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Report

# Corrective Action Plan
# JP-5 Line Area
# Marine Corps
# Air Station

Camp LeJeune
North Carolina

June 1991

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REPORT

# CORRECTIVE ACTION PLAN
# JP-5 LINE AREA
# MARINE CORPS
# AIR STATION
# NEW RIVER, NORTH CAROLINA

JUNE 1991

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# SECTION 1 - INTRODUCTION

## 1.01 Purpose and Scope

The purpose of this Corrective Action Plan (CAP) is to present a summary of the hydrogeologic conditions at the site and present the corrective measures planned to recover free product in the study area.

## 1.02 Site Description

Marine Corps Base Camp LeJeune is located in Onslow County, North Carolina. The facility covers approximately 170 square miles and is bounded by U.S. Route 17 to the west and State Route 24 to the northeast (Figure 1). Associated with Camp LeJeune is Marine Corps Air Station (MCAS) New River. MCAS includes underground pipe lines which transfer fuel to aircraft refueling stations. Military aircraft use fuel which is identified as JP-5.

The study area is a portion of the base called the JP-5 Line site (Figure 2). The site is approximately 600 ft. by 600 ft. and is comprised of several parking lots and an airplane hanger in close proximity to buildings AS-4141 and AS-4146 along White Street. Free product was identified in this area and an interim recovery system was installed and started up in 1986.

## SECTION 2 - SITE ASSESSMENT

### 2.01 Hydrogeology

#### 2.01.1 Regional Geology

A sequence of sedimentary deposits approximately 1400 to 1700 feet thick exists beneath Camp LeJeune. The following discussion of the site geology will be restricted to the uppermost 300 feet of the sequence, since these strata contain the aquifers which are the source of fresh water for the base. These deposits are comprised of unconsolidated and semi-consolidated materials (Reference 1,2).

At the top of the sequence, undifferentiated Pleistocene and Recent sands and clays form the most seaward band of sediments. These deposits can reach a thickness of 35 feet (Reference 1,2).

The Yorktown Formation, of Pliocene age, underlies the Pleistocene and Recent deposits, outcropping in a bank east and south of Jacksonville. This unit consists of lenses of sand, clay, marl, and limestone: it can reach a thickness of 60 feet (Reference 1,2).

An unnamed formation of Oligocene age underlies the Yorktown Formation. These sediments consist of fossiliferous limestone, calcareous sand, and clay. The Oligocene deposits vary in thickness from approximately 40 feet to more than 200 feet (Reference 1,2).

The Castle Hayne Limestone, of Eocene age, unconformably underlies the Oligocene deposits. This unit consists of shell limestone, marl, calcareous sand, and clay. In Onslow County, the

Castle Hayne varies in thickness from 100 feet to more than 200 feet (Reference 1,2).

2.01.2 Site Geology

Under the supervision of an OBG geologist six monitoring wells were installed in the JP-5 Line area (OBG-1 through OBG-6) in accordance with drilling procedures dictated in Appendix C. Figure 3 depicts the monitoring well locations. Except for OBG-3, each well was constructed of 2" I.D. PVC and installed to a depth of 15 feet below grade. OBG-3 was constructed of 6" I.D. PVC and installed to a depth of 25 feet below grade. Well construction diagrams are included as Appendix B. Split spoon soil samples were taken at five foot intervals in each boring. Detailed lithologic descriptions of each sample were recorded on bore logs contained in Appendix A. Soil samples revealed a subsurface geology characterized by sand, silt and clay. Generally, the material in the first 15 feet below grade was dominated by clay while soil taken from below 15 feet below grade was dominated by a fine to medium gray sand.

After installation each well was developed by low yield pumping to eliminate the presence of any fine grained materials that may have entered the well during construction and then sampled for groundwater as further discussed in Section 2.02.2. It should be noted that shortly after completion of the field work, OBG-1 and OBG-3 were destroyed by construction crews working in the area.

2.01.3 Groundwater Data

After installation, each well was surveyed to identify its horizontal position and elevation above mean sea level (AMSL). These elevations are presented on Table 1, along with groundwater elevations that have been corrected to give elevations that would be representative of the aquifer without the effects of the product layer. The presence of a product layer tends to depress the water table due to hydrostatic pressure. The calculation used to correct the groundwater elevations takes into consideration the thickness of the product layer and the density of the product. The corrected elevation is represented by the equation: $Ec = E + (0.80 \times T)$ where:

E = Groundwater elevation under the influence of the product layer
0.80 = Assumed density of JP-5 product layer
T = Product Thickness

Figure 4 is an illustration of the groundwater contours for September 1989. Groundwater appears to be flowing in an easterly direction at approximately 18 ft/year. Groundwater flow velocity was derived by using an effective porosity of 0.40, an average hydraulic conductivity of 7.4 gpd/ft$^2$ and a hydraulic gradient of 0.02 ft/ft.

2.01.4 Aquifer Testing

In September 1989 an 8 hour pump test was attempted on OBG-3. Initially a pumping rate of 15 gpm was attempted but could not be sustained. After allowing the pumping test well to fully recover the aquifer test was retried at a rate of 5 gpm. The well drawdown was at a slower rate but the aquifer could not sustain a pumping

rate of 5 gpm. Due to the character of the pump used for the pump test the field geologist was unable to throttle the pumping to a rate less than 5 gpm.

The field geologist performed in-situ permeability (conductivity) tests on wells OBG-1 and OBG-3. Permeability tests involve removing several gallons of water from each well, creating a potential for flow into the well from the surrounding aquifer. The rate at which the groundwater re-enters the well is monitored until the well's static water level is approached. Values of hydraulic conductivity were calculated based on the change in water level versus the change in time using Horselov's formula. Appendix F contains the in-situ permeability test data. Using this method, OBG-1 was found to have a hydraulic conductivity of 11.0 $gpd/ft^2$ and OBG-3 was found to have a hydraulic conductivity of 3.8 $gpd/ft^2$, yielding an average of 7.4 $gpd/ft^2$.

## 2.02 Environmental Assessment

### 2.02.1 Free Product Characterization

Previous to OBG's involvement at the JP-5 Line site free product was measured in five additional wells (Richard Catlin & Associates, Inc., 1987). Specialized Marine Inc, of Wrightsville Beach, N.C. installed and maintained a recovery system which removed approximately 4,000 gallons of free product up to December 1987 (Exhibit A). The recovery system became an obstacle to the construction of a new hanger and in December of 1987 the recovery system was dismantled and the wells were abandoned.

Of the wells monitored by OBG, free product was detected in only one well at the JP-5 Line site. Monitoring well W-10 contained 0.80 feet of product on 30 Sept. 1989. Figure 6 depicts the free product plume for Sept. 1989.

2.02.2 Groundwater Characterization

In September 1989 groundwater samples from five monitoring wells (OBG-1, OBG-3, OBG-4, OBG-6, and W-1) were collected following the sampling procedures outlined in Appendix D. Each sample was sent to OBG Laboratories in Syracuse N.Y. for analysis by USEPA modified method 503.1. Laboratory results are available for review in Appendix E.

Benzene, Toluene, Ethylbenzene and Xylene (BTEX) were below detection limits in monitoring wells OBG-1 and OBG-4. The only well to contain Benzene and Ethylbenzene concentrations (0.013 mg/l and 0.049 mg/l, respectively) above method detection limits was OBG-3. OBG-6 was the only well sampled to contain a Toluene concentration (0.002 mg/l) above method detection limits. Xylenes levels above method detection limits were limited to wells OBG-3 (0.220 mg/l), OBG-6 (0.002 mg/l), and W-10 (0.490 mg/l). Total hydrocarbon concentrations ranged from below method detection limits in OBG-4 and OBG-6 to 890 mg/l in W-10. Figure 5 illustrates the dissolved total hydrocarbon plume.

2.02.3 Soil Characterization

As previously mentioned split spoon soil samples were collected at five foot intervals in each boring following ASTM D 1586 sampling procedures. Each sample was screened in the field

with a photoionizer organic vapor detector to evaluate the Total Volatile Organics content. Only well OBG-3 contained detectable levels of organics in the soil. These levels, measured in parts per million (PPM) are recorded on the bore logs included in Appendix A.

## SECTION 3 - CORRECTIVE ACTION PLAN

### 3.01 Product Recovery System

### 3.01 General

Field investigations performed by O'Brien & Gere (1989) revealed measurable amounts of free phased and dissolved phase petroleum hydrocarbons in the monitoring wells situated at the JP-5 Line site. Based on the results of the site investigations and evaluation of remedial technologies a petroleum hydrocarbon recovery system was designed to remove fuel from the subsurface. Figure 7 illustrates the location of the proposed recovery system. Final design plans and specifications will be submitted to the U.S. Navy in June 1991.

### 3.02 Designed Recovery System

The designed system consists of two recovery wells and a product treatment system. The recovery wells will be constructed of 6" I.D. Schedule 40 flush jointed PVC and extend to a depth of 25 feet below grade. Each well will contain two pneumatic pumps; a drawdown pump and a product ejector pump, to advance the removal of petroleum hydrocarbons. The product treatment system will be comprised of an oil/water separator, an above ground storage tank to hold recovered petroleum, an air stripper tower and carbon contactors. Free product will be removed from the wells and stored in the storage tank for subsequent removal from the site. Groundwater from the drawdown pumps enters the oil/water separator. The product is decanted and deposited into the storage tank while the remaining recovered groundwater is drained into a surge tank to

be fed to an air stripper tower. The air stripper will volatilize hydrocarbon constituents in the groundwater The groundwater will then be filtered through the carbon contactors for organic adsorption to complete the treatment. Treated groundwater will then be discharged into a nearby sanitary sewer. Figure 8 is a remediation system schematic.

3.03 Treatment Requirements/Effectiveness

As discussed in Section 3.01, recovered groundwater will be passed through an oil/water separator, an air stripper and carbon contactors before discharging to a nearby sanitary sewer. The pretreatment requirement of Naval Facilities Engineering Command, Atlantic Division (LANTDIV) is 2 mg/l of Total Toxic Organics (TTO), (Christina Wallace Memo, 15 May 1990).

Recovered groundwater will be sampled and analyzed for USEPA 602 parameters upon system start-up, and then monthly. If effluent concentrations are consistently below the 2 mg/l TTO concentration for a period of six consecutive months, sampling frequency will be decreased to quarterly.

The recovery system will operate until no free product is present in any of the recovery wells for a period of 6 months. Monitoring wells will be gauged for free product monthly for a period of six months following the recovery system shut down, and then discontinued if no product is identified.

In addition the water depression system will operate until the groundwater meets North Carolina Groundwater Quality Standards for petroleum related components. Groundwater from 5 monitoring wells

will be sampled quarterly and analyzed by USEPA Method 602 until 6 months after the system has been shut down. If concentrations are consistently low for a period of 4 consecutive sampling events sampling will be discontinued.

3.04 Maintenance and Reports

Maintenance of the product recovery system equipment will be performed per manufacturer's recommendations. In addition, the following activities will be conducted monthly:

- Inspect and adjust all systems to ensure optimum operational efficiency
- Collect groundwater discharge flow meter readings.
- Measure product recovery tank.

The following reports shall be prepared quarterly:

- Recovered Product/Discharged Groundwater Report - A tabulation of measurements of the product recovery tank and a tabulation of groundwater discharge flow meter readings.
- Well Report - A tabulation of liquid level measurements (product and groundwater) in all the recovery wells.
- Analytical Report - Summary of analytical results with laboratory data sheet.

In addition to the quarterly reports, an annual report will be submitted and will summarize the data collected over the previous year. The annual report will present conclusions on how the system is working and recommendations for any changes to the program, as necessary, to enhance recovery.

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