

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION
MEETING OF FEBRUARY 13 AND 14, 2008
VICTORVILLE, CALIFORNIA**

ITEM: 11

SUBJECT: **AUTHORIZING THE EXECUTIVE OFFICER TO SIGN THE RECORD OF DECISION/REMEDIAL ACTION PLAN FOR THE ARMITAGE FIELD OPERABLE UNIT, CHINA LAKE NAVAL AIR WEAPONS STATION, CHINA LAKE, KERN COUNTY**

CHRONOLOGY: This is a new item.

ISSUE: The Board will be asked to evaluate whether the Navy's proposed remedy for Armitage field complies with State requirements and for concurrence with the proposed remedy.

DISCUSSION: The Armitage Field Operable Unit (OU) at the China Lake Naval Air Weapons Station (CLNAWS) consists of four sites (sites 1, 2, 44, and 45). Groundwater beneath sites 2 and 45 is affected by two separate contaminant plumes of dissolved phase chlorinated hydrocarbons. Groundwater beneath sites 1 and 44 is affected by a contaminant plume of petroleum hydrocarbons containing floating free product jet fuel, and dissolved phase jet fuel.

The selected remedy consists of free product removal of the jet fuel and monitored natural attenuation of dissolved constituents in the groundwater for all four sites. Soil cleanup will use soil vapor extraction and excavation. The contaminants in groundwater are confined to the upper aquifer only. The upper aquifer has marginal to poor water quality as demonstrated by the TDS concentration ranging from 77 to 3251 milligrams per liter (mg/L) and high arsenic concentrations. The water quality of the upper aquifer will remain marginal to poor even after the contaminants have been cleaned up. The municipal water supply is pumped from the lower aquifer at a depth of over 800 feet below ground surface. The upper and lower aquifers are separated by a very low permeable clay layer several hundred feet thick.

The Record of Decision/ Remedial Action Plan (ROD/RAP) presents the Navy's remedial action to protect the environment and remediate the groundwater and soil. The Navy is proposing drinking water standards for its cleanup levels, which are clean-up levels greater than background. The Navy modeled the groundwater dissolved phase plumes and estimate the largest plume will be remediated in 30 years with the proposed remedy. Smaller plumes will be remediated in less time. In the event that monitoring indicates natural attenuation is not progressing as proposed, the Navy will take measures to augment attenuation.

11-0001

The Navy does not accept that California State requirements such as the Basin Plan Water Quality Objectives for Secondary drinking water standards, Resolution 68-16, and Resolution 92-49 are requirements for this remedial action from a legal perspective. However, it has complied with these requirements from a technical perspective in the proposed action. The ROD includes "agree-to-disagree" language that preserves each party's legal rights.

Water Board staff has reviewed the proposed remedial action. As described in the enclosed staff report, the proposed remedy meets state requirements and is a feasible, cost effective method to remediate soil and restore groundwater quality at the site based on Water Board staff review.

RECOMMENDATION: Adoption of the Resolution as proposed.

Enclosures: 1. Proposed Resolution
2. Staff Report

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ENCLOSURE 1

11-0003

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION**

RESOLUTION NO. R6V-2008-(PROPOSED)

**AUTHORIZING THE EXECUTIVE OFFICER TO SIGN
THE RECORD OF DECISION/REMEDIAL ACTION PLAN
FOR THE ARMITAGE FIELD OPERABLE UNIT, CHINA LAKE NAVAL
AIR WEAPONS STATION, CHINA LAKE**

_____ Kern County _____

WHEREAS, the California Regional Water Quality Control Board, Lahontan Region, (Water Board) finds:

1. In September 2007, the United States Navy prepared a Record of Decision/Remedial Action Plan (ROD/RAP) for Armitage Field Operable Unit, China Lake Naval Air Weapons Station China Lake. The major components of the selected remedial actions for Armitage Field OU as described in the ROD/RAP consist of free product removal, soil vapor extraction, monitored natural attenuation and land use controls.
2. The proposed remedial actions in the ROD/RAP comply with Applicable or Relevant and Appropriate Requirements of the Water Board and are protective of water quality.

THEREFORE BE IT RESOLVED:

That the Lahontan Water Board authorizes the Executive Officer to:

1. Concur with proposed actions as documented in the ROD/RAP; and
2. Sign the ROD/RAP provided there are no significant changes to the intent of the ROD/RAP from that described in the February 2008 Water Board staff report.

I Harold J. Singer, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Control Board, Lahontan Region, on February 14, 2008.

HAROLD J. SINGER
EXECUTIVE OFFICER

ENCLOSURE 2

11-0005

Staff Report

**DRAFT FINAL RECORD OF DECISION/
REMEDIAL ACTION PLAN FOR THE
ARMITAGE FIELD OPERABLE UNIT AT THE
CHINA LAKE NAVAL AIR WEAPONS STATION**

**California Regional Water Quality Control Board, Lahontan Region
14440 Civic Drive, Suite 200
Victorville, CA 92392**

February 2008

Prepared by: Doug Feay, Engineering Geologist

Reviewed by: Cindi Mitton, Senior Engineer

11-0006

1. Introduction

This item provides information for the Regional Water Quality Control Board (Water Board) when considering whether it concurs with a Record of Decision/Remedial Action Plan (ROD/RAP) for remedial actions at the Armitage Field Operable Unit (OU), at the China Lake Naval Air Weapons Station (CLNAWS) China Lake complex. CLNAWS is located within the Mojave Desert, about 150 miles northeast of Los Angeles (Figure 1). This ROD/RAP proposes remediation for four Installation Restoration Program (IRP) sites (sites 1, 2, 44 and 45) at the Armitage Field OU (Figure 2).

The chemicals of concern (COCs) at the Armitage Field OU are volatile organic compounds, including chlorinated hydrocarbons, in soil and groundwater. Groundwater contaminants occur both in the free product phase and the dissolved phase. The free product phase consists of jet fuel. The dissolved phase contaminants are petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylene (BETX), trichloroethene (TCE) and tetrachloroethene (PCE).

The selected remedy consists of free product removal where there is free product, and monitored natural attenuation of dissolved constituents in the groundwater for all sites. Soil cleanup will use soil vapor extraction and excavation. Land use controls will be used to prevent exposure to contaminants.

The Navy has proposed cleanup levels greater than background for groundwater based on a Technical and Economic Feasibility Analysis (TEFA) as required in California Code of Regulation title 23. The Water Board may allow cleanup levels greater than background if certain conditions are met. The ROD/RAP documents the remedial actions for contaminants in soil and groundwater, and actions taken to protect public health, and the environment. Remedial actions proposed for the Armitage Field OU meet state requirements and are feasible, cost effective methods to remediate soil and restore groundwater. As discussed further in this staff report, Water Board staff has reviewed the information and evaluation provided by the Navy and the proposed remedy is: 1) consistent with maximum benefit to the people of the State, 2) does not unreasonably affect present and anticipated beneficial uses and 3) complies with plans and policies of the State.

2. IRP Site Information

The Naval Ordnance Test Station at China Lake was established in 1943. The installation conducts air warfare systems research, development, and testing for the Navy and other branches of the U.S. Department of Defense. Following is a brief description of the four IRP sites requiring remediation at Armitage Field OU. Table 1 lists specific details for each site including contaminant concentrations. The groundwater plumes at the four IRP sites are shown on Figures 3 and 4.

- A. IRP Site 1, Armitage Field Dry Wells, lies within the former Armitage Field fuel supply area which was constructed in 1945 with four 50,000-gallon concrete underground storage tanks. In 1958 two additional 100,000-gallon concrete underground storage tanks were added. Contaminants at this site are from jet fuel releases (JP-4 and JP-5). Remedial actions include free product removal, monitored natural attention, and soil cleanup using soil vapor extraction.

- B. IRP Site 2, Aircraft Washdown Drainage Ditches, consists of a concrete pad and associated drainage culverts and ditches located next to one of the runways on the east side of Armitage Field. Wash water and waste fuel were drained from the pad into an open ditch that connected to a stormwater runoff drainage system for the airfield. The pads were used from 1945 to 1982. Groundwater at the site has been polluted by TCE and PCE. Groundwater remediation at the site will by monitored natural attention. There are no residual soil impacts from TCE or PCE.

- C. IRP Site 44, the Old Armitage Field Fire Fighting Training Area, was in service from 1945 to 1988 as a fire fighting training area. During training activities gasoline, jet fuel and water were used to simulate fire fighting. Approximately 10,000 to 20,000 gallons of wastewater were discharged into a ditch during site use each time. The wastewater runoff contained chlorinated solvents, hydraulic fluids, lube oils, antifreeze and jet fuels. Groundwater at this site has been polluted by free product phase and dissolved phase Volatile Organic Carbons (VOCs). Groundwater will be remediated using vapor extraction free product removal. Dissolved contaminants will be remediated using monitored natural attention. The soil has also been impacted by the VOCs. Free product removal and clean up of the soil will be done together using the vapor extraction method.

- D. Site 45, the Naval Air Facility Maintenance Area serviced ground support equipment and vehicles for the airfield from 1945 to 1981. Wastewater was directed to an unlined ditch and may have contained motor oils, brake fluid, hydraulic oils, and antifreeze. Solvents were collected in a solvent tank at the site. Groundwater at this site contains TCE and PCE. Groundwater remediation at this site is by monitored natural attention. Contaminated soil will be excavated and removed from the site.

3. IRP Site Hydrogeology and Groundwater Quality

The hydrogeology at Armitage Field OU is composed of Pleistocene and Holocene alluvial and playa type deposits as unconsolidated sedimentary deposits.

Regionally groundwater beneath the site occurs in three hydrologic zones; an upper zone, a middle zone, and a lower zone. The upper zone is a permeable sandy-silt aquifer. The middle zone is a very low permeability clay. The lower zone consists of a permeable sandy-silt and is the drinking water aquifer. The groundwater in the upper zone occurs approximately 35 feet below ground surface (bgs) and extends to about 100 feet bgs.

Groundwater quality of the upper zone overall is marginal. Sampling data from site investigations show that total dissolved solids (TDS) concentrations within the upper aquifer vary coinciding with changes in the lithology of the upper aquifer. Data collected from the upper aquifer show TDS concentrations ranging from 77 to 3251 milligrams per liter (mg/L), with the lower TDS concentrations occurring near the top (upper 10 feet) of the upper aquifer. Samples from monitoring wells screened in the first 10 feet of the upper aquifer, between 34 feet bgs and 44 feet bgs, contained TDS concentrations less than 1000 mg/L with an average of 364 mg/L. TDS concentrations in groundwater samples of the upper aquifer from 44 feet bgs to 100 feet bgs were greater than 1000 mg/L with an average TDS of 1838 mg/L. The upper aquifer also contains naturally occurring arsenic levels that exceed the 10 mg/L drinking water standard, with arsenic levels as high as 430 ug/L at a depth of 93 feet.

Data from the site investigations of the four IRP sites indicate that the groundwater contaminants from the IRP sites are confined to the upper groundwater zone. The middle (about 100 to 800 feet bgs) and lower zones (about 800 to 1800 feet bgs) do not contain contaminants from the IRP sites and there is no mechanism for the upper zone contaminants to impact the lower drinking water aquifer, because of the extensive clay layer (about 700 feet thick) beneath the upper zone. Ridgecrest and NAWSCCL both get their drinking water from the lower aquifer.

Beneficial uses of the groundwater as listed in the Basin Plan for all aquifers beneath the site are municipal and domestic supply, agricultural supply, industrial service supply and freshwater replenishment.

4. Proposed Corrective Actions

The Navy developed remedial action objectives for Armitage Field OU based on its most likely future land use, which is consistent with its current use as an operating Navy facility. There are two cleanup action objectives for the Armitage Field OU: 1) protect human health by preventing exposure to groundwater that has contaminant concentrations that are above state and federal drinking water requirements and 2) remove free phase product from the groundwater.

The Navy conducted a Feasibility Study that evaluated a no action alternative, two soil remediation alternatives, four groundwater remediation alternatives, and five free product removal alternatives. These alternatives were compared against the nine criteria shown below used by the Navy to evaluate remedial alternatives.

These criteria are:

- 1) overall protection of humans and the environment;
- 2) complies to all applicable or relevant and appropriate requirements (ARARs)
- 3) long-term protection;
- 4) reduction of toxicity, mobility, and volume,
- 5) short-term effectiveness;
- 6) implementability;
- 7) cost;
- 8) state acceptance; and,
- 9) community acceptance.

The Navy proposes to remove free product from the two sites with free product which are site 44 and site 1. The Navy is proposing monitored natural attenuation with institutional controls for remediation of the groundwater for all four IRP sites. Data indicate groundwater contaminants are declining in concentration and the dissolved phase plumes are stable at all sites. Table 1 compares maximum contaminant concentrations in the dissolved phase plumes over time. Because monitoring data show that the boundaries of the plumes are stable, the lower concentrations over time indicate that natural attenuation processes are reducing contaminant concentrations over time at the sites.

Monitored natural attention was evaluated using the Bioplume III computer model. This model evaluates degradation of VOCs in groundwater. Modeling results showed contaminant concentrations in the dissolved phase plumes are predicted to reach primary and secondary drinking water standards, also called primary and secondary maximum contaminant levels (MCLs), in 5-30 years over the four sites. The Navy also used the Bioplume III computer model to estimate how many years it would take the natural attenuation process to remediate groundwater contaminants to concentrations less than MCLs and to background levels. The computer model calculated 150 years to remediate to background (non-detectable concentrations) for each TCE and PCE plume, and 30 years for each plume of benzene and fuel related compounds. Water Board staff reviewed the model results and the model conditions and agree that it is appropriate for predicting degradation at these sites. The cost estimated to monitor the plumes at all four sites is an additional \$677,000.00 dollars for each 5 years of monitored natural attenuation. The Navy evaluated remediation to concentrations less than the MCLs considering the additional years to reach lower concentrations, along with the related cost, and evaluated this through a technical and economic feasibility study (TEFA). The TEFA analysis indicated that the cost to monitor natural attenuation to background levels would be up to 20 million dollars. The cost to continue exposure controls is approximately 3.5 million dollars. The additional benefit for continuing the remedial action to reach a concentration less than MCLs is not reasonable in this case, given the site specific conditions and anticipated future groundwater use. Use of the water for Base supply is not anticipated at this time because of the marginal quality and because groundwater supply is from the lower aquifer. The additional data from additional monitored natural attenuation is not reasonably necessary to ensure beneficial uses are protected. Discontinuing monitored natural attenuation when

contaminants reach cleanup levels above background (MCLs in this case) is protective of potential beneficial uses considering the quality and location of the groundwater.

The ROD/RAP contains a contingency plan to follow if groundwater monitoring shows natural attenuation does not behave as predicted. Monitoring data for natural attenuation will be collected quarterly for the first two years at each site. After the first two year period the monitoring periodicity may be reduced to semiannual or annual with Water Board Executive Officer concurrence. During the remedial design phase the Navy will establish performance criteria that will be used to evaluate data obtained while the remedy is implemented. Water Board staff will review the performance criteria and monitoring data, as well as any necessary methodologies proposed to augment the natural attenuation process.

5. Compliance with State Requirements

Water Board staff's evaluation of the proposed remediation actions for the four IRP sites at Armitage Field OU has determined that the proposed remedy meets requirements of the Basin Plan, State laws, policies and regulations. See the summary below.

- A. Section 13304 of the California Water Code requires dischargers that have polluted groundwater to clean it up. Water Board staff agrees that the Navy's proposed technical solution to clean up the groundwater at the Armitage Field OU satisfies Section 13304.
- B. SWRCB Resolution No. 92-49 states that a regional board must ensure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible. Resolution No. 92-49 provides that cleanup and abatement actions are to implement applicable provisions of Chapter 15 to the extent feasible. This resolution also requires the application of section 2550.4 of Chapter 15 when approving any alternative cleanup levels less stringent than background. The Navy has completed an evaluation of the proposed remedy and cleanup levels as required by Chapter 15. The Navy's choice of maximum contaminant levels (MCLs) as cleanup standards complies with the substantive requirements of 92-49, III.G and California Code of Regulations, title 23, section 2550.4. Additionally, the Navy has removed contaminant sources and will continue to remove additional contaminants from the soil and groundwater. Water Board staff agree that the Navy's proposed remedy complies with Resolution No. 92-49 and Chapter 15.
- C. SWRCB Resolution No. 68-16 provides that no degradation occur unless certain conditions are determined by the Water Board to be met. Where

polluted groundwater migrates to areas of high quality groundwater, the Water Board has determined the migration of polluted groundwater to be the same as a discharge of waste. In order to comply with this resolution a mechanism needs to be in place to stabilize the plume or there needs to be evidence that the plume is stable. The Navy has submitted groundwater sampling data that demonstrate that the plumes at Armitage Field OU are stable. Data from the Feasibility Study indicate there has been a reduction in concentration of plume contaminants since 1996 and are confined only to the upper aquifer. The reduction in plume contaminants indicates the plumes are stable or shrinking. The reduction of contaminants is attributed to the process of natural attenuation.

- D. The Water Quality Control Plan for the Lahontan Region (Basin Plan) designates groundwater beneficial uses and establishes water quality objectives to protect those uses. The Basin Plan requires the polluted groundwater to be restored in compliance with SWRCB Resolution No. 92-49. Water Board staff agree the proposed technical solution to restore the groundwater at Armitage Field OU complies with the Basin Plan.

6. The Navy's and State's Position Regarding Applicable or Relevant and Appropriate Requirements (ARARs)

The Navy and Water Board staff agree with the proposed technical remedial actions for the four IRP sites at the Armitage Field OU. However, the Navy does not consider some parts of the Basin Plan, and some State Water Resources Control Board resolutions and some portions of the California Water Code as ARARs for this ROD/RAP. To preserve the State's right for future actions at Armitage Field OU or other Federal Sites, agree to disagree language has been incorporated into the ROD/RAP confirming each party's legal basis and position.

7. Conclusions

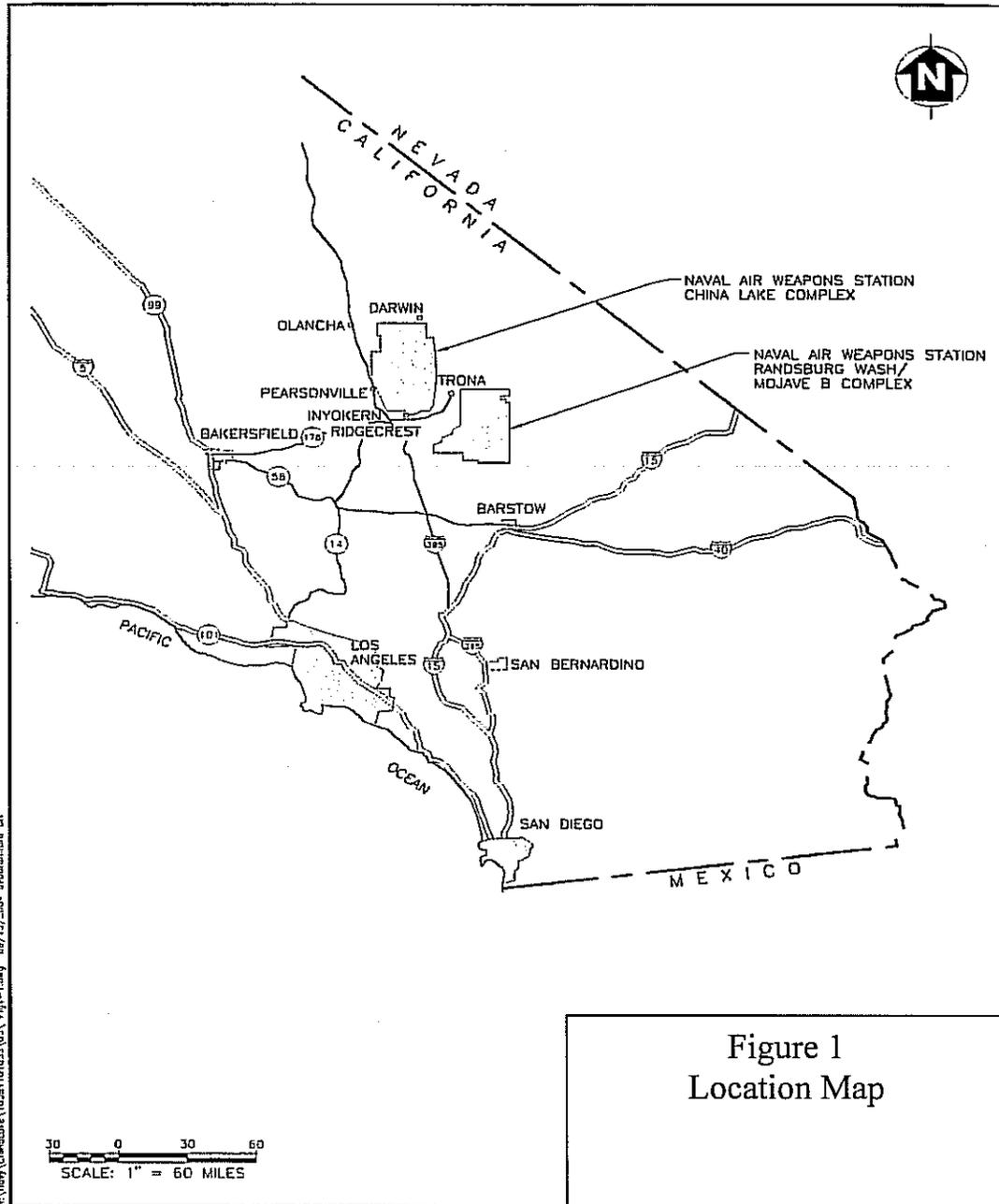
Water Board staff has reviewed the ROD/RAP and other available data and information for the Armitage Field OU. Based on our review the proposed remedies for groundwater and soil remediation meet state requirements. Additionally, appropriate language is included in the ROD/RAP stating each party's position regarding its legal position and preserving its legal rights.

8. Recommendations

Based on our review of the ROD/RAP, staff recommends that the Water Board adopt a resolution authoring the Executive Officer to sign the ROD/RAP.

Table 1
 Armitage Field Chemicals of Concern

IRP Sites	GROUNDWATER IMPACTS				SOIL IMPACTS
	Free Product Phase	Area of Dissolved Phase in Acres	Dissolved Phase (ug/L) Maximum Concentrations 1996 2003		
1	Yes, Jet Fuel (14 acres)	38	benzene=21,000	benzene=660	Yes
2	No	10	TCE=123 PCE=9.3	TCE=64 PCE=5.4	No
44	Yes, Jet Fuel (10 acres)	10	benzene=18 xylenes=480	benzene=0.1 xylenes=30	Yes
45	No	12	TCE=370 PCE=140	TCE=69 PCE=15	Yes



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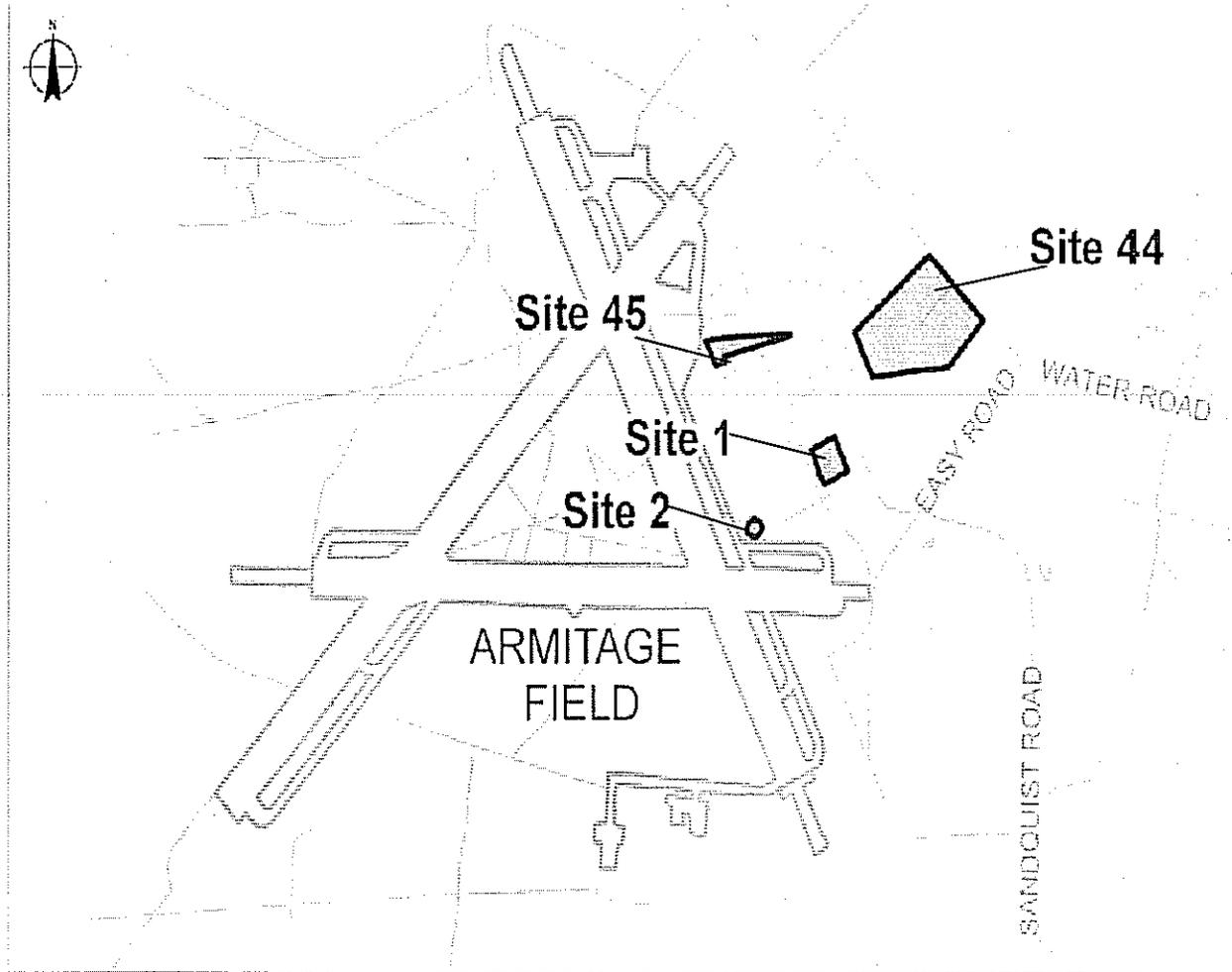


Figure 2 IRP Site Locations

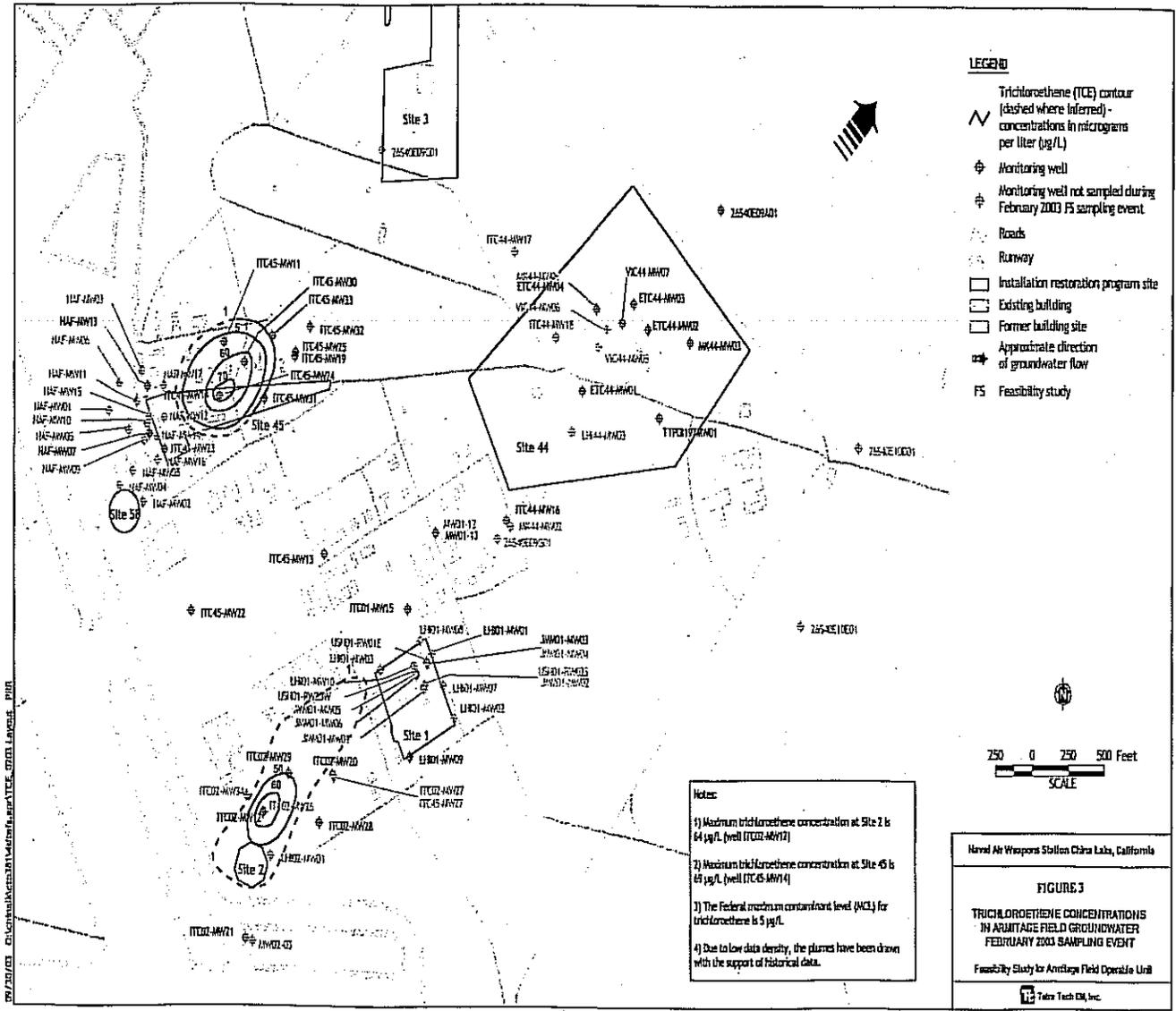


Figure 3 TCE Plumes IRP Sites 2 and 45

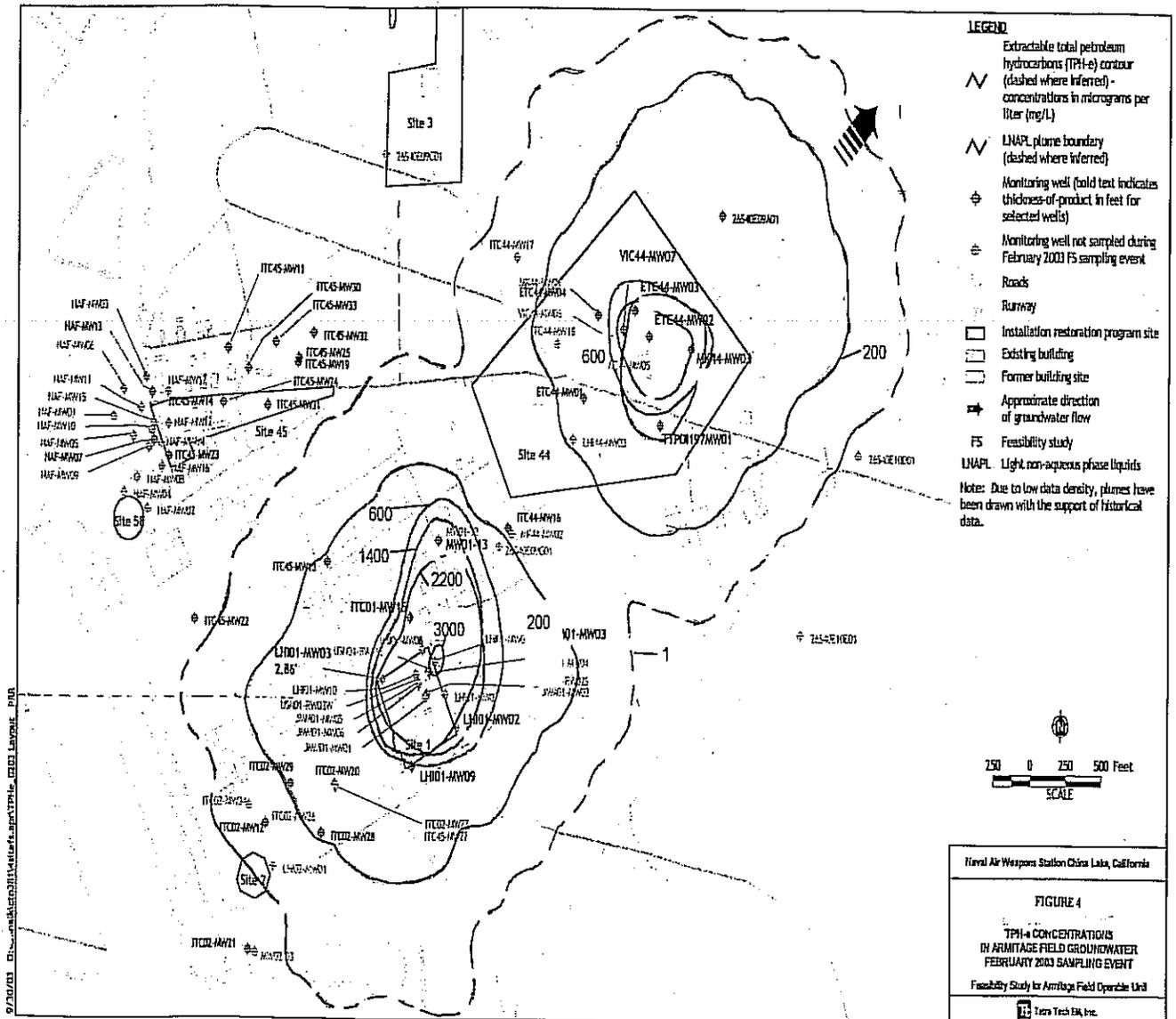


Figure 4 TPH Plumes Sites 1 and 44