Information Package

Above Ground Storage Tank 658

Marine Corps Air Station El Toro, California

4 April 2002

Prepared by:

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File: ETAST658DTSCTRLTR18Apr2002.doc

Transmittal

Date: 18 April 2002

From: Lynn Marie Hornecker LMH

To: **Triss Chesney**
State of California Environmental Protection Agency
Department of Toxic Substances Control (DTSC), Region 4
Site Mitigation Branch, Base Closure Unit
5796 Corporate Avenue
Cypress, CA 90630

Subj: Above Ground Storage Tank (AST) 658
Marine Corps Air Station, El Toro

Provided for your review are three copies of the Information Package for the former above ground storage tank (AST) 658 at the former Marine Corps Air Station, El Toro. The tank has a capacity of approximately 600 gallons and was used for storage of ferrocene at Building 658 - a former jet engine test cell. Building 658 and the former AST Site 658 are located near Installation Restoration Program (IRP) Site 4 (the Ferrocene Spill Area) which achieved no further action status when the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision was signed in 1997.

Based upon our review of historical information, the remedial investigation of the nearby IRP Site 4, and the results of visual inspections of the tank and the former tank site, we are recommending no further action status for former AST Site 658. We propose to document no further action status for this site in the next BRAC Business Plan update. If we do not receive comments from your office within 60 days of receipt of the report, then we will assume that you concur with our recommendation for no further action status for former AST Site 658.

Please do not hesitate to call me at (619) 532-0783 if you have questions on the attachment. Thank you very much.

Attachment
Information Package (SWDIV CSO/ROICC Los Angeles, April 2002)

CF:
Dean Gould (MCAS El Toro BEC)
Project File (MCAS El Toro)

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4. Misc. Information on Ferrocene

Section 1
Introduction

The purpose of this Information Package is to present information regarding Above Ground Storage Tank (AST) 658 at the Marine Corps Air Station (MCAS), El Toro. This undocumented tank was found abandoned at its present location at Building 463 (Maintenance Hangar). It is believed that AST 658 was originally located at Building 658 (Jet Engine Test Cell) and was used to provide ferrocene for engine test operations at the test cell. The test cell ceased operations prior to base closure in July 1999. Ferrocene is an organic compound used as an antiknock additive and catalyst for gasoline and jet fuels and was injected into the JP-5 fuel.

AST 658 is not listed in the MCAS El Toro Base Realignment and Closure Business Plan and it is not included in any documentation pertaining to storage tanks at MCAS El Toro. The tank was observed at Building 463 during an assessment of remaining above ground storage tanks at MCAS El Toro in February-March 2001 by Southwest Division, Naval Facilities Engineering Command Base Realignment and Closure Operations (BRAC) Department and the MCAS El Toro Caretaker Site Office (CSO) personnel.

This Information Package therefore includes an evaluation of available records including historical station construction drawings and photographs and personnel interviews to determine the history of AST 658.

Section 2
Historical Review & Field Investigation

Figure 1 is a vicinity map showing the present location of AST 658 at Building 463 and the original location at Building 658.

Personnel Interviews

Information gathered from interviews with former MCAS El Toro Facilities Installations Department personnel from March 2001 through April 2002 is summarized as follows:

Two above ground storage tanks were installed at Building 658 around 1978 by station maintenance personnel to provide ferrocene for jet engine test cell operations. The tanks were placed on a fiberglass containment pad on top of concrete slab at the south end of Building 658. The tanks were utilized for this purpose until approximately 1983 when ferrocene was no longer used at the test cell. The tanks were removed and the present metal shed was constructed at the former tank location around 1986.

One of the ferrocene tanks may have been removed from the station by a contractor. The other tank, now being referred to as AST 658, remained on the station but it is not known if it was placed at locations other than its current location at Bldg 463. This tank has not been utilized for any known purpose since it was removed from Building 658 in the early 1980s until the present time.

Review of Station Photographs

Historical 35 mm station slides from an unlabeled binder were reviewed and several slides showing the ferrocene tanks were found. Physical features on the south side of Bldg 658 were matched with the features shown in the slides. Additional slides of Bldg 658 are grouped with the ferrocene tank slides in the binder. Although the ferrocene tank slides are not dated, other slides grouped with the ferrocene tank slides in the binder are dated in the early 1980s. A reproduction of one of the ferrocene tank slides is shown in Photograph 1.

Review of Station Drawings

Original construction drawings of Bldg 658 from 1972 are included in Figure 2. Bldg 658 underwent a major renovation in 1986. The drawings do not show the ferrocene tanks or related piping systems. Since the installation of the ferrocene tanks and piping in the late 1970s was performed by station maintenance work forces, the modifications would not have necessarily been included in any station engineering drawings.

Review of IRP Site 4 Documents

The AST 658 site is located near IRP Site 4, Ferrocene Spill Area, and is approximately 50 feet northwest of the Unit 2 Drainage Ditch Area. The AST 658 and IRP Site 4 sites are shown in Figure 3 and Photograph 4.

IRP Site 4 consists of a 2500 square foot oil stained area (Unit 1) and a 2600 square foot drainage ditch area (Unit 2) southeast of Building 658. In August 1983, the contents of a 500 gallon tank containing wash water, residual jet fuel and ferrocene was reported to have overflowed during washing activities and spilled onto the ground and into the drainage ditch. The spill contained approximately five gallons of ferrocene and hydrocarbon carrier solution.

A Phase 1 Remedial Investigation (RI) was conducted by Jacobs Engineering in 1992 and 1993. The Phase I RI investigated the two units and consisted of activities including the construction and sampling of three monitoring wells, the collection of twenty-one shallow soil samples and seven deeper soil samples, the collection of one sediment sample from the Unit 1 catch basin, and the collection additional soil samples from off-site locations.

A Phase II Remedial Investigation was performed by Bechtel National, Inc. in 1995 and 1996. The Phase II investigation consisted of a review of the Phase I RI and other previously gathered information. The Phase I investigation was considered adequate to characterize the nature and extent of contamination. Excerpts from the June 1997 Bechtel National, Inc. Phase II RI Report including the Phase 1 laboratory results are included as Appendix 1. It was concluded that the chemicals identified at IRP Site 4 did not pose a significant risk and the site was recommended for no further action.

A Record of Decision (ROD) for eleven OU-2A and OU-3A sites, including IRP Site 4, was signed in September 1997. The remedy for these sites was for no action. Excerpts from the 1997 ROD are included as Appendix 2.

Review of UST 658A and 658B Documents

Underground Storage Tanks (USTs) 658A and 658B were located southeast of Bldg 658 and partially within the IRP Site 4 Unit 1 area. The tanks were removed by OHM Remediation Services Corp. in January, 1998. The two 10,000 gallon tanks were installed in 1972 to provide JP-5 fuel for the test cell. No significant concentrations of chemicals were found in soil samples from the excavation after the tanks were removed. BTEX was not detected and a maximum TPH (diesel) concentration of 12 mg/kg at a depth of 14.5' was noted. The site was closed by the Orange County Health Care Agency in April, 1998. Excerpts from UST 658A and 658B Closure Report are included as Appendix 3.

Site Investigation

AST 658 was observed by Navy CSO personnel on 16 Feb 2001 lying on its side on concrete pavement at the northwest side of Building 463 (Maintenance Hangar). The capacity of AST 658 is approx. 600 gallons. The tank was noted to be empty and in excellent condition. No stains or cracks were noted on the concrete pavement at Bldg 463.

After it was determined that the tank was originally located at Bldg 658, several visual inspections were conducted by Navy CSO and BRAC personnel including the original inspection in March 2001 and subsequent inspections through April 2002. A large castor bean plant has grown through the pavement near the original tank location. The concrete pavement however is in excellent condition and there are no cracks or stains. As noted, a metal shed was constructed at the tank location around 1986 after the tank was removed. These features are visible in photographs 3-5.

The area at the AST 658 site slopes toward the Unit 2 Drainage Ditch Area described in the IRP Site 4 Remedial Investigation. Any releases from the tank or piping would have drained from the paved concrete area into the open ditch. The IRP Site 4 Remedial Investigation did not find any significant concentrations of chemicals in the drainage ditch soil or catch basin.

Section 3

Summary & Conclusion

AST 658 was a 600 gallon tank used to store ferrocene at Building 658 (Jet Engine Test Cell) during the late 1970s and early 1980s. It has not been used for any purpose since that time and was found to be abandoned and empty at its present location at Building 463.

The tank was not reported to have leaked or spilled any liquids while in use at Building 658. The tank was equipped with secondary containment on a concrete pad. The concrete pad at Building 658 is in excellent condition with no cracks or stains. The AST 658 site was near IRP Site 4, Ferrocene Spill Area, which was investigated and closed as a no further action site in 1997.

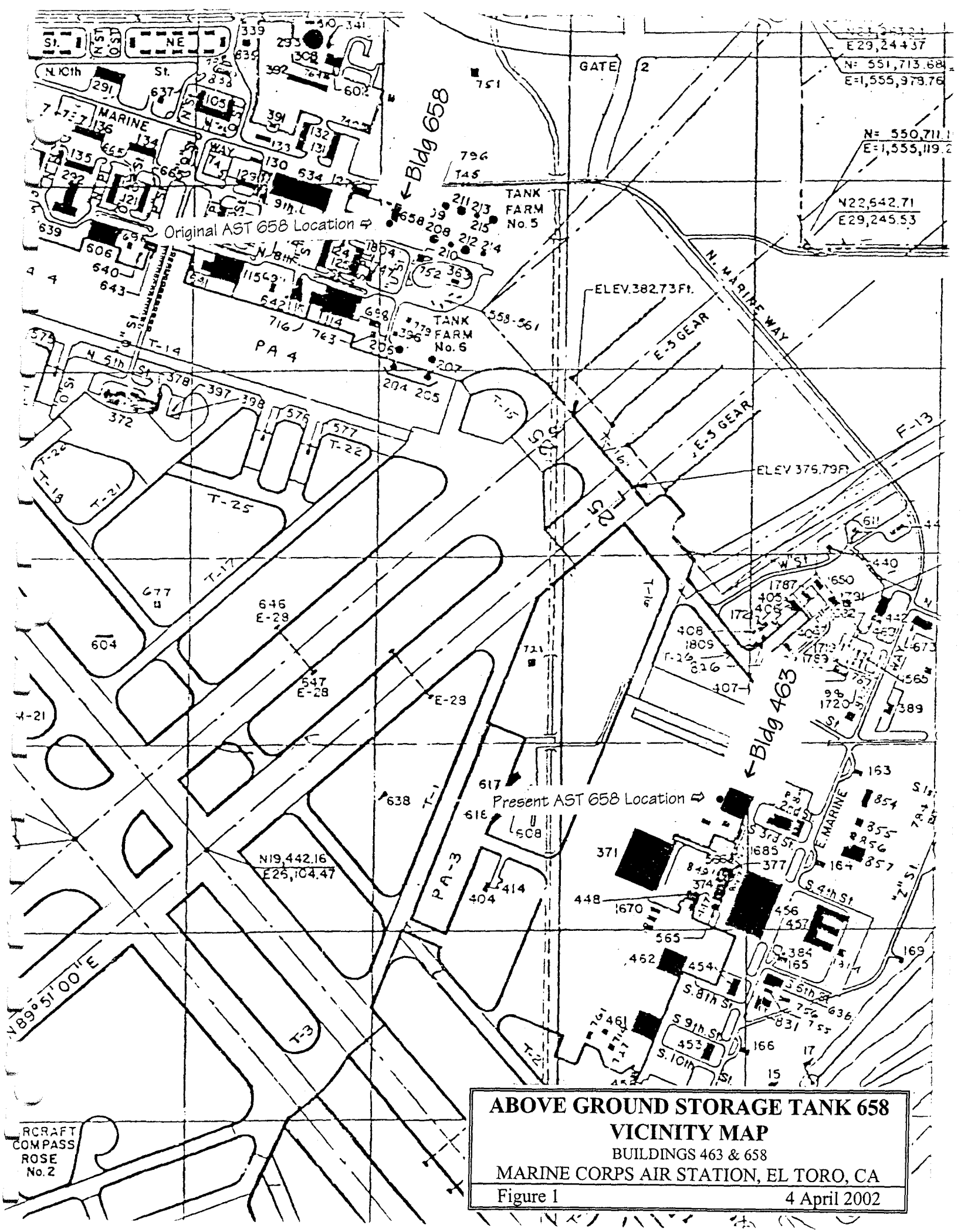
The pavement at Building 463, the present location of the tank, is also in excellent condition with no cracks or stains.

Based upon a review of historical records, results from prior remedial investigation documents and UST removal reports, interviews with station personnel, and visual inspections, it is recommended that no additional investigation and no further action is warranted for AST 658, its original location at Building 658, or its present location at Building 463.

FIGURES

INFORMATION PACKAGE
ABOVE GROUND STORAGE TANK 658

DATED 4 APRIL 2002

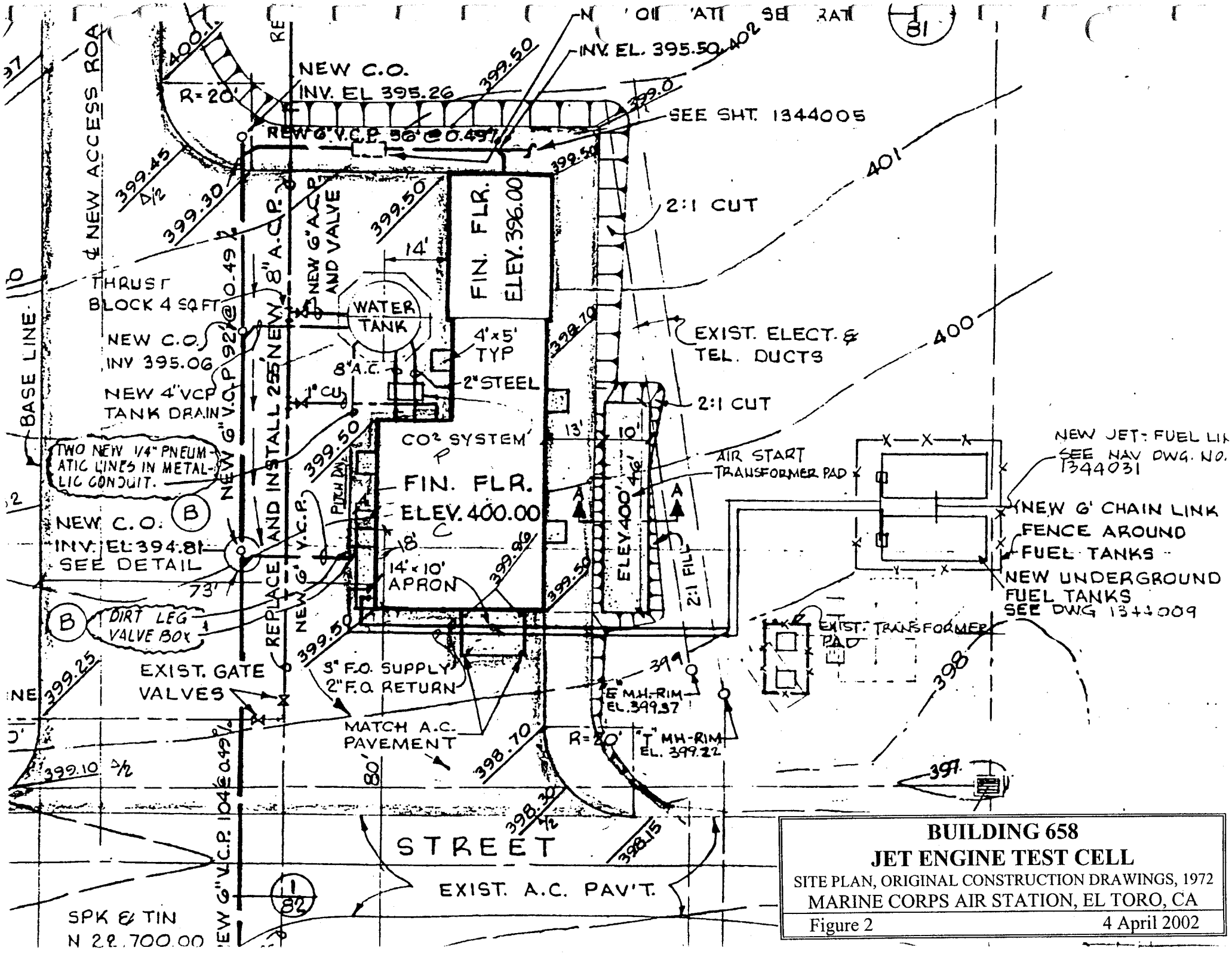


ABOVE GROUND STORAGE TANK 658
VICINITY MAP

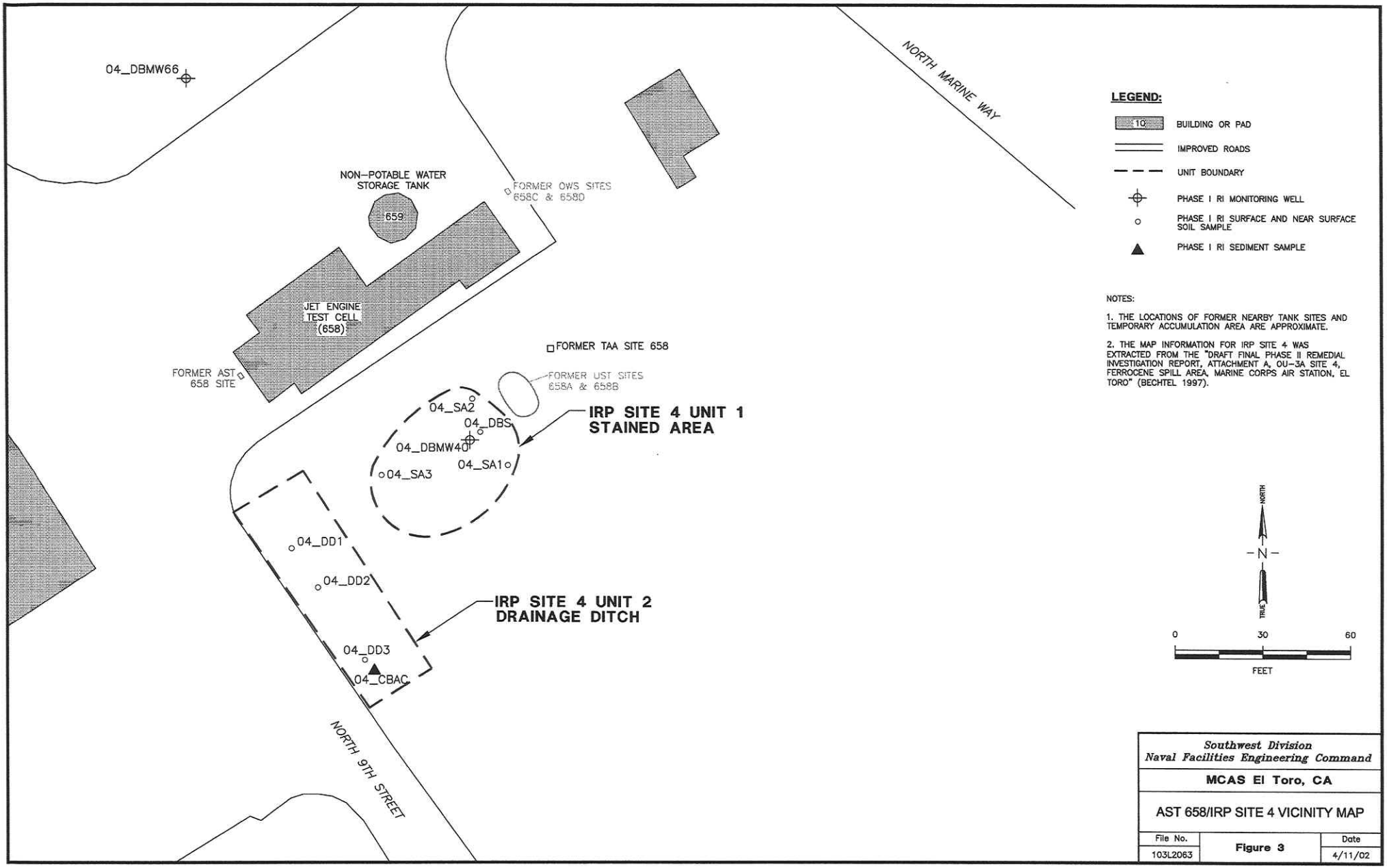
BUILDINGS 463 & 658

MARINE CORPS AIR STATION, EL TORO, CA

Figure 1 — 4 April 2002



BUILDING 658
JET ENGINE TEST CELL
SITE PLAN, ORIGINAL CONSTRUCTION DRAWINGS, 1972
MARINE CORPS AIR STATION, EL TORO, CA
Figure 2 4 April 2002



Southwest Division Naval Facilities Engineering Command		
MCAS El Toro, CA		
AST 658/IRP SITE 4 VICINITY MAP		
File No. 103L2063	**Figure 3**	Date 4/11/02

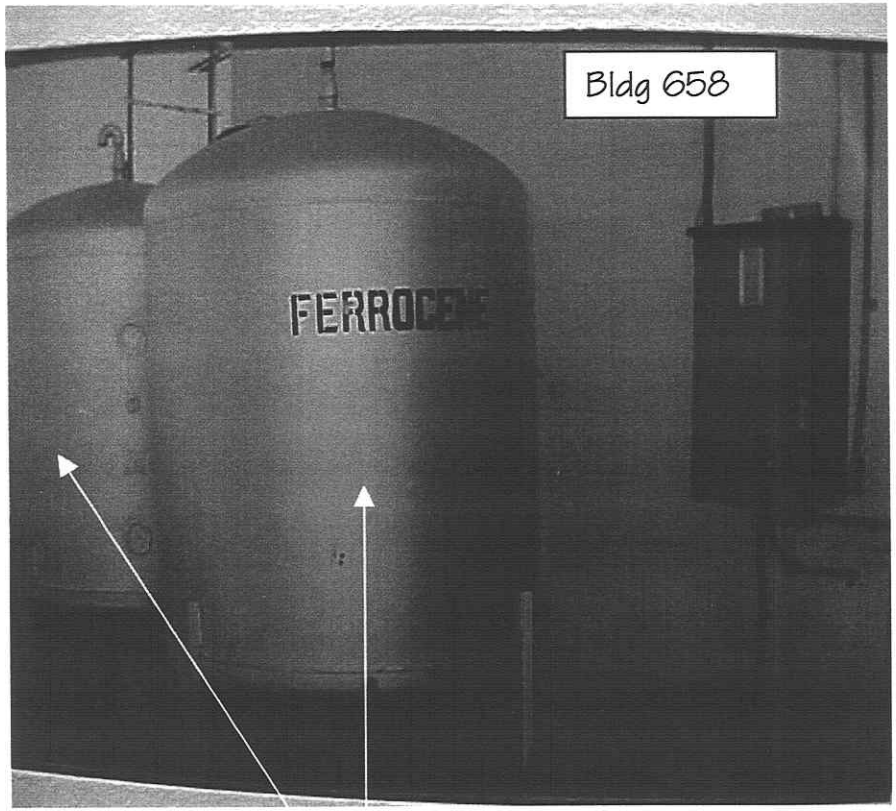
PHOTOGRAPHS

INFORMATION PACKAGE
ABOVE GROUND STORAGE TANK 658

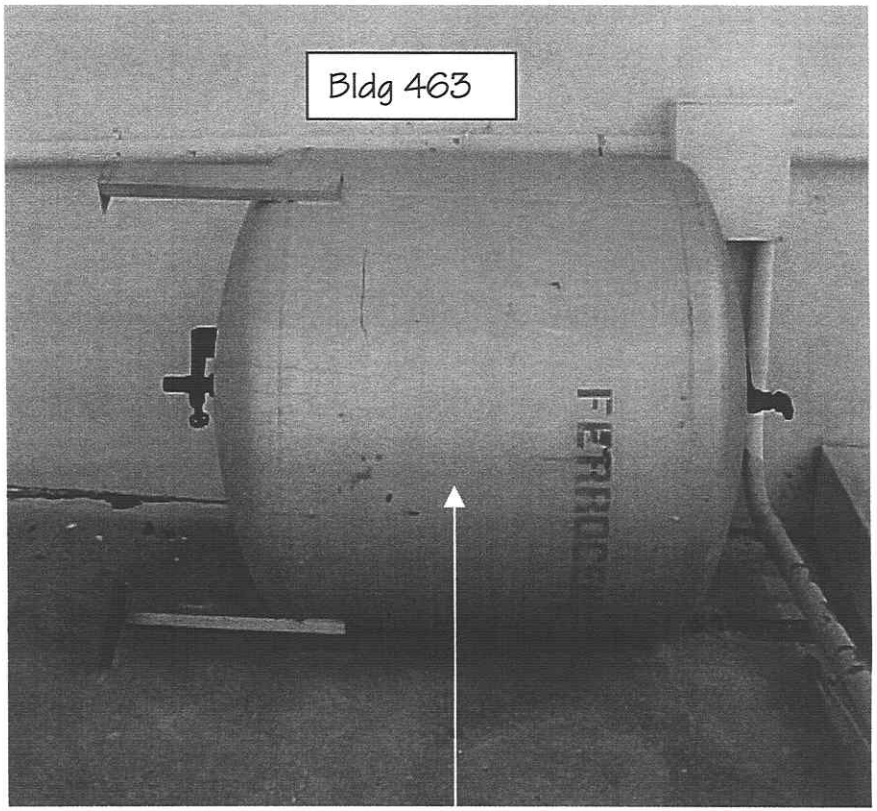
DATED 4 APRIL 2002

AST 658

Photographs of tank at original location at Building 658 and present location at Bldg 463. Photograph at Bldg 658 location is reproduction of undated slide from historical records.



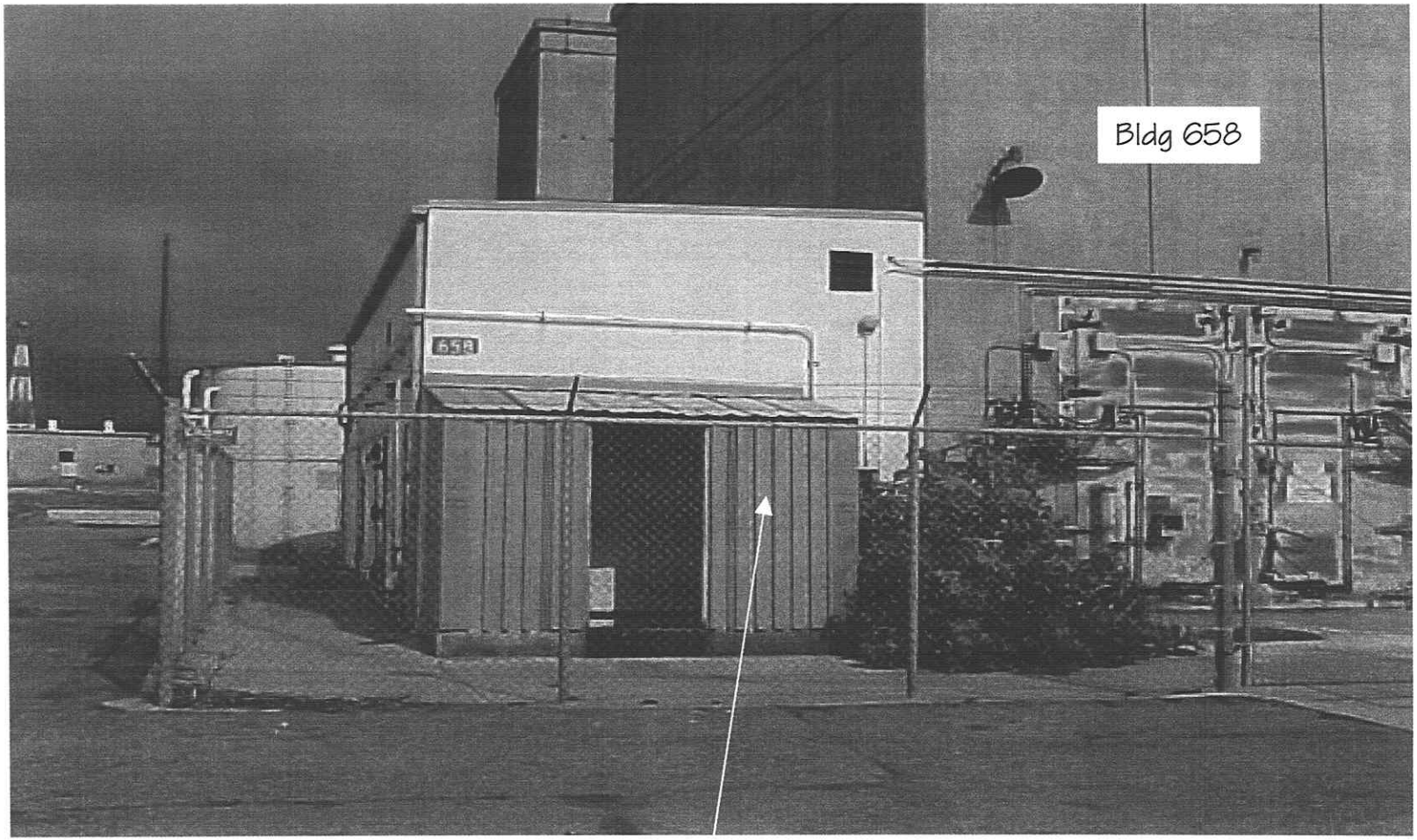
Photograph 1. Ferrocene tanks at original Bldg 658 location.
(photo taken from undated slide)



Photograph 2. Ferrocene tank at present Bldg 463 location.
(photo taken February 2001)

AST 658

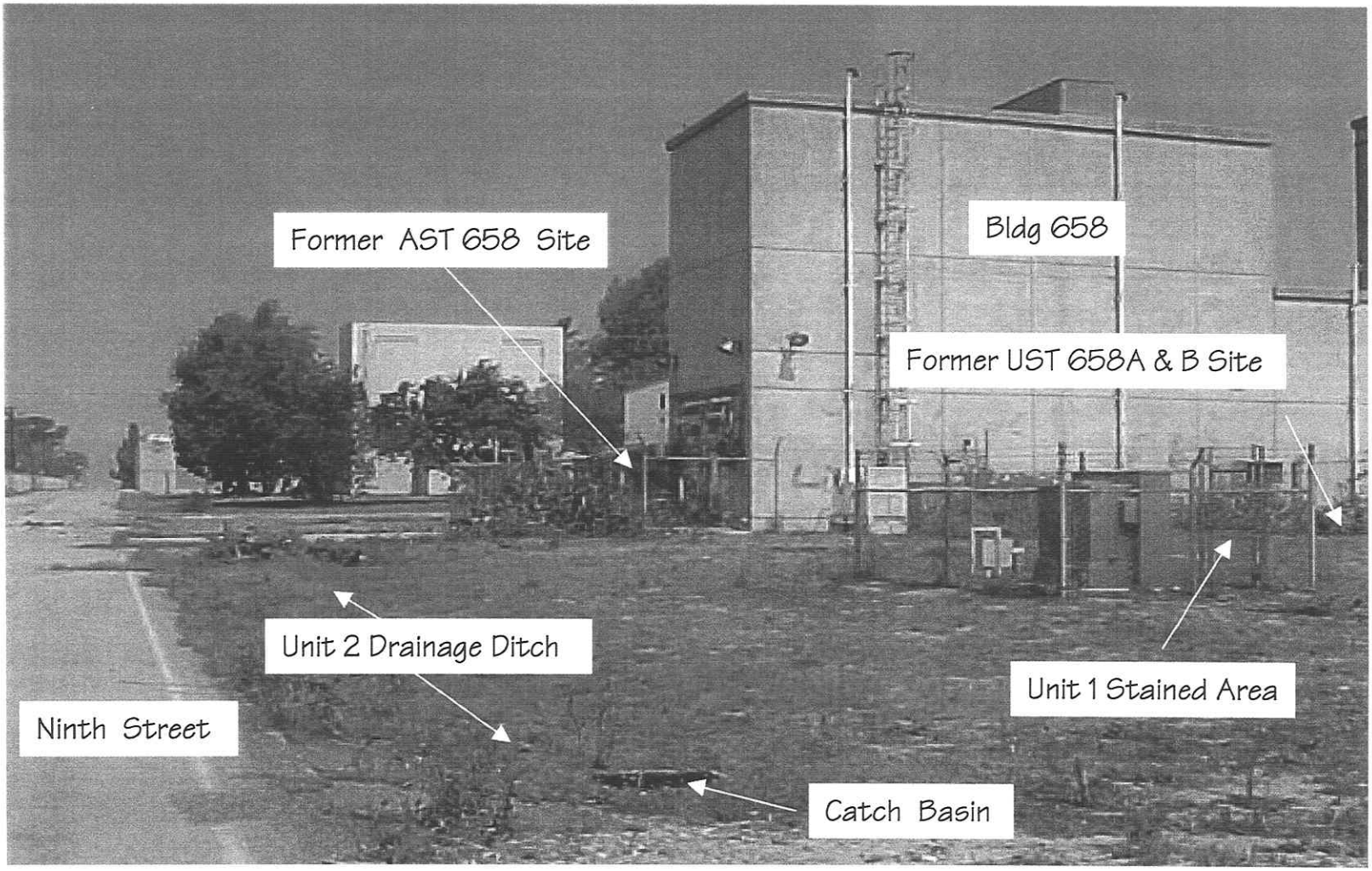
Photograph of Building 658 (Jet Engine Test Cell) and former AST 658 Site.



Photograph 3. Original location of AST 658.
Metal shed was constructed around 1986.
(photo taken March 2001)

AST 658

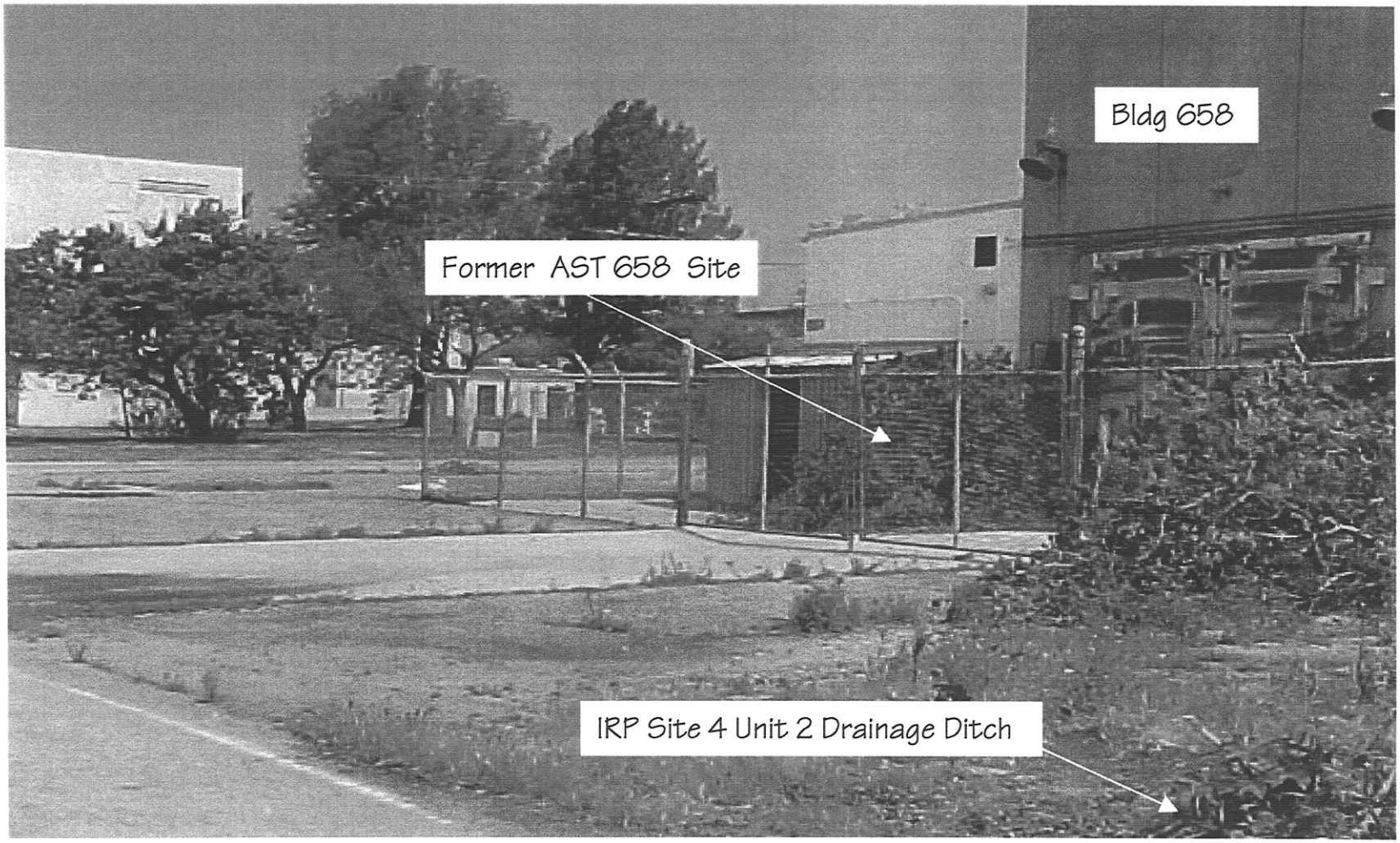
Photograph of Building 658, Former AST 658 Site, IRP Site 4
Ferrocene Spill Area (Units 1 & 2) and Former UST 658A & B Site.



Photograph 4.
(photo taken 4 April 2002)

AST 658

Photograph of Building 658 and former AST 658 Site.



Photograph 5.
(photo taken 4 April 2002)

Section 5
Appendix 1

Phase II Remedial Investigation, Attachment A, OU-3A Site 4, Ferrocene Spill Area, MCAS El Toro. Bechtel National, Inc., September 1997 (excerpts)

Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Room 135
San Diego, California 92132-5187

Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

DRAFT FINAL PHASE II REMEDIAL INVESTIGATION REPORT ATTACHMENT A OU-3A SITE 4, FERROCENE SPILL AREA MARINE CORPS AIR STATION EL TORO, CALIFORNIA

CTO-0079/0391

June 1997

Prepared by:

BECHTEL NATIONAL, INC.
401 West A Street, Suite 1000
San Diego, California 92101

Section 1
INTRODUCTION

This report presents the results of the Phase I Remedial Investigation (RI) performed for Site 4, Ferrocene Spill Area, of Marine Corps Air Station (MCAS) El Toro. No Phase II samples were collected at this site. The discussion includes site-specific RI information and analyses.

The following information pertinent to the Site 4 investigation is included in this attachment:

- a summary of the purpose and objectives of the RI, a general description and history of the site, and a summary of previous investigations (Section 1);
- a summary of the Phase I RI work performed (Section 2);
- a description of the physical characteristics of the site (Section 3);
- a discussion of nature and extent of contamination using Phase I soil data (Section 4);
- a fate-and-transport analysis for soil at the site (Section 5);
- a baseline human-health risk assessment based on Phase I data (Section 6);
- a summary of the RI, its conclusions, and a list of recommended actions (Section 7); and
- a list of references (Section 8).

1.1 SITE BACKGROUND

This section provides a general description of Site 4 and summarizes the site history.

1.1.1 Site Description

Site 4, Ferrocene Spill Area, is located in the northeast quadrant of MCAS El Toro, adjacent to Ninth Street and immediately southeast of Building 658, a jet engine testing facility (Figure 1-1). The site is bounded by Ninth Street to the south, Building 658 to the north and west, and Tank Farm No. 5 to the east. The site consists of two units: an oil-stained area (approximately 2,500 square feet) southeast of Building 658 and a drainage ditch (approximately 2,600 square feet) which received runoff from a ferrocene spill (Figure 1-2). The ditch drains to the east to a catch basin that discharges to Agua Chinon Wash.

Site boundaries for the MCAS El Toro Phase I RI were determined by consensus between the Navy and regulatory agencies prior to initiation of the Phase I RI. In August 1996, the Draft MCAS El Toro Community Reuse Plan was issued. According to this plan, Site 4 is located within an area designated for Research and Development/Light Industrial Land Use.

1.1.2 History

In August 1983, the contents of a 500-gallon tank (wash water and residual jet fuel) reportedly overflowed during washing and spilled onto the ground, draining into a ditch adjacent to Ninth Street (Jacobs Engineering 1993a). A catch basin at the southeast end of the ditch is part of the base storm drainage system and discharges into nearby Agua Chinon Wash. The spilled liquid reportedly contained approximately 5 gallons of ferrocene and hydrocarbon carrier solution. Ferrocene (dicyclopentadienyliron-$[C_5H_5]_2Fe$) is an organic compound used as an antiknock additive and catalyst in gasoline and jet fuel. It takes the form of an orange crystalline solid at standard temperature and pressure. This crystalline solid is relatively insoluble in water, but it is soluble in such volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) as alcohol, ether, and benzene (Jacobs Engineering 1993a).

In addition to the ferrocene spill, Site 4 is characterized by a stained area that was the result of oily discharge emanating from Building 658, observed over at least a 2-year period. Based upon the types of activities taking place at Building 658, the discharges may have consisted of heavy oils, solvents, and fuels (Jacobs Engineering 1993a).

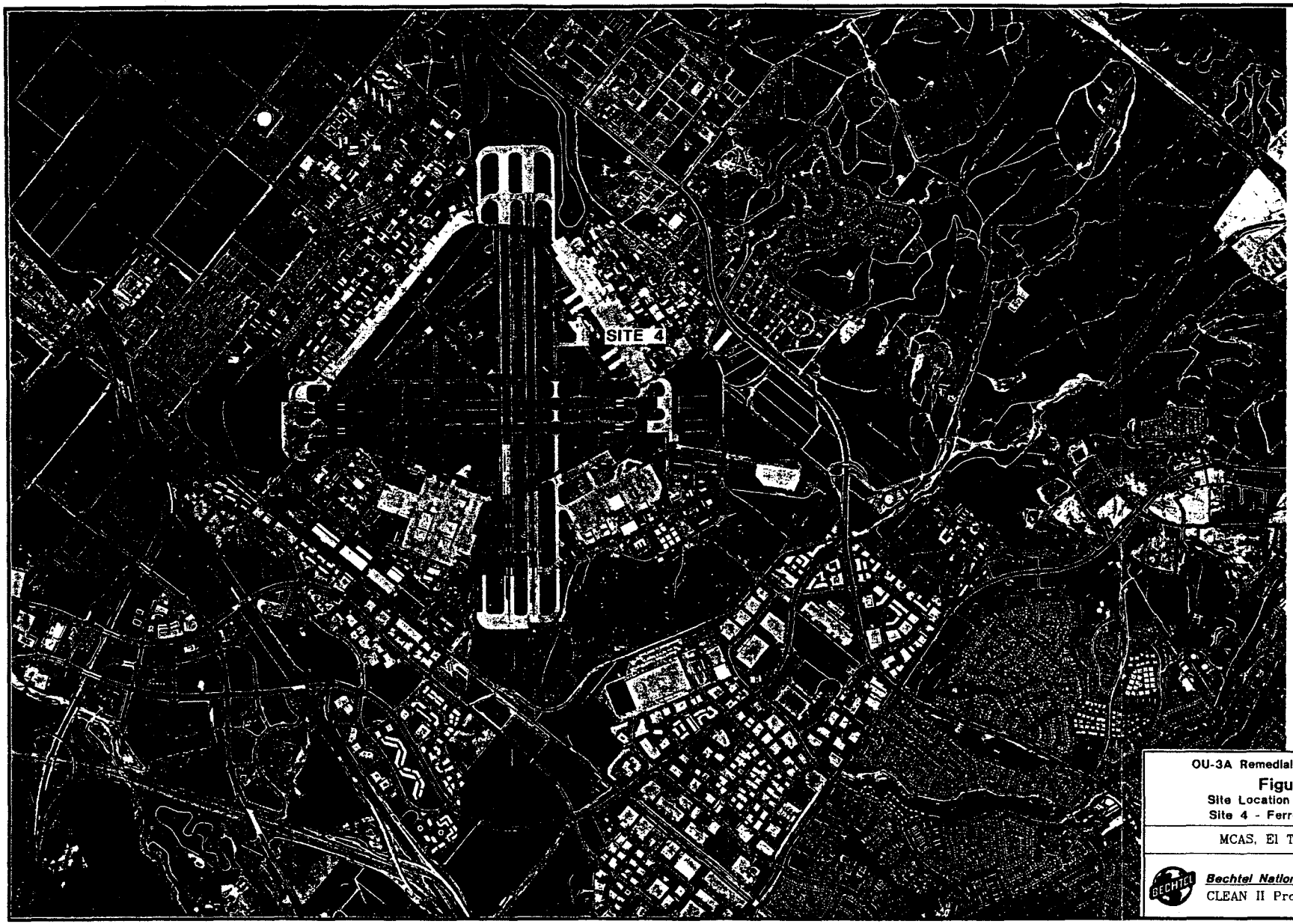
1.2 PREVIOUS INVESTIGATIONS

The following sections summarize the investigations at Site 4.

1.2.1 Phase I Remedial Investigation

The Phase I RI at Site 4 investigated two units (referred to as a stratum during Phase I), the Stained Area (Unit 1) and the Drainage Ditch (Unit 2) (Figure 1-2). The following site-specific activities were conducted during the investigation.

- Shallow-soil samples (0 to 2 feet below ground surface [bgs]) were collected from eight locations (five in Unit 1 and three in Unit 2).
- Shallow-soil samples were collected from one off-site location.
- Deeper subsurface-soil (greater than 10 feet bgs) samples were collected from one location in Unit 1 and from two off-site locations.
- One deep boring was drilled, sampled, and completed as a monitoring well (DBMW40) in Unit 1.
- One upgradient monitoring well (UGMW63) was drilled and sampled.
- One downgradient monitoring well (DGMW66) was drilled and sampled.
- One sediment sample was collected from the catch basin located in Unit 2.
- Groundwater samples were collected from each of the Site 4 monitoring wells following their completion and development.



OU-3A Remedial Investigation Report

Figure 1-1

Site Location Aerial Photograph
Site 4 - Ferrocene Spill Area

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 9/11/96
File No: -
Job No: 22214-079
Rev No: A

NORTH

-N-

TRUE

SOURCE: AERIAL PHOTOBANK INC.
SAN DIEGO, CALIFORNIA
DATE: 1/12/96

OU-3A Remedial Investigation Report

Figure 1-2

Site Aerial Photograph (1/12/96)
Site 4 - Ferrocene Spill Area

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 11/5/96
File No:
Job No: 22214-079
Rev No: A

4.2.1.2 SUMMARY OF NATURE AND EXTENT

VOCs, TPH, TAL metals (above background concentrations), and pesticides were reported in soil samples from Unit 1. Analytes from at least one of these chemical groups were reported at each soil sampling location in Unit 1. The two VOCs, acetone and toluene, were reported at concentrations less than 20 µg/kg. Diesel and gasoline reported in Unit 1 were found only in surface samples. Most of the TAL metals reported above background were in the 4-foot-bgs samples from 04_SA1 and 04_SA3. Pesticides were reported only in the surface sample from 04_DBS and the 4-foot-bgs sample from 04_SA2.

4.2.2 Unit 2, Drainage Ditch

The distribution of chemicals in shallow soil at Unit 2 is illustrated in Figure 4-2. Analytical data from the Phase I investigation are presented in Table 4-3 and in Appendix B4 (Table B4-2) of the Phase I RI Technical Memorandum.

4.2.2.1 FIXED-BASE LABORATORY RESULTS

Fixed-base laboratory results for shallow-soil samples from the Phase I RI of Unit 2 reported VOCs, SVOCs (including the subclass of polynuclear aromatic hydrocarbons [PAHs]), TPH, TAL metals, ammonia and total Kjeldahl nitrogen, and pesticides. Ammonia and total Kjeldahl nitrogen were analyzed to determine general chemistry at the site and are not discussed below.

Volatile Organic Compounds

Acetone, toluene, and xylenes were reported in shallow-soil samples from 04_DD1. All of these VOCs were reported in the surface sample from 04_DD1, acetone at a concentration of 4 µg/kg, toluene at 27 µg/kg, and xylenes at 100 µg/kg. Acetone was also reported in the field blank associated with this sample at the same order of magnitude. Acetone was also reported in the 4-foot-bgs sample from 04_DD1 at a concentration of 24 µg/kg.

Semivolatile Organic Compounds/Polynuclear Aromatic Hydrocarbons

Eleven SVOCs and PAHs were reported in three shallow-soil samples from two locations in Unit 2. The highest concentrations were for naphthalene (23,000 µg/kg) and 2-methylnaphthalene (2,900 µg/kg). Ten of the 11 SVOCs and PAHs were reported in the surface sample from boring 04_DD1. In addition, naphthalene was reported at 780 µg/kg in the 4-foot-bgs sample in 04_DD1 and benzyl butyl phthalate at 170 µg/kg in the surface sample from 04_DD3.

Table 4-3
Unit 2 Phase I Soil Data Summary

Analyte Name/ Method Code	Result Units	SAMPLE LOCATIONS/SAMPLE DEPTH (feet bgs[a]) 04_DD1 0	04_DD1 2	04_DD1 4	04_DD2 0	04_DD2 2	04_DD2 4	04_DD3 0	04_DD3 2	04_DD3 4
VOC[b]/U.S. EPA[c] CLP[d] OLM[e] 01.5										
Acetone	µg/kg[f]	4 J**[g]	12 U[h]	24[i]	11 U	11 U	13 U	11 U	11 U	12 U
Toluene	µg/kg	27	12 U	12 U	11 U	11 U	12 U	11 U	11 U	12 U
Xylenes	µg/kg	100	12 U	12 U	11 U	11 U	12 U	11 U	11 U	12 U
TPH[j]/CA LUFT/SW[k]										
Diesel	µg/kg	16,400,000	103,000	25,200	865,000	56,200	14,900 U	32,400	14,100 U	14,600 U
Gasoline	µg/kg	3,110	947	2,340	1,520	55.4 U	208	73.1	57.1 U	58.3 U
SVOC[l]/U.S. EPA CLP										
Benzyl butyl phthalate	µg/kg	890 U	770 U	810 U	740 U	730 U	790 U	170 J	750 U	770 U
bis(2-ethylhexyl)phthalate	µg/kg	380 J*[m]	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Phenol	µg/kg	270 J[n]	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
PAH[o]/U.S. EPA CLP OLM 01.5										
2-methylnaphthalene	µg/kg	2,900	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Benzo(a)pyrene	µg/kg	220 J	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Benzo(b)fluoranthene	µg/kg	240 J	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Benzo(k)fluoranthene	µg/kg	270 J	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Chrysene	µg/kg	220 J	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Fluoranthene	µg/kg	190 J	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Naphthalene	µg/kg	23,000	770 U	780 J	740 U	730 U	790 U	740 U	750 U	770 U
Pyrene	µg/kg	210 J	770 U	810 U	740 U	730 U	790 U	740 U	750 U	770 U
Pesticides/U.S. EPA CLP OLM 01										
4,4'-DDD[p]	µg/kg	42.4 J	3.98 UJ[q]	4.02 UJ	6.29 J	30.9 J	3.95 UJ	4.59 J	3.71 UJ	3.87 UJ
4,4'-DDE[r]	µg/kg	6.28 J	3.98 UJ	4.02 UJ	5.16 J	7.5 J	3.95 UJ	15.8 J	3.71 UJ	3.87 UJ
4,4'-DDT[s]	µg/kg	4.46 UJ	3.98 UJ	4.02 UJ	17.6 J	20.2 J	3.74 J	58.2 J	3.71 UJ	6.91 J

(table continues)

Table 4-3 (continued)

Analyte Name/ Method Code	Result Units	SAMPLE LOCATIONS/SAMPLE DEPTH (feet bgs) 04_DD1 0	04_DD1 2	04_DD1 4	04_DD2 0	04_DD2 2	04_DD2 4	04_DD3 0	04_DD3 2	04_DD3 4
alpha-chlordane	µg/kg	4.86 J	2.05 UJ	2.07 UJ	1.92 UJ	1.87 UJ	2.03 UJ	1.9 UJ	1.91 UJ	1.99 UJ
BHC[t]-delta	µg/kg	2.47 J	2.05 UJ	2.07 UJ	1.92 UJ	1.87 UJ	2.03 UJ	1.9 UJ	1.91 UJ	1.99 UJ
Dieldrin	µg/kg	32.8 J	3.98 UJ	4.02 UJ	3.72 UJ	3.63 UJ	3.95 UJ	3.7 UJ	3.71 UJ	3.87 UJ
Endosulfan II	µg/kg	14.1 J	3.98 UJ	4.02 UJ	3.72 UJ	12 J	3.95 UJ	3.7 UJ	3.71 UJ	3.87 UJ
Endosulfan sulfate	µg/kg	4.46 UJ	3.98 UJ	4.02 UJ	3.72 UJ	3.63 UJ	3.95 UJ	0.926 J	3.71 UJ	3.87 UJ
Endrin	µg/kg	13 J	3.98 UJ	4.02 UJ	3.78 J	12.5 J	3.95 UJ	3.7 UJ	3.71 UJ	3.87 UJ
Endrin aldehyde	µg/kg	5.16 J	3.98 UJ	4.02 UJ	3.72 UJ	8.78 J	3.95 UJ	3.67 J	3.71 UJ	3.87 UJ
Endrin ketone	µg/kg	3.42 J	3.98 UJ	4.02 UJ	3.72 UJ	7 J	3.95 UJ	0.524 J	3.71 UJ	3.87 UJ
Gamma-chlordane	µg/kg	8.11 J	2.05 UJ	2.07 UJ	1.92 UJ	1.81 J	2.03 UJ	0.302 J	1.91 UJ	1.99 UJ
Methoxychlor	µg/kg	23 UJ	20.5 UJ	20.7 UJ	19.2 UJ	18.7 UJ	20.3 UJ	3.26[u]	3.06[t]	19.9 UJ
Metals/U.S. EPA 200.7/S, 206.2/S, 239.2/S, 279.2/S, SW7471										
Aluminum (14,800)[v]	mg/kg[w]	6,670	7,890	11,900	11,200	8,910	7,670	4,880	8,220	8,970
Arsenic (6.86)	mg/kg	4.2	2.1 b	3.9	5.7	4.7	3.9	6.2	7.5	3.6
Barium (173)	mg/kg	87.7	125	161	171	133	127	78.9	117	129
Beryllium (0.669)	mg/kg	0.12 U	0.38 b[x]	0.44 b	0.43 b	0.3 b	0.31 b	0.24 b	0.37 b	0.33 b
Cadmium (2.35)	mg/kg	6.7	0.86 b	0.93 b	22.8	4.5	0.86 b	0.71 b	0.71 b	0.74 b
Chromium (26.9)	mg/kg	85.1	8.5	11.1	35.4	16.8	8.1	6.3	9.5	9.4
Cobalt (6.98)	mg/kg	5.9 b	3.5 b	6.1 b	8.9 b	5.7 b	4.4 b	3.2 b	4.6 b	4 b
Copper (10.5)	mg/kg	20.8	6.6	8.4	26.4	11.6	6.9	6.1	7.1	6.1 b
Lead (15.1)	mg/kg	224	4.5	4.1	86.4	43.1	6.9	14.8	7.6	5.8
Manganese (291)	mg/kg	142	210	259	370	233	221	135	221	211
Mercury (0.22)	mg/kg	0.84	0.05 U	0.03 U	0.58	0.08 U	0.03 U	0.25	0.04 U	0.04 U
Nickel (15.3)	mg/kg	18.8	6.3 U	8.3 U	17.8	9.2 b	4 U	5 U	5.1 U	4.8 U
Silver (0.539)	mg/kg	0.52 U	0.5 U	0.52 U	1.3 b	0.99 b	0.5 U	0.46 U	0.48 U	0.52 U

(table continues)

Table 4-3 (continued)

Analyte Name/ Method Code	Result Units	SAMPLE LOCATIONS/SAMPLE DEPTH (feet bgs) 04_DD1 0	04_DD1 2	04_DD1 4	04_DD2 0	04_DD2 2	04_DD2 4	04_DD3 0	04_DD3 2	04_DD3 4
Thallium (0.42)	mg/kg	0.17 U	0.17 b	0.17 b	0.19 U	0.16 U	0.17 U	0.15 U	0.16 U	0.17 U
Vanadium (71.8)	mg/kg	29	27.3	37.4	38.3	30.6	26.4	18.4	25.9	27.7
Zinc (77.9)	mg/kg	294	42.9	48.8	529	102	39.4	39.9	42.6	39.4
General Chemistry										
Ammonia-N	mg/kg	1.95	—[y]	0.674	3.99	0.887	1.31	1.35	1.37	1.17
Nitrate/nitrite-N	mg/kg	—	0.993	—	—	—	—	—	—	—

Notes:

[a] bgs – below ground surface
[b] VOC – volatile organic compound
[c] U.S. EPA – United States Environmental Protection Agency
[d] CLP – (U.S. EPA) Contract Laboratory Program
[e] OLM – organic laboratory method
[f] µg/kg – micrograms per kilogram
[g] J** – estimated value, compound is observed in field blanks at the same order of magnitude
[h] U – compound not detected
[i] compound is observed in field blanks at the same order of magnitude
[j] TPH – total petroleum hydrocarbons
[k] CA LUFT/SW – California Leaking Underground Fuel Tank/Solid Waste
[l] SVOC – semivolatile organic compound
[m] J* – estimated value, compound is observed in sample at concentration 5 to 10 times greater than that observed in the field blanks
[n] J – estimated value
[o] PAH – polynuclear aromatic hydrocarbon
[p] DDD – dichlorodiphenyldichloroethane
[q] UJ – concentration less than estimated detection limit
[r] DDE – dichlorodiphenyldichloroethene
[s] DDT – dichlorodiphenyltrichloroethane
[t] BHC – hexachlorocyclohexane
[u] reported sample value is 5 to 10 times greater than that observed in the field blanks
[v] values in parentheses are background concentrations for metals at Marine Corps Air Station El Toro (see Appendix D)
[w] mg/kg – milligrams per kilogram
[x] b – reported value is less than the contract-required detection limit but greater than or equal to the instrument detection limit
[y] — – not analyzed

Total Petroleum Hydrocarbons

Diesel was reported in the surface samples from each sampling location, the 2-foot-bgs samples from 04_DD1 and 04_DD2, and the 4-foot-bgs sample from 04_DD1. The highest concentration of diesel was 16,400 mg/kg in the surface sample from 04_DD1. All other diesel concentrations were less than 1,000 mg/kg. Gasoline was reported in the surface samples from each sampling location, the 2-foot-bgs sample from 04_DD1, and the 4-foot-bgs samples from 04_DD1 and 04_DD2. The highest concentration of gasoline was 3.11 mg/kg in the surface sample from 04_DD1.

Target Analyte List Metals

Eleven TAL metals (arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, silver, and zinc) were reported above background concentrations in shallow-soil samples from Unit 2. Metals were reported above background at all sampling locations. In the surface samples, seven metals were above background from 04_DD1, ten in 04_DD2, and one in 04_DD3. Five metals were above background in the 2-foot sample from 04_DD2 and one from the 2-foot-bgs sample in 04_DD3. The highest concentrations of lead (224 mg/kg, 14.8 times background) and mercury (0.84 mg/kg, 3.8 times background) were reported in the surface sample from 04_DD1. The highest concentration of arsenic (7.5 mg/kg, 1.1 times background) was in the 2-foot-bgs sample from 04_DD3. Cadmium (22.8 mg/kg, 9.7 times background) and zinc (529 mg/kg, 6.8 times background) concentrations were highest in the surface sample from 04_DD2. Figure 4-3 presents the data for TAL metals that were reported above background levels at Site 4.

Pesticides

Thirteen pesticides were reported in shallow soil at Unit 2 sampling locations. In 04_DD2 and 04_DD3, pesticides were reported in the surface, 2-foot-bgs, and 4-foot-bgs samples. Pesticides were also reported in the surface sample from 04_DD1. The highest pesticide concentration was 58.2 µg/kg of 4,4'-DDT in the surface sample from 04_DD3. All other pesticide concentrations were below 50 µg/kg.

4.2.2.2 SUMMARY OF NATURE AND EXTENT

VOCs, SVOCs and PAHs, TPH, TAL metals (above background concentrations), and pesticides were reported in soil samples from Unit 2. Analytes from at least one of these chemical groups was reported at all sample depths from each soil sampling location in Unit 2. However, the highest concentrations of VOCs, SVOCs/PAHs, and TPH in Unit 2 were reported in the surface sample from 04_DD1, which is located at the upstream end of the drainage ditch (sample location nearest to where ferrocene spill runoff entered the ditch. Several pesticides and TAL metals were also reported in the surface sample from 04_DD1.

4.2.3 Catch Basin Sediment Sample: Fixed-Base Laboratory Results

The classes of chemicals reported in sediment at the catch basin are illustrated in Figure 4-2. Analytical data from the Phase I investigation are presented in Table 4-4 and in Appendix B4 (Table B4-2) of the Phase I RI Technical Memorandum.

Fixed-base laboratory results for the sediment sample collected from the catch basin at Unit 4 from the Phase I RI reported VOCs and TAL metals.

4.2.3.1 VOLATILE ORGANIC COMPOUNDS

Acetone was reported at a concentration of 11 µg/kg.

4.2.3.2 TARGET ANALYTE LIST METALS

Seven TAL metals (antimony, cadmium, copper, lead, nickel, silver, and zinc) were reported above background levels. The metal exceeding its background level by the greatest amount was lead, reported at a concentration of 258 mg/kg (17.1 times background). Cadmium and copper were the only other metals reported at concentrations greater than twice their respective background levels. Figure 4-3 presents data for TAL metals reported above background.

Table 4-4
Catch Basin Phase I Sediment Data Summary

Analyte Name/Method Code	Result Units	SAMPLE LOCATIONS/SAMPLE DEPTH (feet bgs[a]) 04_CBAC 0
VOC[b]/U.S. EPA[c] CLP[d] OLM[e] 01.5		
Acetone	µg/kg[f]	11 J[g]
Metals/U.S. EPA 200.7/S, 239.2/S		
Aluminum (14,800)[h]	mg/kg[i]	4,150
Antimony (3.06)	mg/kg	3.5 b[j]
Arsenic (6.86)	mg/kg	3.5
Barium (173)	mg/kg	68.6
Cadmium (2.35)	mg/kg	4.9
Chromium (26.9)	mg/kg	20.8
Cobalt (6.98)	mg/kg	6.4 b
Copper (10.5)	mg/kg	49.4
Lead (15.1)	mg/kg	258
Manganese (291)	mg/kg	224
Mercury (0.22)	mg/kg	0.12
Nickel (15.3)	mg/kg	22.1
Silver (0.539)	mg/kg	0.62 b
Vanadium (71.8)	mg/kg	17.2
Zinc (77.9)	mg/kg	126

Notes:
- [a] bgs – below ground surface
- [b] VOC – volatile organic compound
- [c] U.S. EPA – United States Environmental Protection Agency
- [d] CLP – (U.S. EPA) Contract Laboratory Program
- [e] OLM – organic laboratory method
- [f] µg/kg – micrograms per kilogram
- [g] J – reported value is less than the contract-required detection limit but greater than or equal to the instrument detection limit
- [h] values in parentheses are background concentrations for metals at Marine Corps Air Station El Toro (see Appendix D)
- [i] mg/kg – milligrams per kilogram
- [j] b – estimated value, compound is observed in field blanks at the same order of magnitude

Section 7
CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions and recommendations of the RI conducted for Site 4. Because the physical and chemical conditions within Units 1 and 2 are not closely related, each unit was addressed as an individual area of concern for purposes of assessing risk and the need for further action. A sediment sample collected and analyzed from the catch basin on-site during the Phase I RI was also addressed as an area of concern separately from Units 1 and 2. Included in this section are brief summaries of the physical characteristics, nature and extent of contamination, fate and transport of contaminants, and results of the human-health risk assessment. These results furnish responses to data quality objective (DQO) decisions that provided the framework for the remedial investigation at Site 4. Recommendations are presented for future actions.

7.1 SUMMARY

The purpose of the Phase I RI was to characterize contamination to support the risk assessment and hazard index determinations for Site 4. No Phase II RI sampling was conducted at Site 4.

7.1.1 Physical Characteristics

Site 4 is located in the northeast quadrant of MCAS El Toro, adjacent to Ninth Street and immediately southeast of Building 658, a jet engine testing facility. The site is bounded by Ninth Street to the south, Building 658 to the north and east, and Tank Farm No. 5 to the east. The terrain in the immediate vicinity of the site is relatively flat. The site consists of two units. Unit 1 encompasses a small area southeast of Building 658. Most of this area is covered by grass that does not appear stressed. A small portion of this unit is covered by a transformer and associated concrete pad. The area containing the transformer is surrounded by a fence to limit access. Unit 2 is a drainage ditch that drains parallel to Ninth Street south of Building 658. The ditch is approximately 100 feet long and runs to the east to a catch basin; it is vegetated by grasses that show no signs of stress.

7.1.2 Nature and Extent of Contamination

Defining the nature and extent of contamination at Site 4 is an important aspect of addressing whether further action is necessary at the site. TPH, VOCs, SVOCs, TAL metals, and pesticides were present in shallow soil throughout Site 4. SVOCs, pesticides, and TAL metals were the primary contaminants identified at Site 4, and they are also the most widely distributed classes of chemicals present in shallow soil at the site. The distribution of the risk drivers identified in the Site 4 risk assessment is illustrated in Figure 7-1.

7.1.3 Fate and Transport

The fate-and-transport analysis evaluated release mechanisms and transport pathways for Site 4. The analysis indicates that the two potential migration pathways at Site 4 are air and surface water, and suggested that contaminants in soil at Site 4 are not readily mobilized and transported off-site. Further, due to the low net-infiltration rates and the persistence of the PAHs and metals in soil, transport of chemicals downward in the soil profile appears to be negligible.

7.1.4 Human-Health Risk Assessment

The human-health risk assessment was performed to determine whether contaminants at Site 4 present a carcinogenic and/or noncarcinogenic risk to human health. The significance of cancer and noncancer risk values is discussed in Section 6.6 of the main report. The results of the human-health risk assessment are summarized as follows. The following receptors were analyzed for human-health risk:

- on-site resident and
- on-site industrial worker.

The risks associated with Unit 1 are as follows:

- cancer risk for an on-site resident at Unit 1 is 1.9×10^{-5} using U.S. EPA and Cal-EPA toxicity criteria;
- cancer risk for an on-site industrial worker at Unit 1 is 5.7×10^{-6} using U.S. EPA and Cal-EPA toxicity criteria;
- the HI for an on-site resident at Unit 1 is 1.37 using U.S. EPA toxicity criteria; and
- the HI for an on-site industrial worker at Unit 1 is 0.049 using U.S. EPA toxicity criteria.

The risks associated with Unit 2 are as follows:

- cancer risk for an on-site resident at Unit 2 is 3.0×10^{-5} using U.S. EPA toxicity criteria and 3.6×10^{-5} using Cal-EPA toxicity criteria;
- cancer risk for an on-site industrial worker at Unit 2 is 1.4×10^{-5} using U.S. EPA toxicity criteria and 1.8×10^{-5} using Cal-EPA toxicity criteria;
- the HI for an on-site resident at Unit 2 is 0.75 using U.S. EPA toxicity criteria; and
- the HI for an on-site industrial worker at Unit 2 is 0.12 using U.S. EPA toxicity criteria.

The risks associated with the catch basin are as follows:

- cancer risk for an on-site resident at the catch basin is 1.9×10^{-7} using U.S. EPA toxicity criteria and 5.8×10^{-7} using Cal-EPA toxicity criteria;
- cancer risk for an on-site industrial worker at the catch basin is 3×10^{-8} using U.S. EPA toxicity criteria and 9.1×10^{-8} using Cal-EPA toxicity criteria;
- the HI for an on-site resident at the catch basin is 0.31 using U.S. EPA toxicity criteria; and
- the HI for an on-site resident at the catch basin is 0.021 using Cal-EPA toxicity criteria.

The cumulative cancer risks estimated for future residents and industrial workers at the catch basin are below 10^{-6}. The cancer risks estimated for future residents and industrial workers at Units 1 and 2 are within the acceptable risk range of 10^{-4} to 10^{-6} as stated in the National Oil and Hazardous Substances Pollution Contingency Plan. Arsenic is responsible for almost 100 percent of the carcinogenic risk at Unit 1 and more than 50 percent at Unit 2 in both the industrial and residential scenarios. These arsenic concentrations are not attributable to known historical site activities. Possible explanations for the high arsenic concentrations at the Site 4 could be:

- the concentrations of arsenic in soil in the immediate vicinity of Site 4 may have a higher background concentration than the statistically calculated background concentrations of arsenic for MCAS El Toro; and
- as discussed in Section 6.4.4 of this attachment, arsenic was widely used in various herbicides and pesticides in the past. (The area of MCAS El Toro was primarily agricultural prior to construction and expansion of the Station. Levels of arsenic at the site may be attributable to past agricultural or pest control practices.)

The cumulative HIs estimated for future residents and industrial workers at the catch basin and Unit 2 are below 1.0. The cumulative HI estimated for future industrial workers at Unit 1 is also below 1.0. Under the residential scenario at Unit 1, the cumulative HI estimate is 1.37. At Unit 1, the HI for individual systemic toxic effects exceeds 1.0 for neurotoxicity, respiratory, hematological, gastrointestinal, and reproductive effects. This exceedance is primarily due to manganese (44 percent). However, the HI for manganese at Unit 1 is only 1.3 times its HI at background. This indicates that the concentrations of manganese at Unit 1 are not significantly different from background at Site 4 Unit 1. Therefore, noncancer hazards at this unit are not considered significant.

The estimated cancer and noncancer risks presented are based on numerous assumptions, most of which are conservative. As a result of the cumulative effect of these conservative assumptions, the estimated risks are thought to substantially overestimate the actual risks.

7.2 CONCLUSIONS

Chemicals reported in shallow soil and sediment at Site 4 do not appear to pose an unacceptable risk to a potential on-site resident (or on-site industrial worker) based upon the reported range of concentrations in shallow soil and sediment and the conservatism in the calculated risk values in Units 1, 2, and the catch basin. Arsenic is responsible for more than half the estimated cancer risk at both units in Site 4. These arsenic concentrations are not attributable to known site activities. The concentrations of arsenic at Site 4 could be representative of a higher background level in the shallow soil in the vicinity of Site 4 or remnants of past pesticide and/or herbicide use.

The chemicals identified in soil at Site 4 do not pose an imminent risk to human health or the environment; they are stable in the physical system and are not expected to migrate from the site. The results of the habitat assessment indicated an absence of significant plant and wildlife habitat at Site 4.

7.2.1 Data Limitations and Recommendations for Future Work

The data collected during the Phase I and II RIs were sufficient to characterize the nature and extent of contamination, perform human-health risk assessment, and support decisions on the necessity for remedial actions at Site 4. No future work is necessary.

7.2.2 Recommended Actions

Based on the Comprehensive Environmental Response, Compensation, and Liability Act (1980), National Oil and Hazardous Substances Pollution Contingency Plan, and applicable or relevant and appropriate requirements, as well as the conservative nature of the risk assessment performed for this site, no remedial action is required to address contaminants at Site 4.

Section 5
Appendix 2

Record of Decision, OU-2A and OU-3A Sites, MCAS El Toro.
September 1997 (IRP Site 4 excerpts)

DECLARATION

SITE NAME AND LOCATION

Marine Corps Air Station (MCAS) El Toro
Operable Unit-3A, Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22
Operable Unit-2A, Site 25
Orange County, California

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25 at MCAS El Toro in Orange County, California. The document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the administrative record file for these sites.

The State of California (through the California Environmental Protection Agency, Department of Toxic Substances Control, and Santa Ana Regional Water Quality Control Board) and the U.S. Environmental Protection Agency concur with the selected remedy.

DESCRIPTION OF THE SELECTED REMEDY: NO ACTION

The selected remedy for Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25 is no action. In selecting the no action remedy for these sites, the Navy has determined that the existing condition of the sites is protective of human health and the environment.

Although no deed restrictions are required because of chemicals present in soils at the no action sites, shallow groundwater underlying Sites 9, 10, 13, 15, 21, 22, and portions of Site 25 is contaminated by trichloroethene and tetrachloroethene. Remedial investigations have shown that the contamination does not originate from these sites but from Site 24, the volatile organic compound source area. Use restrictions for several sites (including Site 24 and the no action sites listed above) prohibiting drilling of wells and/or extraction of groundwater and allowing access for groundwater monitoring and maintenance of equipment associated with groundwater remediation will be addressed in the Proposed Plan(s) and Record(s) of Decision for Operable Unit-1 and -2A regarding groundwater.

DECLARATION STATEMENT

Based on extensive field investigations, laboratory analyses, and a thorough assessment of potential human-health risks at each location and of potential ecological risks at Site 25, the Navy has determined that no remedial action is necessary to assure the protection of human health and the environment at Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25. The Remedial Investigations of these sites show that contamination is limited to the shallow soil interval (Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22) and to sediment and

surface water (Site 25). The human health and ecological risk assessments show that the chemicals present in these media do not present an unacceptable risk to human health or the environment. Therefore, no remedial action is required at these sites. Since hazardous substances are not present at concentrations above unacceptable levels, CERCLA Section 121 cleanup standards do not apply.

Signature: _____ Date:_____

Mr. Joseph Joyce
Base Closure and Realignment Environmental Coordinator
Marine Corps Air Station El Toro

Signature: _____ Date:_____

Mr. John E. Scandura, Chief
Southern California Operations
Office of Military Facilities
Department of Toxic Substances Control

Signature: _____ Date:_____

Mr. Daniel D. Opalski, Chief
Federal Facilities Cleanup Branch
United States Environmental Protection Agency, Region IX

Signature: _____ Date:_____

Mr. Gerald J. Thiebeault
Executive Officer
Regional Water Quality Control Board, Santa Ana Region

Section 1

SITE NAME, LOCATION, AND DESCRIPTION

1.1 SITE NAME

The eleven sites addressed in this decision document are contained in operable units (OUs)-2A and -3A, at Marine Corps Air Station (MCAS) El Toro. The Navy Installation Restoration Program (IRP) site numbers and names follow.

OU-2A:

- Site 25, Major Drainages

OU-3A:

- Site 4, Ferrocene Spill Area
- Site 6, Drop Tank Drainage Area No. 1
- Site 9, Crash Crew Pit No. 1
- Site 10, Petroleum Disposal Area
- Site 13, Oil Change Area
- Site 15, Suspended Fuel Tanks
- Site 19, Aircraft Expeditionary Refueling Site
- Site 20, Hobby Shop
- Site 21, Materials Management Group
- Site 22, Tactical Air Fuel Dispensing System

1.2 SITE LOCATION

MCAS El Toro lies in a semiurban agricultural area in southern California, approximately 8 miles southeast of the city of Santa Ana and 12 miles northeast of the city of Laguna Beach (Figure 1-1). Land northwest of the Station is used for agricultural purposes. The land to the south and northeast is used mainly for commercial, light industrial, and residential purposes. Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25 are located throughout the Station as shown in Figure 1-2.

1.3 SITE DESCRIPTION

MCAS El Toro is located on the Tustin Plain, a broad alluvial valley. The Station comprises runways, aircraft maintenance and training facilities, housing, shopping facilities, and other support facilities totaling 4,478 acres. OU-3A no action site elevations range from approximately 240 to 400 feet above mean sea level and are located adjacent to the runways and other industrialized areas of the Station. Each of the OU-3A sites is relatively flat. Most of the sites are covered by asphalt, concrete, or hard-packed soil that is partially vegetated. None of these sites contains any significant ecological habitat. With the exception of Site 12 (immediately adjacent to an exposed

Section 5

SUMMARY OF SITE CHARACTERISTICS

Interpretation of the nature and extent of contamination at Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25 is based on the Phase I and II RI data presented in the Draft Final OU-3A and Site 25 RI reports (BNI 1997a,b). These data include the results of shallow and deeper subsurface soils investigations, groundwater investigations, soil gas investigations, sediment and surface-water investigations, aerial photograph reviews, and interviews with MCAS El Toro personnel.

The Phase I RI was conducted during 1992 and 1993. The Phase II RI was conducted during 1995 and 1996. The Phase II investigation consisted of a review of data gathered previously (e.g., interviews, aerial photograph surveys, soil gas surveys, results of previous investigations) and additional sampling and analysis designed to fill in data gaps from the Phase I investigation and to provide information necessary to conduct a baseline human-health risk assessment (at all sites) and an ecological risk assessment (at Site 25).

The sections that follow provide a history of the contamination at each site, a summary of sampling performed during the Phase I and II investigations, and tables containing site-specific sampling results. The Phase I and II investigations showed that contamination is limited to shallow soils at Sites 4, 6, 9, 10, 13, 15, 20, 21, and 22; and to surface water and sediment at Site 25. Categories of compounds detected in soils at these sites include VOCs, SVOCs, total petroleum hydrocarbons (TPH), pesticides, herbicides, PCBs, dioxins, and metals.

The site-specific tables summarize the contaminants found at each site. As discussed in Table 1-1, most of the OU-3 sites were divided into units to facilitate the RI. Site-specific results are also presented by unit or groups of units. Grouping of units was based on the location of the site units relative to each other, the nature of historic activities, the nature and magnitude of the chemical contaminants, and physiographic characteristics of the various units. TPH results are excluded from these tables because human-health risks were based on the constituents of TPH (e.g., benzene, toluene, ethylbenzene, xylenes, polynuclear aromatic hydrocarbons) rather than total TPH because a toxicity criterion has not been developed for TPH.

A complete discussion of sampling locations and methodologies, compounds detected at each site, and a discussion of the nature and extent of contamination appears in the Phase II Draft Final RI reports for OU-3A and Site 25 (BNI 1997a,b).

5.1 SITE 4

Site 4 is located in the northeast quadrant of MCAS El Toro. In August, 1983, the contents of a 500-gallon tank (wash water and residual jet fuel) reportedly overflowed during washing and spilled onto the ground, draining into a ditch adjacent to Ninth Street (Jacobs Engineering 1993a). The spilled liquid reportedly contained approximately 5 gallons of ferrocene and hydrocarbon carrier solution. Ferrocene is an organic compound used as an antiknock additive and catalyst in gasoline and jet fuel. In addition to the ferrocene spill, Site 4 is characterized by a stained area that was the result of oily discharge emanating from Building 658, observed over at least a 2-year period. Based

upon the types of activities taking place at Building 658, the discharges may have consisted of heavy oils, solvents, and fuels (Jacobs Engineering 1993a).

Twenty-one shallow-soil (0 to 10 feet below ground surface [bgs]) samples and seven deeper subsurface-soil (greater than 10 feet bgs) samples were collected from eight soil boring or monitoring well locations within Site 4 boundaries during the Phase I investigation. Six soil samples (two shallow samples and four deeper subsurface samples) were also collected from two soil boring located off-site. In addition, one sediment sample was collected from a catch basin located within Unit 2 and groundwater samples were taken from three Site 4 monitoring wells. A Phase II RI was not conducted at this site because the results of the Phase I investigation were considered adequate to characterize the nature and extent of contamination. Table 5-1 summarizes the results of the Phase I investigation. Chemicals detected in shallow soil at Site 4 included VOCs, SVOCs, TPH, pesticides, and metals above MCAS El Toro background levels.

5.2 SITE 6

Site 6 is located in the southeast quadrant of MCAS El Toro. From approximately 1969 to 1983, aircraft drop tanks were transported to Site 6 where their remaining fuel was drained from the tanks. Residual JP-5 fuel in the tanks was washed out onto the concrete apron, and the combined fuel/rinsewater ran onto the adjacent grassy area. It is estimated that approximately 1,400 gallons of JP-5 fuel were drained from the drop tanks onto the concrete apron and washed onto the adjacent areas. In addition to fuels, waste lubricant oils from maintenance operations were also reportedly stored in drums and staged in the area. It is estimated that 300 gallons of waste oil leaked from these storage drums (Brown and Caldwell 1986).

Twenty-two shallow-soil samples, six deeper subsurface-soil samples, and one sediment sample from a catch basin were collected at Site 6 during the Phase I investigation. In addition, two shallow-soil samples and four deeper subsurface-soil samples were collected from three off-site locations. Phase II soil sampling included 7 samples in Unit 1, 6 samples in Unit 2, and 13 samples in Unit 3. All Phase II samples were taken from the shallow-soil interval. Table 5-2 summarizes the results of the Phase I and II investigations. Chemicals detected at Site 4 included VOCs, SVOCs, TPH, and metals. above MCAS El Toro background levels.

5.3 SITE 9

Site 9 is located in the southwest quadrant of MCAS El Toro. Between 1965 and 1971, the site was used as a training area for MCAS El Toro crash crew firefighters. During training exercises, two pits were filled with water and covered with various mixtures of residual fuels and other combustible fluids (e.g., JP-5 fuel, aviation gasoline, crankcase oil, and other wastes). The mixtures were then ignited and extinguished by the firefighters. Water was used as the primary means of extinguishing the fires during the

Section 5
Appendix 3

Tank Closure Report, USTs 658A and 658B.
OHM Remediation, 27 March 1998 (excerpts)

COUNTY OF ORANGE
HEALTH CARE AGENCY

PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH

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FAX: (714) 972-0749

April 24, 1998

Capt. Jeff Matthews
Director, Environmental Engineering Division
Commanding General
AC/S Environmental 1AU
Marine Corps Air Station El Toro
P.O. Box 95001
Santa Ana, CA 92709-5001

Subject: **Completion of Tank Removal Project**

RE: Marine Corps Air Station El Toro
Tanks #658A and 658B
Santa Ana, CA 92709

Dear Capt. Matthews:

This is in response to your request for a confirmation of the completion of the tank removal project. With the provision that the results for the soil samples obtained during the tank removal on January 26, 1998, were accurate and representative of existing conditions, it is the position of this office that no significant soil contamination has occurred at the above noted facility location.

It should be pointed out that this letter does not relieve you of any responsibilities mandated under the California Health and Safety Code if additional or previously unidentified contamination is discovered at the subject site.

If you have any questions regarding this matter, please contact Arghavan Rashidi-Fard at (714) 667-3713.

Sincerely,

Deborah A. Greco, M.S.
Supervising Hazardous Waste Specialist
Hazardous Materials Management Section
Environmental Health Division

cc: Patricia Hannon, Santa Ana Regional Water Quality Control Board

OHM Remediation
Services Corp.
A Subsidiary of OHM Corporation

March 27, 1998

Contracting Officer
Naval Facilities Engineering Command, Southwest Division
Mr. Dave Jesperson 57 CS1.DJ
Building 131
1220 Pacific Highway
San Diego, California 92132-5187

Attn: Ms. Lynn Marie Hornecker, Code 56MC.LMH

Re: Tank Closure Report
Underground Storage Tanks (USTs) 658A and 658B at
Marine Corps Air Station El Toro, California
SWDIV Contract No. N68711-93-D-1459
DCN SW 4926, Delivery Order No. 112

This Tank Closure Report summarizes the field activities conducted and associated with the closure of two underground storage tanks (USTs) designated as USTs 658A and 658B at Marine Corps Air Station, El Toro, California (hereinafter referred to as "the Station"). The location of the Station is shown on Figure 1-1, Facility Location Map.

Building 658, Engine Test Cell is located in the northeast quadrant of the Station, west of Agua Chinon Wash. USTs 658A and 658B were located approximatley 12 feet southeast of Building 658. According to the Station's Base Realignment and Closure Cleanup Plan - 1997, USTs 658A and 658B were identified each as 10,000 gallon steel USTs, installed in 1972 for storage of JP-5 fuel. The UST locations are shown on Figure 1-2, Location Map.

Summary of Field Activities
Field activities were conducted in accordance with the approved *Draft Work Plan, Remediation of Various Underground Tanks at the Marine Corps Air Station El Toro, California, OHM 1995*. Details pertaining to USTs 658A and 658B are described in the Tank Closure Summary Sheet provided as Appendix A.

Permitting and Utility Investigation
Prior to initiating field activities, OHM completed an Orange County Health Care Agency (OCHCA) Facility Modification Application and received approval (Plan Check No. 97-323) for the removal of USTs 658A and 658B. The OCHCA Facility Modification Application and Approval form is provided as Appendix B.

A geophysical survey of the UST area was conducted by the OHM subcontractor, Geovision Geophysical Services Inc. to locate the underground utilities in the area. The Geophysical Survey Data is provided in Appendix C.

UST Gauging and Removal

Both USTs 658A and 658B were gauged on January 20, 1998. Approximately 450 gallons of liquid product mixed with water was recovered in each of the USTs. The liquid product was pumped out from both of the USTs on January 21, 1998 and transferred to the separate storage tank (which stores liquid products from the various USTs) at the Station's Central Treatment Facility (CTF) compound (operated and maintained by OHM under another DO).

Excavation procedures commenced on January 21, 1998 by exposing the tops of the steel USTs. During exposure of the USTs, there were no noticeable stains or odors from the excavation. After exposing the tops of the USTs, approximately 40 feet of piping associated with the USTs 658A and 658B was exposed and removed. Both USTs were removed on January 21, 1998. Both USTs were in good condition with no noticeable holes or openings.

Piping associated with the USTs was removed in the vicinity of the tank excavations. The ends of the piping were capped, sealed and grouted with cement, in concurrence with the OCHCA field inspector.

Confirmation Soil Sampling, Analysis, and Results

On January 26, 1998, two confirmation soil samples were collected from the excavation bottom of UST 658A (sample identification numbers 20242-658A-088 and 20242-658A-091) and two confirmation samples were collected from the excavation bottom of UST 658B (sample identification numbers 20242-658B-092 and 20242-658B-093). Samples were collected in the presence of the OCHCA field inspector. The confirmation soil sampling locations are shown in Appendix D, Land Surveying Report and Soil Sample Locations.

The analytical results of the soil samples collected from the UST excavations are presented in Table 1, Confirmation Soil Sample Analytical Results - USTs 658A and 658B. Confirmation soil samples from UST 658A revealed total petroleum hydrocarbons (TPH) as diesel at a concentration of 12 mg/kg. Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) were not detected in the soil samples from UST 658A. TPH and BTEX were not detected in the confirmation soil samples from UST 658B.

Based on review of the analytical results of the soil samples and the observed non-impacted condition of the excavation soil, no further excavation was conducted. Laboratory analytical reports provided by VOC Analytical Laboratories, Inc. are included in Appendix E. Photographs of the field activities are provided in Appendix F, Site Photographs.

Waste Management

On January 21, 1998, approximately 900 gallons of product mixed with water was pumped from the two USTs. The product from USTs 658A and 658B is being stored in separate storage tank at the Station's CTF compound for transport to the Station's Defense Reutilization and Marketing Office (DRMO) compound for recycling.

Approximately 400 gallons of decontamination rinsate water generated from USTs cleaning activities was treated through the Station's carbon adsorption treatment system (operated and maintained by OHM under another phase of this contract), and the treated effluent water was transferred to the Station's Golf Course Holding Tank for re-use.

Approximately 500 cubic yards of soil was removed from the USTs 658A and 658B excavation. The excavated soil was staged on-site and covered with plastic liner for subsequent sampling and backfilling.

A Marine Chemist certified both USTs "clean" on January 22, 1998 prior to transportation to the Station's DRMO yard for recycling. On January 26, 1998 both the USTs and associated piping were transported to the Station's DRMO yard for recycling. Copies of the Marine Chemist Certification and the DRMO receipt are included as Appendix G.

Land Surveying

After completing the field activities at the UST 658 site, the excavation limits and sampling locations were surveyed by a California-registered land surveyor from Calvada Surveying, Inc. The land surveying data for USTs 658A and 658B are presented in Appendix D.

Site Restoration

Following the direction of the OCHCA field inspector and with the concurrence of the Station's ROICC, excavation backfilling commenced on January 26, 1998. The excavated stockpiled soil was used for backfilling the excavations. Prior to backfilling, two samples were collected from the excavated, stockpiled soil (sample identification numbers 20242-658SP-089 and 20242-658SP-090). TPH and BTEX were not detected in the soil samples from the excavated, stockpiled soil. The analytical results of the soil samples collected from the stockpiles are presented in Table 1, Confirmation Soil Sample Analytical Results - USTs 658A and 658B. Laboratory analytical reports provided by VOC Analytical Laboratories, Inc. are included in Appendix E.

An additional 200 cubic yards of clean stockpile soil near Station's Quarry Road was used to backfill the excavations to original grade level.

Backfill soil was spread in loose, shallow lifts then wheel-rolled with a rubber-tire loader for compaction. R.T. Frankian and Associates performed compaction tests. The compaction tests revealed greater than 90 percent relative compaction at the UST 658A

and 658B excavations. A copy of the compaction results is provided in Appendix H, Compaction Test Field Reports.

Conclusion and Recommendation

Based on the information presented in this report and a review of the analytical results, the following conclusions are reached:

- USTs 658A and 658B were removed and recycled.
- There was no evidence of spillage or areas of heavy stains observed in the excavations.
- The analytical results of the confirmation soil samples collected from the excavation indicate that the maximum concentration of TPH is 12 mg/kg; BTEX compounds were not detected in the confirmation soil samples.
- There was no groundwater encountered in the excavation.

Based on the information provided in this report, OHM, on behalf of the Station, recommends that a "No Further Action" status be granted by OCHCA for USTs 658A and 658B.

Should you have any questions or comments, please feel free to contact the undersigned at (714) 263-1146.

Sincerely,
OHM Remediation Services Corporation

Dhananjay Rawal
Project Engineer

Jay Neuhaus, R.G.
Project Manager

Attachments:

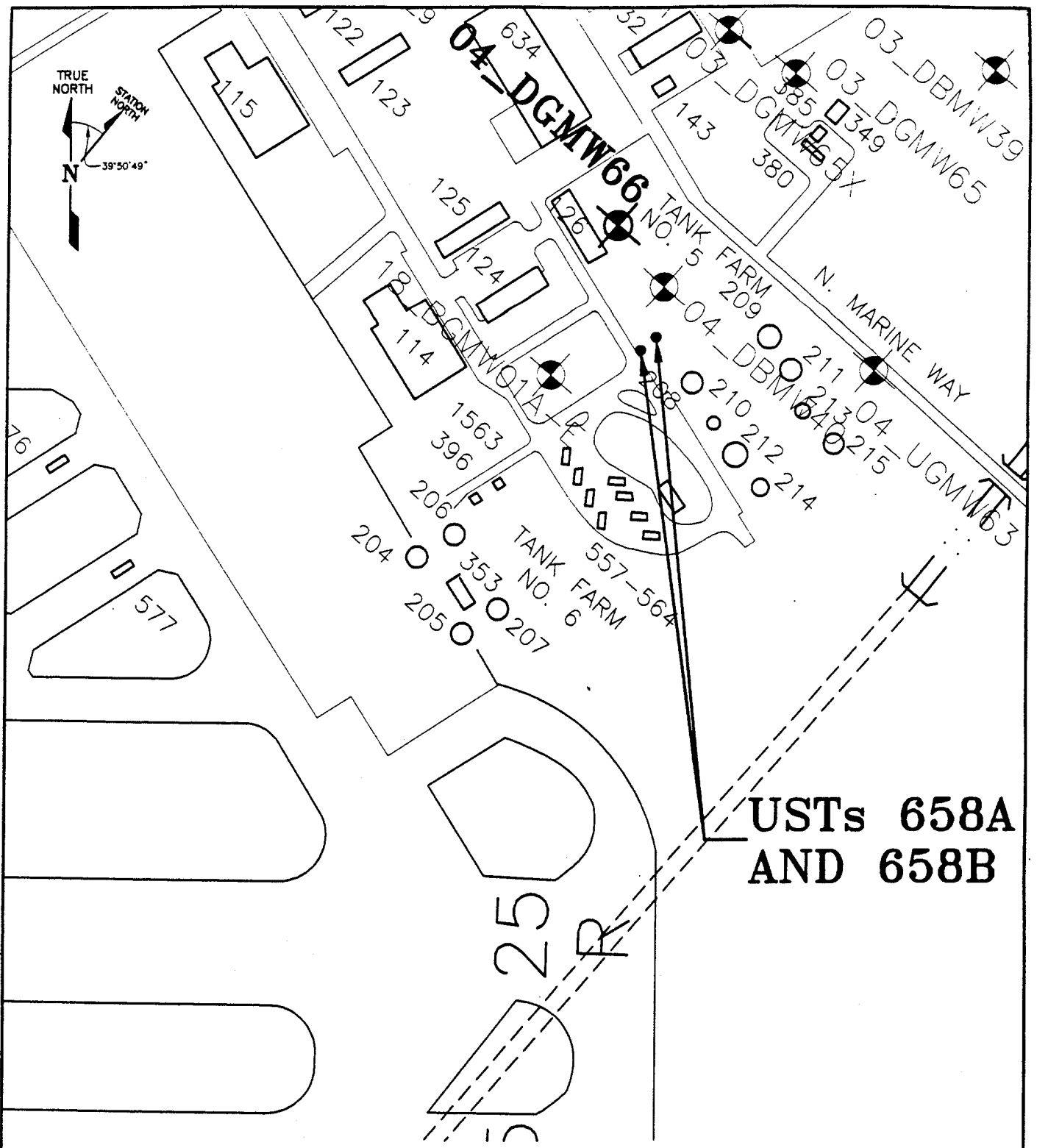
Appendix A	Tank Closure Summary Sheet
Appendix B	OCHCA Facility Modification Application
Appendix C	Geophysical Survey Data
Appendix D	Land Survey Data
Appendix E	Laboratory Analytical Reports
Appendix F	Site Photographs
Appendix G	Marine Chemist Certification and DRMO Receipt
Appendix H	Compaction Test Field Reports

Table 1
Confirmation Soil Sample Analytical Results - USTs 658A and 658B

OHM Sample Number		20242-658A-088	20242-658A-091	20242-658B-092	20242-658B-093	20242-658SP-089
Sample Location		UST-658A SW	UST-658A SE	UST-658B NW	UST-658B NE	UST-658 STKPL N
Date Collected		01/26/98	01/26/98	01/26/98	01/26/98	01/26/98
Sample Depth (feet below ground surface)		14.5	14.5	14.5	14.5	
	Unit					
CA LUFT 8015M						
TPH as Diesel	mg/kg	12	10 U	10 U	11 U	11 U
TPH as JP-5	mg/kg	11 U	10 U	10 U	11 U	11 U
EPA 418.1						
Total Recoverable Petroleum Hydrocarbon	mg/kg	56 U	51 U	52 U	51 U	55 U
EPA 8020						
Benzene	µg/kg	5.6 U	5.1 U	5.2 U	5.1 U	5.5 U
Ethylbenzene	µg/kg	5.6 U	5.1 U	5.2 U	5.1 U	5.5 U
Toluene	µg/kg	5.6 U	5.1 U	5.2 U	5.1 U	5.5 U
Xylenes (total)	µg/kg	22 U	20 U	21 U	21 U	22 U
ASTM D 2216						
Percent Moisture	Percent	11	2.4	4.7	2.5	9.7

Table 1
Confirmation Soil Sample Analytical Results - USTs 658A and 658B

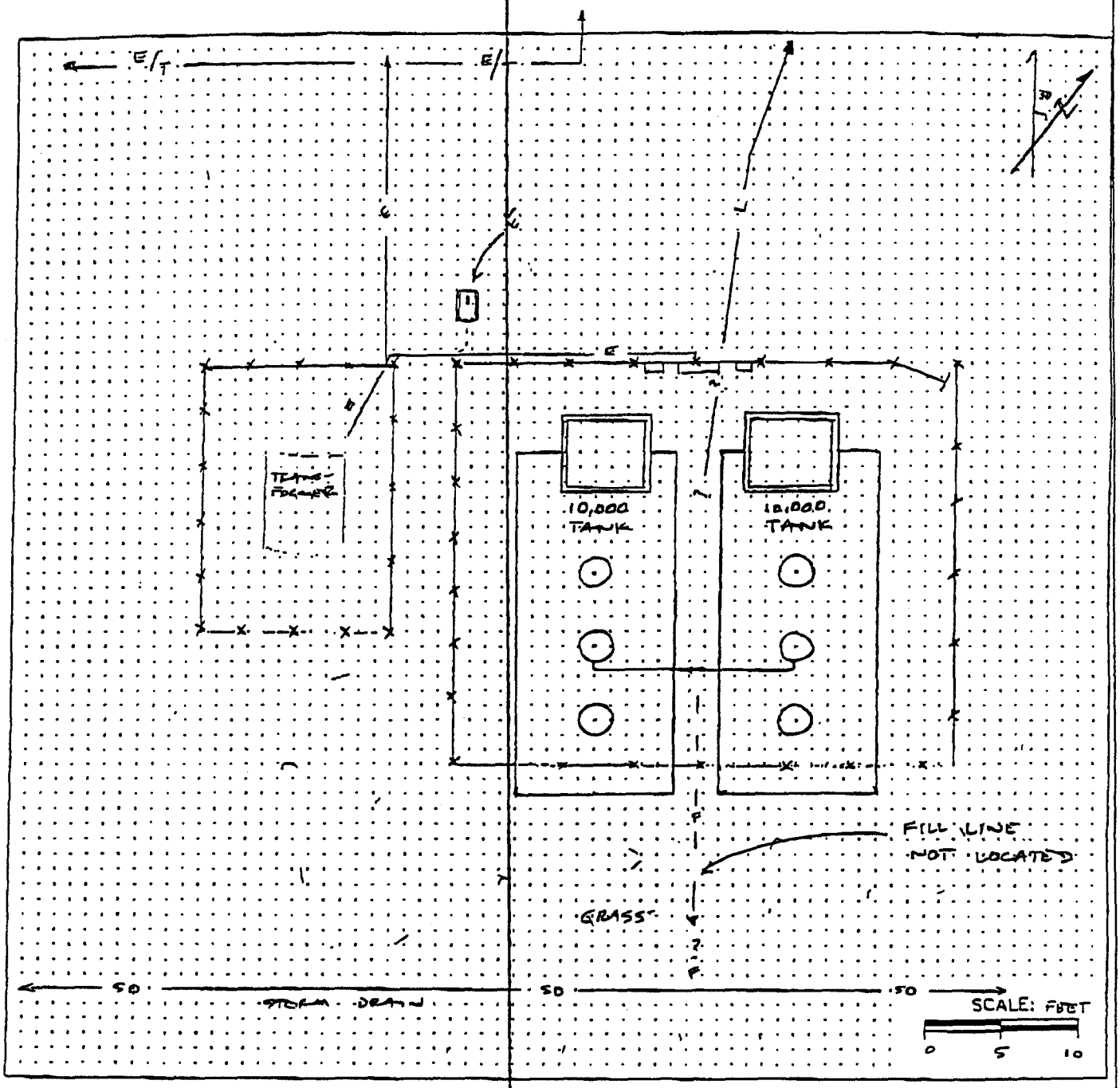
OHM Sample Number		20242-658SP-090
Sample Location		UST-658 STKPL S
Date Collected		01/26/98
Sample Depth (feet below ground surface)		
	Unit	
CA LUFT 8015M		
TPH as Diesel	mg/kg	11 U
TPH as JP-5	mg/kg	11 U
EPA 418.1		
Total Recoverable Petroleum Hydrocarbon	mg/kg	56 U
EPA 8020		
Benzene	µg/kg	5.6 U
Ethylbenzene	µg/kg	5.6 U
Toluene	µg/kg	5.6 U
Xylenes (total)	µg/kg	22 U
ASTM D 2216		
Percent Moisture	Percent	11



OHM Remediation Services Corp. A Subsidiary of OHM Corporation SAN DIEGO, CA				DRAWN BY R. PIRMORADIAN	DATE 03/12/98	LOCATION MAP USTs 658A AND 658B MARINE CORPS AIR STATION EL TORO, CALIFORNIA			
				CHECKED BY	DATE				
				APPROVED BY DR	DATE 3/27/98				
CONTRACT NAME SWDIV				PROJECT MANAGER	DATE				
AUTOCAD FILE No. 20242004.DWG	PLOT SCALE 1=1	SHEET 1	OF 1	SCALE AS NOTED	DOCUMENT CONTROL No. SW4926	OHM PROJECT No. 20242	FIGURE No. FIG 1-2	REVISION 0	

Mar 12, 1998 - 15:37:03 G:\PROJECTS\20242\20242004.dwg

GEOPHYSICAL SURVEY MAP



L = UNKNOWN LINE – FUEL RETURN (?) ON PLANS

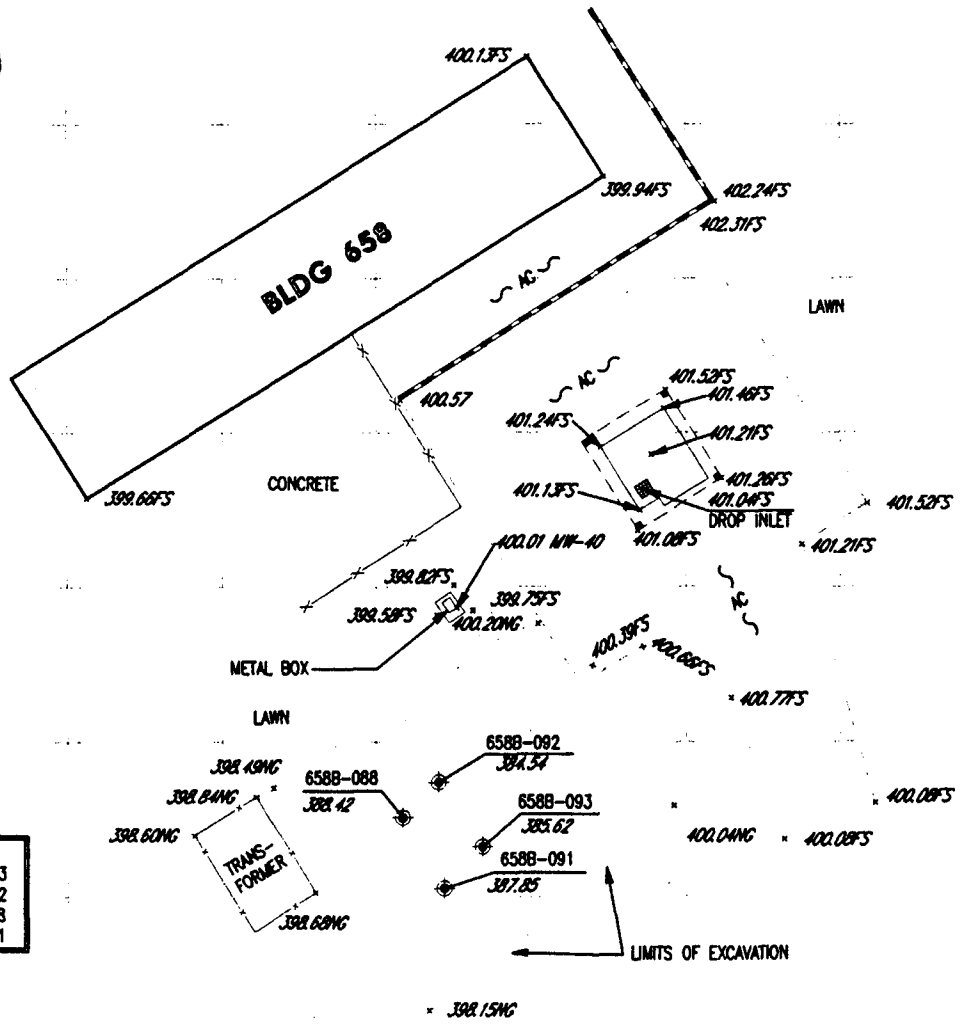
#658

LEGEND

GEOPHYSICAL TRAVERSE

UTILITY:
(E) = ELECTRICAL, T = TELEPHONE,
G = GAS, S = SEWER, (SD) = STORM DRAIN,
W = WATER, P = PRODUCT LINE,
V = VENT LINE, L = UNKNOWN LINE

MCAS, EL TORO
SITE 658/D.O. 70



Graphic Scale

(In Feet)

1 inch = 20 ft.

SAMPLE COORDINATE LISTING

NORTHING	EASTING	ELEV.	SAMPLE #
2192621.6589	6115012.9968	400.01	MW-40
2192583.0374	6115017.0426	385.62	6588-093
2192593.4206	6115010.0251	384.54	6588-092
2192587.7420	6115004.2083	388.42	658A-088
2192576.3058	6115010.9600	387.85	658A-091

LEGEND

- SAMPLE LOCATION
- BUILDING LINE
- EDGE OF PAVEMENT
- BLOCK WALL
- CHAINLINK FENCE
- FS FINISH SURFACE

CAL VADA SURVEYING, INC.
108 BUSINESS CENTER DR. CORONA, CA 91720
1 800 CALVADA PHONE: (909) 280-9960 FAX: (909) 280-9748
WEB SITE http://www.calvada.com

JOB NO. 97102-77A

PREPARED FOR:
OHM REMEDIATION SERVICES, CORP.
2031 MAIN ST., IRVINE, CA 921714
(714) 263-1146

Nov 11, 1998 - 14:51:22 F:\DISK#2\UST\Data\97102-77\Adwg

Section 5
Appendix 4

Miscellaneous Information on Ferrocene

Ferrocene

1. Instruction

1. Property

Ferrocene, or his (Cyclopentadieny) iron, is an organometallic compound. Formula: Fe $(C_5H_6)_2$. It is orange-yellow flake crystals with the smell of camphor at room temperature. Melting point: 172 ~ 174 °C. Insoluble in water. Soluble in benzene, ether, gasoline, diesel and other organic solvents. It is chemically stable and does not react with acid, base and ultraviolet.

2. Applications

(1) Fuel additive for burning-promoting, smoke-abatement and energy-saving: It can be used in various fuels, such as diesel gasoline, heavy oil and coal, Addition of 0.1% ferrocene into engine diesel leads to fuel saving by 10~14 %, increase of vehicle speed by 10%, power output by 10 ~13 % and reduction of smoke in tail gas by 30~80 %. Furthermore, addition of 0.03% in heavy oil and 0.02% in coal can also cause reduction of fuel requirement and smoke (by over 30%).

(2) Additive in synthetic gasoline and synthetic LNG: Addition of 0.01 ~0.50% ferrocene and related additives in synthetic gasoline results in 80#, 85# and 90# synthetic gasoline reformulations; Addition of 0.03% in methanol can reformulate synthetic LNG with fuel value of 33472~ 38656 KJ/Kg; Addition of 0.005~0.080% in methanol- ethanol mixture can reformulate a new highly-efficient civil fuel.

Addition of ferrocene in various fuel considerable benefits energy-saving, smoke abatement, pollution control, inhibiting mechanical abrasion and prolonging life of the machines.

(3) Antidetonator:

Ferrocene can be used as gasoline antidetonator instead of tetraethyl lead to get rid of the contamination and poisoning to man by the lead in tail gas and form high-grade lead-free gasoline. For example, addition of 0.0166~0.0332 g/L ferrocene and 0.05~0.10 g/L tert-butyl acetate can increase octane number by 4.6~6.0.

(4) Polymerization and Ammonia synthesis catalysts and silicone resin and rubber curing agent: Some derivatives of ferrocene can inhibit the degradation of polyethylene by light. When used in agricultural film, they can promote its auto-degradation and self -destruction within certain period so that farming and fertiliser application are not influenced. More over, ferrocene can also be used as the protecting agent of polyethylene, polypropylene and polyester fibres to improve the thermal stability of plastics, rubber and fibres.

(5) Ferrocene can be used as burning rate catalyst of rocket propellant in cosmonantic industry.

(6) Ferrocene can be used as the raw material of antib iotic and blood-nourishing agents.

3. Principle of Action

When ferrocene is burned together with various fuels mentioned above over 400°C, active iron ions are released which fiercely react with the oxygen in air to form active a - Fe_zO_s molecules, a - Fe_zO_s, as a burning-promoting catalyst for various fuels, can speed up the burning and make the combustion complete. More over, Addition of ferrocens in various fuel oils can increase the fraction of lower molecules, lower their fire point, complete the combustion, enhance combustion efficiency, elevate burst pressure of engines and improve dynamic performance of the vehicles. Ferrocene is also a lubricant at higher temperature and thus inhibits mechanical abrasion. Ferrocene is both a chemical catalyst and a high-temperature lubricant. With combustion takes place in engine, combination of all these actions results in fuel oil saving, smoke abatement, power increase and speed enhancement.

4. How to use

The amount of ferrocene used depends on specific fuel oil. Ferrocene is added to the fuel oil and stirred until it is completely dissolved and then the oil can be filled into fuel tank and is ready for used. Alternatively, ferrocene and a certain amount of oil are mixed to form a highly-concentrated mixture, which is diluted to required concentration before use.

When used in solid fuel, it can be mixed with the fuel mechanically or dissolved in some solvent (i, g, diesel, ethanel) and sprayed onto the solid fuel, which is then thoroughly mixed and ready for use.

2. Specification

Product name:	Ferrocene
Content:	95% min.
Formula:	$C_{10}H_{10}Fe$
Formula Weight:	186.04
Appearance:	Burnt -Orange Crystals
Melting Point:	172.00-174.00° C
Boiling Point:	249.0° C/ 760.000mm
Volatilizable Materials:	1.0%
Free Iron:	0.1% max.
Insoluble Materials	0.5% max.

OSHA comments from the January 19, 1989 Final Rule on Air Contaminants Project extracted from 54FR2332 et. seq. This rule was remanded by the U.S. Circuit Court of Appeals and the limits are not currently in force.

DICYCLOPENTADIENYL IRON (FERROCENE)

CAS: 102-54-5; Chemical Formula: $C_{10}H_{10}Fe$

OSHA formerly regulated dicyclopentadienyl iron (ferrocene) under its generic total particulate limit of 15 mg/m^3. The ACGIH has a TLV-TWA of 10 mg/m^3 for this bright orange crystalline solid that smells like camphor. The proposed and final-rule PEL for dicyclopentadienyl iron is 10 mg/m^3 (total particulate) as an 8-hour TWA. The 5-mg/m^3 PEL for the respirable fraction is retained. NIOSH (Ex. 8-47, Table N4) supports the selection of these PELs.

Available evidence in animals suggests that dicyclo-pentadienyl iron has a moderate order of oral toxicity but a high order of intravenous and intraperitoneal toxicity. In mice, the oral LD(50) has been reported as 600 mg/kg (Madinaveitia 1965/Ex. 1-862). In rats, 1000 mg/kg has been reported as the lethal dose, but subacute oral toxicity tests have shown no fatalities when 10 feedings of 200 mg/kg were given over a two-week period (E.I. du Pont de Nemours and Co., Inc. 1955, as cited in ACGIH 1986/Ex. 1-3, p. 195). Ferrocene has been found to be mutagenic in bioassays involving several species (Dangerous Properties of Industrial Materials, 7th ed., Sax and Lewis 1989). NIOSH was the only commenter to the rulemaking record on this substance.

In the final rule, OSHA is establishing 8-hour TWA limits of 10 mg/m^3 (total particulate) and 5 mg/m^3 (respirable fraction) for dicyclopentadienyl iron. The Agency concludes that these limits will substantially reduce the significant risk of material health impairments, in the form of mutagenic and other effects, that are associated with occupational exposure to this substance.

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TRANSMITTAL

Date: 20 APR 2002

From: Lynn Marie Hornecker LMH
MCAS El Toro

To: Diane Silva
Code 01LS.DS

Subj: CERCLA Administrative Record Materials
Marine Corps Air Station, El Toro

Installation: Marine Corps Air Station, El Toro

UIC Number: M60050

Document Title (or subject):

Author: Scott Kehe SWDIV

Recipient: TRISS Chesney DTSC

Record Date: 16 APR 2002

Approximate Number of Pages: 40

EPA Category: 01.1

Sites: AST 658, IRP Site 4

Key Words: ferrocene

Contract: N/A

CTO Number: N/A

Note AST 658 is adjacent to IRP Site 4