We must send them our (114's) report on well data, what it means & what wells to keep shut down.

SITE 22--INDUSTRIAL AREA TANK FARM

Site Investigation

o Two shallow ground water monitoring wells:

Well 22GW1 - In tank farm area.

Well 22GW2 - Between tank farm and deep water supply well No. 602 (Well 22GW3).

o Deep water supply well No. 602 (Well 22GW3)

Data Evaluation

The analytical data for Site 22 is presented in Table 2-9, and information relative to the detected analytical parameters is presented in Table 2-10. As shown in Table 2-9, extremely high levels of benzene, ethylbenzene, toluene, and lead were detected in Well 22GW1 located at the tank farm. These compounds are fuel components and further document the leakage of large quantities of fuel at this site. Additionally, low levels of 1,2DCLEE and 12DCLP were detected in Well 22GW1. These levels may be attributed to possible spillage of degreasing solvents in the tank farm area. Well 22GW2 appears to be free from contamination, with the exception of a low concentration of O&G (1 mg/L). Of extreme importance is the high level of benzene (380 ug/L) detected in the sample collected from deep water supply well No. 602 (Well 22GW3). This benzene concentration far exceeds the 10^{-5} human health risk limit of 6.6 ug/L; therefore, the use of this well should be discontinued immediately. In addition, the CCL3F concentration of 3 ug/L detected in well No. 6 (Well 22GW3) exceeds the 10^{-5} human health risk limit of 1.9 ug/L.

Migration Potential

All analytical parameters for Well 22GW2 were below detection limit, except O&G, and the O&G concentration was only 1 mg/L. Significant migration of contaminants in the shallow ground water westward from the tank farm has not occurred. Water supply well No. 602 (Well 22GW3), however, contains detectable levels of six organic compounds which may

Tabl 2-9. Site 22--Industrial Area Tank Farm Sampling Data

[illegible] SCIENCE & ENGINEERING 13/06/84

STATUS: PRELIMINARY

PROJECT NUMBER 8422.416
FIELD GROUP: CLJM1
PARAMETERS: LJS SAMPLES: DART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/REISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

602

PARAMETERS	STORET # METHOD #	22GW1 374716	22GW2 374717	22GW3 374718
DATE		7/6/84	7/5/84	7/6/84
TIME		83[illegible]	740	850
ACROLEIN (UG/L)	34210 0	<8	<10	<10
ACRYLONITRILE (UG/L)	34215 0	<8	<10	<10
BENZENE (UG/L)	34030 0	17000	<0.3	380
BROMODICHLOROMETHANE (UG/L)	32101 0	<0.50	<0.70	<0.70
BROMOFORM (UG/L)	32104 0	<1.10	<1.60	<1.50
BROMOMETHANE (UG/L)	34413 0	<0.8	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1.0	<1.6	<1.5
CHLOROBENZENE (UG/L)	34301 0	<0.40	<0.50	<0.50
CHLOROETHANE (UG/L)	34311 0	<1	<2	<2
2-CHLOROETHYLVINYLETHER (UG/L)	34576 0	<1	<2	<2
CHLOROFORM (UG/L)	32106 0	0.70	<0.70	<0.70
CHLOROMETHANE (UG/L)	34418 0	<1.9	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<0.90	<1.20	<1.20
DICHLORODIFLUOROMETHANE (UG/L)	34668 0	<0.9	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<0.40	<0.60	<0.60
1,2-DICHLOROETHANE (UG/L)	34531 0	52	<1.0	46
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<0.90	<1.3	<1.3
T-1,2-DICHLOROETHENE (UG/L)	34546 0	<0.80	<1.3	7.8
1,2-DICHLOROPROPANE (UG/L)	34541 0	18	<0.7	<0.7
CIS-1,3-DICHLOROPROPENE (UG/L)	34704 0	<0.6	<0.8	<0.8

Table 2-9. Site 22--Industrial Area Tank Farm Sampling Data (Continued, Page 2 of 2)

ENVIRONMENTAL SCIENCE & ENGINEERING 12/05/84

STATUS: PRELIMINARY

PROJECT NUMBER #4222400
FIELD GROUP: CLJM1
PARAMETERS: LJS SAMPLES: PART

PROJECT NAME CAMP LEJEUNE
PROJECT MANAGER: BOWEN/GEISZLER
FIELD GROUP LEADER: BOB GREGORY

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	22GW1 374716	22GW2 374717	22GW3 374718
DATE		7/6/84	7/6/84	7/6/84
TIME		835	740	850
T-1,3-DICHLOROPROPENE (UG/L)	34699 0	<0.4	<0.6	<0.6
ETHYLBENZENE (UG/L)	34371 0	2900	<1	8
METHYLENE CHLORIDE (UG/L)	34423 0	<0.8	<1	<1
1,1,2,2-TETRACHLOROETHANE (UG/L)	34516 0	<0.6	<0.9	<0.9
TETRACHLOROETHENE (UG/L)	34475 0	<1.2	<2.0	<1.9
1,1,1-TRICHLOROETHANE (UG/L)	34506 0	<0.80	<1.3	<1.2
1,1,2-TRICHLOROETHANE (UG/L)	34511 0	<0.80	<1.2	<1.1
TRICHLOROETHENE (UG/L)	39180 0	<1.0	<1.4	<1.4
TRICHLOROFLUOROMETHANE (UG/L)	34488 0	<0.8	<1	3
TOLUENE (UG/L)	34010 0	27000	<0.6	10
VINYL CHLORIDE(UG/L)	39175 0	<0.6	<0.9	<0.9
LEAD,TOTAL(UG/L)	1051 0	807.0	<40.0	<40.0
OILSGR,IR(MG/L)	560 0	<0.8	1	<0.8

Source: ESE, 1984.

Table 2-10. Site 22--Industrial Area Tank Farm Data Evaluation

Analytes Detected	Regulatory Limit*	Value (ug/L)	Samples Exceeding Limit
O&G	Organoleptic	NL*	None
Pb	Drinking Water/Ambient Water	50	22GW1
1,2-Dichloropropane	NCA†	NL	NL
12DCLEE	NCA	NL	NL
T-1,2-Dichloroethene	NCA	NL	NL
Benzene	10^{-5} Human Health Risk Level	6.6	22GW1, 22GW3
Chloroform	10^{-5} Human Health Risk Level	1.9	None
Ethylbenzene	10^{-5} Human Health Risk Level	1,400	22GW1
Toluene	10^{-5} Human Health Risk Level	14,300	22GW1
CCL3F	10^{-5} Human Health Risk Level	1.9	22GW3

* NCA = No criteria available.
† NL = No numerical limit.

Source: ESE, 1985.

be derived from the tank farm area. This may be attributed to hydraulic connection of the producing zone(s) of well No. 602 with deeper contaminated zones at the tank farm. The absence of contamination at Well 22GW2 indicates that the migration pathway is deep, not shallow. Of the six organic compounds detected at supply well No. 602 (Well 22GW3), only benzene and CCL3F exceed applicable health criteria/guidelines.

Recommendations

Because the first round of verification sampling and analysis conducted at Site 22 indicated significant contamination of deep water supply well No. 602, it is recommended that no further verification monitoring be performed and that a more intensive characterization monitoring program be developed and implemented. The following sections describe the background of the Site 22 investigation, outline the objectives of the proposed characterization monitoring program, and describe the proposed methodology for implementing the Characterization Study at Site 22.

Background--Water quality sampling at Site 22 conducted by ESE during the Verification Step detected the presence of fuel-derived contaminants (benzene, ethylbenzene, toluene, and lead) in shallow monitor Well 22GW1 and deep water supply well No. 602. Trace quantities of several chlorinated solvents also were identified.

In subsequent sampling by LANTDIV at well No. 602 and others, the levels of chlorinated solvents have increased dramatically, whereas the fuel-derived contaminants have remained relatively constant. These facts suggest that a second plume of contamination, characterized by the presence of chlorinated solvents, has reached well No. 602 subsequent to the Verification Step sampling.

Several potential source areas may exist. The main industrial area is a logical source of solvents, although a specific source was not identified in the Initial Assessment Study (IAS) report.

The area to the west of Holcomb Boulevard and well No. 602 contains a disposal area utilized by the Naval Research Laboratory. [Identified as the Naval Research Laboratory Dump (Site 19) in the IAS report.] The records evaluated by the IAS appear to indicate that activities producing the waste materials disposed of in this area did not include solvent use. The data, however, indicate that this area could be a source. This may be possible because small, unauthorized dumps of waste solvent could have taken place without any records.

Site 10, the Original Base Dump, was considered as a potential site. However, water quality data from well No. 637, which is located between Site 10 and the area in which contamination has been identified, show that well No. 637 does not contain detectable levels of any of the analytes of concern.

All proposed Characterization Step efforts will be confined to the Hadnot Point industrial area, and to the area to the west of Holcomb Boulevard and well No. 602.

Objectives--The objectives of the Characterization Step of the investigation of Site 22 are listed below:

1. Locate source of TCE and other chlorinated volatile organic compounds detected in deep water supply wells Nos. 601, 602, 604, and 608; 634, 637, 642
2. Determine concentration of detected analytes in source area(s);
3. Determine hydraulic conductivity of sediments in source area(s) and at affected wells; and
4. Determine continuity of semi-confining bed between water table aquifer and deep zones yielding ground water to supply wells.

Methodology--The observed distribution of contaminants near the main industrial area of Hadnot Point suggests that several contaminant

Integrate their objectives & our scope together & put to them as our idea on how to proceed.

sources may exist. ESE recommends that all records of activities within the industrial area be reviewed with the following goals:

1. Document historical usage of all solvents at specific buildings/yards; and
2. Map locations of all tanks, pits, drains, storage areas, loading docks, oil water separators, and maintenance racks.

The motor pool on the south side of Dogwood Street should be included in this effort because of the documented presence of TCE in an adjacent stream. In addition, a detailed review of the Naval Research Laboratory waste disposal activities should be included also in this study.

The work product of this effort should be a detailed map of all potential source areas within the industrial area and near the Naval Research Laboratory. This map will be used to determine the orientation and density of the grid to be utilized during the proposed soil gas investigation.

A soil gas investigaiton is recommended to delineate the source area(s) of observed waste solvents. An excerpt from a promotional document produced by Tracer Research Corporion of Tucson, Arizona, the developers of the soil gas technique, is presented in Appendix C. The theory, applicability, and benefits of this technique are outlined in Appendix C.

The soil gas investigation should be conducted in a grid-work distribution throughout the main industrial area to attempt to locate discrete sources (i.e., buried storage tanks, bulk liquid disposal areas). Additionally, the area to the west of well No. 602 should be investigated. The pattern of contamination observed in supply well No. 602 may be produced by a contaminant source in the vicinity of Site 19, the Naval Research Laboratory Dump.

The pattern and density of the soil gas investigation may be altered at any time to respond to the real time data generated in the field. The results of the soil gas investigation will allow accurate placement of ground water monitoring wells which will be required to determine concentrations of contaminants in the ground water.

The results of the soil gas investigation should consist of a map outlining source areas of the waste solvents. The pattern of contamination revealed by the soil gas accurately follows the pattern of contamination in the ground water. However, there is not an established correlation between concentration of a compound in the soil gas (micrograms of analyte per liter of air) and the concentration of the compound in the ground water (micrograms per liter of water). Because of this, and the fact that applicable environmental regulations/guidelines/criteria are tied to concentrations of contaminants in water, monitor wells must be installed to sample the ground water in source areas. Why not, let's try it depending on how much it costs!

A best-estimate plot of the proposed monitor well locations is shown in Figure 2-1. Final number and placement of these wells will depend on the results of the soil gas investigation. Wells 22GW4 through 22GW7 are shallow wells which will form pairs with the deep supply wells. The well pairs will allow delineation of flow path of contaminants to the supply wells. These flow paths may be via horizontal shallow ground water flow with vertical flow through discontinuous confining beds near the supply wells, or horizontal flow of contaminants through deep aquifer zones after initial vertical flow of contaminants near a source area.

The well pairs will also allow aquifer testing to quantify the amount of confinement of lower aquifer zones.

Well 22GW8 is a shallow well in the vicinity of the Dogwood Street motor pool facility, which may be the source of TCE observed in a nearby stream.

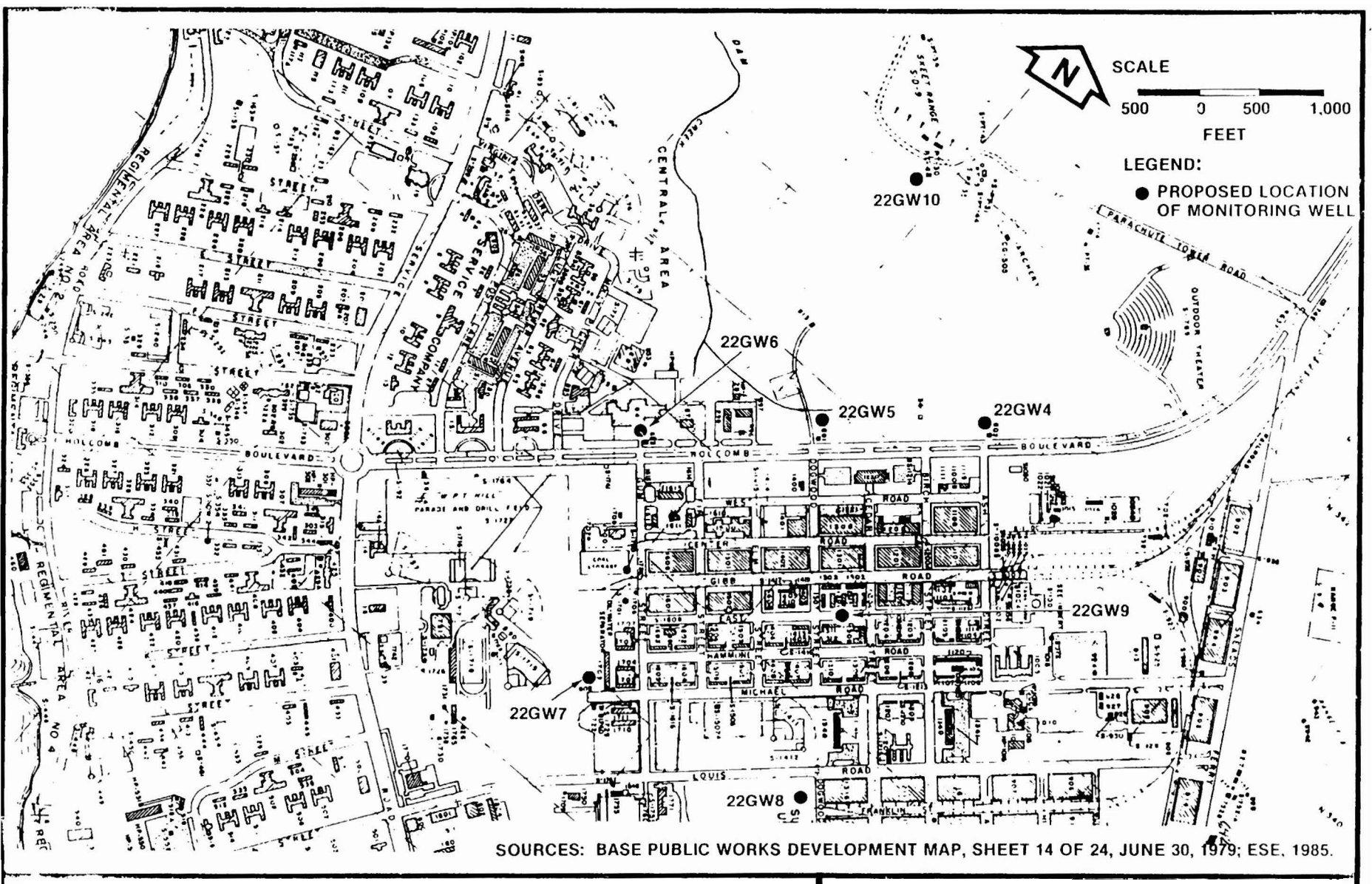

Figure 2-1
PROPOSED LOCATION OF CHARACTERIZATION STEP MONITORING WELLS AT SITE 22--INDUSTRIAL AREA TANK FARM

CONFIRMATION STUDY
MARINE CORPS BASE
CAMP LEJEUNE

Well 22GW9 is a proposed shallow well to quantify ground water contamination near an underground storage tank which has been preliminarily identified by LANTDIV personnel. move NE closer to fuel farm
who? Motmel.

Well 22GW10 will monitor the ground water at the Naval Research Laboratory dump if so indicated by the soil gas investigation. All new monitor wells will be surveyed to a common vertical datum to allow measurement of ground water levels and gradients. Samples of ground water should be collected from Wells 22GW1 through 22GW3 (water supply well No. 602); 22GW4 through 22GW10; and deep water supply wells Nos. 601, 603, and 609 and analyzed for the same analytes tested in the verification program. 608? plus add 634, 637, 642 and Bldg 20 Hadnot Point Water plant (construction info.) and shallow wells for 634, 637, 642
In order to develop data required to calculate rates of flow and travel times of contaminants from source areas toward streams, rivers, or wells, aquifer testing will be performed.

All monitor wells installed during the Characterization Step will be tested by the slug test method. This technique will generate values of horizontal hydraulic conductivity (permeability) of the aquifer in the immediate vicinity of the well screen.

Short-duration pump tests will be conducted at the well pair locations to allow quantification of the nature of the confining bed. Additionally, the pump tests will allow calculation of transmissivity, which is the hydraulic conductivity of the entire saturated aquifer thickness.

These aquifer coefficients, in conjunction with measured ground water gradients, will allow calculation of the rate(s) of movement of ground water contaminants.

Need to address overlapping cones of depression