined in consultation with the RPM.

The Scope of Work (SOW) given to CH2M HILL to produce this report requires a review of the information available. Most of the key passages from these reports were quoted directly in the text of this report, and no attempt was made to perform a technical evaluation of the accuracy of the statements quoted at this time. The reports that have been reviewed were written by authors working for various affected parties, and it is obvious that the conclusions drawn from the reports are in conflict. It is not within CH2M HILL's scope to attempt to resolve conflicting opinions at this time. The reports will be assessed during later stages of the RI/FS process (e.g., the Field Sampling Plan and the RI/FS Work Plan). In addition, information identified during the data assessment phase may require more intensive scrutiny during the RI/FS process. For example, the EPA files have not been available to Jacobs for review because they are presently being reviewed by EPA contractors.

2.0 REGIONAL AND SITE SETTING

2.1 Location

Information on the MCAS El Toro regional setting and contaminant transport potential was extracted and summarized based on the following documents: Groundwater Management, Irvine Area, Orange County, California (Banks, 1984); the Initial Assessment Study (Brown and Caldwell, 1986); the Site Inspection Plan of Action (James M. Montgomery [JMM], 1988); the Phase I Report on the Investigation of Trichloroethylene Contamination in the Vicinity of the MCAS El Toro (Herndon and Reilly, 1989); the Perimeter Investigation Interim Report (JMM, April 1989); and the Off-Station Remedial Investigation Draft Work Plan (JMM, November 1989).

MCAS El Toro is located in Orange County, approximately 8 miles southeast of the City of Santa Ana and 12 miles north-northeast of the City of Laguna Beach on the Pacific Coast. The base covers 4,698 acres, ranging in elevation from 210 to 700 feet above sea level. (See Figure 1.)

2.2 Land Use

Information on land use in the vicinity of MCAS El Toro is reproduced from Brown and Caldwell, 1986:

> MCAS El Toro is situated in a semi-urban agricultural area of Southern California. To the north, south, and east, the majority of the land immediately adjacent to the station is used to raise oranges and other agricultural crops. The University of California has an agricultural field station directly north of the station. A nursery raising fruit trees is just northeast of the base. A small industrial complex across Borrego Canyon Wash adjoins the station boundary to the southeast, next to the MCAS El Toro golf course. The City of Irvine is located immediately adjacent to the northwest margin of the station.
>
> The area around MCAS El Toro is becoming rapidly urbanized. Until 8 to 12 years ago, agricultural lands surrounded the station. Since then urbanization has brought physical development near. However, continuing efforts by the U.S. Marine Corps to work closely with city and county legislators have resulted in establishing generally realistic land use compatibility policies around the station in noise and aircraft hazard zones (NAVFAC ENGCOM, 1982).
>
> Currently, the Atchison, Topeka, and Santa Fe Railroad runs along the southwest boundary of MCAS El Toro. A low density residential area occurs just outside of the southeast border which also lines the Marine Memorial Golf Course. Residential areas of El Toro begin three-quarters of a mile from the southeast border of the base. The main residential areas of the City of Irvine are located about 1/2 mile from the northwest border. The land north and northeast of the base, comprised of the Santa Ana Mountains and the San Joaquin Hills, is open and remains virtually undeveloped.

2.3 Water Supply

Groundwater use in the area of MCAS El Toro is mainly for irrigation of food crops. Areas further to the north of the station utilize groundwater as sources of drinking water.

According to Banks, 1984:

> Irvine Ranch Water District (IRWD) is the major purveyor of water for municipal, industrial and military purposes in the Irvine Area. The District sells water to The Irvine Company (TIC) for agricultural irrigation. IRWD is also the major waste water or sewerage management agency for the Area.

Brown and Caldwell (1986) discusses the IRWD water supply:

> The IRWD obtains water from four sources: surface reservoirs, wells, imported water, and reclaimed water (Banks et al, 1984). The local surface sources for IRWD include:
>
> - Irvine Lake (5.7 miles north of the station).
> - Rattlesnake Reservoir (1.7 miles north of the station).
> - Siphon Reservoir (1.5 miles north of the station).
> - Lambert Reservoir (1.1 miles northeast of the station).
> - Sand Canyon Reservoir (3.1 miles southwest of the station).
> - Laguna Reservoir (1.7 miles south of the station).
> - Big Peter's Canyon Reservoir (6.1 miles northeast of the station).
>
> . . . A new well field is being developed 6 to 6-1/2 miles northwest of the station. The Orange County Water District (1984) estimates that 1.9 percent of the water used at MCAS El Toro is from groundwater sources.
>
> Imported water is obtained from the Metropolitan Water District of Orange County. Reclaimed water is obtained from IRWD's Michelson Water Reclamation Plant, 4.5 miles west of the station.

2.4 Climate

Brown and Caldwell (1986) describes the climate of the study area:

> The climate at MCAS El Toro is typical of the Southern California Coastal Region. There are two seasons, a cool moist winter and a mild dry summer. Early morning light fogs and low clouds are common in the late spring and early summer. Summer temperatures usually do not exceed 100°F. Nights are generally cool throughout the year. Winter temperatures seldom drop below freezing, with 37°F being the approximate mean low.
>
> The average annual precipitation for MCAS El Toro is approximately 12 inches per year and occurs mostly during the winter. . . Dry, damaging winds, locally known as the "Santa Anas," occur for short periods during the late fall or early winter. The combined effect of dry air, strong gusty winds, and unprotected soil occasionally produces clouds of dust.

2.5 Ecology

This discussion on ecology is taken from Brown and Caldwell, 1986:

Ninety percent of the native flora of MCAS El Toro has been cleared for agricultural purposes, construction, and paving. Seventy percent of the existing natural habitat consists of grassland, while the other 30 percent is comprised of sage-scrub communities.

. . . Seasonal rainfall is 12 inches per year on grassland results in a semidesert grassland community. Three types of plants have adapted to this region: annuals, succulents, and desert shrubs. Annuals have adapted by growing only in areas with adequate moisture. Succulents avoid drying out by storing water. Desert shrubs have adapted to lengthy dry periods with many branches and with thick small leaves that shed during droughts (MCAS El Toro, 1984).

. . . The sage-scrub community consists of shrubs under 3 feet high, with the predominant species being the coastal California sagebrush. Buckwheat, also abundant in this community, thrives on the dry hillsides and other stable terrain (MCAS El Toro, 1984).

. . . Because so much of the natural vegetation at MCAS El Toro has been cleared, it can be assumed the native fauna population has greatly declined. Native fauna at the station include various birds, rodents, small game animals, and large and small predators.

A computer search of the Natural Diversity Data Base (NDDB) by the California Department of Fish and Game was conducted for El Toro, California. The NDDB lists Rare, Endangered, and Threatened animals and plants officially recognized by federal and California law. As of 13 March 1985, no plants or animals were listed for El Toro. However, two species of animals were listed for the Tustin area, in the immediate vicinity of the Upper Newport Bay Ecological Reserve. One was listed as Endangered and one was listed as Possibly-threatened (Candidate 2).

2.6 Geology

According to JMM (1988), MCAS El Toro is located on the Tustin Plain, which is "the southernmost extension of the Central Plain and is bounded by the Santa Ana Mountains to the east and by the San Joaquin Hills to the south: Elevations range from 5 to 450 feet above mean sea level (msl) on the floor of the plain to more than 1,100 feet above msl in the San Joaquin Hills, and more than 4,700 feet above msl in the Santa Ana Mountains."

Brown and Caldwell (1986) describes the subsurface geology:

. . . MCAS El Toro lies on alluvial deposits of Holocene Age. The Holocene alluvial deposits are underlain by older alluvial deposits of Pleistocene Age. The Holocene alluvium and the upper Pleistocene stream terrace and older alluvial deposits are composed of silt and clay with occasional lenses of sand and gravel. The estimated total thickness of the two units is variable and less than 200 feet in the MCAS El Toro area. The terrace deposits are thin and occur only along the previous margins of the basin. The upper Pleistocene deposits are generally reddish brown in color and are semiconsolidated. Both the terrace deposits and, in places, the upper Pleistocene deposits lie directly on bedrock

> along the upper reaches (headwaters) of the existing streams, as is likely beneath MCAS El Toro.

These deposits are underlain by the "lower Pleistocene San Pedro Formation," which "is composed of semi-consolidated sand and gravel deposits with silts, clays, and interbedded limestones. Total thickness of the San Pedro Formation is between 100 and 750 feet in the MCAS El Toro area . . . and likely does not exist beneath MCAS El Toro. The San Pedro Formation is of lagoonal or shallow marine origin."

JMM (1988) states that deposits of the San Pedro Formation unconformably overlie older semiconsolidated rocks of late Miocene to late Pleistocene age. "The older semi-consolidated rocks consist of sandstones and siltstones with some conglomerate lenses of the Fernando, Capistrano, and Niguel Formations. The Capistrano and Niguel Formations probably interfinger the Fernando (Pico) Formation west of MCAS El Toro. The Capistrano and Niguel Formations consist of marine deposited clayey and sandy siltstones. These overlay older formations and range from a few feet to greater than 1,500 feet in thickness."

JMM (November 1989) characterizes the geology of the older rocks that lie beneath the semiconsolidated rocks. "The Monterey and Puente Formations underlie the waterbearing sediments of the Tustin Plain in a massive sequence (at least 30,000 ft.) of interbedded marine and nonmarine clastic sedimentary rocks and interbedded volcanic rocks. This sedimentary sequence was deposited from approximately 95 million years ago to approximately 10 millions years ago (Yerkes et al., 1965) upon a basement of older (greater than 95 million years) metamorphic and crystalline igneous rocks. These rocks have been the subject of numerous studies regarding their oil-bearing properties, and since previous surveys have shown minimal contribution from water-bearing strata in these formations, they are considered to be non-water bearing . . . (OCWD, 1989; Poland, et al., 1956; and Yerkes, et al., 1965)."

2.7 Geologic Hazards

Brown and Caldwell (1986) provides a discussion of local geologic structure and potential geologic hazards.

> MCAS El Toro lies on the southeastern margin of the northwest-trending Los Angeles Basin . . . The central block of the Los Angeles Basin, 30 miles to the northwest, is characterized by a northwest-trending, doubly plunging synclinal trough, 31,000 feet deep. This trough is bounded by . . . mountains . . . formed by uplift during Quaternary Time. South of MCAS El Toro, three northwest-trending fault zones exist: Shady Canyon, Pelican Hill, and the Newport-Inglewood Faults. The Pelican Hill and Shady Canyon Faults do not appear to be active fault zones; however, the Newport-Inglewood Fault Zone is believed to be responsible for the 1933 Long Beach earthquake (Yerkes, and others, 1965).
>
> MCAS El Toro is in a seismically active area of Southern California. Historic earthquakes potentially damaging to structures are known to have occurred with magnitudes between 4.7 and 8.0. The faults most likely to have generated these earthquakes are the San Andreas (30 miles north), the Elsinore-Whittier (13 miles north), and the Newport-Inglewood (9 miles southwest) (Miller and Tan, 1976). MCAS El Toro lies on dense soil with a deep groundwater table. The predominant potential seismic hazard is ground motion. Ground breakage or failure is

not expected to be a problem. The possibility of liquefaction is expected to be remote (Naval Facilities Engineering Command, 1983).

2.8 Soils

Brown and Caldwell (1986) describes soils in the immediate vicinity of MCAS El Toro. There are five major soil types, including Sorrento loam, San Emigdio fine sandy loam, Metz loamy sand, Myford sandy loam, and river wash soils.

> . . . The Sorrento loams are derived from the large alluvial fans and floodplains at the station. Sorrento soils have a grayish brown loam, underlain by a grayish brown, light brown gray and pale gray silty clay loam. The loams . . . possess . . . a permeability of 0.2 to 2.0 in/hr, . . . and a moderate infiltration rate (Watchell, 1978). . . The Sorrento loam covers the majority of the central station area at MCAS El Toro and can also be found along the upper reaches of Borrego Canyon Wash.
>
> . . . The San Emigdio fine sandy loams are also derived from alluvial fan materials and floodplain materials. These soils are found north of the main runway area at the station and also along the upper reaches of Borrego Canyon Wash. The San Emigdio loams are well drained, light brownish gray to very pale to pale brown in color . . . The Emigdio loams are rapid permeable (2.0 to 6.0 in/hr) and have a moderate infiltration rate (Watchell, 1978).
>
> . . . The Metz loamy sand is derived from large alluvial fans and floodplain deposits which lie in the area between the MCAS El Toro family housing units and North Marine Highway. These soils are pale brown to brown to very pale brown in color and are excessively drained . . . They have a . . . high permeability (2.0 to 20 in/hr) . . .
>
> . . . The Myford sandy loam is formed on the broad marine terrace deposits which lie in the area of the present-day golf course along Borrego Canyon Wash. These soils are pale brown to pinkish gray in color and have . . . a slow permeability (0.06 to 6.0 in/hr), and a very slow infiltration rate (Watchell, 1978).
>
> River wash soils and miscellaneous canyon soils . . . are generally stratified sandy, cobbly, and bouldery [soils that] have developed along Borrego Canyon Wash. These soils have a slow infiltration rate and a rapid runoff hazard.

2.9 Surface Water Hydrology

JMM (1988) describes surface water flow at the base:

> Off-station surface flow for MCAS El Toro originates in the hills to the north, spreads out from the tributary canyons, and combines with on-station runoff generated from the impervious and saturated surfaces on the air station. In addition, runoff from irrigated farmlands upgradient of the station contribute to this flow. The combined runoff drains generally to the west and southwest, following the gentle slope from east to west which exists over most of MCAS El Toro, with the exception of the hilly northeast corner.

> . . . Four main drainage facilities receive runoff from MCAS El Toro: Marshburn Channel, Bee Canyon Wash, Agua Chinon Wash, and Borrego Canyon Wash. Flows in all four facilities . . . generally travel in the southwest direction. Marshburn Channel is located just inside and parallels the northwestern station boundary between Irvine Boulevard and Trabuco Road, and discharges into San Diego Creek. Bee Canyon Wash transects the station on the northwestern side and empties into San Diego Creek approximately 4,500 feet upstream of Marshburn Channel. Agua Chinon Wash transects the central portion of the station and flows into San Diego Creek approximately 1,500 feet upstream from Bee Canyon Wash. Borrego Canyon Wash roughly parallels the southeastern perimeter of the station, transects the northeastern corner and southeastern leg of MCAS El Toro, and forms a confluence with Agua Chinon Wash approximately 5,500 feet upstream of San Diego Creek. San Diego Creek discharges into Newport Bay approximately 9 miles southwest of MCAS El Toro.

Flow in these streams is ephemeral, with the exception of the lower reaches of San Diego Creek (Banks, 1984).

2.10 Groundwater Hydrology

Herndon and Reilly (1989) describes the regional aquifer zones.

> The aquifer zones of the Irvine area represent the southeastern extension of the Orange County Groundwater Basin (Main Basin). The area is in hydraulic continuity with the Main Basin. In contrast to the Main Basin's thicker continuous aquifers separated by thin aquitards, the aquifers in the Irvine area are much thinner and are separated by thick clay and silt layers (Singer, 1973; Banks, 1984). Banks (1984) was unable to correlate Main Basin aquifer zones with those in the Irvine area due to a facies change where the sediments grade from coarse grained to fine grained southeast of the Costa Mesa Freeway.
>
> Aquifer zones penetrated by the study area wells generally occur as clayey or silty sands and gravels divided by intervals of silt and clay. The contacts between the aquifer and aquitard zones were often gradational and difficult to delineate. . . Lenses of silt and clay occur intermittently within the aquifer zones giving them a very heterogenous composition. The aquifer sediments generally consisted of medium to coarse grained sand and fine grained gravel, usually with significant amounts of silt and clay. . . The aquitard materials were generally comprised of sandy clay and silt. . . The frequently sandy composition and lenticular nature of the silts and clays probably allows groundwater to flow between aquifer zones, resulting in an overall heterogeneous single-layer aquifer system.

Brown and Caldwell (1986) discusses the division of the aquifer system into a confined and unconfined system:

> Within the Irvine subbasin, areas of thick silt and clay deposits effectively divide much of the principal aquifer system into confined and unconfined zones. Banks et al (1984) describe a forebay area, where recharge occurs from the shallow unconfined zones to the lower confined zones through down-basin migration of groundwater. A pressure area defined by wells under confined conditions was

> also identified. . . The contact between the forebay and pressure areas varies seasonally and yearly according to the amount of groundwater withdrawal and recharge (Banks et al, 1984). MCAS El Toro lies within the forebay area, and percolation of groundwater in this area would act as a recharge for the middle aquifer system down-basin from the station. Recharge for down-basin aquifers would also occur in areas along the edges of the Irvine subbasin where thin deposits of permeable alluvium material are present in stream canyons.

Herndon and Reilly further defines groundwater recharge to the aquifer system:

> Groundwater recharge to aquifer zones in the Irvine area primarily occurs along the major washes exiting the Santa Ana Mountains. A lesser amount of recharge occurs along drainages from the San Joaquin Hills. These drainage channels are probably recharged both as groundwater inflow and by surface infiltration. Infiltration of groundwater to the water table along Bee Canyon and Agua Chinon Washes at the El Toro MCAS does not appear to be hampered by impervious strata as evidenced by an absence of perched water in the 90- to 100-foot thick vadose zone in this area. Aquifer zones in the southeastern portion of the study area most likely receive recharge along San Diego Creek, assuming that impeding clay of silt layers are absent there as they appear to be in the vicinity of the Marine base.

JMM (1988) describes groundwater conditions at the base:

> The main aquifer beneath MCAS El Toro is mostly under unconfined conditions. Shallow monitoring wells in the alluvial fill in the foothills to the east indicate that the groundwater is present above the consolidated sedimentary bedrock in some areas and is probably due to the amount of groundwater provided by the foothill watersheds. In comparison to points west, the bedrock at MCAS El Toro is much shallower and ranges in depth from less than a few feet to more than 800 feet below ground surface. The groundwater within the foothills, when encountered, is within 50 feet of the surface.
>
> Between the foothills and the pressure area of the Tustin Basin the groundwater occurs at greater depths. . . the depth to water for the unconfined aquifer [on base] is 120 to 140 feet below land surface. Since some recharge occurs in the area, the depth to the water table is expected to be somewhat less than the depth to the static water level of the irrigation wells penetrating the aquifer at greater depth. . . Discontinuous perched water bodies may occur in the shallow subsurface above the aquifer.

Herndon and Reilly provides a discussion of groundwater flow in the aquifer system:

> Since the 1940s the general horizontal direction of groundwater flow in the study area has been to [the] northwest. . . From the establishment of MCAS El Toro in the mid-1940s until the early 1970s, large pumping depressions west of the base dominated piezometric surface contours. Piezometric head elevations have historically been more than 100 feet lower than present elevations. Since about 1972, decreased groundwater withdrawals, resulting from reduced agricultural demands and use of imported and reclaimed waters, have allowed piezometric levels to recover substantially.

> A range of lateral groundwater flow velocities was calculated, using Darcy's Law, from the . . . November 1988 . . . piezometric gradient (0.008) and two hydraulic conductivity values that are estimated to encompass those of the aquifer zones. . . The estimated effective porosity was 0.25. The first hydraulic conductivity (K) value was calculated by dividing the transmissivity, estimated during [a] 72-hour aquifer test, . . . by the estimated aquifer thickness (210 feet). The resultant value of K (21 feet/day) represented an average permeability over the entire aquifer thickness and produced an average groundwater velocity of 0.7 feet/day.
>
> Aquifer zones with little silt or clay encountered during drilling of [off-station monitoring wells] probably possess much higher than average permeabilities. These zones likely transmit . . . groundwater at higher velocities. Therefore, a K value of 130 feet/day, typical of a clean sand, was used to calculate a flow velocity of 4 feet/day. [Therefore,] the estimated range of lateral groundwater velocities [is] between 0.7 and 4 feet/day. . .

Vertical piezometric gradients measured in a series of multiport monitoring wells installed west of the base revealed a vertical downward component of groundwater flow. Thus, groundwater recharging the regional system near MCAS El Toro appears to move downward toward deeper aquifers and horizontally toward the northwest (Herndon and Reilly, 1989).

2.11 Groundwater Quality

Banks (1984) drew the following conclusions regarding general groundwater quality in the Irvine area:

> Quality of the ground waters underlying a large portion of the Irvine Area has been deteriorating since at least 1971. . .
>
> There are substantial areas, particularly in the forebay area northeast of the Santa Ana Freeway, where nitrate and selenium concentrations exceeding allowable limits have been observed. . .
>
> The only remaining ground waters of acceptable quality for municipal use without treatment or blending with better quality water are those underlying the pressure area in the west central part of the Area, generally northwest of Culver Drive and southwest of Moffett Drive. Quality of some other ground waters is still suitable for irrigation. . .
>
> Quality of the ground water does not meet the water quality objectives established by California Regional Water Quality Control Board (CRWQCB), Santa Ana Region . . ., except those underlying the west central portion of the Area.
>
> Ground water levels in the Area generally have risen since 1973. The greatest rise has been in the northeasterly and southeasterly portions of the Area. Total dissolved solids (TDS) concentrations in the ground water here exceeded usable limits without demineralization or blending. The principal sources of the poor quality water appear to be surface and subsurface inflow from the Santa Ana Mountains and salts in the return flow from irrigation with imported water.

Herndon and Reilly (1989) summarized trichloroethylene contamination in area groundwater in their report to the Orange County Water District:

> In 1985, during the course of basinwide groundwater monitoring for volatile organic compounds, the Orange County Water District (OCWD) detected trichloroethylene (TCE) concentrations as high as 50 ug/l in three Irvine area irrigation wells. One well is on MCAS El Toro property; the other two are west of the base and downgradient with respect to regional groundwater flow. The District conducted an investigation to determine the nature and extent of the groundwater contamination and to identify possible sources.
>
> The OCWD investigation revealed that TCE occurs off-base at depths ranging from 200 to 450 feet below ground surface, and the downgradient contamination extends approximately 3 miles west of the MCAS El Toro. It was estimated that the TCE plume underlies approximately 2,900 acres, impacting about 150,000 acre-feet of groundwater, and is migrating westward at an estimated rate of 1 to 4 feet per day. The JMM Perimeter Investigation Study detected TCE in on-base monitoring wells at concentrations as high as 90 ug/l.

3.0 WASTE TYPES AND WASTE MANAGEMENT PRACTICES AT THE MCAS EL TORO

Background information concerning past and current waste types and management practices at the MCAS El Toro was taken from the following sources:

- Spill Prevention Control and Countermeasure (SPCC) plans produced for the MCAS El Toro by various contractors from 1979 until 1987
- Initial Assessment Study performed by Brown and Caldwell Engineering (May 1986)
- Site Inspection Plan of Action Report produced by James M. Montgomery Engineers (August 1988)
- Hazardous Materials/Hazardous Waste Engineering Study performed by Roy F. Weston Engineers (February 1984)

More detailed information on the types and management practices of hazardous materials and hazardous wastes is available in these reports.

3.1 Waste Types

The November 1979 SPCC plan produced by SCS Engineers states the following:

> In order to maintain the aircraft service operations, a variety of petroleum products must be stored at MCAS El Toro. The principal fuel used at the Air Station is JP-5. However, quantities of JP-4, Motor Gas (MOGAS), Aviation Gas (AVGAS), diesel fuel, and No. 1 and No. 2 fuel oil used for heating and machinery, are also stored at the facility. In addition, lube oil, hydraulic oil, waste petroleums, cleaning solvents, paint thinners, and other hazardous substances are stored at sites located throughout the Station.

Tabulated quantities and types of potential waste materials (either Resource Conservation and Recovery Act of 1978 [RCRA] or Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] wastes) generated from the MCAS El Toro were obtained from two SPCC plans and the 1984 Weston Engineering study. These types and quantities of waste are listed in Table 1. Appendix A presents the 1989 Hazardous Waste Annual Report.

According to the Initial Assessment Study (IAS) by Brown and Caldwell and the Site Inspection Report by JMM, three landfill areas were utilized through the history of the Station to dispose of municipal garbage from base operations. These landfill areas also reportedly received some hazardous materials and wastes as part of their operation. At two of the landfill areas, the refuse was burned prior to landfilling. At one landfill area, the refuse was placed directly into excavations for disposal.

Some explosive ordinance detonation occurs in one area of the Station. Flares and small munitions are buried and exploded here, as well as the historical disposal of "FS Smoke" material by detonation. This area may have also received unspecified quantities of low-level radioactive materials.

3.2 Waste Management Practices

Containerized waste materials generated from base operations are handled by the Defense Property Disposal Office (DPDO). The DPDO has recently been renamed as the Defense Reutilization and Marketing Office (DRMO). The DRMO also handles waste materials generated at the MCAS Tustin, the Long Beach Naval Shipyard, the Seal Beach Naval Weapons Station, the Los Alamitos Naval Air Station, and the U.S. Army Fort McArthur. These military installations were responsible for the proper packaging/marking and transportation to the regional DRMO located at MCAS El Toro.

The DRMO handled all hazardous wastes in their storage yard and two adjacent lots until approximately 1985, when six "conforming" hazardous waste storage units were constructed to conform to new RCRA regulations.

Based on the review of the reports and documents listed in this report, the main concern about the migration of hazardous materials into the environment from operations at MCAS El Toro centers around three sources:

- Direct discharge of oily waters (possibly containing solvents) into the Aqua Chinon, Bee Canyon, and Borrego Canyon Washes. These Washes flow through the facility and discharge on the western and southwestern facility boundary. Numerous reports of oily discharges to these washes have appeared in SPCC plans and other reports. MCAS El Toro installed oil/water separators at strategic points in the washes to remove free-floating contaminants, but these separator units were reportedly undersized during peak runoff periods.

- Disposal of solvents and waste oils into landfills. This practice was reported to have occurred by both the Brown and Caldwell and James M. Montgomery in previous reports. This practice may have allowed high-strength solvent wastes to migrate directly to groundwater resources.

- Migration at miscellaneous leaks and spills from drum storage areas, storage tanks, polychlorinated biphenyl (PCB) transformers, maintenance operations, and fire training operations.

4.0 HISTORY RELATED TO HAZARDOUS MATERIALS HANDLING AT THE MCAS EL TORO FACILITY

4.1 Previous Investigations

Documents that contain substantive information concerning hazardous materials handling at the MCAS El Toro facility are listed chronologically in Table 2 of this Final Summary Report and are described below. Some of the material listed in this section (i.e., Regional Water Quality Control Board Orders) is also discussed in Section 4.3.

Survey of Industrial/Oily Waste Discharge to Storm and Sanitary Systems (Department of the Navy, Western Division, 30 May 1978). This document was produced as a result of discharges of sanitary and untreated oily substances into storm drainage channels on the base. The document presents a description of problem areas and recommends solutions to be implemented to reduce the amount of oily flows into selected storm drainage systems. The document concludes that "The uncontrolled discharge of industrial/oily waste into either the activity's storm or sanitary systems without appropriate pre-treatment is in violation of both state and local environmental rules and regulations."

Oil and Hazardous Substance Spill Prevention, Control, and Countermeasure Field Survey and Report and SPCC Plan for the Marine Corps Air Station El Toro, California (SCS Engineers, November 1979). This report covers the results of a field survey of hazardous materials and hazardous waste handling practices at the time of the report. Also included is a list of recommended actions to be taken to reduce or eliminate potential releases of hazardous materials to the environment as a result of base operations. The report lists sites evaluated for potential oil and hazardous substance spill areas and ranks them for their potential impact. Sixty-seven sites are listed as potentially causing environmental problems. Forty-one additional sites were listed as potential "minor" impacts.

Environmental Quality Report, Marine Corps Air Station, El Toro and Marine Corps Air Station (Helicopter) Tustin (USMC, 1982). "This document highlights the progress made over the past three years in developing a comprehensive program of environmental enhancement. The program minimizes the impact of military operations on the ecosystem at the Marine Corps Air Station, El Toro, California." The document describes several projects that were either implemented or planned for implementation to decrease air, water, and noise pollution resulting from base operations.

Master Plan, MCAS El Toro (NAVFAC, March 1982). This document gives a comprehensive list of current base operations and buildings where those operations were occurring as of the date of the report.

Hazardous Waste Management and Polychlorinated Biphenyl Control Compliance Assessment. MCAS El Toro and Tustin (Department of the Navy, Western Division, November 1983). This document contains the results of an assessment conducted by NAVFAC in October 1983. The compliance assessment covered hazardous waste management compliance, PCB regulatory compliance, and oily waste/wastewater discharge compliance. The report concludes that there were major deficiencies in the areas of hazardous waste and PCB management. "The current status of the hazardous waste management program (including PCB control and oil/oily waste management) at both stations could result in notices of violation, fines, and/or penalties if a routine inspection by the appropriate regulatory agency was made."

Hazardous Materials/Hazardous Waste Engineering Study (Roy F. Weston, February 1984). This document relates the historical quantities of hazardous materials used and hazardous wastes generated at the MCAS El Toro. The document also points out deficiencies in the current storage areas for hazardous materials and wastes, and recommends retrofit solutions to correct the problems.

Operation Plan for Temporary Hazardous Waste Collection Facilities U.S. Marine Corps Air Station El Toro, California (Brown and Caldwell Engineers, October 1984). This document was prepared to comply with Section 66373 of Title 22, Division 4, Chapter 30 of the California Administrative Code requiring that an operations plan be submitted to the California Department of Health Services (CDHS) prior to the issuance of a permit. The operation plan lists information on the characteristics and quantities of hazardous wastes, facility equipment and devices, operational procedures, personnel, emergency procedures, and records/reporting requirements for handling hazardous wastes at the MCAS El Toro.

Records Search Log Forms: MCAS El Toro, MCAS (H) Tustin, MCAGCC Twenty-Nine Palms (Brown and Caldwell Engineers, February 1985). This document is an inventory of all records reviewed by Brown and Caldwell in preparation of the Initial Assessment Study document dated May 1986.

Correspondence to California Regional Water Quality Control Board dated 25 July 1985 (Orange County Water District). This document reports the initial discovery of TCE in irrigation wells 6S/8W-7EL and 6S/9W-1L1.

California NPDES Permit for El Toro MCAS; Surface Water Order No. 85-111 (California Regional Water Quality Control Board, 9 August 1985). This document sets the sampling locations, analytical parameters, and sampling frequency for surface water runoff from the MCAS El Toro facility.

Final Report to Orange County Water District, Trichloroethylene Investigation near the El Toro Marine Air Station (William R. Mills & Associates, November 1985). This report contains the results of an initial investigation of contamination of agricultural wells near the MCAS El Toro facility. "The study concludes that the TCE contamination plume could not be defined by soil vapor analysis, but that the PCE soil and/or groundwater contamination is present in several areas. The report lists suspected sources for the TCE/PCE contamination and outlines several investigative techniques to confirm the suspected sources."

SPCC Plan for the MCAS El Toro (NBS/Lowry Engineers, 1986). This document is similar to the previous SPCC plans. The inventory of potential spill sites lists 7 sites with a "high" potential for surface- or groundwater contamination, 31 sites with a "moderate" potential for surface- or groundwater contamination, and 54 sites with a "low" contamination potential. The SPCC also lists 157 abandoned underground storage tanks, 106 of which are filled with sand. One tank in the inventory was listed as used for "waste solvent."

The Operations Plan for Temporary Hazardous Waste Collection Facilities, MCAS El Toro (Brown and Caldwell, January 1986). This document is an update to the document of the same title/author dated October 1984.

A CDHS Surveillance and Compliance Report (Miguel Monroy and Guatam Guha, 31 March 31 1986). This report contains the results of a RCRA compliance inspection at the MCAS El Toro facility. The document lists administrative and handling violations, but presents no evidence of spills or leaks.

Results of the Site Investigation for a 20.8 Acre Site in the City of Irvine (Gregg & Associates, 30 April 30 1986). This document presents the results of a site investigation for an area near the MCAS El Toro. The report was prepared for Canon, Inc. The report states that "Contamination of both soil and surface/ground water at the 20.8-acre site in the City of Irvine appears minimal with the exception of petroleum hydrocarbons in one area . . ."

Initial Assessment Study of MCAS Station El Toro, California (Brown and Caldwell Engineers, May 1986). This document was prepared by the Navy under the Installation Restoration Program. The document investigated 17 potential sites on the base for potential confirmation study activities. No further action was recommended for Sites 6, 7, 8, 10, 12, 13, and 15. An immediate removal action was recommended for Site 4. Further confirmation studies, including sampling location maps and analytical parameters, were recommended for Sites 1, 2, 3, 5, 9, 11, 14, 16, and 17. None of the recommended field investigations has been performed as of the date of this Final Summary Report.

Hazardous Waste Facility Permit No. CA 6170023208 (CDHS, 30 June 1986). This document is a permit to operate a hazardous waste facility. The permit stipulates general requirements for hazardous waste operations and references specific operating procedures from a previous MCAS El Toro submittal.

Correspondence to W.L. Holey/MCAS El Toro from Scott Simpson/CDHS (5 August 1986). This document references the IAS (Brown and Caldwell, May 1986) and recommends that the sites previously recommended for no further action be included in confirmation study activities.

Correspondence to MCAS El Toro from Jere Johnson/U.S. Environmental Protection Agency (EPA) (4 November 1986). This correspondence references the IAS (Brown and Caldwell, May 1986) and recommends that Sites 4, 6, 7, 8, 10, 12, 13, and 15 be included in the confirmation study program. The correspondence also recommends four "un-numbered sites" for inclusion into the confirmation studies. These sites were listed as the Hobby Shop (Bldg. 626), the Material Management Group (Bldg. 320), The Tactical Air Fuel Dispensing System (TAFDS) Operations Area, and Supply Center Storage (Bldg. 320). This correspondence is included as Appendix B to this Final Summary Report.

Preliminary Hydrogeological Investigation on Spectrum Parcels 1, 2, 3, and 4 (SCS Engineers, 1 December 1986). This document relates the results of sampling and analysis that was performed on parcels owned by Spectrum, Inc. that are downgradient from the MCAS El Toro facility. This report states "No detectable concentrations of VOCs or metals were detected for soils. DDD, DDE, and DDT are present in shallow soils at the site. No surface water contamination of VOCs or metals was found. Groundwater contained maximum concentrations of 0.35 ppb of 1,1,2,2-PCA and 0.14 ppb of 1,1,1-TCA."

Hazardous Waste Analysis Plan and Closure Plan for Facilities at MCAS El Toro, California (NBS/Lowry Engineers and Planners, January 1987). This document was required in order to obtain an operating permit by CDHS for hazardous waste facilities. The document lists analytical methods for documentation and segregation of hazardous waste at storage facilities at

MCAS El Toro. The document also gives closure plans for the storage facilities after the end of their useful lives.

RCRA Compliance Evaluation Inspection Report, MCAS El Toro, Final Report (PRC Engineering, 27 January 1987). This report is very similar to the 1987 TES report. No evidence of any spills was given in the report, and only administrative and handling infractions were noted.

The 1987 TES IV Report on MCAS El Toro (Jacobs Engineering, 1987). This document relates the results of a site inspection performed by Jacobs personnel to assess the status of RCRA compliance at the MCAS El Toro Facility. The inspections covered six hazardous waste storage areas and one PCB storage facility. The deficiencies reported were mostly administrative infractions and handling procedures. The report mentioned only one spill of an unspecified volume of an unspecified chemical onto the floor of hangar 673T3.

Results of a Site Investigation on Lots 10 & 11 (16.36 Acres), Area 3, Irvine East Industrial Complex, City of Irvine (Gregg & Associates, 15 April 1987). This document relates the results of a site investigation of property adjacent to the MCAS El Toro. The study involved sampling the soil and groundwater on the site. The study concluded that petroleum hydrocarbon contamination of soils contains a maximum of 85 ppm TPH, and pesticide and metal contamination of soils was either not detected or below applicable standards. Groundwater contamination showed maximum concentrations of 5 ppb TCE, 14 ppb chloromethane, 3 ppb chloroform, and 19 ppb PCE. The study concludes that groundwater contamination at the site may be coming from other sources such as the Aqua Chinon Wash.

Oil and Hazardous Substance SPCC for the U.S. Marine Corps, El Toro, California (NBS/Lowry Engineers and Planners, May 1987). This document is an update of the previous SPCC plan of 1986 by NBS/Lowry.

Correspondence to NAVFAC. Comments to Preliminary Draft Verification Step Confirmation Study, MCAS Tustin and El Toro, California (Orange County Water District, 11 May 1987). This document relates comments from OCWD on the above-referenced document produced by James M. Montgomery Engineers. The comments relate concerns over the deletion of some sites from the original list by Brown and Caldwell (IAS, 1986).

Correspondence to Ernest Cerini/NAVFAC (James E. McNally/CDHS, 13 May 1987). This correspondence relates comments and recommended additions to the Draft Perimeter Study Plan of Action prepared by James M. Montgomery, 1987.

California Regional Water Quality Control Board Cleanup and Abatement Order 87-97 (8 July 1987). This is a legal enforcement document by CRWQCB that specifies a timetable for certain cleanup and abatement actions at MCAS El Toro. The document specifies that a supplement to the proposed Perimeter Investigation Plan be submitted by 15 September 1987 to address TCE contamination offsite. The Order also requires initiation of the investigation by 15 January 1988 and submission of a draft report of findings by 15 June 1988.

California Regional Water Quality Control Board Memorandum, Significant Groundwater Contamination Projects in Orange County (CRWQCB, 10 July 1987). This document lists several sites that were considered priority sites for CRWQCB. Among the 11 sites listed was the MCAS El Toro facility, with a short description of the IAS findings and the contamination found in agricultural wells downgradient from the site.

Internal Correspondence concerning OCWD Sampling Data (To Base Commander/El Toro MCAS from Base Legal Staff, 27 July 1987). This document takes issue with the Mills report from OCWD, and the fact that this report and subsequent data appear inadequate to define MCAS El Toro as the source of offsite contamination of TCE.

Status of Compliance with Cleanup and Abatement Order No. 87-97 for the United States Marine Corps, Marine Corps Air Station, El Toro, California (CRWQCB, 11 September 1987). This document is an update from the staff to the Board of Directors of CRWQCB. The document states MCAS El Toro refuses to perform any offsite investigations to determine if MCAS El Toro is the source of TCE contamination of agricultural wells. This document references correspondence dated 11 August 1987 from Cpt. Holm/MCAS to R. Bennet/ CRWQCB stating that MCAS El Toro will only perform physical sampling inside the MCAS El Toro facility boundary, and that there is not sufficient evidence that MCAS El Toro is the source of offsite TCE contamination. The CRWQCB memorandum states that unless MCAS El Toro can provide sufficient evidence to refute previous investigations, the Board shall refer the matter to the Attorney General for injunctive relief.

Status of Compliance with Cleanup and Abatement Order No. 87-97 for the United States Marine Corps, Marine Corps Air Station, El Toro, California (CRWQCB, 9 October 1987). This document is a further update to the CRWQCB board from staff. The update recommends MCAS El Toro perform offsite and onsite investigations. No further enforcement action is recommended in this summary, pending further developments.

Investigation of TCE Contamination in the Vicinity of the El Toro MCAS (Orange County Water District, November 1987). This document is the plan of action by OCWD for investigating the source of TCE contamination of the agricultural wells. Monitoring well construction details, locations, and sampling/analysis methods are listed in the document.

The 1988 TES IV Report on MCAS El Toro, Assignment Number 650 (Jacobs Engineering, 1988). This document reports the results of a site inspection performed by Rosemary Glenn and Malu Gawthrop on 17 August 1988. The team investigated six hazardous waste storage areas and one PCB storage area. The results show only administrative and/or handling violations. No spills or leaks were reported.

Investigation of Solvent Use/Disposal at the Former County International Raceway (Anne Marie Brown, Environmental Management Consulting, March 1988). This document relates the results of soil and groundwater sampling at the raceway. The study "found no indication of use of TCE during the operation of Orange County International Raceway." Some petroleum hydrocarbons were found in one soil sample at the facility, and no contamination of groundwater was found.

Correspondence to Gen. Shuter/USMC relating to proposal to place El Toro USMC on the National Priorities List (Jerry Clifford, EPA, 20 June 1988). This document is a standard letter sent to all potential National Priorities List (NPL) list site owners notifying them of a tentative decision to place a facility on the NPL list. The correspondence outlines comment periods and a schedule for final determination of inclusion on the NPL. Included with the document were backup calculations showing a total migration score (SM) of 40.83, with the groundwater component of that score (SGW) equal to 70.64. All other scores were either not evaluated or counted as zero.

Site Inspection Plan of Action, Installation Restoration Program, MCAS Tustin and El Toro, California (James M. Montgomery Engineers, August 1988). This document is a work plan for investigating sources described in the 1986 Brown and Caldwell IAS. The work plan contains sampling and analysis plans for Sites 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 16, and 17. The work plan also adds two additional sites that were not previously studied by Brown and Caldwell. These are Site 18 (the offsite investigation) and Site 19 (the ACER fuel-dispensing site).

Hazard Ranking System Technical Review (James M. Montgomery Engineers, August 1988). This document was prepared under contract to MCAS El Toro. The document proposes a groundwater route subscore of 12.27 or 30.69, with a resulting total score of 7.09 or 17.74. The report states that "Based on technical merit, it is proposed that the HRS score for the MCAS El Toro should be revised as 7.09, and the station should not be included on the NPL."

Memorandum of Understanding between USMC and Orange County Water District (M60050-88337-29E) (Orange County Water District, 10 November 1988). This correspondence is a jointly-signed memorandum of understanding that states OCWD will perform offsite sampling and analysis and USMC will be allowed to oversee the work and comment on the means and methods employed by OCWD. Conversely, OCWD may inspect the work by USMC for sampling and analysis performed within the MCAS El Toro facility boundaries and comment on the means and methods employed by USMC.

Results of an Investigation of TCE Removal in the Irvine Area (Orange County Water District, March 1989). This document was prepared by OCWD to judge the feasibility of removing TCE-contaminated water via an extraction well, and removing the TCE by spray irrigation. The report concluded that the method was feasible and recommended additional steps to implement the action.

Phase I Report - Investigation of TCE Contamination in the Vicinity of the El Toro MCAS (Roy Herndon, Orange County Water District, 29 March 1989). This document presents the data from the implementation of the investigation plan of action by OCWD dated November 1987. "This report concludes that off-base TCE contamination is continuous with on-base contamination. Hydraulic pathways and forces have induced vertical and lateral migration of TCE contamination originating on-base to migrate off-base." Based on past solvent use and disposal practices and on data generated through OCWD and the Marines' investigations, the report concludes that the MCAS El Toro is the source of TCE in the Irvine area.

Installation Restoration Program MCAS El Toro Perimeter Investigation Interim Report (James M. Montgomery Engineers, April 1989). This document presents the results of a perimeter investigation study conducted at the MCAS El Toro facility. This investigation was called the "Site 18" study recommended in the JMM Site Inspection Plan of Action dated 8 August 1988. The report lists 14 potential sources of contaminants that were not previously mentioned in the Brown and Caldwell IAS (May 1986) or the JMM Site Inspection Plan of Action (August 1988). These additional sites are given in Appendix B of this Final Summary Report. The investigations of any areas of potential on-base contamination have not been performed as of the date of this Final Summary Report.

Memorandum to S.R. Holm/El Toro MCAS: Technical Concerns with the James M. Montgomery Interim Report regarding the MCAS Perimeter Study (William R. Mills, Orange County Water District, 14 April 1989). This document was prepared by OCWD to comment on the above-referenced report by JMM. The memorandum suggests some concern about aquifer hydraulic calculations and historical use of solvents on the base.

Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program, Irvine, California (Med-Tox Associates, May 1989). This document is a risk assessment for extracting TCE-contaminated groundwater from an extraction well and utilizing the water for landscape irrigation. The report states that "The risk characterization process reveals that the potential public health risks from exposures to released TCE associated with this project are insignificant or de-minimis."

MCAS El Toro Interim Groundwater Treatment System Draft Conceptual Design Report (James M. Montgomery Engineers, May 1989). This document is a preliminary design report for a granular activated carbon treatment system and a series of extraction wells. Three extraction wells are proposed (10 gpm each) at the southwest perimeter of the base to extract TCE-contaminated groundwater and treat it with activated carbon. The system was installed and began operation on 15 June 1989.

Correspondence to Orange County Water District on the Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program (Irvine Ranch Water District, 25 May 1989). This document relates comments on the Med-Tox risk assessment report. Basically, IRWD concurs with the lack of risk of using TCE-contaminated water for landscape irrigation purposes.

Correspondence to Orange County Water District on the Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program (South Coast Air Quality Management District, 30 May 1989). This correspondence states that OCWD must obtain the proper air release permits before proceeding with the proposed TCE removal program.

Correspondence to Orange County Water District on the Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program (MCAS El Toro, 30 May 1989). This correspondence states that MCAS El Toro concurs and approves of the TCE removal program.

Newspaper Article, Orange County Register, "Irvine Rejects Plan to Spray Polluted Water on Green Belts" (Orange County Register, 21 June 1989). This newspaper article documents the decision of the City Council of the City of Irvine to reject OCWD's proposal to utilize TCE-contaminated water for landscape irrigation unless the water has been treated to remove TCE prior to irrigation.

Correspondence to MCAS El Toro recommending additional sites for investigation (California Regional Water Quality Control Board, 23 June 1989). This document recommends the addition of 35 sites to be added to the onbase investigations. A copy of this correspondence is included as Appendix C to this Final Summary Report as a reference.

California Regional Water Quality Control Board, Status of Investigations of TCE Contamination of Groundwater in the Vicinity of El Toro MCAS (CRWQCB, 14 July 1989). This is another in the series of updates to the CRWQCB Board from the staff. This update references the 23 June 1989 correspondence mentioned above and recommends that the sites mentioned in that correspondence be included in the MCAS El Toro investigations.

Groundwater Treatment System Monthly Reports (James M. Montgomery monthly reports from August-December 1989). These documents are monthly status reports on sampling,

analysis, and mechanical difficulties encountered with the interim groundwater treatment installed at the base on 15 June 1989.

Correspondence to S.R. Holm/MCAS El Toro (Karen Schwinn/EPA, 17 August 1989). This is a warning letter requesting that unspecified violations found in an inspection conducted 11 July 1989 be corrected.

Draft Work Plan, Installation Restoration Program MCAS Tustin and El Toro Off-Station Remedial Investigation (James M. Montgomery Engineers, November 1989). This document presents a plan of action for conducting an off-station remedial investigation for contaminated groundwater. The report also presents the findings of an additional data collection effort in the southwest portion of the base.

Results of chemical analyses for organics, general minerals, and metals for off-site wells (1989) and TIC wells (1985-1989) (Orange County Water District). These records give the analytical results for up to 4 years of sampling of off-station wells by OCWD.

Contract Documents for El Toro TCE Production Well (Orange County Water District, undated). These documents are construction plans and specifications for a production well to pump TCE-contaminated groundwater from an area downgradient of MCAS El Toro.

4.2 Hazardous Waste Sites

The following is a summary of hazardous waste sites identified during previous investigations, including the Initial Assessment Study (Brown and Caldwell, 1986), the Site Inspection Plan of Action (James M. Montgomery Engineers, 1988), and the Perimeter Study Plan of Action (James M. Montgomery Engineers, 1988). Also, as per conversations with the Navy, sites that EPA recommended for inclusion into the studies were added to this summary of hazardous waste sites.

It should be noted that sampling or analysis has not been performed at any of the sites mentioned in this Final Summary Report, with the exception of Site 19 (ACER Site). As a result, these 22 sites are all proposed to be included into the RI/FS process because of their potential threat to human health or the environment and the lack of any data to substantiate or justify a "no-action" alternative. Some sites may be dropped from further consideration if initial phases of the field sampling program show that the sites do not exhibit a potential threat. The locations of the 22 sites for investigation are shown in Figure 2 in the back pocket of this Final Summary Report and are summarized below.

Site 1--Explosive Ordinance Disposal Range

From the JMM Site Inspection Plan of Action:

> Site 1 lies within the valley of a minor drainage basin. At the upper end of the basin, a berm retains a small pond. The area is completely fenced, has controlled access, and is currently used for the destruction of small munitions, flares, and other perishable ordnance. The IAS report identified a possible contamination source from incomplete combustion of sulfur trioxide chlorosulfonic acid (FS Smoke) set into two 100-foot-diameter pits and detonated with C-4 explosives sometime in 1982. The potential for contamination by low-level radioactive wastes was also reported by the IAS. Additional contaminants, such as explosives and

fuel used to assist in combustion, may also be present at the site. Conversations with Explosives Ordinance Disposal (EOD) personnel during site visits by JMM indicated that the FS Smoke disposal area was actually a trench or trenches at the upper end of the site.

Site 2--Magazine Road Landfill

From the JMM Site Inspection Plan of Action:

> The Magazine Road Landfill is approximately a 22-acre site located in a borrow pit between two intermittent tributaries of Borrego Canyon Wash. The landfill was operational from the late 1960s until 1980. During this period, all solid wastes generated at MCAS El Toro and some liquid wastes were disposed of at the site. Unlike most other landfills on-base, the wastes were not burned at this site. The overall volume of waste is estimated to be 800,000 to 1,000,000 yd^3. Material disposed of at the Magazine Road Landfill is expected to consist of typical municipal trash plus lead batteries, solvents, hydraulic oil, petroleum-based lubricants, paint residue, fuel, and possibly electrical transformers.
>
> During operation of the landfill, the sand and gravel were removed from the site for use as aggregate on-base and replaced with trash. Previous reports indicate that a permeable layer of sand and gravel may exist between the site and the underlying bedrock. The sand and gravel zone may allow leachate produced by the landfill to percolate downward into the groundwater system. Shallow groundwater may occur within the sand and gravel layer as a seasonal or permanent aquifer. There is a potential for contaminated groundwater to migrate downgradient through the alluvial sands and gravels and into the main groundwater basin. A second potential mechanism of offsite contaminant migration is by surface runoff through Borrego Canyon Wash.

Site 3--Original Landfill

From the JMM Site Inspection Plan of Action:

> The Original Landfill, Site 3, is an approximate 20-acre tract which was used from 1943 to 1955 for disposal of all base wastes. The landfill was operated as a cut-and-fill facility in conjunction with burning to reduce waste volume. The exact locations of the trenches are unknown, but excavations made at the site for building construction which intercepted a trench showed fill to depths of 15 feet. It is estimated that approximately 163,500 to 243,000 yd^3 of material may have been disposed of at the site during its operation. Wastes are expected to include the same type of materials found at the Magazine Road Landfill, plus wastes from an incinerator located adjacent to the site. The incinerator was operational during the same period as the landfill. The majority of the wastes remaining at the site are expected to consist of combustion residue from the burning operations and incinerators.

Site 4--Ferrocene Spill Area

From the JMM Site Inspection Plan of Action:

> The Ferrocene Spill Area is located in a drainage ditch adjacent to North 9th Street, near Building 658. A storm drain catch basin is located at the southern end of the ditch. In 1983, 5 gallons of liquid composed of ferrocene and a hydrocarbon carrier were flushed from a 500-gallon tank that was being rinsed with water near Building 658. This rinse water spilled onto the asphalt paving, and then into the nearby drainage ditch. According to the IAS report (Brown and Caldwell, 1985), the rinse material that had spilled onto the asphalt was cleaned with absorbent material. However, the soil that had been contacted with the rinsate was not removed, and the vegetation in the ditch was observed to be visibly stressed during the initial site visit in March 1985.
>
> During a site visit in September 1988, JMM observed vegetation growing in this drainage ditch, indicating that the ditch receives runoff from the surrounding area; however, no stressed vegetation was evident. The possibility of groundwater contamination exists due to the infiltration of water into the sandy soil at the site.

Site 5--Perimeter Road Landfill

From the JMM Site Inspection Plan of Action:

> The Perimeter Road Landfill was activated in 1955 after the Original Landfill operations ceased. The landfill continued to operate until the late 1960s when it was replaced by the Magazine Road Landfill. Similar to the Original Landfill, the Perimeter Road Landfill received solvents, fuels, oils, and other municipal wastes from the base. The operation was a trench-and-fill operation with burning to reduce waste volume. Most of the remaining materials probably consist of combustion residues. It is estimated that 50,000 to 60,000 yd^3 of waste are contained in three end-to-end trenches with a total length of 1,200 feet. The location of the fill area is fairly well defined.

Site 6--Drop Tank Drainage Area No. 1

From the JMM Site Inspection Plan of Action:

> Drop Tank Drainage Area No. 1 was reportedly used from 1969 to 1983 to clean auxiliary aircraft fuel tanks. The tanks were transported to the Drop Tank Drainage Area No. 1 where the remaining fuel (mostly JP-5) was drained from the tanks. The tanks were then cleaned by washing with detergent and water. It has been estimated that 1,400 gallons of fuel and 300 gallons of waste lubricating fluid were spilled at the site. The site consists of a concrete apron where the cleaning took place and a grassy area to the west of the apron where the wash water apparently flowed. Two grassy swales, which appear to drain the concrete apron and the vegetated area to the west of the apron, flow to the northwest. There is no visible discoloration of the soil or areas of stressed vegetation. Consequently, the horizontal limits of the contamination cannot be visually identified.

Site 7--Drop Tank Drainage Area No. 2 (North Area Only)

From the JMM Site Inspection Plan of Action:

> From 1969 to 1983, the area north of Building 295 was used to clean aircraft auxiliary drop tanks and for disposal of waste lubrication oils and fuel (JP-5) used by the Marine Air Groups (MAGs) in Building 295. . . The fuel drop tanks were cleaned in a similar manner to the operations at the Drop Tank Drainage Area No. 1 (Site 6). It is estimated that approximately 6,720 gallons of waste were disposed of at this site. The site consists of an east-west trending area of slightly depressed topography north of an elevated concrete parking area for aircraft. Portions of the site are covered with asphalt or Marsdon matting.

Site 8--DPDO Storage Area

From the Brown and Caldwell IAS Study:

> Operated by the Defense Property Disposal Office, the yard has served as a storage area for various scrap and salvage materials since the early years of El Toro operations. These materials include mechanical and electrical components, and containerized liquids from MCAS El Toro and MCAS Tustin. Since the mid-1970s, the storage yard has been a graded gravel pad elevated several feet above the surrounding street culverts.
>
> A PCB spill occurred in the yard in 1984, resulting from a leaking electrical console releasing an undetermined amount but, reportedly, several gallons of PCB-containing insulating oil. The spill occurred in a small area near the east end of the yard. The spill was subsequently cleaned up by excavation to about 1-foot depth and removal of several cubic yards (about 10,000 pounds) of potentially contaminated soils. The excavated soils were trucked to an approved off-station disposal facility by a hazardous waste contractor.

Site 9--Crash Crew Pit No. 1

From the JMM Site Inspection Plan of Action:

> Crash Crew Pit No. 1 was used from 1965 to 1971 as a fire-fighting training area. The pit was approximately 50 feet in diameter and 3 to 4 feet deep. During each training exercise, the pit was filled with water and then a layer of 100 to 500 gallons of jet fuel, aviation gasoline, and other liquid wastes were floated on top of the water. The floating fuel was subsequently ignited and then extinguished by the crash crews. Approximately 123,700 gallons of waste liquids are estimated to have been used while the pit was operational. Previous reports have indicated that the majority of the flammable liquids was consumed during the training exercises and that liquid waste residue was not permitted to set in the pits between fire-fighting sessions.
>
> The exact location of Crash Crew Pit No. 1 has not been verified. The IAS indicated that the pit is adjacent to the taxiway but may be located under Marsdon matting. During a site visit by JMM, an attempt was made to visually

define the location of the crash crew pit. No stressed vegetation or bare spots, which would indicate the location of the pit, were found during the walkover.

Site 10--Petroleum Disposal Area

From the JMM Site Inspection Plan of Action:

> The Petroleum Disposal Area was reportedly in use from 1952 to the mid-1960s. During this period, the area consisted of a flat surface of exposed soil and was presumably used for parking aircraft and equipment. Waste crankcase oil, hydraulic and transmission fluids, motor fuel, and solvents collected from nearby maintenance shops were periodically sprayed over the site for dust control. It is estimated that approximately 52,000 gallons of wastes were disposed of at this location. After the application of the waste oil for dust control was discontinued, the southern portion of the site was covered with concrete. In the process of installing the concrete, the top 2 feet of soil was removed and disposed of offsite. Part of the soil in the northern third of the site was excavated with the construction of the Crash Crew Barn (Building 435). The area adjacent to the barn is presently covered with asphalt or is grass lawn. The area between the Crash Crew Barn and the concrete apron has been covered with Marsdon matting. Prior to the placement of the matting, the existing soil was mixed with dry cement and then wetted, forming a concrete-like material, presumably to improve the structural characteristics of the site.

Site 11--Transformer Storage Area

From the JMM Site Inspection Plan of Action:

> The Transformer Storage Area (TSA) is a 30- by 30-foot concrete pad on the northeast side of Building 369 of MCAS El Toro. . . The pad rests on soil which is drained to the northwest by a 3-foot-wide asphalt-lined ditch. The ditch turns to the southwest along the edge of Building 369 and drains into a catch basin. From 1968 to 1983, 50 to 75 transformers were stored on the pad. Six PCB-containing transformers were documented to have leaked a maximum of 60 gallons of fluid. The PCB-containing fluid ran off the pad and onto the surrounding soil. The transformers were disposed of off-station in 1983, and the pad has since been cleaned.

Site 12--Sludge Drying Beds

From the Brown and Caldwell IAS Study:

> Between 1943 and 1972, the MCAS El Toro operated a secondary wastewater treatment plant. Sludges from this wastewater treatment plant were dewatered using sludge drying beds. . . In September 1972, when the plant was closed, reportedly no special actions were taken with regard to disposal of the final sludges generated by the wastewater treatment plant. Reportedly, the sludges may have been abandoned in place and eventually plowed under. Based on a 1959 aerial photograph, the sludge drying beds appear to cover an area 210 by 135 feet. Assuming a bed thickness of 10 inches, the total volume of sludges

would be about 880 yd^3. The primary concern for sludges would be their toxic metals content.

Site 13--Oil Change Area

From the JMM Site Inspection Plan of Action:

> Site 13 was a location where crankcase oil from heavy equipment was drained and replaced. It is estimated that from 1977 to 1983, approximately 7,000 gallons of waste crankcase oil were drained directly onto the soil of the 1-acre site. Portions of the contaminated soil have been removed and piled in the northwest corner as an interim cleanup activity. During the site visit, it was noted that the majority of the site consisted of bare soil with some minor staining apparent at isolated locations.

Site 14--Battery Acid Disposal Area

From the JMM Site Inspection Plan of Action:

> Site 14 is an "L"-shaped, unpaved strip of ground located west of Building 245 at MCAS El Toro. The site is located near a drainage ditch that flows into Sand Canyon Wash. The disposal area is grassy and lies on the margin of an asphalt parking lot. Between 1977 and 1983, batteries from base vehicles were drained onto the soil. Up to 210 gallons of battery acid are believed to have been disposed of here. Paint wastes were also disposed of in this area. It is suspected that methylene chloride was present in the paint wastes.

Site 15--Suspended Fuel Tanks

From the Brown and Caldwell IAS Study:

> Site 15 was occupied by two elevated, 500-gallon diesel fuel tanks. Interviewees reported that from early 1979 to mid-1984 more than 500 gallons of diesel fuel spilled to the ground beneath these tanks. WES-37 of 3d MAW was the source of the diesel fuel. Reportedly, the fueling hoses and nozzles were constantly leaking. The leakage was evidenced by heavy staining of the soil beneath these tanks, whose operation ceased in mid-1984. The tanks were subsequently removed from the site.

Site 16--Crash Crew Pit No. 2

From the JMM Site Inspection Plan of Action:

> Crash Crew Pit No. 2 is located approximately 200 feet northwest of Building 399. The site is comprised of one main 50- to 60-foot-diameter by 3-foot-deep pit, one 20- to 35-foot diameter by 5-foot-deep secondary holding pit, and one shallow 3-foot-wide by 10-foot-long pit which was used for fire-extinguisher training. None of the pits are lined. For fire-training exercises, the main pit was periodically filled with water which was then covered with a mixture of JP-5 fuel, leaded aviation gas, hydraulic fluid, and crankcase oil. The ratio of the liquids used varied with each fire-fighting event. The floating waste mixture was ignited

and subsequently extinguished during each training session. Residual liquids not consumed were transferred from the main pit to the smaller secondary holding pit. An estimated 27,400 gallons of the residual fluids may have percolated into the soil beneath the pits since their first use in 1972.

In addition to the waste liquids, small quantities of solid and semi-solid napalm, white phosphorus, and magnesium phosphate were burned at the site.

Site 17--Communication Station Landfill

From the JMM Site Inspection Plan of Action:

> The Communication Station Landfill is an approximate 20-acre rectangular area located approximately 1,800 feet west of the Magazine Road Landfill. The landfill is on the top of a hill which has been leveled to clear a flight path. An intermittent stream channel follows a westerly path from the southwest corner of the landfill.
>
> The landfill was used to dispose of all types of waste material generated at the base between 1981 and 1983. A vacuum truck is known to have discharged approximately 36,000 gallons of cooking grease, fuel, and oil at the site. Domestic refuse (couches, refrigerators, etc.), rubble, empty drums, and other unknown materials were also disposed of at the site.

Site 18--Off-Station Investigation

This "site" is, in reality, the investigation of the possible offsite plume of TCE emanating from the base's southwest boundary. This off-station investigation will be considered concurrently with the other on-station sites during the RI/FS process.

SITE 19--ACER Site

From the JMM Site Inspection Plan of Action:

> The ACER Site, situated near Buildings No. 404 and 414, . . . was the location of six bladders used to store JP-5 jet fuel. The bladders were arranged in two clusters of three, surrounded by earthen berms approximately 40 feet square and 4 feet in height. The six fuel bladders were originally installed in 1964 and operated until mid-1987, when they were permanently taken out of service. According to personnel working at the fuel storage area until its closure, one of the bladders was ruptured in early 1986, and most of the fuel that was stored in the bladder was released to the ground. Some of the fuel was collected, but employees estimated up to 15,000 gallons of fuel were spilled during this single incident.
>
> Minor quantities of fuel were also spilled or leaked during the operation of the fuel bladders, due to fuel transfer through leaky hoses and couplings from trucks to the bladders, and then from bladders to aircraft. Each bladder contained 20,000 gallons of fuel and were replenished daily.
>
> After the rupture of the fuel bladder that occurred in early 1986, the middle bladder in each cluster was removed prior to an investigation performed by Harding Lawson Associates (HLA) in May 1986. The purpose of this investigation

> was to determine the extent of subsurface contamination at the site caused by spills and bladder ruptures. Seven soil borings were drilled adjacent to the existing bladders and also where the two bladders had been removed. . . Four samples were selected for laboratory analysis, on the basis of their field Nephelometric Turbidity Unit (HNU) readings. Three of these samples were collected from Boring B-3, at depths of 14.5, 24.5, and 39.5 feet. The fourth sample was collected at a depth of 13.0 feet.
>
> The four samples were analyzed for total hydrocarbons using modified EPA Test Method 418.1. The sample collected from Boring B-3 at 14.5 feet indicated a 11,300 mg/kg total hydrocarbon concentration. The other three samples that were analyzed had no detectable hydrocarbon concentrations above 1 mg/kg.
>
> Subsequently, all bladders were removed, and approximately 2 feet of soil was excavated from an area 60 feet wide by 300 feet long. In one area where the highest levels of soil contamination were detected during the investigation by HLA, soil was excavated to approximately 15 feet in depth, over a 30-foot square area. The excavated soil contained volatile organics, and was disposed at a Class I landfill under manifest documentation.

Site 20--Hobby Shop, Building 626

This site was recommended for inclusion into studies by EPA in a letter dated 4 November 1986. This letter is in Appendix B of this Final Summary Report. EPA gives the following explanation for inclusion of this site into future studies:

> This site is described in Section 5.2.8, page 5-7 of the IAS report. A 600-gallon (underground storage tank) UST is utilized to store waste oil. The report states "the ground around the tank and leading to the building is saturated with oil. Two square feet of the building, in line to the tank and closest to the ground, are discolored black with the oil that has seeped under the floor." This is a description of an operation that has housekeeping problems. Seepage under the floor may include other substances that are considered hazardous waste. From 1967 to before 1976, the asphalt in the compound was washed down with kerosene. The use of kerosene would produce organic compounds, and trace and heavy metals mobile, possibly reaching the groundwater. The extent of contamination and the type of waste(s) being generated should be identified so that a proper environmental assessment can be made.

Site 21--Material Management Group, Building 320

This site was recommended for inclusion into studies by EPA in the 4 November 1986 correspondence. EPA gives the following explanation for inclusion of this site into future studies:

> This site was identified in Section 5.2.13.1, page 5-10 of the IAS report. The report states "the only wastes of concern produced are the leakage from stored chemical drums, and chemical supplies with expired shelf life. The drums are stored outside of Building 320. In 1964, about 1,000 drums were stored there; now there are about 100-125 drums. Leaky drums received are returned to the supplier." From 1964 to present, dated drums containing chemicals appear to

have been stored in this one area. Over the 22 years, this area was utilized for the storage of drums; a considerable number of drums must have leaked.

Site 22--Tactical Air Fuel Dispensing System

This site was recommended for inclusion into studies by EPA in their 4 November 1986 correspondence. The IAS by Brown and Caldwell stated that the TAFDS has had a history of spillage and leakage during operations. A spill that occurred in 1983 or 1984 resulted in a cleanup of an unknown quantity of fuel and soils.

Note that there are other sites that were recommended for future study under the Perimeter Study by JMM. These additional sites were listed in Table 2 of that report, and are provided as Appendix D of this Final Summary Report. Appendixes C and D also give additional sites for study recommended by the California Regional Water Quality Control Board. It was determined through conversations with the Navy that the sites listed in Appendixes C and D would be addressed in other studies of the base and, therefore, will not be included in the RI/FS for the MCAS El Toro.

4.3 Regulations

4.3.1 Agencies Involved with the RI/FS Process

Environmental RI/FS investigations and hazardous waste activities are managed by the EPA and by state and local agencies. Within California, the following agencies have responsibilities in particular areas:

- Air Pollution Control: The State Air Resources Control Board (ARB) and local air districts
- Water Pollution Control: The State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs)
- Hazardous Materials Control: The Department of Health Services, the Health and Welfare Agency (for Proposition 65), the SWRCB (for disposal facility standards and underground tank regulations), and the local counties

In addition, the California Waste Management Board, together with county or regional enforcement agencies, is responsible for nonhazardous solid waste management.

The following agencies make up the Technical Review Committee for environmental investigations being conducted under the Installation Restoration Program: U.S. Department of Defense, California CDHS, CRWQCB-Santa Ana Region, Orange County Health Care Agency, Orange County Environmental Management Agency, OCWD, IRWD, EPA, and the City of Irvine.

4.3.2 Permits

The following is a partial list of permits that are in effect at MCAS El Toro.

- o EPA RCRA Part B Treatment, Storage and Disposal Facility permit application for the EOD Range (currently under review by EPA). The EOD currently has interim status authorization
- o RWQCB-Santa Ana Region National Pollutant Discharge Elimination System (NPDES) permit for El Toro surface water (Permit No. 85-111)
- o CDHS Hazardous Waste Facility permit (Permit No. 6170023208)
- o South Coast Air Quality Management District air pollution permits
- o Sanitary Sewer Discharge Permit for MCAS El Toro issued by Irvine Ranch Water District

4.3.3 Legal Actions and Orders

On 24 June 1988, the MCAS El Toro was proposed for listing on the NPL of the EPA Superfund Program. Final listing of the site was announced on 21 February 1990. A Federal Facilities Agreement between EPA and MCAS El Toro has not been finalized. RI/FS scoping documents (including the present document) are currently being prepared under the CLEAN CTO #0018.

State and local agency actions and orders have concerned the following items:

Cleanup and Abatement Order 87-97. The RWQCB-Santa Ana Region issued this order on 8 July 1987. This order required MCAS El Toro to prepare a supplement to the Perimeter Investigation Plan to address off-station TCE contamination, and set dates for the initiation of the actual investigation and a report setting forth the results of the investigation.

Solid Waste Assessment Test (SWAT). Under the provisions of the Calderon Act, the RWQCB-Santa Ana Region ranked the landfills at the base as Level 4 landfills. MCAS El Toro has recently hired Strata, Inc. to perform air SWATs for the landfill areas on the base.

4.4 Current Investigations

With the exception of the current RI/FS investigation, two separate investigations related to MCAS El Toro are underway. The first investigation, being conducted by OCWD, is a continuation of their Phase I investigation of the TCE plume that is affecting agricultural wells in the area. The current investigation consists of quarterly groundwater sampling and water level measurements in approximately 10 off-station groundwater monitoring wells that were installed by OCWD in the period between 1988 and 1989.

The second investigation is a SWAT for air emissions from the four landfills on the base. This investigation began recently; Strata, Inc. is performing the work as a subcontractor to James M. Montgomery.

5.0 CONCEPTUAL SITE MODEL

This section discusses potential contaminant sources, pathways for contaminant migration, and receptors in and around MCAS El Toro. The term "conceptual" in the following description of the site model should be stressed due to the lack of analytical data from the potential contaminant sources or from migration pathways. The model presented in this section is based solely on the previous reports reviewed as part of the preparation of this Final Summary Report. Many of the conclusions reached in these previous reports may be unsubstantiated and, therefore, the site model will need to be refined as more data becomes available.

Potential contaminants of concern at MCAS El Toro include the constituents of petroleum products (JP-4, JP-5, MOGAS, AVGAS, diesel fuel, lube oil, etc.), solvents, paint thinners, landfill refuse, explosives, transformers, battery acids, and sewage sludges. Twenty-two sites are being proposed for investigation under the RI/FS process. Each of these sites may potentially be a source of contamination, although most have not been characterized at this point. In addition, there may be nonpoint sources of contamination at MCAS El Toro (e.g., runoff from aircraft and vehicle wash racks). Contaminant release could also occur through accidental spillage or natural disaster (e.g., earthquakes).

Potential transport media include groundwater, surface water, and air. Based on the conclusions of previous reports, groundwater and surface water flows appear to be the major environmental pathways of concern. Immediately downgradient of MCAS El Toro, groundwater is used for agricultural irrigation. However, groundwater is used as a source of drinking water further downgradient. For example, the South Santa Ana Well Field being developed by the IRWD lies about 9 miles west of MCAS El Toro (Banks, 1984). Because the base lies in an area that serves as a recharge zone for the regional groundwater system, contaminated groundwater could potentially affect all beneficial uses of groundwater in the area. If contaminated groundwater was pumped as a domestic supply, exposure pathways may include ingestion, dermal absorption, and inhalation.

There are normally no surface waters in the immediate vicinity of MCAS El Toro. However, surface water may act as a transport medium during storm events. Contaminants could potentially run off from point and nonpoint sources during rainfall and migrate through ditches, swales, or the storm sewer system to one of the washes that transect the base. Contaminated runoff may then infiltrate to groundwater, or flow to San Diego Creek and finally to upper Newport Bay. Flooding would exacerbate these conditions. Exposure could then be by direct contact through inhalation, incidental ingestion (e.g., through hand-to-mouth contact), and dermal contact. Contaminated water that reached upper San Diego Creek or Newport Bay could also impact flora and fauna there, including endangered species. Contaminated groundwater probably does not contribute to the base flow of streams near MCAS El Toro.

Air may act as a transport medium for contaminants. Transport may take place directly from a contaminant, as in the event of a spill or during ordinary usage. Contaminants may also be released gradually, as through soil pores to the atmosphere in the vicinity of a landfill. Contaminants may finally be transported on dust particles by the wind. Exposure to air-borne contaminants would be through inhalation.

Potential human receptors include site personnel and residents of housing developments in the rapidly growing region. Environmental receptors may be affected during storm events, particularly in Newport Bay and the lower reaches of San Diego Creek. Terrestrial biota may be affected near source areas.

6.0 IDENTIFICATION OF SITES TO BE INCLUDED UNDER THE RI/FS

As previously stated in Section 4.2 of this Final Summary Report, all of the 22 sites should be included in the RI/FS because of the historical evidence of hazardous waste/hazardous materials spills and the lack of samples at any of the sites to prove or disprove the existence of contamination. Initial field sampling and analysis results may prove adequate to dismiss some of the 22 sites mentioned in this report, based on the absence of any measurable impact on human health or the environment.

7.0 SUMMARY

Previous investigations by Brown and Caldwell (1986), James M. Montgomery (1988), and EPA have identified 22 potential sites at the MCAS El Toro that should be included for study in the RI/FS. A description of these sites is given in Section 4.2 of this Final Summary Report. Although employee interviews and records searches have been conducted, environmental samples have only been collected at 1 of the 22 sites. Initial sampling tasks under the RI/FS may reveal that some of the 22 sites pose no threat. Successive sampling tasks will serve to provide additional characterization of the remaining sites in sufficient detail to determine remedial options.

In addition to these 22 sites, the CRWQCB and James M. Montgomery have identified additional ongoing operations, such as aircraft wash racks and drum storage areas, that may also pose a potential threat to the environment. During previous meetings with the Navy RPM, it was decided that these other sites will not be included in the RI/FS investigations, but will be studied under a separate program.

The OCWD has detected a plume of trichloroethene in groundwater downgradient from the MCAS El Toro. Several agricultural wells have become contaminated with trichloroethene, which was originally detected in 1985. OCWD has installed a system of off-station monitoring wells to trace the source of the plume of TCE, and they have concluded that MCAS El Toro is the source. James M. Montgomery installed a series of perimeter monitoring wells that detected TCE near the downgradient base boundary. In June 1989, an interim groundwater treatment system was installed by MCAS El Toro to withdraw contaminated groundwater from the southwest perimeter of the base and treat the water with activated carbon to remove the TCE.

In addition to sampling and characterizing the 22 source areas on the base, a major task in the RI/FS process will be to develop a sampling and analysis plan to study the off-station plume of TCE and determine if MCAS El Toro is the source of TCE contamination in the agricultural wells. If MCAS El Toro is determined to be the source, remedial options for cleanup of the off-station TCE plume will be investigated in the feasibility study portion of the RI/FS.

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Table 1
Waste Generation Rates at MCAS El Toro

Waste Type	Quantity Generated (gal/yr)[f]			Average
	Nov. 1979 SPCC[a]	Feb. 1984 Survey[b]	March 1986 SPCC[c]	
Polyurethane Paint	2,000	330	330	887
Paint Thinner	Not Listed	210	210	140
Dry Cleaning Solvent	Not Listed	1,900	1,900	1,267
Engine Oil	Not Listed	2,200	48,000	16,734
Hydraulic Fluid	3,000	7,100	24,000	11,367
Lubricating Oil	30,000	34,000	Not Listed	21,334
Brake Fluid	Not Listed	16,000	2,000	6,000
Degreaser	100	210	210	173
Transmission Fluid	Not Listed	360	360	240
Cleaning Solvent	Not Listed	330	330	220
Acetylene	Not Listed	600 cu. ft.[d]	Not Listed	600 cu. ft.[d]
Trichlorotrifluoroethane	Not Listed	750	360	370
Antifreeze	Not Listed	900	Not Listed	300
Battery Acid/Sulfuric Acid	100 gal[e]	930	360	463
Grease	Not Listed	Not Listed	60	20
Fuel Contaminated Absorbent	Not Listed	Not Listed	1,320	440
Oily Rags	Not Listed	Not Listed	2,000	667

Table 1
(Continued)

Waste Type	Quantity Generated (gal/yr)[f]			Average
	Nov. 1979 SPCC[a]	Feb. 1984 Survey[b]	March 1986 SPCC[c]	
Corrosion Preventative	Not Listed	Not Listed	660	220
Stoddard Solvent	Not Listed	Not Listed	240	80
Ethylene Glycol Antifreeze	Not Listed	Not Listed	660	220
Isoprophyl Alcohol	Not Listed	Not Listed	60	20
Acetone	Not Listed	Not Listed	12	4
1,1,1 - Trichloroethane	Not Listed	Not Listed	120	40
Methyl Ethyl Ketone	Not Listed	Not Listed	60	20
Paint Stripper	Not Listed	Not Listed	120	40
Naptha and Ferrocene	Not Listed	Not Listed	12	4
Polychlorinated Biphenyls	Not Listed	Not Listed	200	67
Sealants	Not Listed	Not Listed	12	3
Adhesives	Not Listed	Not Listed	12	3
Asbestos	Not Listed	Not Listed	120 lbs.[d]	120 lbs.[d]
Lithium Batteries	Not Listed	Not Listed	36 lbs.[d]	36 lbs.[d]
Hydrocarbon Contaminated Water	50,000	Not Listed	660	16,887

34

Table 1
(Continued)

Waste Type	Quantity Generated (gal/yr)[f]			Average
	Nov. 1979 SPCC[a]	Feb. 1984 Survey[b]	March 1986 SPCC[c]	
Pentachlorophenol Contaminated Wood	Not Listed	Not Listed	24 lbs.[d]	24 lbs.[d]
Calcium Hypochlorite	Not Listed	Not Listed	300 lbs.[d]	300 lbs.[d]
Diethylene Triamene	Not Listed	Not Listed	60	20
Waste Organic Solvents	5,000	Not Listed	Not Listed	1,667
Pesticide, herbicide, poison, and other hazardous material containers (unless triple-rinsed)	200 containers/yr[d]	Not Listed	Not Listed	200 containers/yr[d]
Infectious Wastes	Unknown	Not Listed	Not Listed	Unknown
Radioactive Wastes	Unknown	Not Listed	Not Listed	Unknown
Contaminated Fuels	200,000 - 2,000	10,000	248,500	152,833
TOTALS:	**290,200**	**75,220**	**332,750**	**232,723**

[a]From "Oil and Hazardous Substance Spill Prevention, Control and Countermeasure Report," SCS Engineers, November 1979.
[b]From "Hazardous Materials/Hazardous Waste Engineering Study", Roy F. Weston, February 1984.
[c]From "Oil and Hazardous Substance Spill Prevention, Control and Countermeasure Report," Neste, Brudin and Stone, March 1986.
[d]Not included in average or totals
[e]Assumes 1 battery = 1 gal. corrosive waste
[f]Unless otherwise noted

Table 2
Chronological Document Inventory

Date	Title	Author
05/78	Survey of Industrial/Oily Waste Discharge to Storm and Sanitary Systems. MCAS El Toro,California	Department of the U.S. Navy, Western Division
11/79	Oil and Hazardous Substance Spill Prevention, Control and Countermeasure Field Survey and Report and SPCC Plan for MCAS El Toro,California	SCS Engineers
1982	Environmental Quality Report	U.S.M.C.
01/82 (Addendum 01/84)	Master Plan, MCAS El Toro Santa Ana,California	Department of the U.S. Navy, Western Division
11/83	Hazardous Waste Management and Polychlorinated Biphenyl Control Compliance Assessment. MCAS El Toro and Tustin,California	Department of the U.S. Navy, Western Division
02/84	Hazardous Material/Hazardous Waste Engineering Study	Roy F. Weston
10/84	Operation Plan for Temporary Hazardous Waste Collection Facilities. MCAS, El Toro,California	Brown and Caldwell
02/85	Records Search Log Forms: MCAS El Toro MCAS (H) Tustin MCAGCC Twenty-Nine Palms	Brown and Caldwell
07/25/85	Correspondence to California Regional Water Quality Control Board. Reports initial discovery of TCE in Wells 6S/8W-7EL and 6S/9W-1L1	Orange County Water District
08/09/85	CA NPDES Permit for El Toro, Surface Water Order No. 85-111	California Regional Water Quality Control Board

Table 2
(Continued)

Date	Title	Author
11/85	Final Report to Orange County Water District, Trichloroethylene Investigation near the El Toro Marine Air Station	William R. Mills & Associates
1986	SPCC Plan and SC Plan for MCAS El Toro	NBS/Lowry Engineers and Planners
01/86	The Operations Plan for Temporary Hazardous Waste Collection Facilities, MCAS El Toro	Brown and Caldwell
03/31/86	A DHS Surveillance and Compliance Report	Miguel Monroy and Guatam Guha/California Department of Health Services
04/30/86	Results of the Site Investigation for a 20.8 acre site in the City of Irvine	Gregg & Associates, Inc.
05/86	Initial Assessment Study of MCAS Station, El Toro,California	Brown and Caldwell
06/30/86	Hazardous Waste Facility Permit (CA 6170023208)	California Department of Health Services
08/05/86	Correspondence to W.L. Hoey of MCAS El Toro	Scott Simpson/California Department of Health Services
11/04/86	Correspondence to MCAS El Toro concerning Environmental Protection Agency review of IAS (1986)	Jere Johnson, U.S. Environmental Protection Agency
12/01/86	Preliminary Hydrogeological Investigation on Spectrum Parcels 1, 2, 3, & 4	SCS Engineers
01/87	Hazardous Waste Analysis Plan and Closure Plan for Facilities at MCAS EL Toro,California	NBS/Lowry Engineers and Planners
01/27/87	The RCRA Compliance Evaluation Inspection Report, MCAS El Toro, Final Report	PRC Engineering

Table 2
(Continued)

Date	Title	Author
03/05/87	The 1987 TES IV report on MCAS El Toro	Jacobs
04/15/87	Results of a Site Investigation on Lots 10 & 11 (16.36AC), Area 3, Irvine East Industrial Complex, City of Irvine	Gregg & Associates, Inc.
04/25/87	Buried Tank Removal-Soil Sample Analysis, Building No. 388 U.S. MCAS, El Toro	Applied Hydrogeologic Consultants
05/87	Oil & Hazardous Substance SPCC for U.S. Marine Corps, El Toro,California	NBS/Lowry Engineers and Planners
05/11/87	Correspondence to NAVFAC. Comments to Preliminary Draft Verification Step Confirmation Study, MCAS Tustin and El Toro,California	Orange County Water District
05/13/87	Correspondence to Ernest Cerini of the Navy, Southwest Division, Naval Facilities Command	James E. McNally of Department of Health Services
07/08/87	California Regional Water Quality Control Board Cleanup & Abatement Order 87-97	California Regional Water Quality Control Board
07/10/87	Memorandum, Significant Groundwater Contamination Projects in Orange County	California Regional Water Quality Control Board
07/27/87	Internal correspondence concerning Orange County Water District's Data	El Toro, MCAS
09/11/87	Status of Compliance with Cleanup & Abatement Order No. 87-97 for the Unites States Marine Corps, Marine Corps Air Station, El Toro,California	California Regional Water Quality Control Board

Table 2
(Continued)

Date	Title	Author
10/9/87	Compliance with Cleanup and Abatement Order #87-97 for the U.S. Marine Corps, Marine Corps Air Station El Toro	California Regional Water Quality Control Board
11/87	Investigation of TCE Contamination in the Vicinity of the MCAS El Toro	Orange County Water District
1988	The 1988 TES IV report on MCAS El Toro, Assignment Number 650	Jacobs Engineering
03/88	Investigation of Solvent Use/Disposal at the Former County International Raceway	Anne Marie Brown, Environmental Management Consulting
06/20/88	Correspondence to Gen. Shuter/USMC relating to proposal to place El Toro on NPL list	U.S. Environmental Protection Agency (San Francisco,California), Jerry Clifford
08/88	Site Inspection Plan of Action Installation Restoration Program. MCAS Tustin and El Toro,California	James M. Montgomery Consulting Engineers, Inc.
08/88	Hazard Ranking System Technical Review	James M. Montgomery Consulting Engineers, Inc.
11/10/88	Memo of Understanding between USMC and Orange County Water District (M60050-88337-29E)	Orange County Water District
03/89	Results of an Investigation of TCE Removal in the Irvine Area	Orange County Water District
03/29/89	Phase I Report - Investigation of TCE Contamination in the Vicinity of the MCAS El Toro	Roy Herndon, Hydrogeologist Orange County Water District
04/89	Installation Restoration Program MCAS El Toro Perimeter Investigation Interim Report, MCAS Tustin and El Toro,California	James M. Montgomery Consulting Engineers, Inc.

Table 2
(Continued)

Date	Title	Author
04/14/89	Memorandum to S.R. Holm MCAS El Toro; Subject: Technical Concerns with JMM Interim Report regarding MCAS Perimeter Study	William R. Mills, Orange County Water District
05/89	Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program. Irvine,California	Med-Tox Associates, Inc.
05/89	MCAS El Toro Interim Groundwater Treatment System Conceptual Design Report	James M. Montgomery Consulting Engineers, Inc.
05/25/89	Irvine Ranch Water District Comments to Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program	Irvine Ranch Water District
05/30/89	Correspondence on the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program	South Coast Air Quality Management District
05/30/89	USMC Comments to Public Health Risk Assessment for the Orange County Water District/Irvine Ranch Water District Proposed Trichloroethene Containment Program	El Toro, MCAS
06/21/89	Orange County Register Newspaper, "Irvine Rejects Plan to Spray Polluted Water on Green Belts"	Orange County Newspaper

Table 2
(Continued)

Date	Title	Author
06/23/89	Correspondence to MCAS regarding additional 35 sites for investigation	California Regional Water Quality Control Board
07/14/89	Status of Investigations of TCE Contamination of Groundwater in the Vicinity of MCAS El Toro	California Regional Water Quality Control Board
08/89, 09/89, 10/89, 12/89	MCAS El Toro Interim Groundwater Treatment System Monthly Reports	James M. Montgomery Consulting Engineers, Inc.
08/17/89	Correspondence to Capt. S.R. Holm of MCAS El Toro (warning letter)	U.S. Environmental Protection Agency, Karen Schwinn
11/89	Draft Workplan Installation Restoration Program MCAS Tustin & El Toro,California. Contract No. N68721-85-C-5592. Off Station Remedial Investigation	James M. Montgomery Consulting Engineers, Inc.
Not Listed	Results of chemical analyses-organics, general minerals and metals for MCAS and USMC offsite wells - 1989; and TIC wells for 1985-1989	Orange County Water District
Not Listed	Contract Documents for El Toro TCE Production Well Facility (Specifications)	Orange County Water District

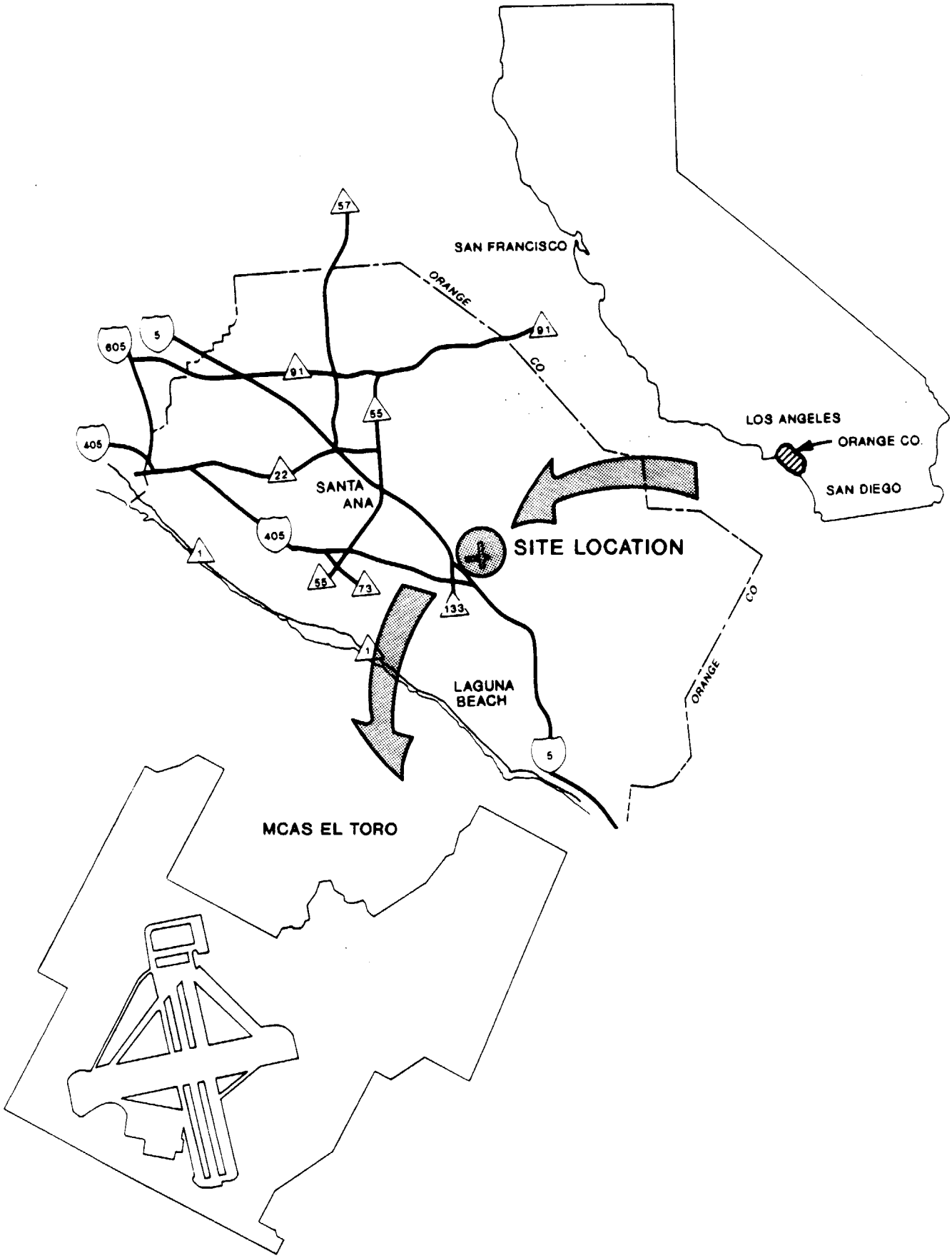
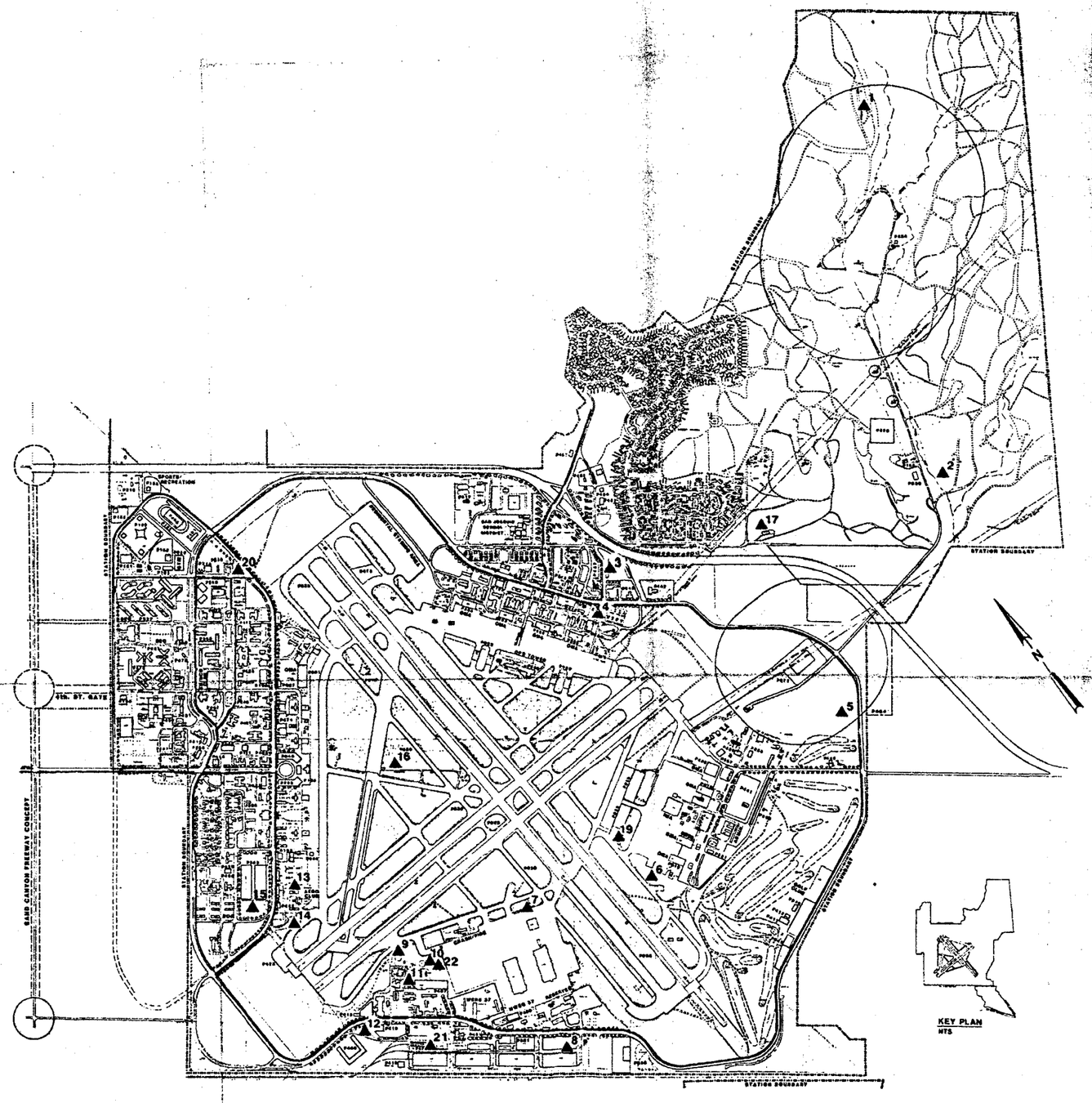


FIGURE 1
MCAS EL TORO
SITE LOCATION MAP

CH2M HILL



LEGEND

- ▲ RI/FS SITE LOCATIONS
- SITE 1 - EXPLOSIVE ORDINANCE DISPOSAL RANGE
- SITE 2 - MAGAZINE ROAD LANDFILL
- SITE 3 - ORIGINAL LANDFILL
- SITE 4 - FERROCENE SPILL AREA
- SITE 5 - PERIMETER ROAD LANDFILL
- SITE 6 - DROP TANK DRAINAGE AREA NO. 1
- SITE 7 - DROP TANK DRAINAGE AREA NO. 2
- SITE 8 - DPDO STORAGE YARD
- SITE 9 - CRASH CREW PIT NO. 1
- SITE 10 - PETROLEUM DISPOSAL AREA
- SITE 11 - TRANSFORMER STORAGE AREA
- SITE 12 - SLUDGE DRYING BEDS
- SITE 13 - OIL CHANGE AREA
- SITE 14 - BATTERY ACID DISPOSAL AREA
- SITE 15 - SUSPENDED FUEL TANKS
- SITE 16 - CRASH CREW PIT NO. 2
- SITE 17 - COMMUNICATION STATION LANDFILL
- SITE 18 - REGIONAL GROUNDWATER VOC INVESTIGATION (NOT SHOWN)
- SITE 19 - ACER SITE
- SITE 20 - HOBBY SHOP
- SITE 21 - MATERIAL MANAGEMENT GROUP
- SITE 22 - TACTICAL AIR FUEL DISPENSING SYSTEM

KEY PLAN
NTS

SITE PLAN

400 0 400 1200 FEET (APPROX)

SOURCE: MCAS EL TORO MASTER PLAN, 1993

CH2M HILL

DSGN
DR P. CAMPFIELD
CHK

FIGURE 2
MCAS EL TORO STATION
PLAN MAP WITH RI/FS SITE LOCATIONS

SHEET
DWG NO
DATE MAR 1990
PRO

PRELIMINARY

Appendix A
1989 HAZARDOUS WASTE ANNUAL REPORT

CY 89 HAZARDOUS WASTE ANNUAL REPORT (HWAR)

Instructions for completing and forwarding this report are provided in the HWAR Guide, NEESA 15-023*

SEPARATE COMPLETE HWARs ARE REQUIRED FOR **EACH** ACTIVITY

PART A: ACTIVITY INFORMATION

1. UIC: M60050
2. ACTIVITY NAME: Marine Corps Air Station (MCAS) El Toro
3. HWAR CONTACT: Richard A. Duffin
4. DEPARTMENT CODE: 1J6.20
5. PHONE (AV,Commercial): A/V: 997-6606 Com: (714) 726-6606

PART B: HW MANAGEMENT INFORMATION

1. EPA GENERATOR IDENTIFICATION NUMBER: CA6170023208

   Name of Activity holding ID number: MCAS El Toro

2. REGULATORY PERMITS AND INSPECTIONS

a) RCRA TSD PERMIT NUMBER: CA6170023208

   Name of Activity holding TSD Permit: MCAS El Toro

b) RCRA TSD PERMIT STATUS:

	(Circle yes or no)		TYPE OF PERMIT (Circle all that apply)
Part A Permit RECEIVED:	NO (YES)	DATE: 3/30/81	T (S) D
Part B Permit APPLIED FOR:	NO (YES) *	DATE: 2/26/86	(T) (S) D
Part B Permit RECEIVED:	NO (YES) +	DATE: 6/30/86	T (S) D

* - Amendment for Open burning/Open detonation treatment operation submitted on 08 Nov 1988. Update for the storage Part B permit submitted on 04 Oct 1989.

\+ - Received from the Cal. Dep. of Health Services. This permit is not recognized by the U.S. EPA.

* NEESA 15-023 available from: Naval Energy and Environmental Support Activity, Code 11ADC, Port Hueneme, CA 93043, (805) 982-2629, A/V 551-2629

PART B. Management information (continued)

c) LIST ALL T.S.D PERMITTED FACILITIES (RCRA AND NON-RCRA):

Facility/Type (i.e. Bldg #, T.S.D.)	Permit Type (RCRA, NPDES)	Issuing Agency
o B.673T3/Storage	RCRA *	U.S. EPA
o OB/OD Area/Treatment	RCRA *	U.S. EPA
o		
o		
o		

* - Interim status

d) NUMBER OF RCRA HW REGULATORY INSPECTIONS RECEIVED:

Local____ State____ Federal 1

- See attached sheet for summary

For each inspection, provide (on separate sheet of paper): Date of Inspection, Inspecting Organization, Summary of Findings, HW Non-Compliance Notices, Letters of Warning or Deficiency, Consent or Agreement Orders, Notices of Violations (NOVs) received and resolved by the Activity, resulting in lawsuits. Please provide current status or plans to correct the deficiencies. (Copies of inspection report summaries are recommended in lieu of write-up. If inspection was done jointly, e.g. EPA and state, mark the one that did the write-up.)

3. GENERATION

GENERATOR CLASS: (Check one)

CLASS I: ☒

Generates 1,000 kg (2,200 lbs) HW or more, or 1 kg (2.2 lbs) or more acute HW per MONTH. (Equal to 26,400 lbs HW or more, or 26.4 lbs or more acute HW per YEAR.)

CLASS II: ☐

Generates 100-1,000 kg (220-2,200 lbs) HW and less than 1 kg (2.2 lbs) acute HW per MONTH. (Equal to 2,640-26,400 lbs HW and less than 26.4 lbs acute HW per YEAR.)

CLASS III: ☐

(Conditionally Exempt Small Quantity Generator) Generates less than 100 kg (220 lbs) HW and less than 1 kg (2.2 lbs) acute HW per MONTH. (Equal to less than 2,640 lbs HW and less than 26.4 lbs acute HW per YEAR.) If your activity is a tenant Class III generator, your host activity will report for you. If your activity is a Class III but not a tenant then you must report all but the section on recycled wastes and Part E (pages 6 & 7) of the HWAR.

PART B. Management information (continued)

4. OPERATIONAL COSTS

a) ANNUAL HW PROGRAM COSTS FOR CY (do not include salaries):

Treatment	$ 23,000	Storage	$ Ø
Disposal	$ 110,000	DRMO	$ 203,531
Other	$ 50,000*	TOTAL COSTS	$ 386,531

*- Lab Analyses, TAD/Tuition, Supplies, Document Updates

b) PERSONNEL labor years: 6.24*

Env. Director	.5	Military HW Coordinators	1
Env. Prot. Spec.	2	Secretary	.5
Env. Eng.	.16	Contract Coordinator	.08
Recycling Manager	1	Pump Truck Driver	1

* Some of MCAS El Toro's labor was expended at MCAS Tustin. Total for both stations is 8.44 years.

PART C: HAZMIN

1. HAS ACTIVITY TAKEN MEASURES TO MINIMIZE HW? YES [X] NO [ ] (check one)

2. If yes, INDICATE WHAT MEASURES WERE TAKEN. CHECK ALL THAT APPLY.

Material Substitution	[X]	
Plastic Media Blasting	[ ]	
Zero discharge Hard Chrome Plating	[ ]	
Other process changes	[ ]	(specify)
Tighter controls on supplies	[X]	
Procedures changes	[ ]	
Other methods	[X]	(Briefly describe)

Generator education
Increased inspections

PART D. RECYCLING (continued)

6. RECYCLING REVENUES RECEIVED BY ACTIVITY:

Recycling Program	Gross Revenues ($)	Costs ($)	Savings ($)	Net Revenues (Gross - Costs + Savings)
Used Oil	5,015	1,000	72,829	$76,844
Used Solvent Elimination (USE)	—	—	—	—
Other Programs (Specify) Used JP-5 Jet fuel	50,877	1,000	658,061	$707,938

PART D: RECYCLING

(Circle one)

1. DOES ACTIVITY HAVE A RECYCLING PROGRAM? (YES) NO

2. DOES THE RECYCLING PROGRAM MEET THE REQUIREMENTS OF A QUALIFIED RECYCLING PROGRAM? (YES) NO

3. DOES ACTIVITY HAVE A USED SOLVENT ELIMINATION (USE) PROGRAM? YES (NO)

If "yes", are solvents recycled/replaced by:

- o On-site Distillation YES NO
- o Organic Solvents Replaced by Water Compounds YES NO
- o Solvent Rental YES NO
- o Off-site Recycling YES NO
- o Other Method _____ YES NO
  (Specify)

If "yes", list quantities of solvents recycled or replaced in the table (Section D.7) at the end of this section.

4. IS USED OIL DEFINED AS A HW IN YOUR STATE? (YES) NO

5. USED OIL RECYCLING (YES) NO

If your activity recycles used oil, specify gallons of used oil by each of the following methods:

- o Re-refined On-site: Ø Gallons
- o Re-refined Off-site: Ø Gallons
- o Burning:
  - Used Oil Ø Gallons
  - Virgin fuel mixed w/used oil: Ø Gallons
- o Sold: 28,179 Gallons
- o Reutilized by DOD Facilities: Ø Gallons
- o Transferred to Non-DOD Federal Agencies: Ø Gallons
- o Donated to Non-federal Agencies: Ø Gallons

55

PART D. RECYCLING (continued)

UIC OF GENERATOR M60050

7) HAZARDOUS WASTE/MATERIAL RECYCLED: (Include recycled used oil ONLY if it is a HW in your state.)

EPA#	DOT#	WASTE DESCRIPTION	PROCESS CODE	QUANTITY (Pounds-P or Tons-T)	RECYCLING METHOD (Also indicate whether on-base, off-base, or DRMO*)
D001	NA1270	Waste Oil	FC	98 T	Sold through DRMO
D001	UN1863	Waste Jet Fuel (JP-5)	MS	896 T	Sold through DRMO

*DRMO: DRMO-hired contractor or DRMO custody/accountability.

PART E: HAZARDOUS WASTE OPERATIONS

EIC OF GENERATOR M60050

READ THE INSTRUCTIONS IN THE HWAR GUIDE BEFORE COMPLETING

WASTE LOCATION CODES

N - On-site
F - Off-site (e.g. private contractor)
D - DRMO (DRMO-hired contractor or DRMO custody/accountability)

ABBREVIATIONS FOR UNITS

Pounds - P
Tons - T

QUANTITIES GENERATED + BACKLOGGED = QUANTITIES STORED + TREATED + DISPOSED

Add these 2 together for total in year 1989 Insert into Table 1 of summary report (change lbs to gal or change Table 1 format)

WASTE IDENTIFICATION**			WASTE ORIGIN			WASTE STATUS as of 31 Dec CY 89						
WASTE ID NUMBER EPA #	DOT #	WASTE DESCRIPTION	PROCESS CODE*	QUANTITY GENERATED In Report CY (Specify Units)	QUANTITY BACKLOGGED Previous CY (Specify Units)	STORED QUANTITY (Specify Units)	LOCATION (N,F, or D)	TREATED QUANTITY (Specify Units)	LOCATION (N,F, or D)	DISPOSED QUANTITY (Specify Units)	LOCATION (N,F, or D)	HAZMIN IMPLEMENTED Code
D001	UN1325	RAGS/ABSORBENT	SC	448,406 P	74,000 P	74,000 P	N	Ø		448,406 P	F/D	SU
D002	UN2921	PAINT (SOLID)	PO	11,200 P	1860 P	1860 P	N	11,200 P	F/D	Ø		MP
D002	UN1760	PAINT (LIQUID)	PO	4,200 P	700 P	700 P	N	4,200 P	F/D	Ø		MP
F002	UN1610	HALOGENATED SOLVENT	SO	82,369 P	13,720 P	13,720 P	N	82,369 P	F/D	Ø		
F002	UN1610	HALOGENATED SOLVENT	SO	306,670 P	50,000 P	50,000 P	N	306,670 P	F/D	Ø		
F003	UN1271	NON-HALOGENATED SOLVENT	SO	31,710 P	5285 P	5285 P	N	31,710 P	F/D	Ø		
F005	UN1271	NON-HALOGENATED SOLVENT	SO	1,260 P	210 P	210 P	N	1,260 P	F/D	Ø		
ORM-E	NA9189	ASBESTOS	MS	2,015 P	7195 P	Ø		Ø		9,210 P	F/D	
ORM-E	NA9189	PCB	MS	Ø	42,411 P	20,000 P	N	5603 P	D	16,808 P	D	
U002	UN1090	ACETONE	SO	9,100 P	1500 P	1500 P	N	9,100 P	D	Ø		
P058	UN1090	PHOTOGRAPHIC	MS	210 P	35 P	35 P	N	Ø		210 P	D	
D008	NA2794	SAND BLAST GRIT	AB	14,280 P	2380 P	2380 P	N	Ø		14,280 P	F/D	
D006	UN1263	CADMIUM BATTERIES	MS	23,840 P	Ø	Ø		23,840 P	D	Ø		
D003	UN2794	LEAD ACID BATTERIES	BA	15,000 P	20,000 P	35,000 P	N	Ø		Ø		RE

*See list of Process Codes in HWAR Guide, NSESA 15-023.

**RCRA, State and Local regulated only.

NOTE: RECYCLED MATERIAL SHOULD BE LISTED IN PART D. FOR AN EXPLANATION OF THE DIFFERENCE BETWEEN RECYCLED AND TREATED SEE THE HWAR GUIDE ESA 15-023.

Hazardous Waste Storage

Permit Application

for

TRW Electronics and Defense

Redondo Beach, California

Prepared by:

Environmental Affairs
Facilities Operations
Operations and Support Group

I. Facility Identification

A. EPA identification number: CAD008324949

Name: TRW Electronics and Defense

Facility Type: Storage

Mailing Address: TRW, E&D
One Space Park 66-1212
Redondo Beach, California 90278
Attn: Environmental Engineer

Location: Near the intersection of Redondo Avenue and 33rd Street in Manhattan Beach

Telephone: (213) 535-1467

SIC Codes: 3662, 3674, and 3679

B. Same as IA

C. Same as IA

D. Contact Person: Kraig Scheyer, Environmental Engineer – (213) 535-1467

E. Same as ID

F. Certification: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this Operation Plan and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Date: 5-2-83

P. W. Schwegler
Vice President and General Manager
Administrative Services Division

Hazardous Waste Storage Area

Operating Plan

for

TRW Electronics and Defense

Redondo Beach, California

Prepared by:
Environmental Affairs
Facilities Operations
Operations and Support Group

II. Facility Information

A. See Attachment 1 – Site Map
See Attachment 2 – Well Locations

B. See Attachments 3 and 4 – Topographic Maps
See Attachments 5, 6, and 7 – Drum Storage Area – Plan View
See Attachment 8 – D-1 Storage Area
See Attachment 9 – R-6 Storage Area
See Attachment 10 – Site Utility Plan

C.1. The property as shown on Attachment 2 can be described by the following legal description:

Buildings	Map Book	Page	Parcel Number
0-2,M-5,R-6	4138	18	3
66, 65	4138	17	10
67	4138	17	2
D-1	4138	18	2
Drum Storage Area	4138	18	15

C.2. It is estimated that the following traffic associated with hazardous waste hauling and storage by trucks is:

Area	Type of Vehicle	Frequency
Drum Storage	pick-up truck, large flatbeds	10 times per month
D-1 Storage	vacuum truck	4 times per year
R-6 Storage	vacuum truck	2 times per year

C.3. Information regarding the loading capacity of the local streets is unavailable.

III. SITE GEOLOGY

A general discription regarding the geology of the subject area is presented in Attachment II.

A specific evaluation regarding geologic hazards of the subject area was prepared by a registered geologist and is presented in Attachment 25.

IV. 100-Year Flood Plan Information

The National Flood Insurance Program has not identified any 100-year flood plains in the Manhattan Beach area. Reference: Discussions with Michael Morris at the Los Angeles County Flood Control District on November 11, 1982.

V. Characteristics of Hazardous Wastes Handled

A. See Attachment 13 for information pertaining to specific wastes to be handled at the storage site.

B. Waste Identification

Drum Storage Area

Hazardous wastes are generated in TRW laboratory, manufacturing, and maintenance areas. These wastes are identified, labelled and packaged properly at the source. Identification of the hazardous properties of the wastes is normally found by utilizing one or more of the following sources:

- Laboratory personnel knowledge
- Title 22 of the California Administrative Code
- Title 40, Code of Federal Regulations
- Title 49, Code of Federal Regulations
- Dangerous Properties of Industrial Materials by N. Irving Sax, Reinhold Book Corp., 1968

If the hazardous property cannot be found by one of these sources, the waste can be analyzed at TRW. TRW's Energy and Environmental Division has the full capacity of performing the tests as described in the CAM manual or the specific compound can be determined using a gas chromotograph/mass spectrometer. Specific test methods will be from Test Methods for Evaluating Solid Waste Physical/Chemical Methods SW-846 USEPA 1982, 2nd edition or Standard Methods, published by American Public Health Association, 14th edition, 1981. Normally, no analysis is performed as the waste can be identified utilizing one or more of the sources mentioned above.

D-1 and R-6 Storage Areas

Hazardous wastes which are stored in tanks in these areas are identified before the wastes are discharged into the tanks. Laboratory personnel have been instructed that only solvents are to be dumped into the sinks which are directly plumbed to the storage tanks.

C. In order to ensure that acceptable wastes are handled at the facility, the following precautions are taken:

- All wastes are evaluated at the point of generation (i.e., at on site or off site facilities). At this time the waste is identified by the generator of the waste.

- Only TRW wastes are accepted at the facility

- If there are any concerns about the specific nature of the waste or possible unknown components, the wastes will not be treated on site. Instead, these wastes will be shipped off site for disposal.

VI. Hazardous Waste Management Devices

A.1 Storage in Containers (Drum Storage Area Only)

Hazardous wastes are normally packaged for shiping at the source of the waste generation (i.e., laboratories, manufacturing areas, etc.). DOT specification 17-H drums are the most common container used. Other types of containers used are cartons, carboys, bottles and cans (if they are approved DOT shipping containers). All containers meet EPA and DOT labelling requirements prior to being placed in the storage area. Attachment 14 is a sample of a completed container label.

A.2a The basic containment system can be best described by observing the specifications and details on Attachments 5, 6, and 7. In general, all secondary containment areas are sealed concrete without any cracks or openings.

A.2b All containers are elevated by storing the containers on pallets. In addition, the drum storage area concete pad is sloped so that any spill will flow to the containment pit outside of the storage area (see Attachments 5, 6, and 7).

A.2c Data obtained from the Los Angeles County Flood Control District (Attachment 15) shows that a 24 hour/25 year storm would drop 5.08 inches of rain. This would yield 5,500 gallons of runoff (5.08" x 35' x 50'). The maximum drum storage capacity of the storage area is 8,300 gallons (∿ 150 55-gallon drums). Ten percent of the storage capacity plus the 25-year 24-hour runoff is 6,400 gallons. The containment pit provided has a total capacity of 7,200 gallons; thus exceeding minimum requirements by 13 percent.

A.2d In all cases, run-on is prevented from occurring because of curbs or walls as indicated on Attachments 5, 6, and 7.

A.2e As discussed in Section V, waste analysis can be performed on-site to determine hazardous properties. Turn-around time from sample collection to analysis can be less than a day if needed. If a containment area is about to overflow due to rainfall, either the BKK Corp. or IT Corp., whom we have current contracts with, can be on site with a vacuum truck in less than two hours. The collected water would be disposed of as a hazardous waste.

A.3a Buffer zones are indicated on Attachments 5, 8, and 9.

A.3b,c See Attachment 7 for location of wastes relative to each other and aisle space for the drum storage area.

A.4 Not applicable – no polychlorinated biphenyls to be stored for longer than 60 days.

A.5 I have approved the design and construction of the container storage area, appurtenant structures and containers for the intended use.

K. H. Scheyer
Mechanical Engineer
Certification No. 21574

B. Storage tanks (D-1 storage and R-6 storage areas).

B.1,2 See Attachment 16 for D-1 tank specifications.

B.3 See Attachments 8 and 16 for D-1 Storage area. See Attachment 9 for R-6 storage area.

B.4 Feed systems for all solvent tanks are the same. Wastes will enter specially-constructed stolvent sinks which will be directly plumbed to the storage tanks. Each system will not be equipped with shut-off valves at the inlet of the tanks since waste discharge to the tanks is not continuous. There will not be a bypass system constructed, however wastes can be drummed for disposal if the tank system is down for repairs or maintenance. Vents are shown on the drawings (Attachments 8 and 9).

B.5a,b See Attachment 13.

B.5c D-1 waste storage tanks are to be 316 stainless steel, all solvents are compatible with this material. The R-6 storage tank is to be a phenolic-coated steel tank which is compatible with all the solvents.

B.5d No vapor control is to be provided at this time. The South Coast Air Quality Management District regulations specifically exempt these tanks from pollution control requirements (see AQMD Rule 441 h(1)).

B.5e All tanks will be labeled as required by EPA and local fire codes.

B.6 Not applicable.

B.7 Containment can best be described by observing the drawings of the containment area as shown on Attachments 8 and 9. All incompatible wastes at the D-1 storage area will be separated by walls. These walls will also prevent run-on.

B.7e See Section VI A2e.

8. I have approved the design and construction of each tank and its appurtenant structures for the intended use.

K. H. Scheyer
Mechanical Engineer
Certification No. 21574

VI. H Treatment

This section describes two different treatment processes, heavy metal treatment and elementary pH neutrailization, which will be utilized to treat TRW generated hazardous wastes. Both of these systems will be located adjacent to building D1 as shown on Attachment 8.

Heavy Metal Treatment

Heavy metal treatment will consist of two waste treatment systems: ammoniacal copper treatment and heavy metal (non-ammonia) treatment. The two waste streams will flow by gravity from the second floor through the units and subsequently to the wet well near the pH control control system. The waste streams will consist of dilute rinse waste water. In addition to these rinse waters, a metered flow of concentrated wastes from tank dumps and floor spills will also be passed through each unit.

It is expected that once in a while heavy metal solutions from other TRW plating shops would require treatment. Thus the reason for permitting this unit as a hazardous waste treatment facility. Detailed Specifications regarding the subject heavy metal treatment system are presented in Attachment 21 and in a process flow diagram shown on Attachment 22.

Elementary pH Neutralization

The pH Neturalization System is a three stage system which will receive acidic wastewater (heavy metal free) from a wafer fab facility, heavy metal plating shop, and brine reject water from a reverse osmosis-deionized water (RO/DI) system. The pH system will utilize ammonia to neutralize the acidic wastewater. Causitc cleaners and etchants will also be discharged to the system. However, the system will not have capacity to neutralize caustic wastewater.

In addition, it is expected that acidic wastes from other TRW facilities may require neutralization from time to time. Thus the requirement for permitting this portion of the facility as hazardous waste treatment facility.

Detailed specifications regarding the pH neutralization system are presented in Attachment 23. The Process flow diagram is shown on Attachment 22 and the actual system layout is shown on Attachment 8.

VII. Facility Equipment and Devices

A. Waste handling equipment is described by area

Drum Storage Area

- Forklift
- Pallet cart
- Drum mover
- ½-1 ton pickup trucks
- Siphons (for waste transfer)

D-1 Treatment Area

Hazardous wastes (acids or heavy metal solutions) treated by this portion of the facility would be metered into the treatment system by a metering pump with hoses. 55 gallon drums (or smaller containers) would be placed inside the contained areas prior to metering their contents into the treatment systems.

D-1 Storage and R-6 Storage Areas

Waste solvents are transferred from the storage tanks to a vacuum truck (provided by a registered hazardous waste hauler) through permanent pipe lines, as shown on Attachments 8 and 9.

B.1 Forklifts, pallet carts and drum movers are used at the drum storgae area to safely move containerized hazardous wastes into and out of the storage pad.

C. Safety and emergency equipment are described in Attachment 17, Section 5.

D.1-3 Site Security by Area:

Drum Storage Area

As is shown on Attachment 6, the area is enclosed by two chain-link fences and locked. The main entrance is limited to several TRW personnel. The entrance to the drum storage area pad is limited to hazardous waste and security personnel only.

D-1 Storage Area

Area is to be enclosed by a chain link fence as shown in attachment 8. The tanks are secured with locked kamlock fittings on the discharge pipes.

R-6 Storage Area

Area is in a 15 foot deep pit with a locked entrance, as shown on Attachment 9. The waste storage tank is secured with a locked kamlock fitting on the discharge pipes.

D.4 Warning signs are located as shown on the drawings in Attachments 6, 8, and 9.

E. Not applicable - Hazardous wastes are not moved during hours of darkness.

F.,G. Five hydrants are located near each of the storage locations, as shown on Attachments 6, 8, and 9. Additional water is provided near drum storage area as indicated on Attachment 6. The water supply is protected by a backlfow preventer as indicated on the same attachment.

VIII. Operational Procedures

A.1 Hazardous waste is accepted from on site and off site TRW facilities only. Hazardous wastes from on site TRW facilities will be moved utilizing a TRW Hazardous Waste Manifest (see sample, Attachment 18). Hazardous wastes from off site TRW facilities will be moved by a registered hazardous waste hauler utilizing the California Hazardous Waste Manifest.

Since all wastes are packaged, labelled, and transported under the supervision of a hazardous waste technician there should not be any discrepancies with respect to the manifest and contents of the shipment. In addition, the hazardous waste technician will be responsible for:

- Obtaining copies of the manifests from the waste hauler
- Sign and date manifests of received shipments
- Give Hauler a copy of the signed manifest
- Maintain a file of the manifests for three years

Since TRW will be the producer as well as the receiver of the waste, a copy of each manifest will be kept in the Environmental Affairs office and not returned to each generation point.

A.2 Unknown wastes are identified (at the point of generation) using the procedures as stated in Section V. Compatibility of wastes and proper treatment is ensured by a trained technician who interfaces with the generators of the wastes and who ensures that only properly identified wastes are treated on site. All other wastes will be disposed of off site.

A.3 The facility will not be open to the public.

B. All waste movement whether coming from TRW buildings or hauling off site for disposal or recycling is supervised by trained hazardous waste personnel. In addition, off site moves will be by a registered hazardous waste hauler. (See Section IX regarding personnel training program.)

Drum Storage Area

- Protective clothing and devices (i.e., gloves, boots, goggles, overalls and resperator) are utilized on an as needed basis. Normally, personnel are not exposed to hazardous wastes when moving and storing wastes. However, in some cases transfer of wastes is required (e.g., transfer of solvents from 5 gallon containers to 55 gallon drums). In these cases, protective clothing and devices are available and are utilized on an as needed basis.
- Aisle space sufficient to allow access to all drums is maintained in the storage area.
- Fire and explosions are minimized by waste segregation of incompatibles and movement of the containerized wastes within the storage area by pallet carts and drum movers only (forklifts are not used inside the storage areas).

C. Control of Hazardous Wastes

In order to ensure proper control of hazardous wastes, personnel are trained as indicated in Section IX, training is the key to safe and proper control.

C.1. Containers (Drum Storage Area Only)

- Overpack containers are available for leaking or corroding containers.
- Wastes are stored in containers as required by DOT regulations (49CFR).
- All containers are kept closed unless waste is being added or removed.
- A weekly inspection log is kept of all containers in the storage area (see sample inspection log, Attachment 20).

- Wastes are placed only in reconditioned drums or original containers.
- Incompatible wastes are separated by aisles of compatible wastes as shown in Attachment 5.
- Empty containers contaminated with hazardous waste, as defined by 40CFR part 261, are disposed of as a hazardous waste.
- Containers which may deteriorate from the weather are over-packed or disposed of immediately.

C.2. Tanks (D-1 and R-6 Storage Area Only)

- Only compatible solvents are to be stored in the solvent storage tanks. Specially marked and segregated (i.e., separately placed away from other sinks so that other chemicals are not placed in the sinks) sinks are plumbed to the storage tanks. Laboratory personnel will be instructed, and monitored by Environmental Affairs personnel to ensure that only solvents will be dumped in the solvent storage system.
- Overfilling is prevented by daily inspection of tank levels. In addition, the D-1 storage area is provided with high level alarms.
- The ignitable solvent wastes are protected from ignition by spark aresters on the tank vents.
- The minimum buffer zone as required by the National Fire Protection Association codes is 5 feet. In all cases, this distance is exceeded.
- The storage tanks meet all the requirements as stated in NFPA for above ground flammable storage tanks.
- All of the above line items together will ensure that the flammable solvents will not ignite.

C.3-C.8 Not applicable

VIII. C.9. Operation of Heavy Metal Treatment and pH Neutralization Systems.

a. Failure of the equipment and process is prevented by the following:

- Materials of construction compatible with wastes and reagents
- Daily monitoring of the processes
- Automatic controls with alarms for out of limit conditions. Specific alarms are detailed in Attachment 21.
- Periodic sampling and analysis to ensure compliance with discharge regulations (required by the LACSD)

b. Shown on Attachments 8 and 22 are shut-off valves for infulents to the pH neutralization system and heavy metal treatment system. Offsite wastes will be metered into both systems by metering pumps (manually for acidic wastes and automatically for heavy metal solutions). Thus if any non compliance condition should occur (i.e., high pH in neutralization effluent or heavy metal carry over in the effluent from the heavy metal treatment system) the addition of the wastes to the treatment systems can be stopped immediately.

c. If different wastes are to be treated or if the process is to be changed the DHS will be notified and procedures will be taken (i.e., pilot tests and analysis) to ensure that the treatment process will operate properly.

d.,e.,f. All treatment systems will be inspected daily with respect to:

- safety and discharge control equipment
- Monitoring equipment and data
- Construction materials and equipment checked for leaks.

Any discrepancies will be noted in the inspection log and repairs will be undertaken immediately.

h. Ignitable or reactive wastes are not to be treated in treatment systems as described herein.

VIII D. Facility Inspection

- Daily inspection of the following equipment and processes will be performed:
  - influent and effluent pipes for all tanks and treatment systems.
  - safety equipment.
  - alarms on all key process functions in the treatment areas are monitored on a continous basis. If a condition is out of limit an audible alarm is sounded and lights will flash on the control pannel. See Attachment 21 for more details.
- Weekly inspection will include:
  - inspection of containment area for cracks or leaks.
  - inspection of tank materials for corrosion and leaks.
  - inspection of containerized materials for leaks or corrosion.
  - inspection of treatment systems for corrosion and leaks.
  - inspection of fences for controlling entry.
- Any deterioration or malfunction detected will be recorded in the inspection log (see Attachment 20) and TRW's Maintenance Department will be notified immediately to begin correction actions.
- Records of inspections will be kept for three years.

IX. Personnel

Three positions at TRW (Environmental Affairs Personnel) are involved constantly with hazardous waste handling, treatment and storage at TRW. In addition, laboratory personnel are involved with the generation of hazardous wastes. However, these laboratory personnel are not responsible for packaging, labeling, and shipping the hazardous wastes; a full time hazardous waste technician is responsible for these duties. A few trained laboratory personnel will discharge solvents to the specially designed solvent sinks which drain to the solvent storage system. The following training discussion will cover: The three Environmental Affairs personnel and the laboratory personnel who discharge solvents to the waste solvent storage systems.

Environmental Affairs Personnel

Information regarding duties, job titles, job descriptions, and a log of training is presented in Attachment 19. Future training for new employees will be implemented through Facilities Environmental Affiars. This Operation Plan will be the key document which would be used to train personnel. New employees would be sent to seminars and classes similar to those shown on Attachment 19 and trained on the job with supervision and classroom teaching by existing personnel. Existing personnel will continue their training and education through additional seminars, classes and periodic review of the Operation Plan.

Laboratory Personnel

These individuals are trained by Environmental Affairs personnel. Specific individuals in each laboratory are instructed as to what can be poured into the solvent drain system. Following the initial instructions for new personnel, all laboratories which have solvent drain systems are inspected on a monthly basis by Environmental Affairs personnel to ensure that laboratory personnel are disposing solvents only in the solvent drain system.

In addition to the training, the solvent sinks are labeled and oriented in the laboratories so as to ensure that only solvents will be discharged to the solvent drain system. Also, the laboratories which utilize these solvent sinks are secure laboratories, they can be entered by specific personnel only (via cypher locks) and the laboratories are closed and locked after working hours. These conditions will ensure that unauthorized dumping in the solvent sinks will not occur

X. Emergency Procedures

The TRW Hazardous Waste Containment and Contingency Plan covers all emergency procedures and is Attachment 17.

XI. Environmental Control Permits

- A building permit has been obtained for all of the facilities from the City of Manhattan Beach.
- No Air Quality Management District permit is required.
- A Los Angeles County Sanitation permit has been applied for. This permit is for the effluent from the heavy metal treatment and pH neutralization systems.

XII. Records and Reports

A.1. Facilities Environmental Affairs keeps permanent records of all wastes accepted at the site. Copies of manifests are stored in a file. In addition, information regarding the specific generators, types of wastes and historical waste generation data is kept in a computer file. A log is kept of all wastes accepted at the facility by manifest number (see Attachment 24). In addition, this log shows the disposition of the waste (i.e., off-site disposal or on-site treatment) and the dates of each movement of the waste. No waste is accepted at the site without a manifest.

In addition to the waste log, any incidents (spills, fires, etc.) will be recorded and filed in the operating record file.

A.2. Copies of manifests for each off-site waste load received will be sent to the DHS monthly. Monthly reports summarizing all off-site manifest information will also be submitted.

A.3. Copies of manifests for each on-site load received will be sent to the DHS monthly.

A.4. Reports of any accidents which could result in a hazard to public health and safety or a discharge of hazardous waste outside of the storage area will be reported to DHS within 24 hours.

A.5. No unmanifested waste will be accepted at the storage area.

A.6. An annual report will be submitted with the information required by DHS.

B. All records are maintained permanently by the Facilities Environmental Affiars office. Upon closure, all wastes will be removed from the facility.

XIII. Closure

A.1a,b Not applicable.

A.1c Maintenance after closure will be minimized by removing all hazardous wastes and contaminated equipment from the facility when the facility is closed.

A.1d The chance of environmental pollution will be eliminated by removing all hazardous wastes and contaminated equipment from the facility when the facility is closed.

A.1e The maximum inventory of wastes at the facility is:

Drum storage area – 150 55-gallon drums
D-1 storage area – 6,000 gallons of waste solvent
R-6 storage area – 2,000 gallons of waste solvent

A.1f The following steps will be taken to decontaminate the storage area:

Drum Storage Area

1) Remove all stored wastes
2) Sample and analyze the storage pad concrete for contamination
3) If required, remove any contaminated concrete.

D-1 and R-6 Storage Areas

1) Remove all hazardous waste in storage tanks
2) Flush all piping and tanks with a water/soap/caustic mixture to remove all solvents. Any equipment which cannot be decontaminated will be removed and disposed.

A.1g Not applicable.

A.2.,3 Environmental Affairs is responsible for all hazardous waste activities and will notify DHS of any changes in facility design and operation and will notify DHS at least 180 days prior to the expected date of closure.

A.4 Refer to A.1f.

XIV Financial Responsibility

XIVA.1 Cost Estimate for Closure

Drum Storage Area

Closure Task	Cost Estimate
• Disposal of Containerized wastes	$15,000.00
• Clean area	1,000.00
• Sample and analyze concrete pad for contamination	10,000.00
• Remove concrete pad (if required)	4,000.00
Subtotal	$30,000.00
20% contingency	6,000.00
Total cost	$36,000.00

D-1 and R-6 Areas

Closure Task	Cost Estimate
• Disposal of collected wastes	$ 3,000.00
• Clean storage tanks and piping	
- Flush system with cleaning solution	$ 1,500.00
- Disposal of cleaning solution	3,000.00
- Disposal of contaminated equipment	5,000.00
- Sampling and analysis to verify decontamination	10,000.00
Subtotal	$22,500.00
20% contingency	4,500.00
Total Cost	27,000.00
Total Closure Cost Estimate	$63,000.00

XIV. FINANCIAL RESPONSIBILITY

Procedures for Satisfying Sect. 265.143 Financial Assurance for Closure

- The Company will satisfy the requirements for this section by demonstrating that it passes the financial test as specified in Section 265.143 (e) Financial Test and Corporate guarantee for closure.

  - The Company will submit a letter signed by the chief financial officer of the Electronics and Defense Sector. The letter will be worded as specified in Sec. 264.151(f), and will include the financial information required by Alternative/1. The financial information will be derived from the independently audited, year-end financial statements for the fiscal year ended December 31, 1982.

  - A copy of the Company's independent certified public accountant's, Ernst & Whinney's, report on examination of the owner's or operator's financial statements for the fiscal year ended December 31, 1982, also will be submitted.

  - A special report from Ernst & Whinney will be submitted and will include the information specified in Sect. 265.143(e) (3) (iii) (A) and (B), stating that the financial information submitted in the chief financial officer's letter has been derived from the independent year-end financial statements for the fiscal year ended December 31, 1982.

List of Attachments

Attachment Number	Subject
1	Site Map
2	Well Locations
3, 4	Topographic Maps
5, 6, 7	Drum Storage Area
8	D-1 Storage Area
9	R-6 Storage Area
10	Utilities
11	Geologic Report
12	Location of Faults
13	Waste Characteristics
14	Container Label
15	Precipitation Data
16	D-1 Tank Specifications
17	Contingency Plan
18	TRW Manifest
19	Hazardous Waste Personnel
20	Inspection Log
21	Heavy Metal Treatment Specifications
22	Process Flow Diagram
23	pH Neutralization Specifications
24	Hazardous Waste Log
25	Geologic Hazardous Evaluation

APPENDIX A
1989 HAZARDOUS WASTE ANNUAL REPORT
LIST OF ATTACHMENTS

FINAL SUMMARY REPORT

THE ABOVE IDENTIFIED ATTACHMENTS ARE NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY SOUTHWEST DIVISION TO LOCATE THIS PAGE / SECTION(S) / ATTACHMENT / APPENDIX / ENCLOSURE. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

Appendix B
4 NOVEMBER 1986 CORRESPONDENCE
FROM EPA RECOMMENDING ADDITIONAL SITES
FOR INVESTIGATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

RECEIVED
86 NOV 7 PM 2 16
SECTION
SER.

NOV 4 1986

In Reply Refer to: T-4-3
Facility No.: CA6170023208

Commanding General
Marine Corps Air Station El Toro
El Toro, CA 92709-5001

ATTN: Environmental Office

Dear Sir:

The Environmental Protection Agency (EPA) has completed its review of the Initial Assessment Study of Marine Corps Air Station El Toro, California, May, 1986 (IAS). Based on the information contained in the IAS, EPA has determined that additional characterization is needed at twelve additional sites (Sites 4, 6, 7, 8, 10, 12, 13, 15, the Tactical Air Fuel Dispensing Systems Operations area (TAFDS), Building 626, and at two sites near Building 320) before any decision regarding further action at these sites is made.

As you may know, in the Memorandum of Understanding (MOU) between the Department of Defense (DOD) and EPA for the Implementation of P.L. 96-510, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, currently expired but under renegotiation, DOD committed to respond to releases or potential releases of hazardous substances, pollutants, and contaminants in a manner consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300 (NCP). Accordingly, the recommendations of the IAS have been reviewed for consistency with the NCP.

The IAS indicates that hazardous substances are known or are suspected to have been released at Sites 4, 6, 7, 8, 10, 12, 13, 15, TAFDS, Building 626 (Hobby Shop), Building 320 (Material Management Group) and at Building 320 (Supply Center Storage), yet the IAS recommends no further action at these sites. These substances may migrate into ground water resources, which are used for both potable and agricultural purposes, or may migrate via surface run-off. Even without migration, these substances and sites may pose a threat to human health or the environment. EPA recommends that, consistent with the NCP, MOU, and relevant EPA guidance, Confirmation Studies be conducted at the twelve sites listed above in addition to the nine sites the IAS recommends for Confirmation Studies. Specific comments on the IAS and the twelve additional sites of concern are enclosed.

In order for EPA to more promptly provide oversight and technical assistance to the investigation and cleanup activities at Marine Corps Air Station El Toro, I would appreciate receiving a schedule of future Installation Restoration Program (IRP) activities. In addition, please send me a copy of the draft Confirmation Study Scope of Work when available so that EPA may review and comment on the proposed activities.

If you do not plan to implement these recommendations during the next phase of IRP activities, please respond in writing. If you have any questions regarding this letter, please contact Nicholas Morgan, Superfund Federal Facilities Coordinator, at (415) 974-8918, or Lewis Mitani at 415/974-7836.

Sincerely,

Jere Johnson
Acting Chief, Federal Response Section
Superfund Programs Branch

Enclosure

cc: √Nestor Acedera, DOHS
Gary Gasperino, NEESA
Ron Rodriguez, RWQCB
Hank Shanks, WESTDIV

ENCLOSURE 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

29 OCT 1986

Memorandum

Subject: Review of Installation Assessment Study of Marine Corps Air Station, El Toro, California

From: Lewis Mitani
Remedial Project Manager, T-4-3

To: Marine Corps Air Station El Toro File

General Comments

Section 6.2.4. page 6-2, POL Storage, Underground did not adequately address underground storage tanks (UST), both active and inactive as well as product and waste storage holding tanks. UST represents a significant source of soil and groundwater contamination and an inventory of the UST on MCAS El Toro should be more complete than the one presented in Appendix C of the report. The size of the tank, construction material, the age of the UST, and type of product or waste the tank held as well as its location should be included in the inventory. Any UST program on base should be noted, including integrity testing, spill control, leak detection systems, base response to leaks and any cleanups.

Not fully addressed in the report is how MCAS El Toro stored, handled or shipped electrical insulating fluids, specifically polychlorinated biphenyls (PCB). MCAS El Toro has been operational since 1943, potentially, older electrical equipment may be still present on base. What knd of electrical insulation is in the electrical equipment (transformers, switches, and oil fuse cutoffs) that is located on MCAS El Toro? Has the older PCB filled electrical equipment been replaced over time? Of the electrical equipment that is or have been present on MCAS El Toro, what type of maintenance (repair, preventative) was conducted on them? Were there any instances of spillage or malfunctions of electrical equipment that lead to spillage or leakage of electrical fluid? Were electrical insulation fluids utilized for dust control on unpaved roads? Where were insulating fluids stored or disposed?

Disagree with the compositing of samples for the sites recommended for confirmation study. A confirmation study should identify unknown compounds present, to what extent they are present and how they are integrated into the environment. Compositing of samples can mask problems by diluting isolated concentrations of hazardous compounds to below detection limits. A sampling program should generate data suitable for subsequent analysis so that informed environmental decisions can be made.

EPA concurs that the following sites should go to confirmation study at MCAS El Toro:

-Site 1 Explosive Ordnanace Disposal Range
-Site 2 Magazine Road Landfill
-Site 3 Original Landfill
-Site 5 Perimeter Road Landfill
-Site 9 Crash Crew Pit No. 1
-Site 11 Transformer Storage Area
-Site 14 Battery Acid Disposal Area
-Site 16 Crash Crew Pit No. 2
-Site 17 Communication Station Landfill

The following are sites of concern and are recommended for confirmation study or further investigation and evaluation:

-Site 4 Ferrocene Spill Area
-Site 6 Drop Tank Drainage Area No. 2
-Site 7 Drop Tank Drainage Area No. 7
-Site 8 DPDO Storage Yard
-Site 10 Petroleum Disposal Area
-Site 12 Sludge Drying Beds
-Site 13 Oil Change Area
-Site 15 Suspended Fuel Tanks
-Unnumbered Site, Hobby Shop (Building 626)
-Unnumbered Site, Material Management Group (Building 320)
-Unnumbered Site, Tactical Air Fuel Dispensing System (TAFDS) Operations Area
-Unnumbered Site, Supply Center Storage (Building 320)

Comments for Sites of Concern

Site 4 Ferrocene Spill Area. Although the quantity of material spilled (5 gallons) appears to be small, the visibly stressed vegetation is indicative that some environmental impact has taken place. Not addressed in the report is how long the tank was utilized for the storage of ferrocene. Could spillage of the ferrocene from past operations cause the stressed vegetation? Ferrocene is 29-30 percent lead, the accumulation of lead in the soil or vegetation would not be readily apparent and what stressed vegetation that is apparent, could be due to the hydrocarbon carrier. Also, the hydrocarbon carrier itself could be a persistent and hazardous substance.

Site 6 Drop Tank Drainage Area No. 2. The combination of JP-5 fuel washed out and lubrication oils that was reportedly disposed of from 1960 to 1983 could pose a threat to groundwater as well as the accumulation of hazardous components in the soils.

The JP-5 fuel could make the trace and heavy metal componets of the lubrication oils more mobile than anticipated. Also the hazardoous components of JP-5 fuel could accumulate in soil or migrate to groundwater.

Site 7 Drop Tank Drainage Area No.2. See comments for Drop Tank Drainage Area No. 1.

Site 8 DPDO Storage Yard. The dismissal of the DPDO storage yard appears be based on the spillage of several gallons of PCB which were excavated. The actual cleanup of the PCB spill area was unsubstantiated by laboratory analysis. In section 5.2.14 the DPDO yard has been utilized at this site from early 1940's to present date. The report states "leaks or spill have reportedly occurred in the storage yard complex from stored containers and mechanical electrical components but there is little or no documentation regarding timing and volume. The greatest potential for environmental pollution may be associated with storage of solvents, paints, thinners and other substances and leakage of PCB containing insulating oils for stored electrical transformers". This site clearly has the potential to present an environmental threat from sources other than the single documented PCB release. Not addressed in this report is whether or not this site is paved, runoff patterns from the site and spill control countermeasures.

Site 10 Petroleum Disposal Area. The spraying of 52,000 gallons of mixed antifreeze, waste crankcase oil, hydraulic and transmission fluids and solvents from 1952 to mid-1960's would allow the accumulation and/or migration of trace and heavy metals, and organic components to levels that represent an environmental hazard. The mixing of waste could make components more viscous and mobile than can be predicted. Also, synergistic reactions were not taken into account. The excavation of soil from portions of the site during construction is not a sufficient reason to dismiss the site.

Site 12 Sludge Drying Beds. The use of available data on typical concentrations of heavy metals in municipal sewage sludges to give a "ball park" estimate of metals content that would be expected is to broard an assumption to make a sound environmental judgement.

Site 13 Oil Change Area. Crankcase oil contains trace and heavy metals which could accumulate to levels that represent an environmental hazard. Crankcase oil may contain additives whose components are considered hazardous which may also be present. Also the disposition of the contaminated soil that was scraped up and piled at the north end of the area was not addressed.

Site 15 Suspended Fuel Tanks. Reportedly 500 gallons of diesel fuel spilled to the ground and stained a 750 square foot area. Components of diesel fuel can accumulate to levels that represent an environmental hazard. The assumption of ultraviolet and bio-degradation of diesel fuel is an insufficient reason to dismiss the site. A sound environmental decision should be made based on laboratory data.

Unnumbered Site, Hobby Shop (Building 626). This site is described in Section 5.2.8, page 5-7 of the IAS report. A 600 gallon UST is utilized to store waste oil. The report states "the ground around the tank and leading to the building is saturated with oil. Two square feet of the building, in line to the tank and closest to the ground, are discolored black with the oil that has seeped under the floor". This is a description of an operation that has housekeeping problems. Seepage under the floor may include other substances that are considered hazardous waste. From 1967 to before 1976 the asphalt in the compound was washed down with kerosene. The use of kerosene would make organic compounds, trace and heavy metals mobile, possibily reaching the groundwater. The extent of contamination and the type of waste(s) being generated should be identified so that a proper environmental assessment can be made.

Unnumbered Site, Material Management Group (Building 320). This site was identified in section 5.2.13.1, page 5-10 of the IAS report. The report states "the only wastes of concern produced are the leakage from stored chemical drums, and chemical supplies with expired shelf life. The drums are stored outside of Building 320. In 1964 about 1,000 drums were stored there; now, there are about 100-125 drums. Leaky drums received are returned to the supplier". From 1964 to present date drums containing chemicals appear to have been stored in this one area. Over the 22 years this area was utilized for the storage of drums, a considerable number of drums must have leaked. Not addressed in the report is exactly where outside Building 320 are the drums stored? Is the site paved? Is the site bermed? What is the runoff pattern of the site? Are there unpaved areas where runoff can collect or percolate into the soil? Were solvents ever used to wash down the drums or "clean" the area? What spill control countermeasures has the Material Management Group taken?

Unnumbered Site, Tacticle Air Fuel Dispensing System (TAFDS) Operations Area. This site was identified in section 5.2.13.2 on page 5-11 and in section 5.3.3.1 on page 5-16 of the IAS report. The use of bladder tanks for the storage of fuel has resulted in the spillage or leakage during operations. Not addressed in the report is the area in which the bladder tanks are stored, is the area paved? Is the area bermed? What is the runoff pattern of the area? What spill control countermeasures

has TAFDS taken? During the cleanup of one of the spills that occurred two or three years ago (page 5-11) the dirt under the fuel bladder was hauled away by TAFDS. Is this a standard operating procedure? Were soil samples collected to determine the adequacy of cleanup? Where were the contaminated soils disposed?

Unnumbered Site, Supply Center Storage. This site was identified in section 6.2.6 on page 6-3 of the IAS report. Is this the same site described in section 5.2.13.1 on page 5-10 of the IAS report? See comments for unnumbered Site, Material Management Group Building (Building 320).

Preliminary Assessment Recommendation

MCAS El Toro ERRIS file should remain active and the MCAS El Toro should be notified of EPA's determination that confirmation studies are recommended to ensure consistency with the NCP. National Priorities List scoring should be initiated as soon as sufficient confirmation study data is available.

Appendix C
23 JUNE 1989 CORRESPONDENCE FROM CRWQCB
RECOMMENDING ADDITIONAL SITES
FOR INVESTIGATION

CALIFORNIA REGIONAL WATER ' ALITY CONTROL BOARD
ANTA ANA REGION
309 INDIANA AVENUE, SUITE 200
RIVERSIDE, CALIFORNIA 92506
PHONE (714) 782-4130

ATTACHMENT 2

June 23, 1989

LTJG Michael Rehor, Environmental Director
MCAS El Toro (Code 1JG)
Santa Ana, CA 92709-5001

MCAS EL TORO - SITE INSPECTION PLAN OF ACTION

Dear LTJG Rehor:

As we discussed in our May 30, 1989 meeting, we are hereby transmitting our recommendations for additional sites at the El Toro Marine Corps Air Station (MCAS) which we believe should be included in the Site Inspection Plan of Action.

Although the Installation Restoration (IRP) program is intended to address only past facility operations, we believe that some currently operating facilities should be included in the IRP program. Past and current chemical use and disposal practices at these sites may have allowed contaminants to be discharged where they could impact water quality. We believe that it is appropriate to include these sites in the present phase of investigation. The sites listed are areas where trichloroethylene (TCE) is either known or suspected to have been used. Chemical use and disposal practices, documented in the November 1987 Oil and Hazardous Substance Spill Prevention Control and Countermeasure (SPCC) plan, strongly suggest that there are areas on the base where TCE was routinely discharged to bare ground and unlined channels.

Although some of these areas are located near sites that have already been selected for investigation, we believe that the sites require individual investigation to adequately evaluate the threat to water quality from past chemical use practices. In some cases adequate coverage may be provided by expanding the specific site investigations. However, in most cases separate site investigations will be necessary. Investigation of these sites should focus on potential discharge areas and any adjacent drainage channels. The following sites should be given highest priority:

1. Building 359 - corrosion control facility, which housed 2 TCE degreasers.

2. Three engine test cells - the SPCC plan documents oily discharges from two of these test cells, located in buildings 658 and 447, that eventually entered storm drains. The location of the third test cell is not indicated.

6 6

3. Six drum storage areas - The SPCC plan depicts numerous drum storage areas on bare ground. The plan documents solvent storage in the following areas:

   A. Northeast of building 392

   B. Southeast of building 602

   C. Between buildings 454 and 456

   D. Northeast of building 320

   E. Northeast of building 317

   F. East of building 359

4. Hazardous and flammable materials storehouses 320 and 357.

5. Oil/water separators at Bee Canyon Wash and Agua Chinon Wash.

In addition, the SPCC plan identifies 23 wash areas including seven aircraft wash facilities. Each of these wash areas should be evaluated to determine whether solvents were used. If solvents were used at any wash area, that area should be included in the investigation.

Please submit a proposed sampling program for the sites discussed above in the form of an amendment to the Site Inspection Plan of Action. If you should have any questions, please call me or Steven Overman of our Pollutant Investigation Section.

Sincerely,

Kurt V. Berchtold

Kurt V. Berchtold
Supervising Engineer

cc: OCWD - Jim Reilly

TDP/mcaset2

Appendix D
TABLE FROM JMM PERIMETER INVESTIGATION
LISTING ADDITIONAL SITES FOR INVESTIGATION

TABLE 2

Summary of Solvent Use Areas - Initial Assessment Study Solvent Use Areas, Perimeter Study at MCAS El Toro, California

Building Number(s)	Operations Name	Map Identification	Period of Practice	Types of Materials Used	Comments
288,289	Station Operations and Maintenance - Aircraft Maintenance Dept.	A	1943 to present	POL, PD-680, other solvents	50 gallons per year stored in drums and bowsers,(till mid-1970s 450 gallons per year (1970s to present). Disposal by Facility Maintenance.
138	- Station Electronics and Maintenance Div.	B	? up to 1980	Carbon Tetrachloride TCE, Trichloroethane (TCA)	Two to Three 55 gallon Barrels used per year. Most solvents volatilized, residual solvents drummed and stored near Bldg. 730
626	- Auto Hobby Shop	C	1967 to present	Solvents	Operations include three 50 gallo solvent parts tanks. Yearly usag unknown. Mud/solvent sludge to separators. Very dirty solvent t two drums per year disposed by Facilities Management.
347 past	- Exchange Gasoline Station	D	? to 1971	Solvents	110 gallons per month to wash parts. Solvent had also been use to wash the decks. Quantity unknown.
360	- Defense Property Disposal Office	E	1940s to 1980	Solvents	Surplus solvent materials held prior to resale/reuse. Undocumented spills may have occurred.
370	- Facilities Management Dept. (FMD) - Pipe Shop	F	1940s? to present	metal cleaners/ degreasers	Portion of up to 24 gals./year. Disposed in shop trash sent to then current sanitary landfill.
370	- FMD - Machine Shop	G	1940s? to present	metal cleaners/ degreasers	Portion of up to 24 gals./year. Disposed in shop trash sent to

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TABLE 7 (Continued)

Summary of Solvent Use Areas - Initial Assessment Study Solvent Use Areas, Perimeter Study at MCAS El Toro, California

Building Number(s)	Operations Name	Map Identification	Period of Practice	Types of Materials Used	Comments
1589	- FMD - Motor Transport Div. (MTD) - Heavy Duty Maintenance Shop	H	prior to 1952 to mid 1960's	dry cleaning solvents	Use in parts dip tank about 75 gallons per year. This solvent used to wash decks once per week (144 gallons/year) and lube racks daily (240 gallons/year). Solvent in waste oil disposed to Oil Disposal Area (Site 10).
298	- FMD - MTD - Light Duty Maintenance Shop	I	up through mid 1960s	solvent	Solvent dip tank, thirty gallon capacity, changed once every six weeks (used to present). Solvent used to clean the cement decks (gallons per year).
388	The Third Marine Air Wing (3d MAW) - Third Force Field Support Group Detachment B	J	? to present	Solvents, predominantly methylene chloride	Three 55-gallon drums of solvent used for parts cleaning each year. Waste solvents stored in drums.
634	- Marine Air Group 11 (MAG-11) - Headquarters and Maintenance Squadron 11 (H&MS-11)	K	late 1960s present	Solvents/paint strippers	2-1/2 gallons per month generated during paint stripping. Waste is drummed for storage, hauled off site for disposal by private contractor.
605 current	- MAG-11 - VFMA-314	L	1952 to present (unit operation)	POL and solvents	Currently disposed off site by private contractor. Otherwise past waste disposal unknown.
115 current	- MAG-11 - VFMA-323	M	1946 to present (unit operation)	POL and solvents	Spills on Tarmac, otherwise disposal off site by private contractor

4/17/89 TDP

Tom D Peltier
SARWQCB

MCAS EL TORO

ADDITIONAL SITES NEEDING INVESTIGATION

Test Cells 658 and 447	
Bldg. 626	Wash Rack
Bldg. 392	Wash Rack and Drum Storage Area
Bldg. 127	Wash Rack
Bldg. 673	Wash Rack and Drum Storage
Bldg. 390	Wash Rack
Bldg. 386	Steam Cleaning Area
Bldg. 298	Maintenance Shop
Bldg. 388	Wash Rack
Hanger 605	Aircraft Wash Area
Hanger 606	Aircraft Wash Area
Hanger 114	Aircraft Wash Area
Hanger 463	Aircraft Wash Area
Hanger 461	Aircraft Wash Area
Hanger 297	Aircraft Wash Area and Drum Storage
Bldg. 320	Trichloroethylene Drum Storage
Bldg. 357	Drum Storage
Bldg. 454/456	Drum Storage
Bldg. 317	Drum Storage
Bldg. 534	Drum Storage
Bldg. 655	Drum Storage
* Bldg. 359	Drum Storage
Bldg. 130	Drum Storage
Bldg. 602	Drum Storage
Salvage Yard	Drum Storage

OTHER POTENTIAL AREAS OF CONTAMINATION

Mag. 13	Paint Sheds
Auto Hobby Shop	Leaking waste Oil Tank
Bldg. 103	Paint Shed
Heavy Equipment	Vehicle Wash Area

Empty or Destroyed Buildings 143, 343, and 1789

Combat Ready Vehicle Storage and Wash Area

Bldgs. 359 & 651	Wash Areas
Bldg. 262	Wash Rack

Exchange Car Wash