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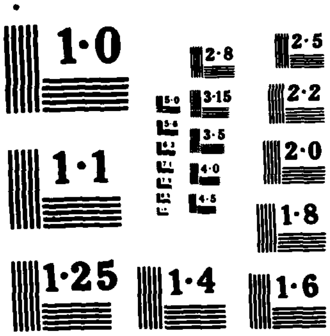
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INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

FINAL REPORT

FOR

NELLIS AIR FORCE BASE, NEVADA

TACTICAL AIR COMMAND

PREPARED FOR

UNITED STATES AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (OEHL)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

AUGUST 9, 1985

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The Nellis AFB Phase II, Stage 1 field evaluation of the Installation Restoration Program investigated 5 sites through drilling and sampling 12 new borings and sampling 5 preexisting base wells.

Two ground water systems exist beneath the base. The shallow ground water system comprises approximately the upper 200 feet of valley sediments. It is maintained by upward leakage from a deeper artesian aquifer and recharged by septic tank effluent, irrigation waters, and wastewater treatment plant effluent. Precipitation is an insignificant source of recharge. The deeper artesian ground water system consists of more permeable sediments at depths greater than about 200 feet. It is the principal source of ground water for the base and the Las Vegas Valley.

Of 44 parameters analyzed in ground water, only 6 were present in one or more samples above detection limits. The detected parameters included two halocarbons (1,1,1-trichloroethane and toluene), two pesticides (aldrin and DDT isomers), nitrate, and phenol. Nitrate concentration in one monitoring well sample exceeded primary drinking water standards.

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STAGE 1

FINAL REPORT

FOR

NELLIS AIR FORCE BASE, NEVADA

TACTICAL AIR COMMAND

AUGUST 9, 1985

PREPARED BY

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE, ILLINOIS 60068

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PREFACE

As part of the U.S. Air Force Installation Restoration Program (IRP), investigations were undertaken at five sites on Nellis Air Force Base, Nevada, to determine whether hazardous material contamination is present. This report, prepared by Dames & Moore under Contract No. F 33615-830D-4002, Order 0003, presents the results of the Phase II, Stage 1 IRP investigations. The period of work reported on herein was September 1983 through August 1985. The field investigations were directed by Dr. Kenneth J. Stimpfl. Mr. John Dudley, Hydrogeologist, supervised installation of monitoring wells, and Mr. Thomas Lee, Geotechnical Engineer, supervised the soil sampling activities. Maj. Dennis D. Brownley, Technical Services Division, USAF Occupational and Environmental Health Laboratory (OEHL), was the Technical Monitor.

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SUMMARY

Nellis Air Force Base (AFB) is located approximately 8 miles northeast of Las Vegas, Nevada. It is situated near the eastern edge of the Las Vegas Basin, which is an intermountain valley and typical of basin and range physiography. Nellis AFB has been in operation since 1940 as a gunnery school for fighter pilots and is currently the largest base in the Tactical Air Command.

The Phase II, Stage 1 field evaluation of the Installation Restoration Program (IRP) consisted of investigations at the following five sites:

Site 1 - Main Base Landfill;
Site 17 - Location of Former Sewage Treatment Plant (STP) Percolation Ponds;
Site 4 - Fuel Tank Sludge Disposal Area;
Site 15 - Storm Drain Gully; and
Site 20 - Existing Fire Training Area.

The field investigation consisted of the following activities:

- Installation and sampling of three monitor wells along the southernmost boundary of the base, which is immediately south of Sites 1, 17, and 24.
- Sampling of base wells 6, 11, 12, 13, and 14.
- Drilling and sampling five borings at Site 15.
- Drilling and sampling four borings at Site 20.

The ground water and soil samples were analyzed for up to 44 constituents, including purgeable halocarbons and aromatics, pesticides, lead, nitrate, oil and grease, and phenol.

Two ground water systems exist beneath Nellis AFB. The shallow ground water system comprises approximately the upper 200 feet of valley sediments and is maintained by upward leakage from the deeper artesian aquifer and recharged by septic tank effluent, irrigation waters, and wastewater treatment plant effluent. Precipitation is an insignificant source of recharge. The artesian ground water system consists of the more permeable sediments at depths greater than about 200 feet and is the principal source of ground water for the base and the rest of the Las Vegas Valley. The influence of pumping from base wells completed in the artesian aquifer can be seen by the parallel decline of shallow and artesian ground water levels with time. Data collected from this study indicate that the downgradient direction of the shallow aquifer system is not in the direction

anticipated by previous studies. Therefore, the monitoring wells that have been constructed may not present maximum contaminant concentrations.

Of the 44 parameters in the ground water analyses, only 6 were present in one or more samples above detection limits. The detected parameters included 2 halocarbons (1,1,1-trichloroethane and toluene), 2 pesticides (aldrin and DDT isomers), nitrate, and phenol. The nitrate concentration in one of the monitor well samples exceeded primary drinking water standards. There is some uncertainty in the aldrin analysis because the level indicated is near the threshold of detection and for various geochemical reasons as discussed in the main text. The elevated nitrate concentrations posed no risk to human health to the base because shallow ground water is not used for drinking water at the base. However, it is possible that Site 17 is the source of excessive nitrate concentrations south of the base, where shallow ground water is a source of drinking water for many domestic wells.

No significant evidence of contamination was found at either Site 15 or Site 20.

The Phase II, Stage 1 conclusions are as follows:

1. Aldrin was tentatively identified in samples from base wells 11 and 13. However, because the analyses are at the threshold of detection, there is some uncertainty in the analysis for aldrin.

2. The concentrations of nitrate in monitor well samples pose no health risks to the base, but may indicate that migration of contaminants from wastes disposed at the base create a health risk for residents south of the base. This is also true regarding DDT isomers.

3. More information regarding the shallow ground water regime needs to be collected in order to assess the true direction of contaminant movement and the source, extent, and magnitude of contamination in the shallow ground water system.

Recommendations for the next phase of investigation at Nellis AFB are given in Section VII.

I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DOD) initiated the Installation Restoration Program (IRP) in 1976 to investigate and mitigate any environmental contamination that may be present at DOD facilities as a result of handling or disposing hazardous wastes. IRP was revised in 1981 and reissued as the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5. The Air Force implemented DEQPPM 81-5 in 1982 as a four-phase program.

Phase I	Problem Identification/Records Search
Phase II	Problem Confirmation and Quantification
Phase III	Technology Base Development
Phase IV	Corrective Action

For Nellis AFB, Las Vegas, Nevada, Phase I was completed by CH2M Hill (1982). Dames & Moore has been retained by the Air Force under Contract Number F33615-83-D-4002 to conduct the Phase II, Stage 1 field evaluation.

This report presents the results of Dames & Moore's field and laboratory investigations in the vicinity of hazardous waste disposal and handling areas at Nellis AFB. Chemical analyses were undertaken by UBTL, Inc. of Salt Lake City, Utah.

B. PURPOSE AND SCOPE

The purposes of the field evaluation portion of Phase II of the IRP were to:

1. Determine if environmental contamination has resulted from waste disposal practices at Nellis AFB;

2. If contamination is found, provide estimates of the magnitude and extent of contamination; and

3. Identify any additional investigations and their attendant costs necessary to identify the magnitude, extent, and direction of movement of discovered contaminants.

The scope of work as outlined for Phase II, Stage 1 of the IRP consisted of the following activities:

1. Drilling, sampling, and geologically logging three borings to a depth of 120 feet at locations south of the base landfill (Site 1);

2. Installing and developing a monitor well in each boring;

3. Sampling the three monitor wells and base wells 6, 11, 12, 13, and 14;

4. Analyzing the ground water samples for 44 parameters including halocarbons, aromatics, pesticides, and others;

5. Drilling, soil sampling, and geologically logging 5 borings to a depth of 20 feet at Site 15 (storm drain gully) and 4 borings to a depth of 20 feet at Site 20 (existing fire training area);

6. Analyzing selected soil samples from both sites for the organic parameters and oil and grease; and

7. Preparing this report, which presents our findings.

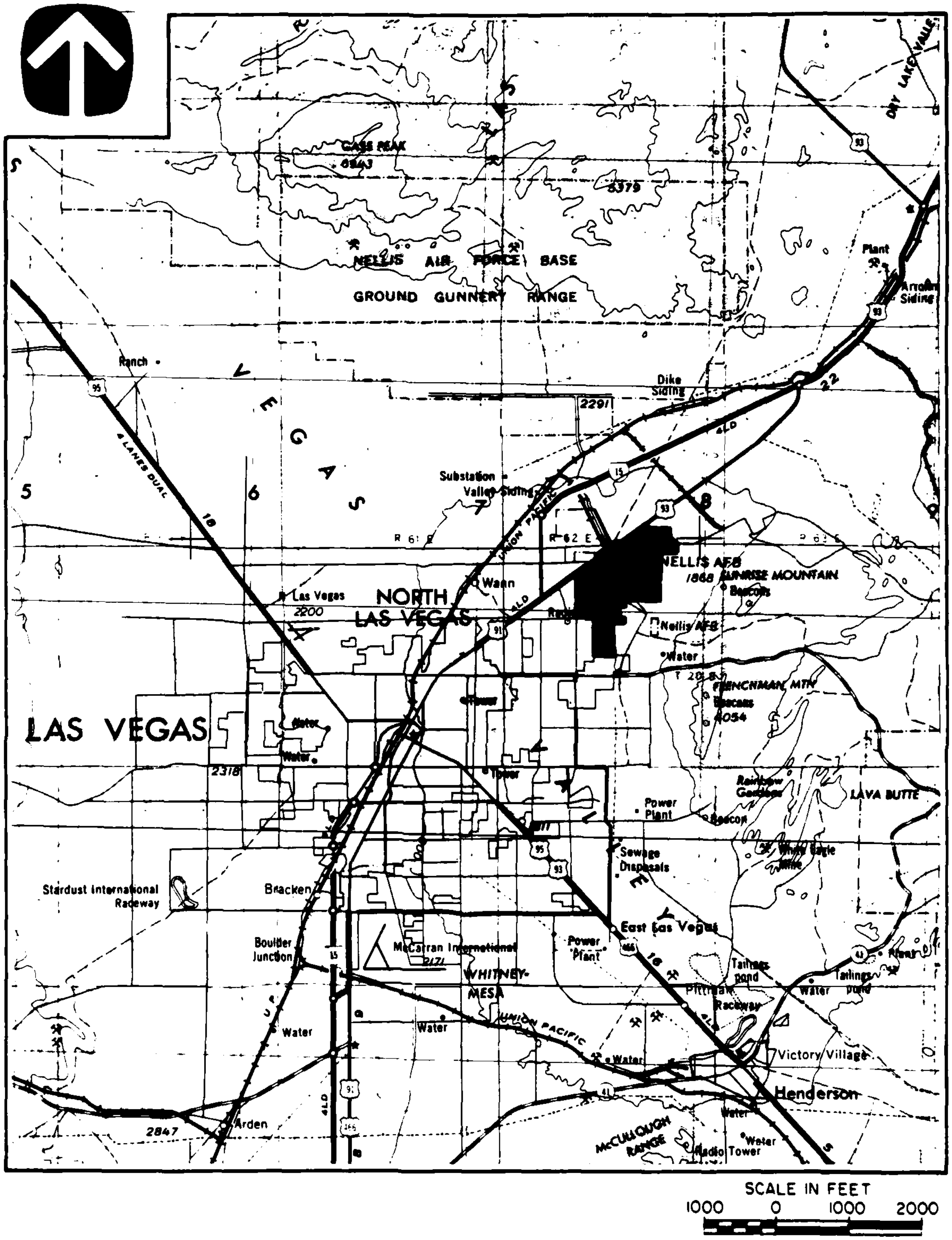
Field work began on 28 Oct 83 and was completed on 9 Nov 83.

C. BRIEF HISTORY OF NELLIS AFB AND WASTE DISPOSAL OPERATIONS

The site on which Nellis AFB is located (see Plate 1) was used for flight operations beginning in 1929, when it consisted of dirt runways and a few buildings. In 1940, the City of Las Vegas purchased and improved the site for training civilian pilots and offered it to the Army Air Corps later that year for gunnery training. Since 1940, the base has functioned as a gunnery school, training pilots in all phases of fighter gunnery. Nellis AFB is currently the largest base in the Tactical Air Command.

Potentially hazardous wastes have been generated at Nellis AFB from activities involving vehicle and aircraft maintenance, ground support equipment maintenance, and aircraft corrosion control. Pest control laboratory operations, fuel analyses, nuclear weapon assembly, and a small plating operation have also created potentially hazardous wastes (CH2M Hill, 1982). The wastes have included solvents and paint strippers such as trichloroethane, trichloroethene, methyl ethyl ketone, toluene, PD-680 (safety solvent), and carbon tetrachloride. Pesticides and herbicides that have been applied and disposed of at the base include diazinon, malathion, chlordane, krovar, paraquat, princep, DDT, and lindane. Other wastes include waste oils, hydraulic fluid, waste battery acid, fuels, and grease.

Prior to about 1970, wastes generated at Nellis AFB were disposed of in the sanitary sewer, base landfills, or were burned in fire training exercises. Essentially all the maintenance shops discharged their wastes, including solvents and oil and



VICINITY MAP

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U.S.G.S. MAP TITLED, "LAS VEGAS, NEVADA; ARIZONA; CALIFORNIA".

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PLATE 1

grease, into the sanitary sewer system, and the wastes underwent secondary treatment at one of the two base sewage treatment plants. The original wastewater treatment plant was located just west of the midpoint of the runway and was operated between 1940 and 1952. The plant used trickling filters and discharged the effluent into the storm drain gully, which carried the effluent to the landfill south of the golf course (see Plate 2). The second sewage treatment plant was operated between 1952 and 1971 and utilized a primary clarifier and trickling filter system for secondary treatment. The effluent was placed in percolation ponds for oxidation and evaporation or used to irrigate the golf course. Digester sludge was used as a soil conditioner in various parts of the base. Solid wastes from the maintenance shops and waste pesticides and herbicides were dumped in the base landfills prior to the early 1970s. Fire training activities consumed most of the waste petroleum oil and lubricants between the early 1950s and the mid-1970s.

Since about 1970, potentially hazardous wastes such as solvents and pesticides have been reclaimed and containerized, and oil/water separators have been installed on shop drains. Sanitary wastes have been discharged to a Clark County regional wastewater treatment plant since 1972. Only clean fuels have been used recently for fire training, and the soil in the fire training pit is periodically scraped up and spread on the surrounding area to allow for biological degradation.

D. DESCRIPTION OF SITES

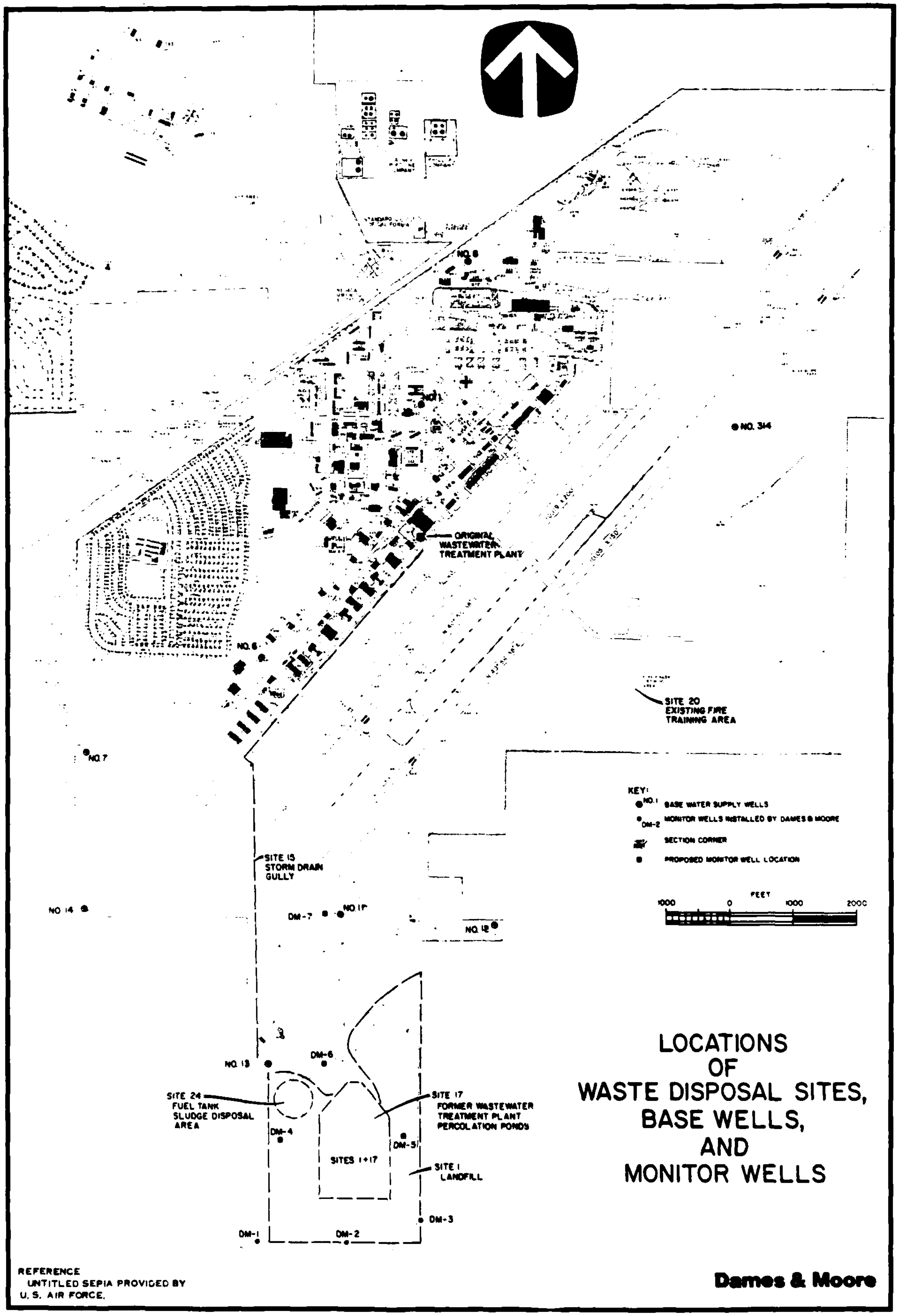
CH2M Hill (1982) identified 33 sites within Nellis AFB at which potentially hazardous wastes were generated, disposed of, or used in some activity. Each site was rated on the basis of potential contamination and/or surface or subsurface migration of the wastes. Sixteen of the 33 sites received priority ranking, and the remaining sites were judged not to warrant further investigation. A scope of work was issued under Contract F33615-83-D-4002 for Phase II, Stage 1 investigations at the following five sites:

Site 1 - Main Base Landfill
Site 17 - Former STP Percolation Ponds
Site 24 - Fuel Tank Sludge Disposal Area
Site 15 - Storm Drain Gully
Site 20 - Existing Fire Training Area

These sites are shown on Plate 2 and are described below:

1. Site 1 - Base Landfill

Site 1 occupies about 150 acres in the southernmost part of Nellis AFB, along with Sites 17 and 24. It has been the base landfill since 1942



LOCATIONS OF WASTE DISPOSAL SITES, BASE WELLS, AND MONITOR WELLS

REFERENCE
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PLATE 2

except for the period from 1968 to 1974. All types of solid wastes generated by the base have been dumped here, along with potentially hazardous wastes including solvents, paint thinner, pesticides, waste oil and grease, and fuels. Both trench and area fill techniques have been used at the site, and the fill was burned regularly until the mid-1960s (CH2M Hill, 1982). The storm drain gully, part of which comprises Site 15, also runs through the landfill. Site 1 currently serves as the main base landfill.

2. Site 17 - Former STP Percolation Ponds

The base wastewater treatment plant was operated at Site 17 from 1952 until 1972, when the base sanitary sewer system was connected to the county wastewater treatment plant. The base plant provided secondary treatment and discharged the effluent to percolation ponds and to the golf course irrigation system. This site is being investigated because of the potential for contaminant migration. The principal contaminants are expected to be trace organic chemicals and heavy metals due to the disposal of shop wastes to the sanitary sewer system, and nitrate contamination from seepage of secondary effluent from the ponds.

3. Site 24 - Fuel Tank Sludge Disposal Area

Site 24 is located south of the golf course and north of the landfill at Site 1. This area may have received wastewater treatment plant sludge and leaded fuel storage tank cleaning sludge at any time between 1942 and 1972. Since 1951, as many as 25,000 gallons of jet fuel and leaded gasoline sludge have been landfilled (CH2M Hill, 1982).

4. Site 15 - Storm Drain Gully

The storm drain gully runs south from the site of the original wastewater treatment plant past the west side of the golf course and into the landfill (Site 1). No shop drains have ever been connected to the gully, but it does receive potentially hazardous wastes in runoff from the flight line. CH2M Hill (1982) also observed waste fuel and hydraulic fluid in the gully. An effluent containing solvents and other maintenance shop wastes was discharged into a gully prior to 1952 from the original wastewater treatment plant.

5. Site 20 - Existing Fire Training Area

Fire training has been conducted at Site 20 since the early 1950s, although only clean fuels have been burned since the late 1970s. As many as 10,000 gallons of waste petroleum, oil, and lubricants were burned per month prior to 1972. This volume decreased to 300 gallons per month after 1972 because most of the wastes were disposed of off site. The surficial soils of Site 20 are periodically scraped off and mixed with surrounding soils to allow biological decomposition of the petroleum-based waste.

E. IDENTIFICATION OF POLLUTANTS SAMPLED

Based on the wastes present in the above sites, potential contaminants would include the chlorinated and brominated hydrocarbons (halocarbons), aromatic hydrocarbons, pesticides, and other parameters listed in Table 1. Ground water samples from the monitor wells and all the base wells except 6 and 14 were analyzed for all the parameters in Table 1. Nitrate, phenol, and DDT isomers have been deleted from the analyses for wells 6 and 14. Soil samples have been analyzed for halocarbons, aromatics, and oil and grease.

F. IDENTIFICATION OF THE FIELD TEAM

The field work required for Phase II, Stage 1 was accomplished by Mr. John Dudley, Hydrogeologist, who supervised the monitor wells. Mr. Thomas Lee, Geotechnical Engineer, supervised the soil sampling activities. Appendix F contains a description of the qualifications of these personnel.

TABLE 1

PARAMETERS, LIMITS OF DETECTION FOR SOIL AND GROUND WATER ANALYSES, AND WATER QUALITY CRITERIA

CONSTITUENT	LIMIT OF DETECTION, SOIL (µg/g)	LIMIT OF DETECTION, WATER (µg/L)	WATER QUALITY CRITERIA
Purgeable Halocarbons and Aromatics			
Chloromethane	0.01	0.5	—
Bromomethane	0.01	0.5	--
Dichlorodifluoromethane	0.01	0.5	—
Vinyl Chloride	0.01	0.5	—
Chloroethane	0.01	0.5	—
Methylene Chloride	0.01	0.5	—
Trichlorofluoromethane	0.01	0.5	—
1,1-Dichloroethene	0.01	0.1	—
1,1-Dichloroethane	0.01	0.1	—
Trans-1,2-dichloroethene	0.01	0.1	—
Chloroform	0.01	0.1	—
1,2-Dichloroethane	0.01	0.1	—
1,1,1-Trichloroethane	0.01	0.1	—
Carbon Tetrachloride	0.01	0.1	—
Bromodichloromethane	0.01	0.1	—
1,2-Dichloropropane	0.01	0.1	—
Trans-1,3-dichloropropene	0.01	0.5	—
Trichloroethene	0.01	0.1	—
Dibromochloromethane	0.01	0.5	—
1,1,2-Trichloroethane	0.01	0.1	—
Cis-1,3-dichloropropene	0.01	0.5	—
2-Chloroethylvinylether	0.01	1.0	—
Bromoform	0.01	0.1	—
1,1,2,2-Tetrachloroethane	0.01	0.5	—
1,1,2,2-Tetrachloroethene	0.01	0.5	—
Chlorobenzene	0.01	0.1	—
1,2-Dichlorobenzene	0.01	0.5	—
1,3-Dichlorobenzene	0.01	0.5	—
1,4-Dichlorobenzene	0.01	0.5	—
Ethyl Benzene	0.01	0.5	—
Benzene	0.01	0.5	—
Toluene	0.01	0.5	—
Pesticides (µg/L)			
Aldrin	NA	0.01	—
Dieldrin	NA	0.01	—
Chlordane	NA	0.1	—
DDT isomers	NA	0.01	—
Endrin	NA	0.01	1 µg/L*
Endrin Aldehyde	NA	0.01	—
Heptachlor	NA	0.01	—
Lindane	NA	0.01	4 µg/L*
Others (mg/L)			
Lead	NA	0.01	0.05 mg/L*
Nitrate (as N)	NA	0.02	10.0 mg/L*
Oil and grease	0.05 mg/g	0.5	—
Phenol	NA	0.005	—

Source: Federal Register, November 28, 1980.

*Primary drinking water standard.

NA = Not analyzed
mg/L = milligrams per liter
µg/L = micrograms per liter
mg/g = milligrams per gram
µg/g = micrograms per gram

II. ENVIRONMENTAL SETTING

A. PHYSICAL GEOGRAPHY

Nellis AFB is located in Clark County, Nevada, 8 miles northeast of the City of Las Vegas and approximately 10 miles northwest of Lake Mead. Land surface elevations range from about 1,900 feet above mean sea level at the northern boundary of the base to approximately 1,800 feet at the southern boundary.

Nellis AFB is situated in the northeastern portion of the Las Vegas Valley, which is bordered by the Las Vegas Range and the Sheep Range to the north, the River Mountains to the east, the Spring Mountains to the west, and the McCullough Range to the south. This area typifies the physiography of the Basin and Range Province, in which mountain ranges are separated by desert valleys.

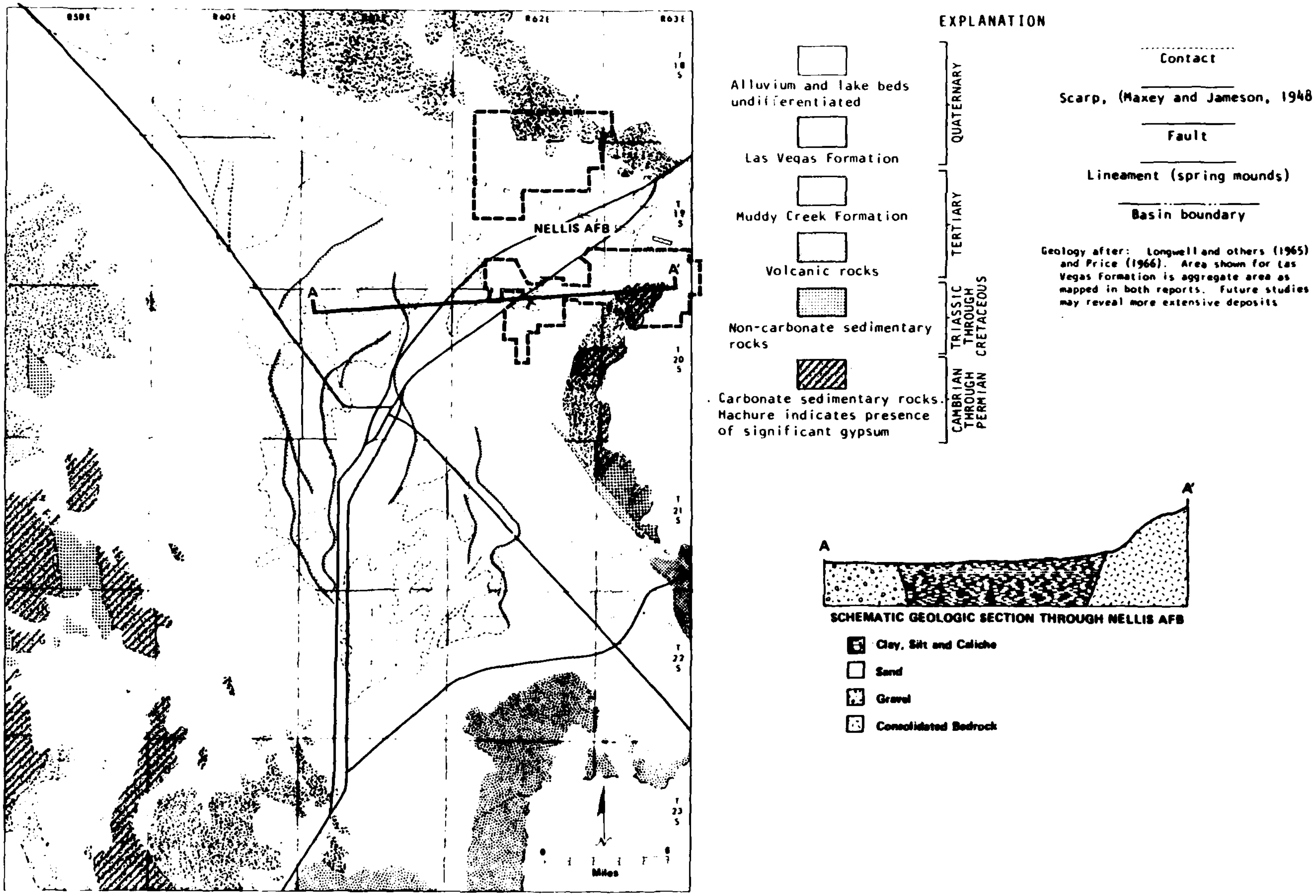
The low-relief surface of the Las Vegas Valley was formed by stream erosion of the surrounding mountains and deposition of the sediments in coalescing alluvial fans in the basin. The topography of the Nellis AFB area generally slopes to the southwest. Numerous small gullies and washes drain the area in a southerly direction. Surface runoff in the immediate vicinity of the base drains to the south, where it subsequently joins the Las Vegas Wash draining to the southeast.

The average annual precipitation at the base is 3.8 inches, and it is evenly distributed throughout the year. Mean monthly temperatures range from a low of 45°F in January to a high of 91°F in July. Annual average lake evaporation in the vicinity of the base is 72 inches (CH2M Hill, 1982).

B. REGIONAL GEOLOGY AND HYDROGEOLOGY

The Las Vegas Valley is a structural basin containing both consolidated and unconsolidated rock. The division of the principal lithologic units in this report follows that of Harrill (1976), in which there are two major lithologic groups based on hydrologic properties. One group consists of unconsolidated and semiconsolidated sediments that were eroded from the surrounding mountains and deposited in the valley as it subsided due to faulting. The second group is composed of the consolidated rocks that underlie the valley fill and occur in the mountains.

The consolidated rocks consist of sedimentary, metamorphic, and igneous rocks of Precambrian to Tertiary age. These units generally have low porosity and permeability and probably do not transmit water except where fractures occur. There is no evidence of significant hydrologic connections between the consolidated rocks and the principal aquifers in the valley fill. Plate 3 shows the general geology of the region.



Geology after: Longwell and others (1965) and Price (1966). Area shown for Las Vegas Formation is aggregate area as mapped in both reports. Future studies may reveal more extensive deposits

SOURCE: Harrill, 1976

DRAWING REFERENCE: MODIFIED FROM CH2M HILL, 1982.

GENERALIZED GEOLOGY

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PLATE 3

The valley fill is composed of the Tertiary Muddy Creek Formation and Quaternary alluvium. The Muddy Creek Formation, approximately 4,000 feet thick, overlies the consolidated rock units and consists of silt, clay, fine sand, and some lenses of pebble conglomerate. Quaternary alluvium is composed of gravel, silt, sand, and clay deposited in alluvial fans and lake beds. The valley fill sediments are the primary source of ground water in the Las Vegas Valley.

As reported by Harrill (1976) and Kaufmann (1976), the valley fill can be divided into two hydrologic units: the near-surface aquifer or shallow ground water system, and the deeper artesian aquifer system. The shallow ground water system is maintained by upward leakage through semiconfining deposits above the artesian aquifers and is also recharged by precipitation, irrigation return flows, and septic tank and sewage treatment plant effluents. Precipitation is only a negligible source of recharge because of the high evaporation rate. The near-surface aquifer ranges up to about 200 feet thick and consists of clay and silt with discontinuous layers of sand, gravel, and caliche. Depths to shallow ground water range from a few feet to approximately 100 feet below ground. The shallow ground water surface generally slopes toward the east and discharges into the Las Vegas Wash along the east side of the valley.

The principal artesian aquifers are generally between 450 and 700 feet in depth, especially in the western part of the valley (Kaufmann, 1976). A deeper aquifer, between 700 and about 1,100 feet deep, is tapped to a lesser extent by the valley wells. The quantities of sand and gravel decrease from west to east, and wells in the eastern part of the valley yield correspondingly less water than wells in the western part of the valley. Transmissivities in wells of the Las Vegas Valley Water District in the western part of the valley range from 240,000 to 310,000 gallons per day per foot (gpd/ft), while wells 5 miles west of Nellis AFB at the Craig Road Well Field showed aquifer transmissivities of 30,000 to 40,000 gpd/ft (Malmberg, 1965). Wells installed at Nellis AFB in the eastern part of the valley indicate transmissivities of approximately 4,300 to 14,000 gpd/ft based upon specific capacities of the wells. Depth to potentiometric surface in the artesian aquifers is highly variable, ranging up to 100 feet below ground. In other words, deep wells drilled into the deep aquifer will strike major aquifer zones between 450 and 700 feet deep. This pressurized aquifer water will rise in the well to approximately 100 feet below surface. The potentiometric surface of the artesian aquifer generally slopes toward the southeast, except for local variations due to pumping.

C. GENERAL HYDROGEOLOGY

Nellis AFB is located in the eastern part of the valley, where the basin sediments contain higher fractions of clay and silt than western and central valley locations. Two hydraulically connected aquifer zones similar to the rest of the valley are recognized beneath the base. The base production wells are completed up to 1,000 feet below ground, where artesian conditions prevail. Shallow ground water within about 100 feet of ground surface also exists beneath the base.

1. Artesian Ground Water System at Nellis AFB

Logs of the base production wells show that the sediments beneath the base consist of clay with occasional layers of sand or gravel up to about 20 feet thick. Ground water in the permeable layers is under artesian pressure and is the source of water for the base water supply wells. Typically, the well casing is perforated over most of its length in order to intercept water from as many permeable layers as possible. Transmissivities estimated from specific capacities measured in base wells of the water-producing layers range from 4,300 to 14,000 gpd/ft. This range is about 1/10 of the transmissivities measured in western and central portions of the valley. Drillers' well logs and completion reports are provided in Appendix A and summarized in Table 2.

Water level records are available for several base wells. Water levels were at about 50 feet below ground in base wells installed in the early 1950s and were at 60 to 70 feet below ground in base wells installed in the 1960s. Since installation, water levels have declined 30 to 60 feet in the base wells, as shown on Plate 4. The decline reversed during the late 1970s, when the base reduced its ground water pumpage by purchasing Lake Mead water from the Southern Water Supply System of the Southern Nevada Water Supply Project (Phase I) (Patt, 1976). The water levels rose as much as 20 feet between 1977 and 1982, although water levels measured during Phase II, Stage 1 were at 1977 levels. Plate 5 shows regional water level contour maps for the principal aquifers for 1973 and 1975.

The local potentiometric surface of the deep aquifer on 8 Nov 83 is shown on Plate 4. Pumping from wells 11, 12, and 13 has apparently created a cone of depression centered near well 13, as shown by the nearly 30-foot difference between the water level elevations measured in wells 13 and 14. These ground water levels represent a gradient of about 40 feet per mile, which is slightly steeper than the 30-foot-per-mile gradient shown on Plate 5 for the regional potentiometric surface. Well 7 had been out of service for 6 months prior to measuring, and it appears that well 14 is also out of service or is not pumped often. The transmissivity indicated by well 14 is relatively low (4,300 gpd/ft), and pumping would create a noticeable

TABLE 2

BASE WELL CONSTRUCTION, YIELD, AND WATER LEVEL DATA

WELL NUMBER	YEAR INSTALLED	DEPTH[a]	CASING DIAMETER (in)	PERFORATED INTERVAL	INITIAL YIELD (gpm)	APPROXIMATE TRANSMISSIVITY[b] (gpd/ft)	WATER LEVEL AT INSTALLATION[a]	RECENT WATER LEVEL[a,c]
6	1951	1,000	12¾	144 to 826	650	7,300	58.1	112
7	1951	760	12¾	150 to 760	320	14,000	54	92
8	1959	913	12	150 to 900	970	NA	NA	NA
11	1962	802	14	302 to 778	400	NA	NA	112
12	1963	1,000	14	320 to 980	600	6,600	59	109
13	1962	694	14	274 to 674	440	9,000	72	113
14	1963	650	14	290 to 630	350	4,300	70	97
314	1951	300	12	120 to 300	NA	NA	17	NA

Source: Well logs filed with Nevada State Engineer and miscellaneous Nellis AFB records (see Appendix A).

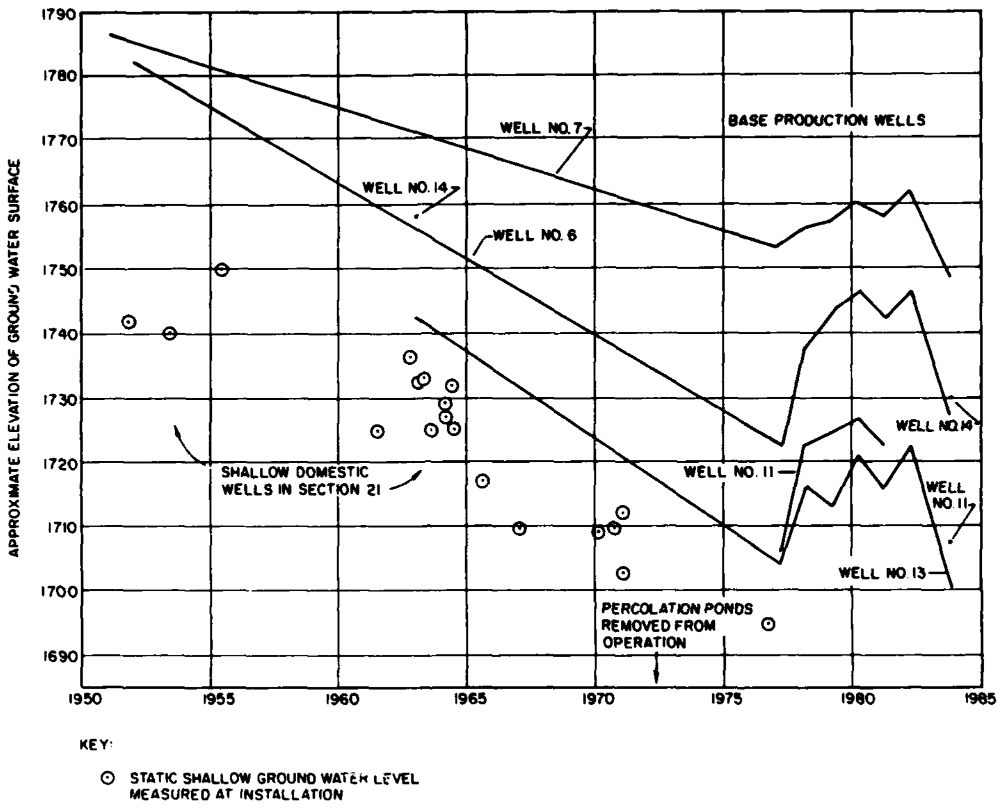
[a] Feet below ground.

[b] Estimated from specific capacity using method of Theis and others (1963) in gallons per day per foot.

[c] Measurement taken 8 Nov 83.

NA = not available

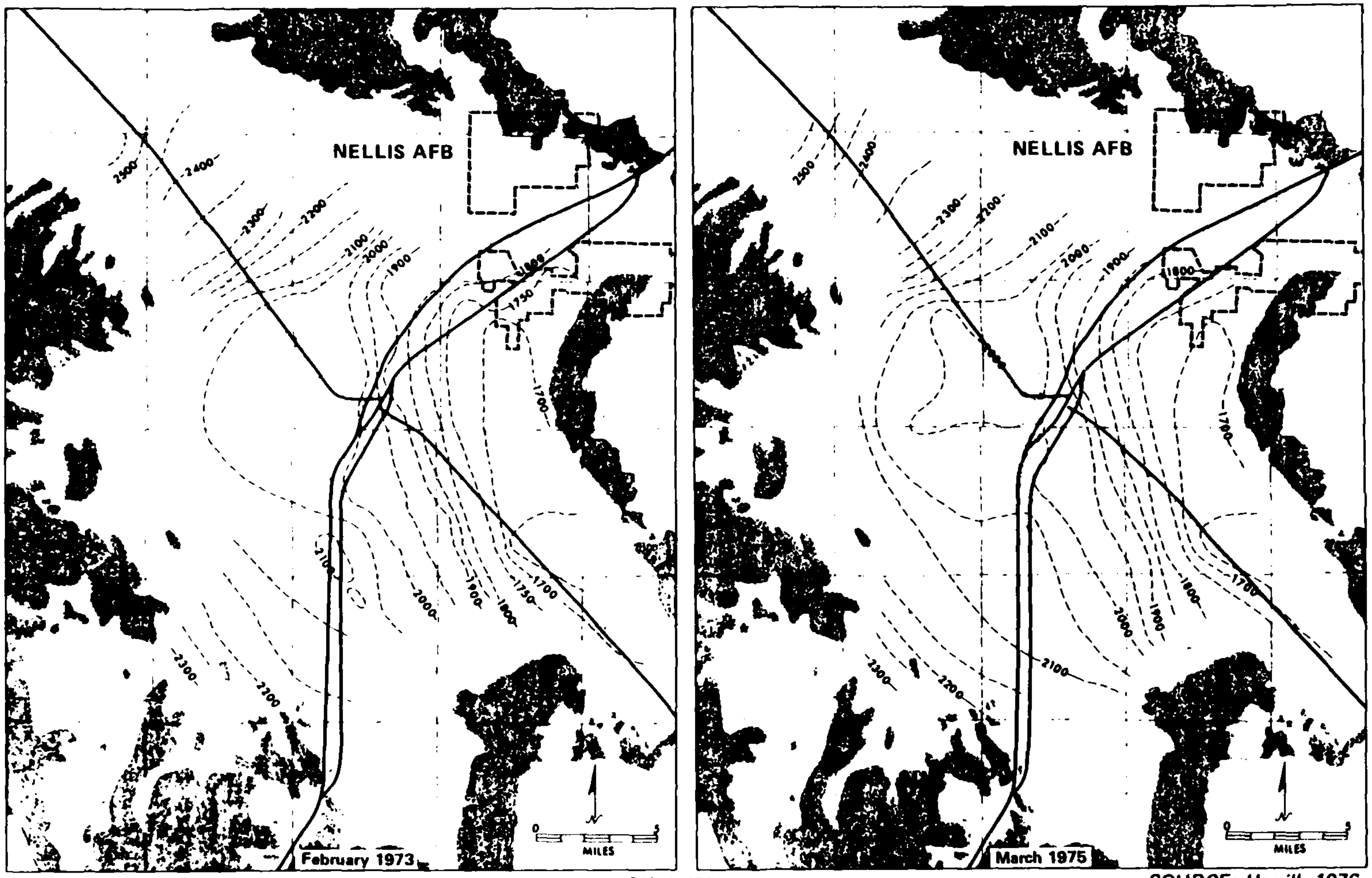
Well locations are shown on Plate 2.



COMPARISON OF SHALLOW AND DEEP GROUND WATER ELEVATIONS

Dames & Moore

PLATE 4



SOURCE: Harrill, 1976.

EXPLANATION

Valley-fill

Consolidated rocks

Contact

Basin boundary

-----------2000---------
Water-level contour, shows altitude of water levels in wells that penetrate the principal aquifers. Dashed because approximately located. Contour interval 50 feet. Datum is mean sea level

WATER LEVEL CONTOUR MAPS FOR WELLS THAT PENETRATE THE PRINCIPLE AQUIFERS, FEBRUARY 1973 AND MARCH 1975

DRAWING REFERENCE: MODIFIED FROM CH2M HILL, 1982.

Dames & Moore

PLATE 5

cone of depression. The highest water levels were in wells 7 and 14 and create a gradient to the southeast, which conforms with the regional artesian ground water system gradient.

Based on analyses of ground water samples from base wells 1, 2, 4, 6, and 7, covering the years between 1954 and 1981, ground water used by the base has always been of relatively good quality (Kaufmann, 1976; CH2M Hill, 1982). The ground water is very hard, although concentrations of total dissolved solids and major anions and cations are low. Only one analysis included trace metals, and all the concentrations except arsenic were below primary drinking water standards (well 4, on 17 Sep 81). None of the analyses included any organic constituents.

2. Shallow Ground Water System at Nellis AFB

Logs of 19 domestic wells located in the northern half of Section 21 (T20S, R62E) immediately south of the base were obtained from the Nevada Department of Water Resources to provide information about the shallow ground water system in the vicinity of the base. The logs (see Appendix A) show that the upper 200 feet of sediments consist primarily of clay with varying fractions of sand, gravel, and caliche. Depth to shallow ground water shown on the logs ranges from 35 to 90 feet below ground, and well yields given on the logs range from 40 to 200 gallons per minute (gpm). The logs are summarized in Section G and Table 3.

Despite the low permeability of the sediments, there is some degree of hydraulic communication between the deep artesian aquifer and shallow ground water. Shallow ground water is recharged by upward flow from deeper artesian ground water, along with infiltration of surface water such as golf course irrigation and seepage from the former base sewage treatment plant percolation ponds when they were in operation. To investigate the relationship between the shallow ground water system and the artesian ground water below, static water levels measured at the time of installation of the 19 domestic wells were plotted on Plate 4. The water levels declined from 30 to 50 feet below ground in the 1950s to 90 feet below ground in 1976, paralleling the decline in base well water levels. The trend shows that as artesian water levels declined, recharge to the shallow ground water system also decreased and lowered shallow ground water levels. It is possible that lowering of the artesian water levels below shallow ground water levels by pumping induced the shallow ground water to drain downward into the deep aquifer. The cone of depression produced in the potentiometric surface of the artesian aquifer by pumping would locally reverse the hydraulic gradient between the deep and the shallow aquifer, causing ground water to move downward in response to the downward gradient instead of upward, which is the natural condition.

TABLE 3

SUMMARY OF DOMESTIC WELLS IN SECTION 21

OWNER	DEPTH*	LOCATION QUARTER	QUARTER	YEAR INSTALLED	CASING DIAMETER	PERFORATED INTERVAL*	WATER LEVEL AT INSTALLATION*	LENGTH OF SURFACE SEAL*	YIELD (gpm)
Brown	100	NW	NE	1952	8	None	43	55	50
Conner	100	NA	NE	1953	8	NA	45	40	NA
Ayers	100	SE	NE	1955	8	60 to 100	35	50	50
Rice	200	SW	NE	1961	8 5/8	60 to 200	60	NA	NA
Mugleston	205	SW	NE	1962	6	85 to 200	49	NA	NA
Black	200	SW	NE	1963	8	100 to 190	60	50	NA
Groft	160	SW	NE	1963	6 5/8	80 to 160	52	NA	NA
Kemp	190	SW	NE	1963	6 5/8	35 to 190	52	NA	NA
Bushone	125	SW	NE	1964	8 5/8	75 to 125	53	50	40
Carbell	200	SW	NE	1964	6	135 to 195	58	NA	NA
Pader	200	NW	NE	1964	6	120 to 200	56	NA	NA
Pruter	150	NW	NE	1964	8	80 to 150	60	50	100
Wells	200	SW	NE	1965	8	135 to 195	68	50	NA
Azvedo	200	SW	NE	1967	8 5/8	60 to 200	75	50	60
Bennett	200	SW	NE	1970	8 5/8	90 to 200	77	50	NA
Newman	200	SW	NE	1970	6 5/8	140 to 200	75	NA	NA
Linn	235	NW	NE	1971	6 5/8	135 to 235	82	NA	NA
Shannon	200	SW	NE	1971	8 5/8	80 to 200	73	50	NA
Dodge	200	SE	NE	1976	6 5/8	160 to 200	90	NA	NA

Source: Well logs filed with Nevada State Engineer (see Appendix A).

*Feet below ground surface.

NA = Not available.

The water levels shown on Plate 4 also suggest that infiltration from the former percolation ponds (Site 17) had little effect on shallow ground water levels south of the base. The effect of the infiltration would have been to maintain uniform shallow ground water levels after 1952, followed by a sharp decline after 1972 when the ponds were abandoned. No such decline is noted on Plate 4. It is conceivable that pumping the base wells created northerly gradients in the shallow ground water system, and seepage from the ponds migrated north toward the base wells. This would explain why no effect from the infiltration was observed in shallow ground water levels south of the base.

No historic information is available on shallow ground water quality beneath the central part of the base; however, elevated nitrate concentrations in shallow ground water south of the base are described in Section E.

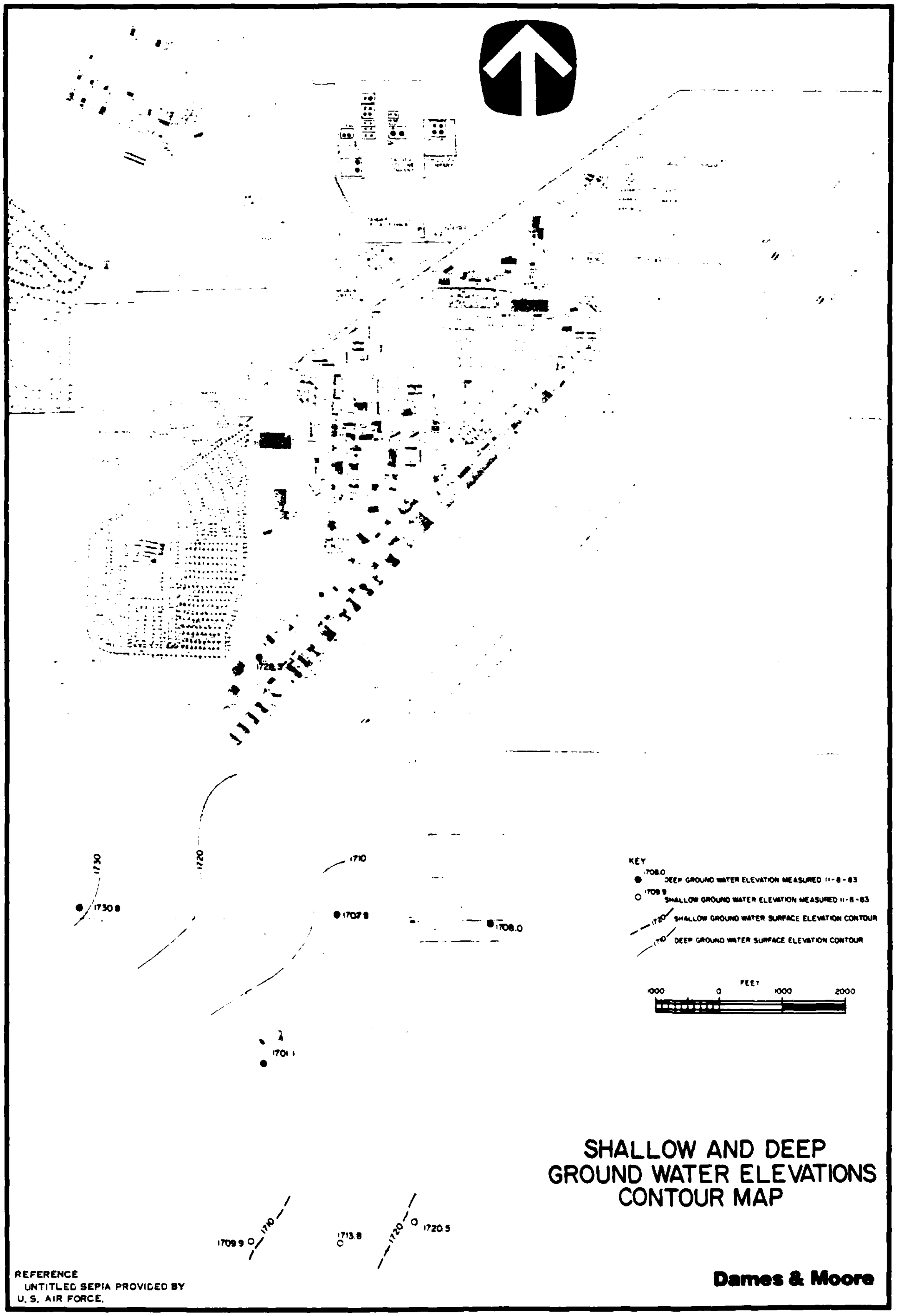
D. SITE-SPECIFIC GEOLOGY AND HYDROGEOLOGY

This section presents the results of surface and subsurface investigations conducted during Phase II, Stage 1 at Sites 1, 17, 24, 15, and 20 at Nellis AFB. The field program is described in Section III, and the results of chemical analyses are presented in Section IV.

1. Sites 1, 17, and 24

These sites comprise the base landfill, former STP percolation ponds, and fuel tank sludge disposal area, respectively, and are considered as a single area because of their close proximity to each other (see Plate 2). Three monitor wells were installed to a depth of 120 feet along the southern end of the landfill, as shown on Plate 2. Based on the results of the IRP Records Search, it was believed that the monitor wells would be downgradient from Sites 1, 17, and 24. Samples collected while drilling the wells consisted of gray and brown clay with varying fractions of sand and silt (see monitor well logs in Appendix A). Ground water levels ranged from 79.3 to 92.2 feet below ground in November 1983. Water level recovery tests conducted in the monitor wells yielded a transmissivity of about 200 gpd/ft (Appendix L), which is low but typical for clayey sediments.

The configuration of the three monitor wells, in a virtual straight line, makes it very difficult to define the attitude of the shallow ground water surface. A strict, geometric interpretation of the shallow ground water level measurements in the three monitor wells results in a west to southwest gradient, unlike the regional shallow ground water surface, which slopes toward the southeast (Plate 6). However, it is more likely that the shallow ground water gradient slopes north or northwest. As previously discussed, shallow ground water levels appear to be affected by



SHALLOW AND DEEP GROUND WATER ELEVATIONS CONTOUR MAP

REFERENCE
UNTITLED SEPIA PROVIDED BY
U. S. AIR FORCE.

Dames & Moore

PLATE 6

pumpage from the artesian aquifer by base wells. If so, a cone of depression created by pumping the base wells would form a northeast-trending, trough-like depression in the shallow ground water surface that encompasses the area between base wells 11, 12, and 13. DM-1, DM-2, and DM-3 are located in a line perpendicular to the southeastern flank of the depression, which is reflected by the increasing depth to water from east to west (DM-3 to DM-1). Net shallow ground water movement would be toward the center of the depression near well 13. Therefore, it is likely that shallow ground water levels are deeper north of the landfill than south of the landfill where the monitor wells have been installed. However, a shallow monitor well would have to be installed in that area to confirm if a northward hydraulic gradient in the shallow ground water system exists. Another consequence of the effects of pumping the base wells is that shallow ground water elevations are probably higher than the artesian water level elevations in the vicinity of base wells 11, 12, and 13 and create a downward hydraulic gradient from the shallow ground water system to the artesian ground water system. This is significant because a downward gradient would provide impetus for contaminants to migrate to the aquifer.

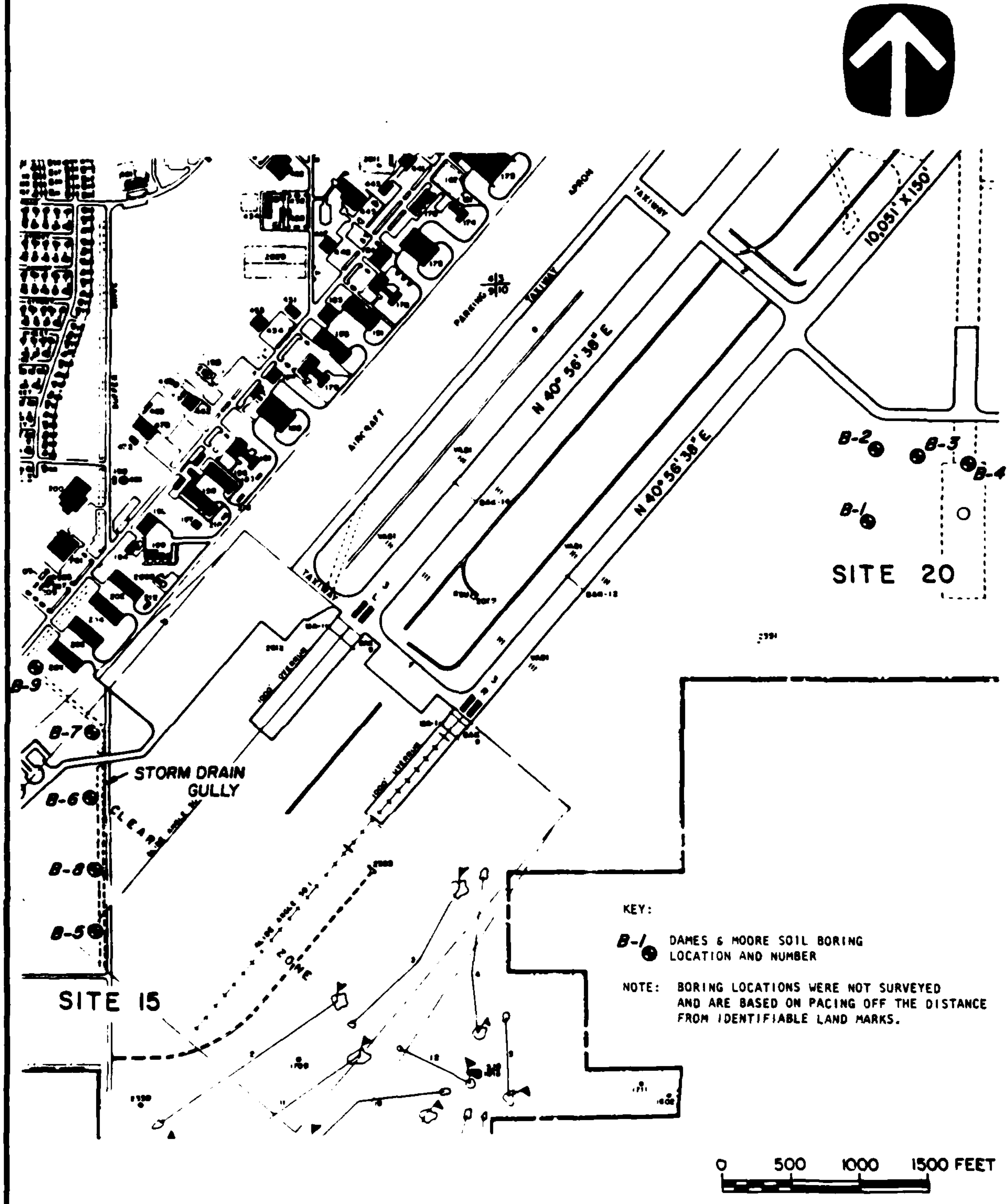
Ground water samples were collected from the three monitor wells and base wells 6, 11, 12, 13, and 14, and the analyses are discussed in Section IV. HNU and explosimeter readings were always less than 1 unit.

2. Site 15

The storm drain gully, designated as Site 15, is located near the southwest end of the runway, as shown on Plates 2 and 7. The ditch is approximately 5 feet deep and approximately 8 feet wide at the bottom. The side slopes of the ditch range from 3:1 to 5:1, horizontal:vertical. In general, the ditch drains toward the south and ultimately terminates in the landfill south of the golf course. The surface of the ditch is covered with grass and small scrubs, and water ponds in spot locations.

The subsurface soil conditions at the storm drain gully were investigated by drilling a total of five borings to depths of 20 feet below the existing ground surface along the bottom of the ditch at locations shown on Plate 7. The logs of borings are presented in Appendix A.

In general, the subsurface soils in the storm drain gully consist of clayey to fine sandy soil with varying amounts of silt and occasional pockets of caliche. Moisture contents ranged from moderately moist (11 to 19 percent) near the surface to very moist (21 to 28 percent) at depth. No ground water was encountered in any of the borings. HNU and explosimeter readings were always less than 1 unit.



LOCATION OF SOIL BORINGS AT SITES 15 AND 20

REFERENCE
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PROVIDED BY U.S.A.F.

Dames & Moore

3. Site 20

The existing fire training area, designated as Site 20, is located at the east side of the runway, as shown on Plates 2 and 7. In general, the site consists of clayey sandy soil covered with occasional grass and scrub. A two-story brick house and several steel cylindrical storage tanks are structures set on fire during training sessions. Surface runoff from the site is collected by a small ditch located along the eastern boundary of the fire training area that continues south past the boundary of the base.

The subsurface soil conditions at the fire training area were investigated by drilling a total of four borings to 20 feet below the existing ground surface at locations shown on Plate 7. The logs of borings are presented in Appendix A.

The soils underlying the fire training area are predominantly clayey silt and fine sandy clay. Moisture contents range from moderately to slightly moist (6.6 to 14 percent) near the surface to very slightly moist (<5 percent) at depth. No ground water was encountered in any of the borings. HNU and explosimeter readings were always less than 1 unit.

E. HISTORIC GROUND WATER PROBLEMS

This section describes two historic ground water problems that have occurred in the vicinity of the base: elevated nitrate levels south of the base, and land subsidence due to ground water depletion.

Kaufmann (1976) investigated elevated nitrate concentrations in private wells south of the landfill (see Plate 2). Nitrate concentrations ranged as high as 22 milligrams per liter as nitrogen (mg/L as N) in wells within 1 mile of the southern boundary of the base. The primary drinking water standard for nitrate is 10 mg/L as N. CH2M Hill (1982) showed one analysis from a USGS well located in a trailer park immediately south of the base. The sample, collected 21 Oct 81, contained 18 mg/L as N, 290 mg/L chloride, 1,200 mg/L sulfate, and 2,430 mg/L total dissolved solids (CH2M Hill, 1982). These concentrations are on the order of 10 times higher than those in ground water from base wells. According to Kaufmann (1976), the degradation of the shallow ground water has been caused by southward (downgradient) migration of contaminants from the landfill and from the former wastewater treatment plant. Percolation ponds (Site 17) were located in the middle of the landfill area. Although there are also septic tanks in the vicinity of the well, Kaufmann (1976) believed the percolation ponds were the source because the nitrate levels in domestic wells were higher than the range observed in domestic wells near other areas of septic tanks in the Las Vegas metropolitan region.

Kaufmann (1976) reported analyses from 12 domestic wells within a mile of the southern boundary of the base, and four of the analyses showed nitrate concentrations in excess of 10 mg/L as N.

The Las Vegas Valley has experienced rapid development since 1954, along with increasing ground water demands. A general decline of ground water levels in the principal artesian aquifers has occurred throughout the valley, especially in the vicinity of the pumping centers located in the western and central portions of the basin. Land subsidence in the Las Vegas Valley is due to the declining hydraulic head and resulting dewatering and compaction of fine-grained aquifer materials. Subsidence of almost 2 feet was recorded near major pumping centers in the Las Vegas Valley from 1963 to 1972. Nellis AFB has experienced approximately ½ foot of total subsidence (CH2M Hill, 1982). Subsidence cracks and fissures have also developed in the alluvium in some parts of the valley. Such cracks may provide conduits for rapid movement of contaminants to the water table; however, no such cracks are known to exist near any of the disposal sites at Nellis AFB (CH2M Hill, 1982).

F. LOCATIONS OF WELLS ON AND OFF BASE

Drilling logs and well construction information were collected for several of the base production wells and for 19 domestic wells located in the northeastern quarter of Section 21 immediately south of the base. Plate 2 shows the locations of the base wells, and they are summarized in Table 2. The domestic wells are summarized in Table 3.

A well inventory of domestic wells located in areas adjacent to Sites 1, 15, 17, and 24 was conducted at the Las Vegas office of the Nevada State Engineer. The inventory included wells located in Township 20 south, Range 62 east, Sections 15, 21, and 22. Section 15 is located east of the disposal sites, Section 21 is to the south and southwest of the sites, and Section 22 is located southeast of the sites.

No records of private wells were found in Section 15, and approximately 350 well records were found in Section 21. Records of six private wells were on file in Section 22, all of which were in the southern half of the section and greater than ½ mile from the base. Therefore, the wells located in Section 21 provide the most information for the purposes of this report. Nineteen representative well records, including well logs, were selected from the northeast quarter of Section 21 and are included in Appendix A and summarized on Table 3. These wells are directly south and within ½ mile of the southern base boundary south of the golf course. Most of these wells were drilled as private domestic supply wells and were completed in the shallow ground water system less than 250 feet below ground. The wells were drilled between 1950 and 1976, and it is not known how many of the wells are active today.

III. FIELD PROGRAM

A. FIELD PROGRAM DEVELOPMENT

The field portion of this study consisted of:

1. Drilling, constructing, and developing three new monitor wells at Site 1, the base landfill;
2. Preparing descriptive geologic logs for each new monitor well;
3. Measuring static water levels and collecting samples for water quality analyses from each new monitor well, and from five base water supply wells;
4. A field survey to establish vertical and horizontal control of all sampled wells was performed by the Air Force; and
5. Drilling and sampling 5 borings to a depth of 20 feet at Site 15 and 4 borings to a depth of 20 feet at Site 20.

B. IMPLEMENTATION

1. Monitor Well Installation

Three monitor wells were constructed at three locations adjacent to and generally southwest, south, and southeast of the base landfill (see Plate 2). The wells were drilled by Thompson Well Drilling of Las Vegas, Nevada using the conventional rotary method with air and foam circulation. A 12-inch borehole was drilled for each well, and cutting samples were collected at regular 10-foot intervals. Descriptions of the cuttings were made in the field by an experienced Dames & Moore hydrologist. These descriptions were used to prepare geologic logs for each drill hole.

The drill holes were also monitored for organic vapors during drilling using an HNU photoionization meter and an explosimeter. Readings were taken with both meters at the top of the borehole at the same time cuttings were collected and described. Readings thus obtained were recorded directly on the boring logs.

The casing installed in the monitor wells is 6-5/8-inch OD, 5-5/8-inch ID Schedule 80 PVC pipe and well screen. The screen used is 40 slot (0.04-inch slots), consisting of horizontal slots factory-sawed in parallel rows. All casing and screen sections were coupled with threaded joints; no PVC solvent or metal screws were used at connections. The three wells were constructed with 30-foot screen sections at the bottoms of the drill holes. The bottoms of the screen sections were fitted with threaded PVC plugs. Screens were set so that the upper 3 to 5 feet of screen extended above the water table. Above the screen, blank casing was installed to 1 to 2 feet above ground surface. Table 4 contains a summary of monitor well construction details.

A prepared, well-sorted silica sand was poured into the annular space adjacent to the screen and blank casing to a depth of about 50 feet below ground surface. The remainder of this annular space was grouted with concrete to the surface. The installations were completed with a 3-foot length of steel pipe equipped with a locking steel cap embedded in a concrete pad surrounding each well.

2. Monitor Well Sampling

After the three monitor wells were constructed and developed, samples for water quality analysis were collected from each well and shipped to the laboratory on the same day. Sampling was conducted in accordance with strict sampling protocol and established chain-of-custody procedures, as described below.

Continuous bailing was conducted at each hole for periods ranging between 50 and 90 minutes, and approximately 10 to 20 casing volumes of water were removed prior to sample collection. Temperature, conductivity, and pH measurements of the well discharge were made periodically during bailings (see Appendix B). Once these parameters had stabilized, samples were collected from the wells using a Teflon sampling bailer. The sampling bailer was suspended in the well by a stainless steel cable and was lowered and retrieved using a hand reel. Prepared sampling containers were completely filled and immediately packed on ice in shipping coolers. One sample for lead analysis was collected from each well, filtered in the field through a 0.45-micron membrane filter, and placed in a sampling container pretreated with nitric acid as a preservative. Table 5 lists the parameters for which laboratory analyses were performed, and the sample size, type of sample container, and preservatives used.

The filtering apparatus, Teflon bailer, the various probes and beakers used during operation of the pH, and conductivity meters were thoroughly rinsed with distilled water after each use to avoid any cross-contamination of samples between wells. All field instruments functioned well and were carefully calibrated after each use, using prepared buffer solutions and conductivity standards. The samples were shipped by air in ice chests and were received at UBTL in Salt Lake City the day following sample collection

TABLE 4

MONITOR WELL CONSTRUCTION DETAILS

WELL	DEPTH[a]	SCREENED INTERVAL		TOP OF GRAVEL PACK[a]	ELEVATION (MSL)		STATE PLANE COORDINATES		STATIC WATER LEVEL[b]
		FROM	TO		MARKER POINT	GROUND SURFACE	NORTH	EAST	
DM-1	120	88	118	50	1804.00	1801.7	529,621	656,743	94.56
DM-2	120	78	108	50	1799.98	1797.9	529,608	658,261	86.18
DM-3	120	74	104	50	1801.85	1799.7	529,975	659,442	81.39

[a] Feet below ground surface.

[b] Feet below marker point, measured 5 Nov 83.

TABLE 5

SAMPLE PRESERVATION AND ANALYTICAL METHODS

PARAMETER	PRESERVATIVE[a]	CONTAINER[a]	MAXIMUM HOLDING TIME[a]	SAMPLE VOLUME[a] (ml)	ANALYTICAL METHOD[b]
Oil and grease	Cool, 4°C, H_2SO_4 to $pH<2$	glass	28 days	1,000	USEPA 413.2
Lead	HNO_3 or HCl to $pH<2$	plastic, glass	6 months	250	USEPA 239.2
Phenol	H_3PO_4 to $pH<4$ 1.0 g $CuSO_4$/1	glass	28 days	1,000	USEPA 420.2
Pesticides	Cool, 4°C	glass, Teflon cap	7 days	1,000	USEPA 608
Nitrates	Cool, 4°C	plastic, glass	48 hours	100	USEPA 353.2
Volatile Aromatics	Cool, 4°C	glass, Teflon cap	14 days	40	USEPA 601
Volatile Halocarbons	Cool, 4°C	glass, Teflon cap	14 days	40	USEPA 602

[a] Water samples only.

[b] USEPA, 1978.

Chain-of-custody forms were prepared and accompanied the samples from the field to the laboratory. These records document the integrity of the samples at each point of transfer, from field personnel to shippers and couriers to laboratory staff. The signatures of the individuals relinquishing and accepting custody of the samples, and the date and time, appear on the records at each point of transfer (see Appendix C).

Water level measurements were made at various times during well construction, after well development, and after sampling. Static water levels were measured after sampling and after sufficient time for equilibration. A battery-powered electric tape was used to measure all water levels. Depth-to-water measurements were made and recorded to the nearest 0.01 foot, using either the top of the PVC casing or a marked measuring point on the top of the steel standpipe as the point of reference.

3. Base Well Sampling

Water samples were also collected from five base wells located in the general vicinity of the base landfill. Base wells 6, 11, 12, 13, and 14 were sampled (see Plate 2). All wells sampled were equipped with electric motor-driven turbine pumps, which were turned on prior to sample collection. Wells were pumped continuously for 2 to 3 hours, during which time periodic measurements of pH, conductance, and temperature were made on the discharge water. Flow meters installed on the discharge line were monitored during pumping, and 9 to 17 casing volumes were removed from the wells prior to sampling. After pH, conductivity, and temperature had stabilized in the discharges, sample bottles were filled directly from a spigot on the discharge line. All sample bottles were filled completely to eliminate head space and were immediately packed with ice in ice chests for shipping to UBTL. Overnight shipping and delivery services were used to insure that all samples were received at UBTL the day after the samples were collected. Chain-of-custody records were maintained as previously described. Table 5 summarizes the sampling parameters, sample size, container type, and preservatives used for each well sampled.

Water level measurements were also made in the five base wells sampled, and in base well 7 located at the west entrance to the base (see Plate 2). Water level measurements were made using an electric tape. Considerable difficulty was encountered in getting reliable water level measurements from the base supply wells because of interference caused by several inches of oil (with low electrical conductivity) present on the water surface within the casing of these wells. As explained by civilian employees responsible for well maintenance on the base, the source of this oil is an automatic oil dripping device installed in each well to lubricate the pump drive shaft. The presence of this oil has never presented any noticeable problems, since water levels during pumping are well above the pump intakes (Reese, 1983). Special care and patience were required to obtain reliable water level measurements, and they are believed to be accurate to the nearest 0.1 foot. The water level measurements were made prior to turning the pumps on for water sampling; however, it should be noted that all the base wells (except well 7, which was out of service for repairs) are pumped varying amounts daily, depending on water demands throughout the base. Consequently, the water levels measured in the base wells may not represent true static water levels. These oils could potentially affect water quality results from these wells; however, since the wells are highly pumped and the pump intakes are far below the floating oil, we believe that the effect of the oil is below detection limits.

4. Well Location and Elevation Survey

The location and elevation of each of the three new monitoring wells and the five base supply wells sampled during the study were surveyed after completion of the field work. The survey work was performed by the Air Force's 820th Civil Engineering Squadron RH (RED HORSE), stationed at Nellis AFB. Vertical control on all wells is reported to be accurate to the nearest 0.1 foot (the limits of a standard second-order survey). Vertical control for the monitoring wells was established at ground level and at the measuring point labeled at the top of the steel surface casing. Vertical control for the base supply wells was established at ground level and on the lower lip of the water level access port from which water levels were measured in the field. Horizontal control on all wells was established using the transverse Mercator projection, State of Nevada, East Zone, Central Meridian 115°35'00.000", N.A. Datum (1927). The results of the survey work are presented in Appendix I.

5. Soil Sampling

The soil sampling program completed during this study consisted of drilling, sampling and logging nine borings to 20 feet below existing ground surface. The borings were drilled using a Mayhew-600 truck-mounted drill rig and were advanced by air rotary using 4-3/4-inch tricone and drag bits. The locations of the borings are presented on Plate 5. The logs of the borings are presented in Appendix A. The field investigation was continuously supervised by a Dames & Moore soils engineer who collected soil samples, classified the soil encountered, and maintained a complete log of each boring. The samples were placed in sterile glass jars and packaged in ice chests until received by the analytical laboratory.

The subsurface soil was sampled using both the Dames & Moore Type U sampler and the California ring sampler, which is a split-barrel sampler similar to the Type U sampler (see Appendix D). The samplers were driven using a 360-pound downhole hammer falling a free distance of 30 inches for each blow. During our investigation, vapors from the potentially contaminated soil were monitored by the HNU photoionization device and/or the explosimeter. The soil samplers were cleaned with acetone and hexane between each sample to prevent cross-contamination of samples.

Upon completion of the drilling, the borings were grouted to the ground surface with mortar mixture consisting of sand, cement, and bentonite.

6. Analytical Methods

The ground water and soil samples were analyzed according to USEPA (1978) methods. Table 5 lists each parameter and its analytical method. More details are given in Appendix D.

IV. DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

A. DISCUSSION OF RESULTS

This section presents a discussion of the chemical analyses of ground water and soil samples collected during field investigations at Sites 1, 17, 24, 15, and 20. The second part of this section discusses the significance of the results. Primary drinking water standards, along with detection limits for the parameters analyzed, are given in Table 1.

1. Sites 1, 17, and 24

Sites 1, 17, and 24 will be considered together because of their close proximity to each other (see Plate 2). Field investigations included installing and sampling three monitor wells immediately south of the landfill, and sampling base production wells 6, 11, 12, 13, and 14. The field investigation is described in Section III, and the complete analyses are in Appendices B and D.

a. Detectable Parameters

Of the 44 parameters in the ground water analyses (Table 1), only 6 were present in one or more samples above detection limits, as shown in Table 6. The detected parameters included 2 halocarbons (1,1,1-trichloroethane and toluene), 2 pesticides (aldrin and DDT isomers), nitrate, and phenol. The nitrate concentration in the DM-3 sample exceeded the primary drinking water standard (PDWS) of 10 mg/L for nitrate (as N) established by the U.S. Environmental Protection Agency (USEPA).

1,1,1-trichloroethane was detected in four samples (DM-1, DM-2, DM-3, and base well 12) at a maximum concentration of 3.5 µg/L. Toluene was detected in samples from DM-2 and base wells 6 and 13 at a maximum concentration of 12.77 µg/L. Of the pesticides, aldrin was detected in samples from DM-1 and base wells 11 and 13, while DDT isomers were detected in the DM-1 sample. The aldrin concentrations in all the above samples were 0.01 µg/L [or 10 nanograms/liter (ng/L)], which is the level of detection for aldrin. Concentration of DDT isomers in the DM-1 sample was 0.06 µg/L. Phenol was detected only in the well 13 sample at 0.0080 mg/L.

Nitrate was not included in the analyses for the samples from base wells 6 and 14. Nitrate was detected in all the samples in which it was analyzed, and ranged from 9.2 to 16 mg/L in monitor wells DM-1 through DM-3 and from 0.39 to 0.67 mg/L in the base wells. Only the concentration of nitrate in the DM-3 sample exceeded the water quality criterion (PDWS) of 10 mg/L as N. The PDWS was

TABLE 6

SUMMARY OF CONSTITUENTS ABOVE DETECTION LIMITS IN GROUND WATER ANALYSES

	WELL NUMBER							
CONSTITUENT	DM-1	DM-2	DM-3	WELL 6	WELL 11	WELL 12	WELL 13	WELL 14
Purgeable Halocarbons and Aromatics (mg/L)								
1,1,1-trichloroethane	0.34	3.5	0.95	ND	ND	2.5	ND	ND
Toluene	ND	12.77	ND	0.7	ND	ND	7.1	ND
Pesticides (μg/L)								
Aldrin	0.01	ND	ND	ND	0.01	ND	0.01	ND
DDT isomers	0.06	ND	ND	NA	ND	ND	ND	NA
Others (mg/L)								
Nitrate (as N)	9.8	9.2	16	NA	0.45	0.67	0.39	NA
Phenol	ND	ND	ND	NA	ND	ND	0.80	NA

Notes:
(1) Those constituents not listed above were present at concentrations less than detection limits.
(2) Table 1 lists all the constituents analyzed and their detection limits.
(3) Concentrations that exceed water quality criteria are underlined.
(4) ND = none detected; NA = not analyzed.

established at 10 mg/L as N because infant methemoglobinemia does not occur when nitrate is below that level. The levels found in the base wells are considered to be at or below background.

b. Reliability of the Analyses

The water quality analyses are considered to be reliable by virtue of the well construction measures taken in the field to ensure that the samples were representative, and by virtue of quality control procedures in the laboratory. The analyses may not represent downgradient conditions, however, because of the monitor well locations.

There is some doubt whether the monitor wells are actually downgradient from the waste disposal sites. The shallow ground water gradient appears to slope toward the north or west, based on monitor well water levels and effects of pumping in the artesian aquifer. This suggests that the monitor wells may be upgradient from Sites 1, 17, and 24 and, therefore, may not be intercepting contaminants from the sites.

The monitor wells were screened above and below the water table, where contaminants would be concentrated. After the monitor wells were installed, they were thoroughly developed by bailing to remove all traces of drilling fluid from the wells and to improve the flow of ground water into the wells. Bailing was continued until the specific conductivity of the well water stabilized. At least three casing volumes of water were removed from the monitor wells and base wells prior to sampling. The monitor well samples were collected with a Teflon bailer to minimize agitation and consequent aeration of the sample, which could volatilize organic chemicals. The Teflon bailer does not absorb any chemicals from the sample, thereby preventing any effects on sample chemistry and cross-contamination of subsequent samples.

The laboratory quality control (QC) program is described in detail in Appendix B. In general, analyses of duplicate samples were satisfactory. Recovery of spikes was always greater than 100 percent and ranged as high as 133 percent for the halocarbons and aromatics. Therefore, the reported concentrations of 1,1,1-trichloroethane are probably overestimated. This is not significant because the reported concentrations of 1,1,1-trichlorethane do not represent a health risk. Recovery of pesticide spikes ranged from 86 to 113 percent, slightly beyond the generally acceptable limits of 90 to 110 percent. Because the average is about 100 percent, the reported concentrations of aldrin and DDT isomers are considered reliable. However, at these very low concentrations of aldrin detected (at 0.01 μg/L, the detection limit), ambiguities in the analytical results may erroneously indicate the presence or absence of this constituent. Although the results were rechecked, the analyst said that it is possible that the results may have been caused by a constituent other than aldrin. There are also physical reasons why aldrin would not be expected to be present. Aldrin is a relatively unstable compound and readily converts to dieldrin, which is one of the more persistent chlorinated pesticides (USEPA, 1979). It would be more likely that both aldrin and dieldrin, or dieldrin alone, would be detected rather than only aldrin.

c. Background Concentrations

Background concentrations of the detectable parameters are only available for nitrate and are very limited. No previous analyses included volatile organics, pesticides, or phenol. Kaufmann (1976) considered concentrations of nitrate up to 2.2 mg/L as N as background levels in shallow ground water. This concentration was based on nitrate concentrations observed in samples from wells completed in deeper levels of the artesian aquifer. Ground water from the deeper aquifer would not be contaminated by urban nitrate sources such as septic tanks and sewage treatment plant effluent.

2. Site 15

Site 15 is located several hundred feet southwest of the runway and flight line, as shown on Plate 2. The field investigation consisted of five borings drilled to a depth of 20 feet at locations shown on Plate 7. Soil samples were collected at 1-foot intervals, and 16 samples were analyzed for oil and grease and the purgeable halocarbons and aromatics listed in Table 1. None of the parameters was present above detection limits in soil samples from Site 15.

These results are considered reliable because of efforts taken in the field to avoid contamination of the samples, although the analytical results may have underestimated the actual concentrations based on results from the QC program in the laboratory. The soil sampler was rinsed between samples with acetone and hexane, and the soils engineer wore disposable gloves when it was necessary to handle the samples. The samples were placed in sterile glass jars and kept on ice until delivered to the laboratory.

Appendix B contains a complete description of the laboratory QC program. In general, the duplicate samples were analyzed satisfactorily, but spike recovery was variable. Recovery of spikes ranged from 18 to 130 percent and averaged about 71 percent for 0.01 µg/g spikes, which is the detection limit for the halocarbons and aromatics. Recovery of the 0.025 µg/L spikes improved but was frequently beyond the acceptable limits of 90 to 110 percent. Reported concentrations near the detection limits are probably less than the actual concentrations.

Despite the low spike recoveries, it is likely that the soil contains insignificant amounts of contaminants. Readings from the photoionization meter (HNU) were usually low, and no explosive vapors were detected. The contaminants are volatile, and vaporization is accelerated by the relatively high soil temperatures.

3. Site 20

Site 20 is located east of the runway, as shown on Plate 2. The field investigation consisted of drilling four borings to depths of 20 feet at locations shown on Plate 5 and collecting soil samples at 1-foot intervals. Twelve samples were analyzed for oil and grease and volatile halocarbons and aromatics listed in Table 1. Only benzene was detected above detection limits in any of the Site 20 samples. Sample 6 from Boring 2 contained 0.016 µg/g on a dry weight basis, as shown in Table 7. These analyses are considered reliable for the reasons described above for Site 15.

B. SIGNIFICANCE OF FINDINGS

Based on the results described in the previous section, this section will estimate, to the degree possible, the extent of contamination at each site.

1. Extent of Contamination at Sites 1, 17, and 24

Contamination of the ground water beneath Sites 1, 17, and 24 was shown by the presence of six inorganic or organic chemicals in one or more of the monitor well and/or base well samples. The absence of the other 37 parameters suggests that the contamination is relatively limited.

Nitrate was detected in all the samples in which it was analyzed. The concentrations were highest in the monitor wells south of the landfill and lowest in the base wells north of the golf course (see Plate 2). Because the concentrations in the base wells were below levels considered to be background, the deep artesian aquifer system appears to be currently unaffected by nitrates.

The extent of nitrate contamination in the shallow ground water encompasses the area in the vicinity of the monitor wells and, as reported by Kaufmann (1976), includes areas south of the base. No wells have been sampled east, west, or north of Site 17, so it is impossible to trace the extent in those directions.

According to Kaufmann (1976), excessive nitrate concentrations in shallow ground waters south of the landfill are due primarily to leakage from the former sewage treatment plant percolation ponds operated at Site 17 by Nellis AFB from 1940 until 1971. About 0.55 million gallons of wastewater per day were treated

TABLE 7

SUMMARY OF CONSTITUENTS ABOVE DETECTION LIMITS IN SOIL SAMPLES

CONSTITUENT	SITE	BORING NUMBER	SAMPLE NUMBER	SAMPLE DEPTH (ft)	CONCENTRATION (µg/g)*
Benzene	20	B-2	6	6	0.016

*Micrograms per gram on a dry weight basis.

Note: Oil and grease and the purgeable halocarbons and aromatics listed in Table 1 comprised the soil sample analyses. Detection limits are also listed in Table 1.

between 1958 and 1971. Other potential sources of nitrate include infiltration from the base golf course, which was partially irrigated with secondary effluent until 1971, or septic tank leachate from septic tanks west of the landfill area or near the contaminated private wells. The hydrologic information collected for the shallow ground water system was inadequate to distinguish between these several possible sources.

There is some doubt that Site 17 is the source of nitrate contamination because of the lack of information regarding the shallow ground water gradients south of the landfill. As discussed previously, the regional shallow ground water gradient was anticipated to be toward the south and east, based on the findings of Phase I. It is likely, however, that the shallow ground water surface is locally affected by pumping of the base production wells, and it appears that the shallow ground water gradient may slope toward the north. It is possible that the northerly gradient also prevailed while the percolation ponds were in operation, and infiltration from the ponds would have migrated north away from the private wells. A second cause of uncertainty regarding the former percolation ponds as a current source of off-base nitrate contamination is the lack of a driving force. When the percolation ponds were in operation, there were substantial amounts of infiltration from the ponds to carry nitrate to the shallow ground water system. Currently, precipitation and golf course irrigation are the only driving forces to carry nitrates into the shallow ground water system. Precipitation is an insignificant source of recharge because only about 2 percent of the annual precipitation of 3.7 inches infiltrates to the shallow ground water system (Patt, 1976). Therefore, there currently is no driving force to carry nitrate directly from Site 17. Irrigation of the golf course required an estimated 485 acre-feet per year in 1973, of which about 200 acre-feet, or 0.18 million gallons per day, recharged the shallow ground water system (Patt, 1976). The absence of a monitor well completed in the shallow ground water system between the golf course and Site 17 makes it impossible to estimate the amount of nitrate that is being carried from the golf course to the water table.

1,1,1-trichloroethane was detected in one of the base wells (well 12) and in all three monitor wells. The source of 1,1,1-trichloroethane in the monitor wells may have been waste solvents disposed of in the landfill or discharged in the percolation ponds from the former wastewater treatment plant. The source of the 1,1,1-trichloroethane in well 12 is unknown, although solvents were disposed of at Sites 17, 15, and 24, and leachate from any of those sites could be captured by the hydraulic gradient created when well 12 is pumping. However, some of the area of influence in well 12 is beneath off-base areas. 1,1,1-trichloroethane does not readily sorb onto soil particles, so it can be carried by downward percolating ground water with minimal attenuation (USEPA, 1979).

The extent of contamination due to 1,1,1-trichloroethane includes shallow ground water beneath the landfill and areas south of the landfill and the deep aquifer in the vicinity of well 12. The presence of elevated nitrate concentrations in shallow ground water south of the base indicates that there is also potential for migration of 1,1,1-trichloroethane south of the base.

The four remaining contaminants, aldrin, DDT isomers, phenol, and toluene, were each detected in three or fewer samples and show no patterns that define the extent of contamination in the area north of the golf course. Contaminants detected in the monitor well samples show that the extent of contamination includes the shallow aquifer in the area south of and probably including Sites 1, 17, and 24. There are no analyses of samples from off-base wells that included organic chemicals from which to estimate off-base contamination. The extent shown by nitrate may serve as a rough approximation, but organic constituents behave differently in the subsurface environment, and the extent of organic contamination should also be different. As discussed above for well 12, the hydraulic gradients in the artesian aquifer created by pumping wells 11, 12, and 13 can intercept leachate from any of several disposal sites. This makes it very difficult to estimate the extent of contamination due to any single disposal site or contaminant. Further, the contaminant may have entered the well below or through fractures in the borehole seal.

In general, the extent of contamination shown by the six detected parameters in shallow ground water samples include Sites 1, 17, and 24; areas to the south of those sites; and, according to Kaufmann (1976), nitrate contamination extends almost a mile south of the base. The extent of contamination in the artesian aquifer north of Sites 1, 17, and 24 is difficult to assess because there was no pattern in the contaminants detected in the base wells. The hydraulic gradients created by pumping the base wells and the downward gradient from the shallow aquifer to the deep aquifer could induce contaminants from any of several disposal sites to migrate to the base wells.

2. Extent of Contamination at Sites 15 and 20

Soil analyses yielded no evidence of contamination at Site 15, and only one sample from 6 feet below ground at Site 20 contained any contamination. Based on these results, there is apparently no significant contamination at these sites.

3. Evaluation of Contamination at Sites 1, 17, and 24

Six constituents were detected at one or more of the base or monitor well samples. Nitrate exceeded PDWS. As discussed previously, nitrate contamination is limited to shallow ground water in the vicinity of the monitor wells. Therefore, the base water supply is not threatened at this time, and the principal concern is the elevated nitrate concentrations in shallow ground water that were found in the monitor wells and reported for private wells south of the base.

Nitrate in shallow ground water in the vicinity of the monitor wells does not pose a health risk for the base because the base does not utilize shallow ground water for any purpose. However, it is possible that nitrate from Site 17 has contaminated the shallow ground water that is used for drinking water south of the base, thereby creating a moderate health risk. The health risk is deemed moderate because shallow ground water south of the base is not severely contaminated. The maximum nitrate concentrations reported by Kaufmann (1976) are only about a factor of two above the drinking water standards, and only one of the concentrations in the monitor well samples exceeded the PDWS of 10 mg/L as N (16 mg/L as N in DM-3). Further, the percolation ponds at Site 17 were taken out of operation in 1972, thereby terminating both the suspected principal source of the nitrate and the infiltration that may have been carrying nitrate to the water table. Since then, only a negligible amount of infiltration is created by the fraction of precipitation that is not evaporated or transpired. Currently, only golf course irrigation has the potential of generating enough infiltration to carry nitrate through the water table, but it is unknown if the infiltration is creating any contamination. There does not appear to be a substantial plume of ground water highly contaminated with nitrate originating from Sites 1, 17, and 24.

4. Evaluation of Contamination at Sites 15 and 20

Based on the fact that no significant evidence of contamination was found at Sites 15 and 20 during this study, there does not appear to be a health risk associated with these sites.

V. ALTERNATIVE MEASURES

This section describes several alternatives for further defining the extent and magnitude of ground water contamination that has been identified at Nellis AFB. The alternatives include installation of four additional shallow monitor wells, resampling the base wells and monitor wells that were sampled once during Phase II, Stage 1, addition of major cations and anions to subsequent ground water analyses, monitoring of selected wells in which contaminants are found, and inventorying and possibly sampling private wells and septic tanks south of the base where nitrate contamination in shallow ground water has been reported. Each alternative is discussed below.

The results of Phase II, Stage 1 did not provide enough information to adequately define the shallow ground water regime. In fact, the results were somewhat contradictory to what was expected. For example, CH2M Hill (1982) and Kaufmann (1976) anticipated that shallow ground water would flow southeast or east on a regional basis; however, water level measurements from the monitor wells installed by Dames & Moore indicated that the shallow ground water gradient apparently slopes to the west or north. Based on our analyses, it is questionable whether the monitor wells are actually downgradient, and it appears that the monitor wells may, in fact, be upgradient from Sites 1, 17, and 24. Further, more information needs to be collected about the shallow ground water system before reliable estimates can be made of the extent and magnitude of shallow ground water contamination.

It is recommended that four additional monitor wells be installed at locations shown on Plate 2. For ease of reference, these have been numbered DM-4 to DM-7. The basis for each well is as follows:

DM-4 and DM-5 — Water levels from these proposed wells and the existing monitor wells would define the attitude of the shallow ground water surface and would indicate the direction contaminants are migrating from Sites 1, 17, and 24.

DM-6 — This well should be located north of Sites 1, 17, and 24 and would provide needed information on the shallow ground water gradient. However, DM-6 may intercept infiltrating irrigation water from the golf course and would indicate whether the golf course is a significant source of nitrate contamination. Located near base well 13, DM-6 may also provide information on the degree of hydraulic communication between the shallow and artesian ground water systems through a comparison of water level fluctuations and water quality in the two wells.

DM-7 — This well, located north of the golf course and next to base well 11, would yield water samples that should be minimally affected by infiltration of irrigation water from the golf course. Information gained would include better background water quality data for the shallow aquifer system, better definition of the elevation of the ground water table surface, and data on vertical hydraulic gradient.

The four additional wells would be completed at a depth of about 120 feet and would be constructed from PVC casing and well screen similar to the monitor wells installed for Phase II, Stage 1 (see Section III).

The base wells and monitor wells should be resampled to confirm the presence or absence of the parameters in the first analyses. Most of the organic constituents were at or below detection limits in the ground water samples. At these very low concentrations, ambiguities in the analytical results may erroneously indicate the presence or absence of a constituent. Resampling would confirm the existence of aldrin and other organic constituents that may have been falsely identified or overlooked. Extraction of large volume samples and double column confirmation would provide lower detection limits and positive confirmation of components detected. This second round of sampling should include the additional monitor wells described above.

The major anions, cations, and drinking water parameters listed in Table 8 should comprise the analyses of all subsequent ground water samples to more accurately assess ground water quality in both aquifers beneath the base. The additional parameters will provide a detailed characterization of the ground water composition in both ground water systems. Tracing the changes in composition of ground water from different areas beneath the base will show the effects of mixing of various waters, and would indicate the impacts of the various base facilities and disposal areas on ground water quality. One or more of the anions such as chloride or sulfate may serve as an accurate contamination indicator. The cations, along with the anions, generally define a "fingerprint" of a particular ground water type that can be recognized among different samples. Comparison of the ground water types can show the occurrence of mixing of shallow and artesian ground water or the addition of contaminants to the ground water systems.

The wells in which contaminants are confirmed should be sampled three more times at quarterly intervals to define the temporal variation of the concentrations. The analyses should show the relationship of contaminant concentrations and seasonal pumpage and would help to prioritize the contaminants that may warrant remedial action. The quarterly monitoring, where necessary, would include measurement of the water level and analysis of the confirmed contaminants plus pH, specific

TABLE 8

RECOMMENDED PARAMETERS FOR FUTURE GROUND WATER ANALYSES

Cations

- Calcium
- Magnesium
- Potassium
- Sodium

Anions

- Sulfate
- Chloride
- Fluoride
- Bicarbonate
- Carbonate
- Nitrate

Others

- pH
- Specific Conductivity
- Total Dissolved Solids
- Lead
- Oil and Grease
- Phenol
- Total Organic Carbon
- Total Organic Halogen

Organic Constituents

- EPA 601 and 602 Purgeable Halocarbons and Aromatics

Pesticides

- Aldrin
- Dieldrin
- Chlordane
- DDT isomers
- Endrin
- Endrin Aldehyde
- Heptachlor
- Lindane

conductivity, TDS measurements and the major cations and anions in Table 8 to indicate general water quality. Sample collection and analytical methods would be the same as those employed for Phase II, Stage 1 and are described in Section III. After samples have been collected for the three quarters following the resampling, the results should be examined, and the need for either continued monitoring or other actions should be evaluated at that time.

If information about the shallow ground water system collected during the next phase indicates that hazardous levels of contaminants may be migrating from the base to private wells used for drinking water, then an inventory should be conducted of private wells completed in shallow ground water downgradient of the base. The purpose of the inventory would be to identify the number of private wells in use in areas that may be affected by contamination from the base. The extent and magnitude of contamination caused by the base would be directly proportional to the number of private wells adversely affected by the contaminants. The results of the inventory may also reveal other potential sources of contamination in the vicinity of the private wells. The inventory should include the following information: well depth, completion date, casing size, screened interval, lithologic log, yield, use, daily extraction, static and pumping water levels and elevations, appearance of water, condition of surface seal and evidence of nearby contamination sources (i.e., heavily fertilized lawns or gardens, livestock, garbage dumps, waste petroleum products, or septic tanks). Some of this information may be available from the Department of Water Resources or State Engineer, but the remainder should be obtained in the field for accuracy. Because the inventory might create considerable public concern, it should be done only if hydrologic information shows little doubt that the base is a potential source of contaminants in the shallow private wells.

Prior to 1972, water infiltrating from the percolation ponds at Site 17 and golf course irrigation were significant sources of recharge to shallow ground water and maintained a driving force carrying contaminants to the water table. Currently, golf course irrigation is probably the principal source of recharge of the shallow ground water. Although sewage effluent is no longer used to irrigate the golf course, excess irrigation may be a significant driving force to leach contaminants from the soil and carry them to the shallow water table. According to Patt (1976), golf courses in the Las Vegas area in 1973 were irrigated with volumes of water ranging from 2.7 to 11.5 acre-feet per year, while the Nellis golf course was irrigated with 7.82 acre-feet per year. Overwatering may create net downward infiltration of water which could leach contaminants from the soil, especially the part of the golf course built over the former landfill. The permeability of the unsaturated zone between ground surface and the water table increases with the soil moisture content, and by minimizing soil moisture content, contaminant migration can be slowed or attenuated. Excessive fertilization adds more nutrients such as nitrate to the soil than can be utilized by vegetation. The excess may migrate downward increasing the already high nitrate concentrations in shallow ground water. A study should be conducted to evaluate current irrigation and fertilization practices of the golf course. If excessive watering or fertilization is indicated, optimization studies and procedures can be recommended.

Contaminant plumes may often be defined using surficial resistivity surveys. Ground water carrying contaminants generally contains a higher concentration of dissolved solids and is consequently more conductive than ground water upgradient from the contaminant source. The contaminated ground water might then be identified by its relatively low resistivity. The advantages of resistivity surveys include the capability to cover large areas in less time and at relatively less cost than could be done by installing wells. A combination of resistivity surveys calibrated with a small number of wells may provide a very cost-effective and informative subsurface investigation. However, the disadvantages of the technique preclude its use at Nellis AFB. The large depth to shallow ground water severely diminishes the resolution of the survey. The technique requires a significant resistivity contrast between the contaminated and uncontaminated ground water. As discussed previously for nitrate in the shallow ground water system, there does not appear to be a contaminant plume composed of contrasting water quality originating from the base. There are significant differences between the nitrate concentrations in the shallow and artesian ground water systems, but the resistivity survey would only detect the shallow ground water system. Concentrations of the other constituents are too close to detection limits to create the necessary water quality contrast.

Borehole geophysical methods such as resistivity, self potential, density, and gamma radiation are often used to characterize and correlate geologic and hydrologic conditions. However, they would not yield significantly more subsurface information than that collected during the drilling and sampling carried out for Phase II, Stage 1. Like surficial geophysical methods, borehole methods yield the most information from sediments with contrasting properties such as composition, grain size, moisture content, density, or degree of consolidation. The shallow sediments beneath the base consist primarily of clay and silt without sufficiently contrasting characteristics, which would make the borehole measurements at Nellis AFB relatively useless.

Unsaturated zone monitoring is a method of investigation that is used to characterize the quality of water in the soil pores above the water table. The sample is collected in a lysimeter that is buried at some depth beneath the area of investigation. A lysimeter is a porous ceramic container with separate sampling vacuum hoses attached to it. Soil water is collected by evacuating the lysimeter and then pressuring it to retrieve the sample. If the soil moisture content is low, up to several days may be required for soil water to seep into the lysimeter. Lysimeters are useful because they provide samples of downward infiltrating water before it reaches the water table. They can be used to isolate sources of ground water contamination.

The main disadvantages of lysimeters are that the porous ceramic filter plugs with soil or the hoses break or collapse. Their usefulness at Nellis AFB would be limited by the lack of infiltrating water because of the high evaporation rate. Lysimeters might be useful beneath the golf course to collect samples of irrigation water as part of a program to optimize irrigation procedures.

Nitrogen isotopes have been used to distinguish between nitrogen generated by fertilizers and human or animal wastes. The technique is based on the relative enrichment of nitrogen-14 and nitrogen-15. At Nellis AFB, this technique could be used to determine whether nitrate in the shallow ground water samples originated from human wastes at Site 17 and septic tanks, or from fertilizers at the golf course. The disadvantage of isotopes is that there is enough uncertainty in the isotope analyses that supporting hydrologic evidence is needed to corroborate the results. Therefore, the use of isotopes at Nellis AFB is premature until the shallow ground water flow regime is better known.

VI. CONCLUSIONS

The following section contains a summary of the conclusions reached after completion of Phase II, Stage 1. Recommendations for the next phase of IRP are given in Section VII. Attendant costs are given under separate cover in Appendix K.

The results of Phase II, Stage 1 showed that two ground water systems exist at Nellis AFB. The shallow ground water system occurs in approximately the upper 200 feet of sediments and is maintained by upward leakage from the deeper artesian ground water system and surface infiltration from precipitation, septic tank leachate, and irrigation waters. Current shallow ground water levels are approximately 90 to 100 feet below ground surface. Many domestic wells in the vicinity of Nellis AFB are completed in the shallow ground water system. Although the regional shallow ground water gradient is reportedly toward the south and east, shallow ground water levels in monitor wells installed during this investigation appear to be affected by base well pumping and indicate that shallow ground water gradient in the vicinity of the base may be toward the northwest.

Beneath the shallow ground water system are several artesian aquifers that comprise the principal ground water supply for not only the base but also the major ground water users in the Las Vegas Valley. Artesian water levels range between 90 and 110 feet below ground and appear to form a depression in the vicinity of base wells 11, 12 and 13. The deep artesian aquifer is recharged primarily by precipitation in the mountains surrounding the Las Vegas Valley.

Although the shallow ground water system has a low transmissivity, there is a small degree of hydraulic communication between the two aquifers. A comparison of the artesian water levels measured in base wells and shallow ground water levels measured in domestic wells since 1950 showed that the shallow water levels declined at the same rate as the artesian water levels. This indicates that, as the artesian water levels decline, recharge to the shallow aquifer decreases and causes shallow ground water levels also to decline. Therefore, it is possible that shallow ground water levels north of Sites 1, 17, and 24 are lower than shallow ground water levels in the vicinity of the monitor wells installed south of those sites. If this is true, then the monitor wells may be upgradient rather than downgradient from the disposal sites.

It is also possible that shallow ground water levels in the vicinity of the base production wells are higher than the artesian water levels, thereby creating a downward hydraulic gradient. This is significant because a downward hydraulic gradient may induce contaminants from the shallow aquifer to migrate to the artesian aquifer. However, more information regarding the shallow ground water system needs to be collected to better define the relationship between the shallow and artesian ground water systems.

Contaminants that may have originated from past waste activities at the base were present in samples from the base wells and monitor wells. Nitrate, phenol, 1,1,1-trichloroethane, toluene, aldrin, and DDT isomers were present in one or more ground water samples. Nitrate in the DM-3 sample exceeded PDWS. Aldrin determinations are suspect, as discussed previously.

Nitrate was detected in all the ground water samples. The concentrations were low in the base well samples and near or above drinking water standards in the monitor well samples. Although the nitrate concentrations pose no health risk for the base, there is a possibility that Sites 1, 17, and 24 may be the source of elevated nitrate concentrations in domestic wells immediately south of the base. Reported nitrate concentrations from this area are high enough to create a moderate health risk. However, the shallow ground water system in that area must be better defined to determine the source of the nitrate and to determine whether other contaminants are migrating from the base.

VII. RECOMMENDATIONS

The recommendations presented in this section have two primary purposes: (1) to collect information to further define the ground water regime in the vicinity of Sites 1, 17, and 24; and (2) to confirm the presence and determine the temporal variation of contaminants in the shallow and artesian ground water systems beneath the base.

Further definition of the ground water regime is necessary to establish the true downgradient direction from the disposal sites and, hence, the direction of contaminant movement. This is necessary in order to determine whether ground water contamination has resulted due to past disposal practices on the base, and to estimate the magnitude and extent of contamination.

Various alternative measures for achieving these purposes, along with detailed discussion of the information that would be obtained, are given in Section V of the main text. The following gives our recommendations for additional study at this time.

The first recommendation is to install three additional monitor wells surrounding Sites 1, 17, and 24 at locations shown on Plate 2. The new wells would be located immediately east, west, and north of the three sites and are designated DM-4, DM-5, and DM-6 for the sake of reference. Information from the three new wells, along with the three existing monitor wells, will better define the shallow ground water surface and the degree of hydraulic communication between the shallow and artesian ground water systems, as discussed previously. Completion and sampling of proposed well DM-7 is not recommended at this time, since serious ground water contamination has not been confirmed.

The second recommendation is to resample all the base wells and the new and existing monitor wells for the parameters in the first sampling round plus the major cations and anions listed in Table 8. This round of analyses will confirm the presence of contaminants in the two ground water systems, and the additional parameters will characterize the chemical nature of ground water beneath the base. We recommend that larger volume samples be collected and extracted for organic analyses, and that double column confirmations be run.

The third recommendation is to monitor ground water quality with time by collecting three additional quarterly samples after the resampling from wells in which contaminants were confirmed, and analyze them for the parameters listed in Table 8. The results will show whether contamination is increasing or decreasing, and the water level information will indicate temporal changes in the direction of contaminant movement. After a year of monitoring, the results should be reviewed and a decision made to continue monitoring or to pursue other courses.

A domestic well inventory is not recommended until there is adequate hydrogeologic basis for suspecting that the base is the source of contamination south of the base. Because of the public concern created by the inventory, it should be done only when deemed necessary.

The fourth recommendation is to evaluate the rates of irrigation and fertilization of the golf course to determine if this is presently a contributor to the problem.

Other alternatives discussed previously are not justified at present, in our opinion, and are not recommended at this time.

The following summarizes our recommendations and rationale:

Sites	Recommended Action	Rationale
1, 17, 24	Installation of 3 additional monitor wells encircling Sites 1, 17, and 24	To define the shallow ground water table surface and the relationship between shallow and artesian ground water systems
1, 17, 24	Resampling base wells 6, 11, 12, 13, and 14, and existing and new monitor wells for halocarbons, aromatics, pesticides, nitrate, and other major cations and anions	To confirm the presence of contaminants and characterize shallow and artesian ground water quality
1, 17, 24	Collect 3 additional quarterly samples from above wells for confirmed contaminants and major cations and anions	To determine temporal variations of ground water quality and trend of contaminant concentration
15, 20	No further action	No significant evidence of contamination

APPENDIX A

LOGS OF BORINGS, MONITOR WELLS, BASE WELLS, AND SELECTED OFF-SITE WELLS

Logs of Borings and Monitor Wells Drilled by Dames & Moore

BORING 1

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.F.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS						
0				0	0.6	23	⊠	SM/ ML	BROWN CLAYEY SILTY FINE SAND TO SANDY SILT WITH TRACE OF GRAVEL, DAMP
				0	2.0	29	⊠		GRADING TO DARK BROWN
	X	X	X	0	4.0	42	⊠		INCREASING CLAY, DAMP
				0	3.6	47	⊠		
	X	X	X	0	8.1	75	⊠		GRADING TO LIGHT BROWN, DAMP
5				0	3.6	82	⊠		
				0	4.6	82	⊠		
				0	3.8	79	⊠		INCREASING CLAY
				0	1.2	29	⊠		
				0	1.6	18	⊠		INCREASING SAND
10				0	1.6	41	⊠		
	X	X	X	0	2.6	52	⊠		
				0	0.8	29	⊠		
				0	1.8	40	⊠		TRACE OF GRAVEL
				0	2.0	36	⊠		
15				0	2.2	87/ 9"	⊠		
				0	1.8	80/ 11"	⊠		WHITE CLAYEY/SILTY SAND
	X	X	X	0	2.4	97/ 10.5"	⊠		
				0	1.8	95	⊠		CALICHE
				0	2.2	29	⊠		DAMP
20									
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/8/83.
NO GROUNDWATER ENCOUNTERED.

LOG OF BORINGS

BY **Dames & Moore** Plate A-1

BORING 2

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.F.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS						
0				0	2.4	6	☒	CL	BROWN MEDIUM TO FINE SANDY SILTY CLAY, TRACE OF ROOTS, DRY
	X	X	X	0	4.6	8	☒		
				0	2.3	37	☒		DECREASING SAND
				0	2.0	47	☒		INCREASING CLAY, DAMP
5				0	1.8	50/4"	☒		
	X	X	X	0	1.8	31	☒		
				0	1.2	24	☒		
				0	1.0	16	☒		INCREASING CLAY
				0	1.2	8	☒		INCREASING SAND
10	X	X	X	0	1.6	13	☒		DAMP
				0	1.4	14	☒		
				0	1.0	25	☒		DECREASING SAND
				0	0.8	35	☒		
				0	0.4	44	☒		
15				0	1.6	66	☒		
				0	0.6	84/11"	☒		WHITE TO LIGHT BROWN, DAMP
				0	1.0	98/10"	☒		
				0	1.0	100/4"	☐		
				0	0.8	42	☒		
20				0	0.4	72/11"	☒		INCREASING SILT
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/8/83.
NO GROUNDWATER ENCOUNTERED.

LOG OF BORINGS

BY **Dames & Moore** Plate A-2

BORING 3

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE: OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS	EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
0	X	X	X	0	2.4	12	☒	ML/ SM	BROWN CLAYEY SANDY SILT TO CLAYEY SILTY FINE SAND, DAMP
				0	1.0	7	☒		
				0	1.4	11	☒		
				0	1.5	21	☒		LIGHT BROWN
5				0	1.0	50	☒		DAMP
				0	1.0	84	☒		TRACE OF ROOTS
				2	2.0	60	☒		
				0	1.7	99/ 11"	☒	CL/ ML	LIGHT BROWN SANDY SILTY CLAY TO CLAYEY SILT, DAMP
	X	X	X	0	2.8	21	☒		
10				0	1.8	10	☒		DAMP
				0	2.4	17	☒		
				0	1.6	49	☒		
				0	2.2	64	☒	ML/ SM	BROWN TO LIGHT BROWN CLAYEY SANDY SILT TO SILTY SAND
				0	1.2	38	☒		
15				0	2.0	32	☒		
				0	1.5	56	☒		ROCK FRAGMENTS
				0	1.8	38	☒		
				0	1.2	50	☒		
				0	1.0	44	☒		
20				0	0.9	65/ 10"	☒		
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/8/83.
NO GROUNDWATER ENCOUNTERED.

LOG OF BORINGS

BY **Dames & Moore** Plate A-3

BORING 4

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS						
0				0	1.9	7	☒	ML/ CL	BROWN FINE SANDY CLAYEY SILT TO SILTY CLAY, MOIST
				0	2.4	4	☒		INCREASING CLAY
	X	X	X	0	2.6	8	☒		
				0	2.5	7	☒		
5				0	2.5	11	☒		
				2	2.5	21	☒		INCREASING SAND
	X	X	X	0	3.2	53	☒		LIGHT BROWN, DAMP
				0	4.0	36	☒		
				0	3.2	59	☒		
10				0	4.5	99/ 10.5"	☒		
	X	X	X	0	6.0	47	☒		
				0	3.6	16	☒		
				0	5.0	18	☒		CLAY POCKET
				0	4.6	21	☒		
15				0	2.6	32	☒		
				0		34	☒		
				0		73	☒		DAMP
				0		37	☒		
				0		35	☒		
20				0		27	☒		INCREASING SILT
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/8/83.
NO GROUNDWATER ENCOUNTERED.

LOG OF BORINGS

BY **Dames & Moore** Plate A-4

BORING 5

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.F.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS						
0				0		9	☒	CL/ ML	BROWN FINE SANDY SILTY CLAY TO CLAYEY SILT WITH TRACE OF ROOTS, MOIST
				0		13	☒		INCREASING SAND
				0		20	☒		DAMP
				0		11	☒		
5	X	X	X	0		29	☒		LIGHT BROWN WITH TRACE OF FINE GRAVELS, DAMP
				0		21	☒		
				0		70	☒		
				0		84/ 11"	☒		INCREASING SAND
				0	NO READINGS*	47	☒	SM	BROWN TO LIGHT BROWN CLAYEY SILTY FINE SAND, DAMP
10	X	X	X	0		34	☒		
				0		25	☒		
				0		31	☒		
				0		20	☒		
				0		25	☒		
15				0		23	☒		INCREASING CLAY
				0		86/ 7"	☒		
				0		75	☒		
				0		16	☒		INCREASING CLAY
				0		52	☒		
20				0		38	☒		INCREASING MOISTURE
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/10/83.
NO GROUNDWATER ENCOUNTERED.

*INSTRUMENT MALFUNCTIONED

LOG OF BORINGS

BY **Dames & Moore** Plate A-5

BORING 6

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE: OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS	EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
0				0		15	☒	ML/ SM	LIGHT BROWN TO BROWN CLAYEY SANDY SILT TO SILTY SAND WITH TRACE OF GRAVEL AND ROOTS, MOIST
				0		37	☒		FINE SANDY CLAYEY SILT DAMP
				0		25	☒		
	X	X	X	0		56	☒		SLIGHTLY CEMENTED SAND POCKETS
5				0		29	☒		INCREASING CLAY
				0		68	☒		
				0		26	☒		INCREASING SILTY CLAY
				0		17	☒		
	X	X	X	0	NO READINGS*	18	☒		
10				0		15	☒		
				0		32	☒		INCREASING CLAY
				0		24	☒		
				0		14	☒		
	X	X	X	0		15	☒		INCREASING CLAY
15				0		19	☒		
				0		17	☒		
				0		10	☒		CLAY POCKETS
				0		11	☒		
				0		7	☒		
20				0		6	☒		MEDIUM BROWN SILTY SAND
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/10/83.
NO GROUNDWATER ENCOUNTERED.

*INSTRUMENT MALFUNCTIONED

LOG OF BORINGS

BY **Dames & Moore** Plate A-6

BORING 7

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.F.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS						
0									
	X	X	X	0		11	☒	ML/ SM	LIGHT BROWN CLAYEY FINE SANDY SILT TO SLITY FINE SAND, DAMP
				0		43	☒		
				0		57	☒		
				0		50/6"	☒		INCREASING SILT
5	X	X	X	0		57	☒		
				0		96/11"	☒		
				0		50/4.5"	☒		INCREASING FINE SAND
				0		66	☒		
				0		80/11"	☒		
10	X	X	X	0	NO READINGS*	34	☒		
				0		42	☒		
				0		52	☒		
				0		24	☒		INCREASING MOISTURE
				0		16	☒		
15	X	X	X	0		14	☒		
				0		23	☒		POCKET OF BROWN SANDY SILTY CLAY WITH TRACE OF GRAVEL
				0		16	☒		
				0		28	☒		CLAYEY FINE SANDY SILT, DAMP
				0		17	☒		
20				0		24	☒		
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/20/83.
NO GROUNDWATER ENCOUNTERED.

*INSTRUMENT MALFUNCTIONED

LOG OF BORINGS

BY **Dames & Moore** Plate A-7

BORING 8

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS						
0				0		6	☒	SM	BROWN SILTY FINE SAND WITH TRACE OF CLAY, MOIST
				0		6	☒		INCREASING SILT
	X	X	X	0		16	☒		
				0		25	☒	ML	LIGHT BROWN FINE SANDY CLAYEY SILT, MOIST
5				0		18	☒		
				0		26	☒		
				0		16	☒		
	X	X	X	0	NO READINGS*	20	☒		
				0		48	☒		
10				0		35	☒		
				0		24	☒		
				0		12	☒		
	X	X	X	0		44	☒		BROWN SILTY CLAY POCKET, MOIST
				0		72	☒		ROCK FRAGMENT
15				0		31	☒		INCREASING CLAY
				0		21	☒		
				0		24	☒		MEDIUM BROWN SILTY SAND
				0		40	☒		
				0		48	☒		SAND SEAMS
20				0		19	☒		INCREASING MEDIUM TO FINE SAND
25									
30									
35									
40									

BORING TERMINATED AT 20.0 FEET ON 11/10/83.
NO GROUNDWATER ENCOUNTERED.

*INSTRUMENT MALFUNCTIONED

LOG OF BORINGS

BY **Dames & Moore** Plate A-8

BORING 9

DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.F.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES	SYMBOLS	DESCRIPTION	
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS							
0								SM	BROWN SILTY FINE SAND WITH TRACES OF CLAY AND GRAVEL	FILL FOR DRILL PAD
								SM/ML	DARK BROWN CLAYEY SILTY SAND TO SANDY SILT	
5				0		29	⊠	ML	LIGHT BROWN CLAYEY SANDY SILT, DAMP	
	X	X	X	0		28	⊠			
				0		33	⊠		INCREASING FINE SAND	
				0		29	⊠			
10				0		91	⊠			
				0	NO READINGS*	54	⊠		SANDY SILTY CLAY	
	X	X	X	0		49/10"	⊠		CALICHE MEDIUM TO LIGHT BROWN CLAYEY SANDY SILT	
				0		50/3"	⊠			
				0		52	⊠			
15				0		48	⊠			
				0		14	⊠	CL	MEDIUM BROWN FINE SANDY SILTY CLAY, DAMP	
	X	X	X	0		17	⊠			
				0		15	⊠		SILTY SAND POCKET	
				0		13	⊠		TRACE OF GRAVEL, DAMP	
20				0		13	⊠		BESPECKLED WITH LIGHT BROWN	
				0		16	⊠			
	X	X	X	0		35	⊠		1/2" THICK MOIST SEAM AT 22.0 FEET	
				0		27	⊠			
				0		22	⊠			
25				0		23	⊠			
30										
35										
40										

BORING TERMINATED AT 25.0 FEET ON 11/8/83.
NO GROUNDWATER ENCOUNTERED.

*INSTRUMENT MALFUNCTIONED

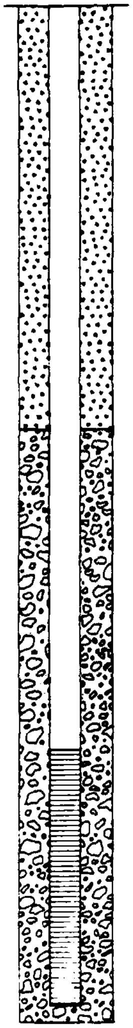
LOG OF BORINGS

BY **Dames & Moore** Plate A-9

BORING DM-1

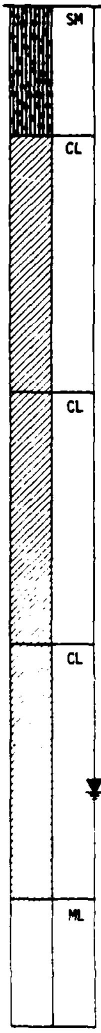
SURFACE ELEVATION: 1801.7 FEET

WELL CONSTRUCTION



DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.F.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS				
0							
10				0	<1		⊠
20				0	<1		⊠
30				0	<1		⊠
40				0	<1		⊠
50				0	<1		⊠
60				0	<1		⊠
70				0	<1		⊠
80				0	1		⊠
90				0	1		⊠
100				0	<1		⊠
110				0	<1		⊠
120				0	<1		⊠
130							
140							
150							
160							

SYMBOLS **DESCRIPTION**



SM TAN SILTY SAND

CL BROWN SANDY CLAY

CL GRAY SANDY CLAY

CL BROWN SANDY CLAY

WATER LEVEL MEASURED AT 92.2 FEET ON 11/5/83

ML BROWN CLAYEY SILT

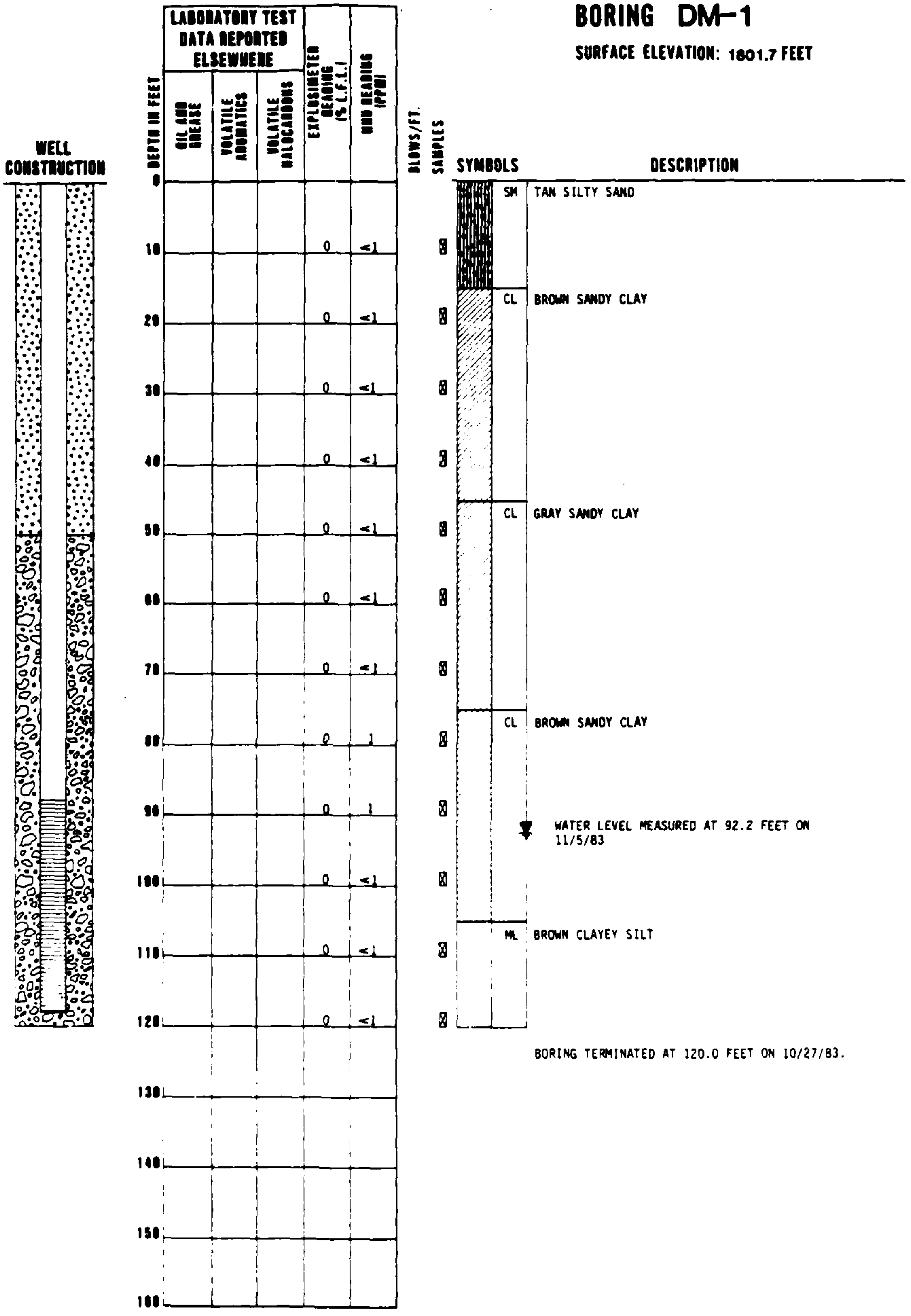
BORING TERMINATED AT 120.0 FEET ON 10/27/83.

LOG OF BORINGS

BY **Dames & Moore** Plate A-10

BORING DM-1

SURFACE ELEVATION: 1801.7 FEET



DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE: OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS	EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES
0							
10				0	<1		⊠
20				0	<1		⊠
30				0	<1		⊠
40				0	<1		⊠
50				0	<1		⊠
60				0	<1		⊠
70				0	<1		⊠
80				0	1		⊠
90				0	1		⊠
100				0	<1		⊠
110				0	<1		⊠
120				0	<1		⊠
130							
140							
150							
160							

SYMBOLS	DESCRIPTION
SM	TAN SILTY SAND
CL	BROWN SANDY CLAY
CL	GRAY SANDY CLAY
CL	BROWN SANDY CLAY
	WATER LEVEL MEASURED AT 92.2 FEET ON 11/5/83
ML	BROWN CLAYEY SILT

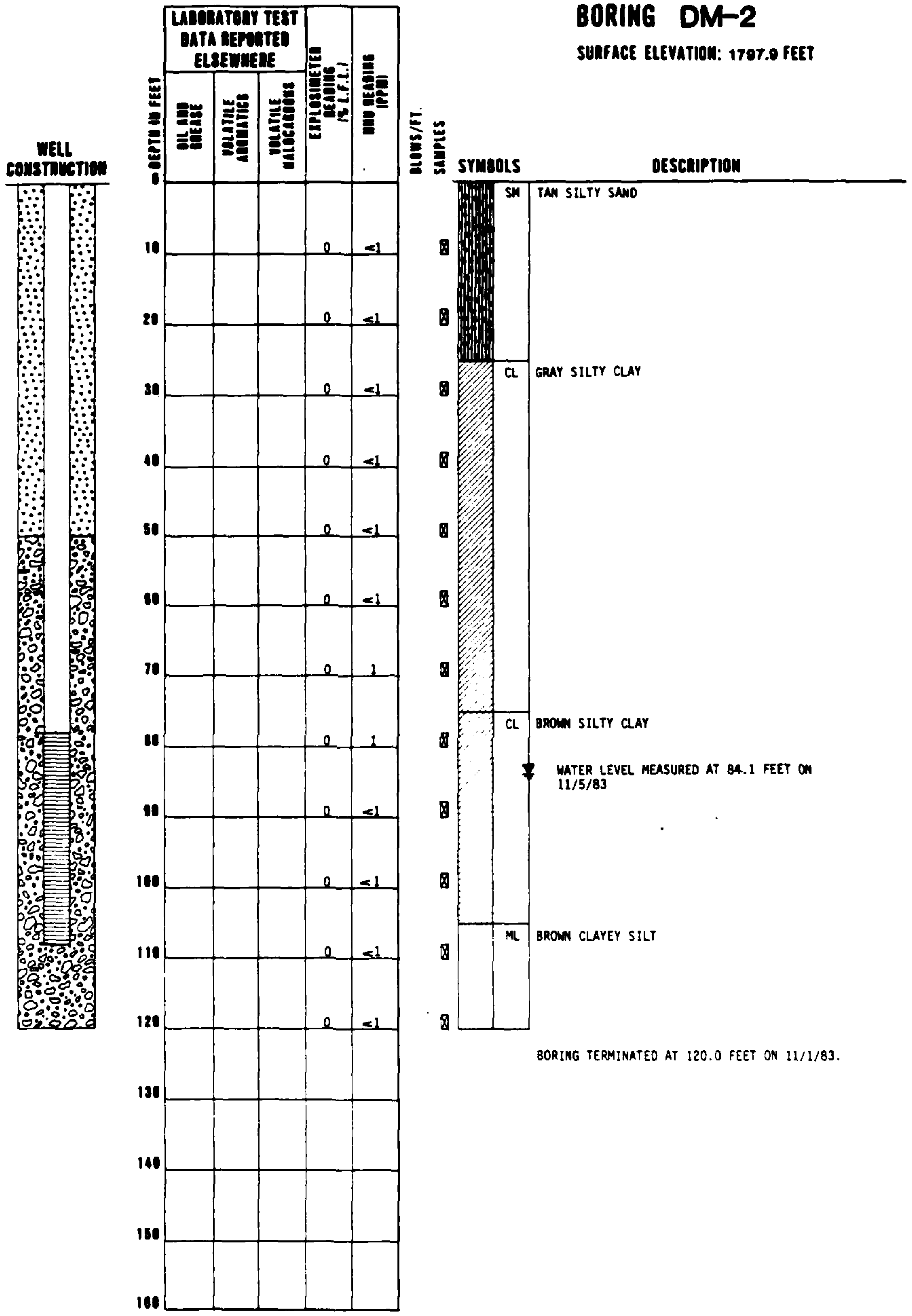
BORING TERMINATED AT 120.0 FEET ON 10/27/83.

LOG OF BORINGS

BY **Dames & Moore** Plate A-10

BORING DM-2

SURFACE ELEVATION: 1797.0 FEET



DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE			EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES
	OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS				
0							
10				0	<1		☒
20				0	<1		☒
30				0	<1		☒
40				0	<1		☒
50				0	<1		☒
60				0	<1		☒
70				0	1		☒
80				0	1		☒
90				0	<1		☒
100				0	<1		☒
110				0	<1		☒
120				0	<1		☒
130							
140							
150							
160							

DESCRIPTION

SM TAN SILTY SAND

CL GRAY SILTY CLAY

CL BROWN SILTY CLAY

WATER LEVEL MEASURED AT 84.1 FEET ON 11/5/83

ML BROWN CLAYEY SILT

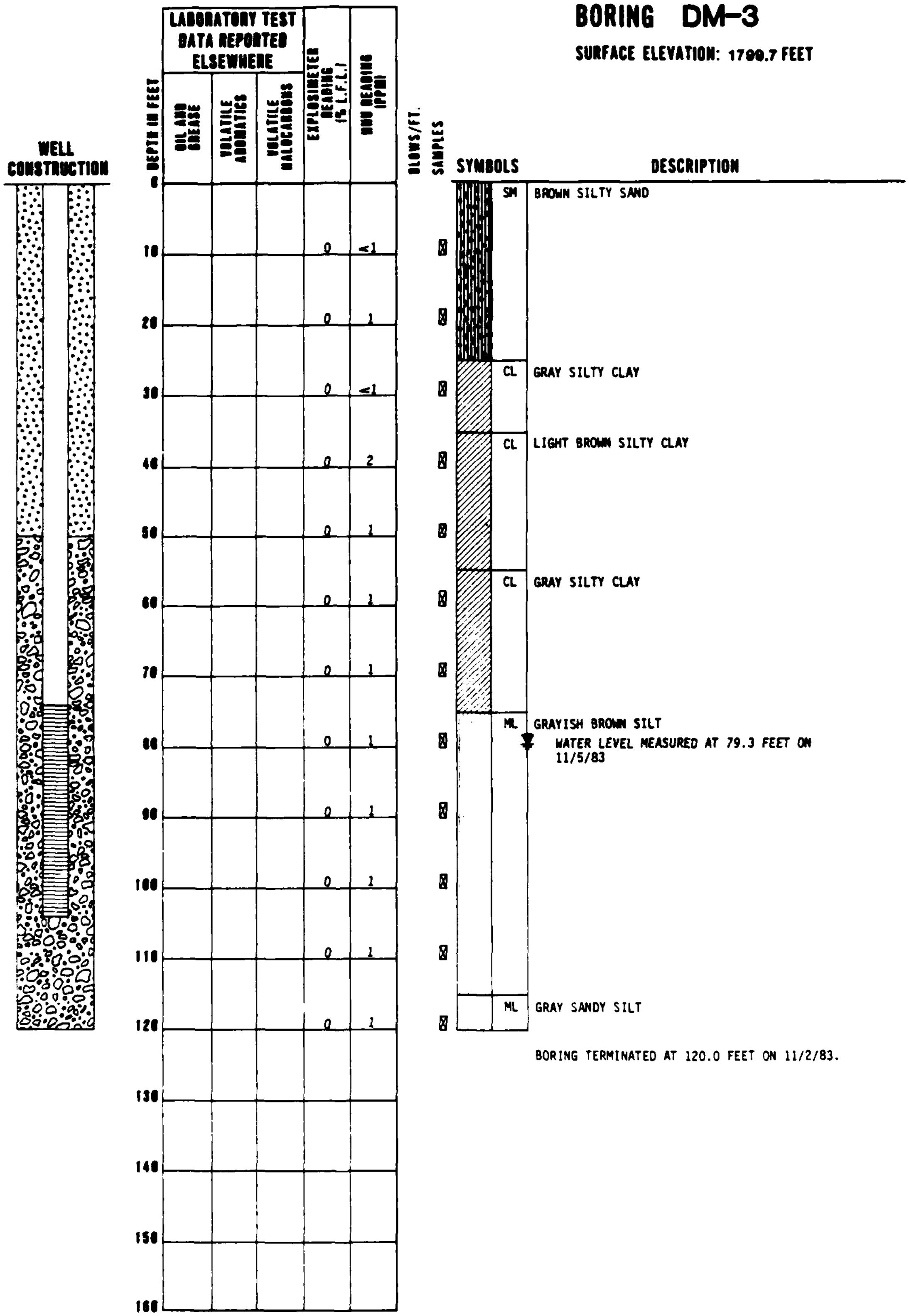
BORING TERMINATED AT 120.0 FEET ON 11/1/83.

LOG OF BORINGS

BY **Dames & Moore** Plate A-11

BORING DM-3

SURFACE ELEVATION: 1799.7 FEET



DEPTH IN FEET	LABORATORY TEST DATA REPORTED ELSEWHERE: OIL AND GREASE	VOLATILE AROMATICS	VOLATILE HALOCARBONS	EXPLOSIMETER READING (% L.E.L.)	HNU READING (PPM)	BLOWS/FT.	SAMPLES
0							
10				0	<1		▨
20				0	1		▨
30				0	<1		▨
40				0	2		▨
50				0	1		▨
60				0	1		▨
70				0	1		▨
80				0	1		▨
90				0	1		▨
100				0	1		▨
110				0	1		▨
120				0	1		▨
130							
140							
150							
160							

SYMBOLS	DESCRIPTION
SM	BROWN SILTY SAND
CL	GRAY SILTY CLAY
CL	LIGHT BROWN SILTY CLAY
CL	GRAY SILTY CLAY
ML	GRAYISH BROWN SILT WATER LEVEL MEASURED AT 79.3 FEET ON 11/5/83
ML	GRAY SANDY SILT

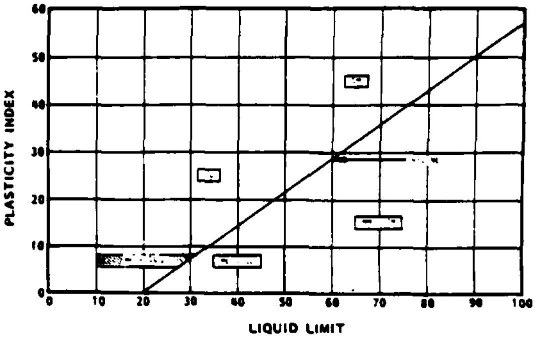
BORING TERMINATED AT 120.0 FEET ON 11/2/83.

LOG OF BORINGS

BY **Dames & Moore** Plate A-12

SYMBOL	TYPE OF TEST
M	MOISTURE
QD	QUICK MD TEST BASED ON ASSUMED SPECIFIC GRAVITY
MD	MOISTURE-DENSITY
CD	CHUNK DENSITY ON BULK SAMPLE
RD	RELATIVE DENSITY
COMP	COMPACTION CURVE
CI	CALIFORNIA IMPACT
CC	COMPACTED CORE
G	SPECIFIC GRAVITY
pH	HYDROGEN ION CONCENTRATION
MA	MECHANICAL ANALYSIS*
SA	SIEVE ANALYSIS (+200 ONLY)
HA	HYDROMETER ANALYSIS (-200 ONLY)
AL	ATTERBERG LIMITS (LL & PL)
SL	SHRINKAGE LIMIT
FS	FREE SWELL
SS	SHRINK-SWELL
EXP	EXPANSION
C (COL)	CONSOLIDATION (COLLAPSE)
VC	VIBRATING CONSOLIDATION
P	PERMEABILITY
FP	FIELD PERMEABILITY
UC	UNCONFINED COMPRESSION
	TRIAXIAL COMPRESSION TEST
TXUU	1. UNCONSOLIDATED-UNDRAINED
TXCU	2. CONSOLIDATED-UNDRAINED
TXCUM	3. CU/MULTIPHASE**
TXCUPP	4. CU/WITH PORE PRESSURE MEASUREMENTS
TXCD	5. CONSOLIDATED-DRAINED
	DIRECT SHEAR TEST
DS/UU	1. UNCONSOLIDATED-UNDRAINED
DS/CU	2. CONSOLIDATED-UNDRAINED
DS/CD	3. CONSOLIDATED-DRAINED
DS/CD/M*	4. CD/MULTIPHASE**
LV	TORVANE SHEAR (LAB VANE SHEAR)

* INCLUDES COMPLETE ANALYSIS, SIEVING AND HYDROMETER
** SERIES OF TESTS RUN ON SAMPLE



PLASTICITY CHART

- A - ACKER SOIL SAMPLER
- D - DAMES & MOORE, TYPE D SAMPLER
- P - DAMES & MOORE PISTON SAMPLER
- U - DAMES & MOORE TYPE U SAMPLER
- PT - PITCHER TUBE SAMPLER
- NX - NX CORE SAMPLER
- TW - DAMES & MOORE TYPE U SAMPLER WITH THIN WALL ATTACHMENT
- SPT - STANDARD PENETRATION TEST SAMPLER
- ST - SHELBY TUBE SAMPLER

KEY TO SAMPLERS

■ INDICATES DEPTH OF UNDISTURBED SAMPLE

⊠ INDICATES DEPTH OF DISTURBED SAMPLE

☐ INDICATES DEPTH OF SAMPLING ATTEMPT WITH NO RECOVERY

◪ INDICATES DEPTH OF STANDARD PENETRATION TEST

⧄ INDICATES DEPTH OF STANDARD PENETRATION TEST WITH NO RECOVERY

70% I 5% INDICATES DEPTH AND LENGTH OF CORE RUN

RQD (ROCK QUALITY DETERMINATION) PERCENT OF THE TOTAL CORE RUN HAVING AN UNFRACTURED LENGTH OF 4" OR MORE

PERCENT OF CORE RUN RECOVERED

▣ INDICATES DEPTH OF FIELD VANE SHEAR TEST

NOTE

UNLESS OTHERWISE NOTED SAMPLING RESISTANCE IS MEASURED IN BLOWS PER FOOT REQUIRED TO DRIVE SAMPLER 12-INCHES AFTER SAMPLER HAS BEEN SEATED 6-INCHES. A 140-POUND HAMMER, FREE FALLING A DISTANCE OF 30 INCHES IS USED TO DRIVE THE SAMPLER.

KEY TO SAMPLES

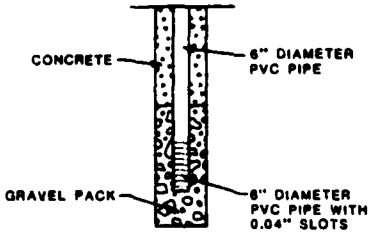
KEY TO
LOG OF BORINGS

BY **Dames & Moore** Plate A-13

MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	▒	GW	WELL GRADED GRAVELS GRAVEL SAND MIXTURES LITTLE OR NO FINES
			▒	GP	POORLY GRADED GRAVELS. GRAVEL SAND MIXTURES. LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▥	GM	SILTY GRAVELS GRAVEL SAND SILT MIXTURES
			▨	GC	CLAYEY GRAVELS. GRAVEL SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	▒	SW	WELL-GRADED SANDS GRAVELLY SANDS, LITTLE OR NO FINES
			░	SP	POORLY GRADED SANDS. GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▥	SM	SILTY SANDS. SAND-SILT MIXTURES
			▨	SC	CLAYEY SANDS SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▥	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▥	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	■	MH	INORGANIC SILTS MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			■	CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS			▤	PT	PEAT HUMUS SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

KEY TO WELL CONSTRUCTION



UNIFIED SOIL CLASSIFICATION SYSTEM

BY **Dames & Moore** Plate A-14

On-Base Well Records

6

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec.
Well No.
Permit No. 13769
Do not fill in

~~U.S. Air Force~~ no. 6

Owner Nellis Air Force Base
Driller Allen Water Well Service C

Address Las Vegas, Nevada
Address 231 Maryland Pkwy.
Lic. No 40

Location of well: NW ¼ Ne ¼ Sec. 9, T. 20 N/S, R62 E, in Clark C

or

Water will be used for ~~Base Supply~~ Quasi-Municipal
Total depth of well ~~858~~ 1000

Size of drilled hole 20" with 12 3/4 liner
Weight of casing per linear foot 42.7 & liner 26

Thickness of casing 3/16"
Temp. of water

Diameter and length of casing 20" I.D. 100 feet 12 3/4 O.D. 850 feet
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside dia

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 58.11 feet 11/16/51

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well Sept. 12, 1951
Date of completion of well Nov. 20, 1951

Type of well rig Keystone 50 A Cable tools

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	4	4	Top soil
4	16	12	Caliche
16	69	53	Brown clay
69	74	5	water sand and gravel
74	127	53	brown clay
127	130	3	sandy gravel
130	165	35	Sandy brown clay
165	175	10	brown clay
175	182	7	white clay
182	200	18	brown clay and gravel
200	235	35	brown clay
235	240	5	sandy brown clay
240	245	5	brown clay and gravel
245	247	2	white clay
247	250	3	sandy gravel
250	265	15	light brown clay and gravel
265	385	120	brown clay
385	405	20	Hard brown sand. Some water
405	410	5	sticky wet clay
410	470	60	brown clay
470	485	15	blue clay
485 490	490	5	sandy blue clay
490	530	40	blue clay
530	555	25	brown clay
555	560	5	water sand
560	650	90	sandy brown clay
650	670	20	blue and grey clay
670	673	3	white sand

(OVER)

Water-bearing Formation Cas
Perforations, Etc

Chief aquifer (water-bearing formation)

from 730 to 750

Other aquifers 760 to 73

127 to 130, 247 to 2

385 to 405, 555 to 5

670 to 673, 787 to 8

818 to 828, 950 to

First water at 69 to fe

Casing perforated

from 144 to 826

Size of perforations

5/32" X 1 1/4" 10n

6

LOG OF FORMATIONS—*Continued*

	To feet	Thickness	Type of material
	690	17	sandy brown clay
	730	40	blue and brown clay
	750	20	brown sand
0	760	10	brown clay
0	780	20	grey sand
0	787	7	blue clay
7	810	23	grey sand
0	818	8	blue-grey clay
8	828	10	grey sand
28	830	2	sticky grey clay
30	857	27	sticky black clay
57	860	3	sandy black and blue clay
60	905	45	sticky blue clay
05	915	10	blue clay with streaks of lime
15	925	10	blue clay

925--940 blue clay with streaks of lime
940--945 white clay and lime
945--950 sandy light blue clay & l
950--955 sand
955--1000 sandy grey clay & lime

CASING RECORD

Diam casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
20" ID	0	100	100'	Cemented in place with 138 sacks of straight cement, A bit steel shoe 8" x 20" x 1"
12 3/4	0	850	850'	liner with bit steel shoe 8" x 12 3/4" x 3/4" machine perforated from 144 feet to 826, Perforations 5/32 1 " 3½" apart around circumference 1½" between rov Gravel packed between 20" hole and 12 3/4" liner, w 1/4" to 3/8" gravel.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

~~3.2 gallons per feet of draw down to a depth of 150 feet. (depth of test r~~

Tested 650 gpm With DD of 220'

WELL DRILLERS STATEMENT	(Not to be filled in by Driller)
This well was drilled under my jurisdiction and the above information is true to my best information and belief. Signed Fred B. Allen Well Driller By License No. 40 Dated Dec. 20 1951	

WELL DATA

WELL # 6 FACILITY # 490

LOCATION Nellis AFB

DATE DRILLED 1951 DEPTH 1000′

DRILLER Allen Water Well Service

BOTTOM ELEVATION 842 TOP 1842.52 WELL DIAMETER 20"

GRAVEL PACK Yes CASING DIAMETER 12"

CASING PERFORATIONS Location not Known

COLUMN SIZE 8" GAGE LINE None

PUMP SETTING 350' PUMP STAGES 12

PUMP: MANUFACTURER Fairbanks Morse

SERIAL # PR 2953

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER Fairbanks Morse

HP AND VOLTAGE 75 PR 2953 220-440 TRANSFORMER CAPACITY

AUXILIARY ENGINE: DESCRIPTION BUDA Eng & Equip Co Mod #L525 Serial #359557
6 ~~cycle~~ cyl.

WELL HOUSED IN BUILDING Fac #490

INITIAL PRODUCTION, GPM 600 LATEST PRODUCTION 239 December 1971

WATER WELL DATA #6

Well Depth: 1000'

Pump Setting: 350'

Production Column Diameter: 8

Casing Diameter: 12" and location of perforations
not known

Well Diameter: 20" well is gravel packed; not gravel packed gravel packed

Type drive shaft lubrication: Oil or Water OIL

Drive Shaft Diameter:

Electric motor: 75 HP 220-440 Voltage

Auxiliary motor, type and HP GAS ENGINE (Buda) 6 Cyl

Static water level: 102'

Well design capacity: 600 GPM

Pump Description: Vertical turbine pumps, 12 Stages
" bowl assembly with rated capacity 380 GPM
at TDH

Description of building housing the well. Does it have removable hatch?

6

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 1
Well No.
Permit No. 13769
Do not fill in

~~U. S. Air Force~~ no. 6

Owner Hollis Air Force Base
Driller Allen Water Well Service C
Address Las Vegas, Nevada
Address 231 Maryland Pkwy. Lic. No 40
Location of well: NW ¼ Ne ¼ Sec. 9, T. 20 N/S, R 62 E, in Clark C
or
Water will be used for Base Supply Quasi-Municipal
Total depth of well [illegible] 1000
Size of drilled hole 20" with 12 3/4 liner
Weight of casing per linear foot 41.7 & liner 26
Thickness of casing 3/16"
Temp. of water
Diameter and length of casing 20" I. D. 100 feet 12 3/4 O. D. 850 feet
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside din
If flowing well give flow in c.f.s. or g.p.m. and pressure
If nonflowing well give depth of standing water from surface 58.11 feet 11/16/51
If flowing well describe control works
(Type and size of valve, etc.)
Date of commencement of well Sept 12, 1951
Date of completion of well Nov. 20, 1951
Type of well rig Keystone 50 A Cable tools

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	4	4	Top soil
4	16	12	Caliche
16	69	53	Brown clay
69	74	5	water sand and gravel
74	127	53	brown clay
127	130	3	sandy gravel
130	165	35	Sandy brown clay
165	175	10	brown clay
175	182	7	white clay
182	200	18	brown clay and gravel
200	235	35	brown clay
235	240	5	sandy brown clay
240	245	5	brown clay and gravel
245	247	2	white clay
247	250	3	sandy gravel
250	265	15	light brown clay and gravel
265	335	120	brown clay
385	405	20	Hard brown sand. Some water
405	410	5	sticky wet clay
410	470	60	brown clay
470	485	15	blue clay
485 490	490	5	sandy blue clay
490	530	40	blue clay
530	555	25	brown clay
555	560	5	water sand
560	650	90	sandy brown clay
650	670	20	blue and grey clay
670	673	3	white sand

(OVER)

Water-bearing Formation. Cas
Perforations, Etc.

Chief aquifer (water-bearing formation)
from 730 to 750
Other aquifers 760 to 78
127 to 130, 247 to 2
385 to 405, 555 to 5
670 to 673, 787 to 8
818 to 828, 950 to
First water at 69 to fe

Casing perforated
from 144 to 826

Size of perforations
5/32" X 1 1/4" 10/s

LOG OF FORMATIONS—*Continued*

	To feet	Thickness	Type of material
	690	17	sandy brown clay
0	730	40	blue and brown clay
0	750	20	brown sand
0	760	10	brown clay
0	780	20	grey sand
0	787	7	blue clay
37	810	23	grey sand
10	818	8	blue-grey clay
18	828	10	grey sand
28	830	2	sticky grey clay
30	857	27	sticky black clay
57	860	3	sandy black and blue clay
50	905	45	sticky blue clay
05	915	10	blue clay with streaks of lime
15	925	10	blue clay

925--940 blue clay with streaks of lime
940--945 white clay and lime
945--950 sandy light blue clay & l
950--955 sand
955--1000 sandy grey clay & lime

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
20"ID	0	100	100'	Cemented in place with 138 sacks of straight cement, A bit steel shoe 8" X 20" X 1"
12 3/4	0	850	850'	liner with bit steel shoe 8" x 12 3/4"X 3/4" machine perforated from 144 feet to 826, Perforations 5/32 1 [illegible]" 3½" apart around circumference 1½" between row Gravel packed between 20" hole and 12 3/4" liner, w 1/4" to 3/8" gravel.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

~~3.2 gallons per feet of draw down to a depth of 160 feet. (depth of test~~

Yielded 650 gpm With D.D. of 220'

WELL DRILLERS STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed: Fred B. Allen
Well Driller

By

License No. 40

Dated Dec. 20, 1951

(Not to be filled in by Driller)

WELL DATA

WELL # 6 FACILITY # 490

LOCATION Nellis AFB

DATE DRILLED 1951 DEPTH 1000′

DRILLER Allen Water Well Service

BOTTOM ELEVATION 842 TOP 1842.52 WELL DIAMETER 20"

GRAVEL PACK Yes CASING DIAMETER 12"

CASING PERFORATIONS Location not Known

COLUMN SIZE 8" GAGE LINE None

PUMP SETTING 350' PUMP STAGES 12

PUMP: MANUFACTURER Fairbanks Morse

SERIAL # PR 2953

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER Fairbanks Morse

HP AND VOLTAGE 75 PR 2953 220-440 TRANSFORMER CAPACITY

AUXILIARY ENGINE: DESCRIPTION BUDA Eng & Equip Co Mod #L525 Serial #359557
6 ~~cycle~~ cyl.

WELL HOUSED IN BUILDING Fac #490

INITIAL PRODUCTION, GPM 600 LATEST PRODUCTION 239 December 1971

WATER WELL DATA #6

Well Depth: 1000'

Pump Setting: 350'

Production Column Diameter: 8'

Casing Diameter: 12" and location of perforations
not known

Well Diameter: 20" well is gravel packed; not gravel packed
gravel packed

Type drive shaft lubrication: Oil or Water OIL

Drive Shaft Diameter:

Electric motor: 75 HP 220-440 Voltage

Auxiliary motor, type and HP GAS ENGINE (Buda) 6 cyl)

Static water level: 102'

Well design capacity: 600 GPM

Pump Description: Vertical turbine pumps, 12 Stages
" bowl assembly with rated capacity 380 GPM
at TDH

Description of building housing the well. Does it have removable hatch?

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

(6-76)

Local Well Number
212 N (S) 22 E [illegible] 9 abc 1
H.A. T. R. Sec ¼s Seq

Project 6

Name ______ MP: +.1 ft above below LSD

MP description and sketch:

Station ID (lat-long)
3[illegible]1331115[illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	⑩ Status	⑪ Method	BY	REMARKS
[illegible]/-5/19[illegible]	[illegible]	17	1.7.[illegible]	[illegible]			JK	[illegible] for 8 hrs.
[illegible]/ /19[illegible]		[illegible]	[illegible]	[illegible].25			JK	
[illegible]/[illegible]/19[illegible]	[illegible]	[illegible]	[illegible]	96.94		S	DW	off 90 days - Pump out
02/26/1980	100	6.53	93.47	93.37		S	DW	[illegible]
[illegible]/26/1981	[illegible]	31.13	98.87	98.77		S	DW	[illegible]
[illegible]/25/19[illegible]	[illegible]0	7.39	92.61	12.61		S	DW/LS	off 1 month
/ /19				.				
/ /19				.				
/ /19				.				
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/ /19				.				
/ /19				.				
34 ② 44				49 ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤	*
5 19	20	34	44	49	56	61	62	67	68

⑩ Site status
D-dry
F-flowing
G-nearby, flowing
H-nearby, recently flowing
O-obstruction
P-pumping
R-recently pumped
S-nearby, pumping
T-nearby, recently pumped
V-foreign substance
X-surface water effects
Z-other

⑪ Method of measurement
A-airline
C-calibrated airline
R-reported
S-steel tape
T-electric tape
Z-other

Location sketch:
has spigot - ok for DW

Punched ______ Entered ______ Checked ______

Local Well No. ______

(6-76)

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

Local Well Number

Project 6

212 H.A. N (S) 20 T. E 102 R. 9 Sec abcc ¼S 1 Seq

Name ____ MP: +.1 ft above below LSD

Station ID (lat-long)

36	13	31	115	02	53	01

5 19

MP description and sketch:

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	④ Status	⑤ Method	BY	REMARKS
3/25/1977	[illegible]	[illegible]	117.03	116.93			TK	off for 8 hrs.
5/[illegible]/197[illegible]	[illegible]	[illegible]	[illegible]	[illegible].25			TK	
12/26/1979	120	23.46	96.54	96.44		S	DW	off 90 days - Pump out
02/26/1980	100	6.53	93.47	93.37		S	DW	MP is 0.3' lower at
02/26/1981	130.0	31.13	98.87	98.77		S	DW	current hgt
03/03/1982	100.	7.39	92.61	92.61		S	DW/LS	off 1 month
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34 ② 44				49. ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤	*
5 19	20	34	44	49	56	61	62	67	68

④ Site status

- D-dry
- F-flowing
- G-nearby, flowing
- H-nearby, recently flowing
- O-obstruction
- P-pumping
- R-recently pumped
- S-nearby, pumping
- T-nearby, recently pumped
- V-foreign substance
- X-surface water effects
- Z-other

⑤ Method of measurement

- A-airline
- C-calibrated airline
- R-reported
- S-steel tape
- T-electric tape
- Z-other

Location sketch:

has spigot - ok for QW

Punched ____ Entered ____ Checked ____

Local Well No. ____

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No. ....
Rec. ....19......
Well No. 691
Permit No. 13770
Do not fill in

~~U.S. Air Force~~ #7

Owner Nellis Air Base
Driller Allen Water Well Service Co.
Address Las Vegas Nevada.
Address 231 Maryland Parkway Lic. No. 40
Location of well: SW ¼ NW ¼ Sec. 9 T. 20 N/S, R. 62 E, in Clark County
or..........
Water will be used for Base supply
Total depth of well 760 Feet
Size of drilled hole 20"
Weight of casing per linear foot 40.2
Thickness of casing 3/16"
Temp. of water..........
Diameter and length of casing 20" I.D. & 12 3/4" O.D.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)
If flowing well give flow in c.f.s. or g.p.m. and pressure..........
If nonflowing well give depth of standing water from surface - 54 feet
If flowing well describe control works..........
(Type and size of valve, etc.)
Date of commencement of well November 18, 1951
Date of completion of well January 18, 1952
Type of well rig 50 A Keystone cable tools

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	10	10	sandy soil
10	30	20	gravel
30	50	20	grey clay
50	65	15	brown clay
65	70	5	white clay
70 8	80	10	water sand (fine grey)
80	147	67	grey clay
167	177	10	gravelly brown clay
177	209	32	brown clay
209	219	10	brown clay and gravel
219	228	9	white clay
228	240	12	brown clay
240	243	3	sticky white clay
243	245	2	sandy light brown clay
245	252	7	gravel
252	273	21	brown clay
273	280	7	brown clay and gravel
280	285	5	gravel
285	287	2	brown clay
287	292	5	gravel
292	327	15	sandy grey clay
327	350	23	brown clay
350	410	60	sandy brown clay
410	420	10	brown clay and gravel
420	429	9	sandy gravel
429	434	5	brown clay
434	440	6	fine grey sand
440	459	19	caliche

(OVER)

Water bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 245 to 252 ft.
Other aquifers 286 to 292
420 to 429, 434 to 440
485 to 490, 550 to 557
591 to 596, 687 to 693
754 to 759.
First water at 70 to 80 feet.

Casing perforated
from 150 to 760 ft.

Size of perforations
5/32 x 1 1/4, 3 ½"
apart around circumfer
1 ½" between rows

LOG OF FORMATIONS—*Continued*

om et	To feet	Thickness	Type of material		
	470	11	white clay	754-759	5ft. grey sand & gravel
	475	5	caliche	759-788	29ft. grey clay
	485	10	brown clay	788-980	192 ft. blue clay
	490	5	fine sand	980-985	5 ft. brown clay
	535	45	brown clay and gravel		
	540	5	blue clay	988-1000	15 ft. blue clay.
	550	10	sandy clay		
	557	7	brown sand		
	566	9	brown clay		
	591	25	brown clay & gravel		
	596	5	gravel		
	660	64	brown clay		
	687	27	sticky grey clay		
	693	6	grey sand		
	705	12	grey clay		
	754	49	brown clay		

CASING RECORD

m. ng	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
I.D.	0	100'	100'	Cemented in place with 138 sacks of straight cement. has a 3/4" x 8" x 20" bit steel shoe.
3/4"	0	760	760	liner (3/16" wall) Machine perforated from 150' to 760' 5/32 x 1 1/[illegible] x 3 1/2" apart around the circumference with 1 1/2" between rows

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

~~tatic water level is [illegible] feet , test pumping shows a yield of 6.4 gallons per foot of draw down~~

Note) well formations to 1000 ft. but back filled to 760

Well - 320 GPM DD 220' from Surface

410 GPM

WELL DRILLERS STATEMENT

s well was drilled under my jurisdiction and the nformation is true to my best information and belief.

Signed .... Well Driller

By ....

License No. 10

January 18, 1952

(Not to be filled in by Driller)

PERIODIC MEASUREMENTS

(8-78)

Project 7

Name

Local Well Number

212 (S) 20 E 02 9 bccc 1
N.A. T. R. Sec ¼s Seq

N

MP: 4 ft above ~~below~~ LSD

Station ID (lat-long)

[illegible]	[illegible]	[illegible]	[illegible]			

5 19

MP description and sketch:

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	Status	Method	BY	REMARKS
[illegible]/1977	[illegible]	[illegible]	[illegible]	[illegible]		S	TK	off & rrc
[illegible]/197[illegible]			[illegible]	41.35		S	R	
[illegible]/19[illegible]	[illegible]	11.20	[illegible]	[illegible].20		S	DW	
02/26/1980	100	19.58	80.92	80.02		S	DW	
02/26/1981	[illegible]	40.13	82 [illegible]	82.47		S	DW	no oil on tape, well overhauled
03/03/1982	100	[illegible]	79.[illegible]	79.82		S	DW/LS	off about 1 month
/ /19				.				
/ /19				.				
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34 ② 44 49 ③ 56 61 ④ 67 ⑤

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

			①				R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤	*
5						19	20	34	44	49	56	61	62	67	68

④ Site status: D-dry, F-flowing, G-nearby, flowing, H-nearby, recently flowing, O-obstruction, P-pumping, R-recently pumped, S-nearby, pumping, T-nearby, recently pumped, V-foreign substance, X-surface water effects, Z-other

⑤ Method of measurement: A-airline, C-calibrated airline, R-reported, S-steel tape, T-electric tape, Z-other

Location sketch:

OK for QW

Punched ________ Entered ________ Checked ________

Local Well No. [illegible]

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No. 691
Permit No. 13770
Do not fill in

~~U.S. Air Force~~ #7

Owner Nellis Air Base
Driller Allen Water Well Service Co.

Address ~~Las Vegas, Nevada~~
Address 231 Maryland Parkway Lic. No. 40

Location of well: SW ¼ NW ¼ Sec. 9, T. 20 N/S, R. 62 E, in Clark Coun

or

Water will be used for Base supply
Total depth of well 760 Feet

Size of drilled hole 20"
Weight of casing per linear foot 40.2

Thickness of casing 3/16"
Temp. of water

Diameter and length of casing 20" I.D. & 12 3/4" O.D.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diamet

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface - 54 feet

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well November 18, 1951
Date of completion of well January 18, 1952

Type of well rig 50 A Keystone cable tools

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	10	10	sandy soil
10	30	20	gravel
30	50	20	grey clay
50	65	15	brown clay
65	70	5	white clay
70 8	80	10	water sand (fine grey)
80	147	67	grey clay
167	177	10	gravelly brown clay
177	209	32	brown clay
209	219	10	brown clay and gravel
219	228	9	white clay
228	240	12	brown clay
240	243	3	sticky white clay
243	245	2	sandy light brown clay
245	252	7	gravel
252	273	21	brown clay
273	280	7	brown clay and gravel
280	285	5	gravel
285	287	2	brown clay
287	292	5	gravel
292	327	15	sandy grey clay
327	350	23	brown clay
350	410	60	sandy brown clay
410	420	10	brown clay and gravel
420	429	9	sandy gravel
429	434	5	brown clay
434	440	6	fine grey sand
440	459	19	caliche

(OVER)

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 245 to 252 ft.

Other aquifers 286 to 292
420 to 429, 434 to 440
485 to 490, 550 to 557
591 to 596, 687 to 693
754 to 759.

First water at 70 to 80 feet.

Casing perforated

from 150 to 760 ft.

Size of perforations

5/32 x 1 1/4, 3 ½"
apart around circumfer
1 ½" between rows

LOG OF FORMATIONS—*Continued*

om et	To feet	Thickness	Type of material
	470	11	white clay 754-759 5ft. grey sand & gravel
	475	5	caliche 759-788 29ft. grey clay
	485	10	brown clay 788-980 192 ft. blue clay
	490	5	fine sand 980-985 5 ft. brown clay
	535	45	brown clay and gravel
	540	5	blue clay 985-1000 15 ft. blue clay.
	550	10	sandy clay
	557	7	brown sand
	566	9	brown clay
	591	25	brown clay & gravel
	596	5	gravel
	660	64	brown clay
	687	27	sticky grey clay
	693	6	grey sand
	705	12	grey clay
	754	49	brown clay

CASING RECORD

m. ng	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
I.D.	0	100'	100'	Cemented in place with 138 sacks of straight cement. has a 3/4" X 8" X 20" bit steel shoe.
3/4"	0	760	760	liner (3/16" wall) Machine perforated from 150' to 760' 5/32 X 1 1/4 X 3 1/2" apart around the circumference with 1 1/2" between rows

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

~~Static water level is 54 feet , test pumping shows a yeald of 6.4 gallons per foot of draw down~~

(Note) well formations to 1000 ft. but back filled to 760

Yield - 320 GPM DD 220' [illegible] - Surface

410 GPM

WELL DRILLERS STATEMENT

is well was drilled under my jurisdiction and the information is true to my best information and belief.

Signed ....

Well Driller

By ....

License No. 40

January 18, 1952

(Not to be filled in by Driller)

WATER LEVEL CODING FORM
(6-76)

PERIODIC MEASUREMENTS

Local Well Number

212 H.A. N [✓ S] 20 T. E 03 R. 9 Sec bccc ¼s 1 Seq

Project 7

Name

MP: 4 ft above ~~below~~ LSD

MP description and sketch:

Station ID (lat-long) [illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	WATER LEVEL, IN FT BELOW LSD	Status	Method	BY	REMARKS
[illegible]/1977	[illegible]	[illegible]	[illegible]	[illegible]		S	TK	off 8 hrs
[illegible]/1978				[illegible]		S	TK	
[illegible]/26/1979	[illegible]	11.80	[illegible]	[illegible].80		S	DW	
02/26/1980	100	19.58	80.92	80.02		S	DW	
02/26/1981	123.0	40.13	82.87	82.47		S	DW	no oil on tape, Well cover leaks
03/02/1982	100	[illegible]	79.[illegible]	77.82		S	DW/LS	off about 1 month
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34 ② 44				49 ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤	*
5 19	20	34	44	49	56	61	62	67	68

Ⅲ Site status
- D-dry
- F-flowing
- G-nearby, flowing
- H-nearby, recently flowing
- O-obstruction
- P-pumping
- R-recently pumped
- S-nearby, pumping
- T-nearby, recently pumped
- V-foreign substance
- X-surface water effects
- Z-other

Ⅲ Method of measurement
- A-airline
- C-calibrated airline
- R-reported
- S-steel tape
- T-electric tape
- Z-other

Location sketch:

Ck for QW

Punched ______ Entered ______ Checked ______

Local Well No. [illegible]

WELL DATA

WELL # X FACILITY # 1789

LOCATION Nellis AFB, Nv

DATE DRILLED 1962 DEPTH 802

DRILLER Pat Thompson

BOTTOM ELEVATION [illegible] GRD. [illegible] WELL DIAMETER 30"

GRAVEL PACK CASING DIAMETER 14"

CASING PERFORATIONS ~~Location not known~~ 302' TO 778'
(1/4" x 5" on 2 5/8 CENTERS, STAGGERED)

COLUMN SIZE 8" GAGE LINE

PUMP SETTING 260' PUMP STAGES 3

PUMP: MANUFACTURER Johnson Pump

SERIAL # JV 2253

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER U.S. Motors (Installed Apr 71) # 6105 P05 [illegible]
FRAME 326 50 AMP. DESIGN B CODE C 40°C 1760 RPM SER # 593045

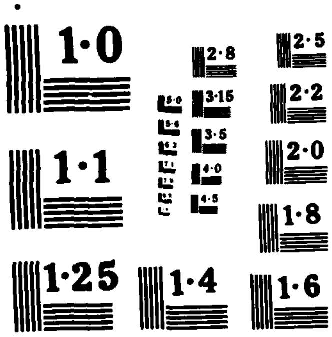
HP AND VOLTAGE 40 440 TRANSFORMER CAPACITY 45 KVA

AUXILIARY ENGINE: DESCRIPTION Continental Mod M363 Spec 2309
Engine No 3791

WELL HOUSED IN BUILDING None

INITIAL PRODUCTION, GPM 400 LATEST PRODUCTION 310 Dec 1971

AD-A162 920 INSTALLATION RESTORATION PROGRAM PHASE II 2/5
CONFIRMATION/QUANTIFICATION STA..(U) DAMES AND MOORE
PARK RIDGE IL 09 AUG 85 F33615-83-D-4002
UNCLASSIFIED F/G 13/2 NL



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

X

WATER WELL DATA #11

Well Depth: 202'

Pump Setting: 250'

Production Column Diameter: 6"

Casing Diameter: 14" and location of perforations

Well Diameter: 20" well is gravel packed; not gravel packed

Type drive shaft lubrication: Oil or Water OIL

Drive Shaft Diameter:

Electric motor: 40 HP 220/440 Voltage

Auxiliary motor, type and HP

Static water level: 98'

Well design capacity: 350 GPM

Pump Description: Vertical turbine pumps, 8 Stages
" bowl assembly with rated capacity 350 GPM
at TDH

Description of building housing the well. Does it have removable hatch?

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS (6-76)

Local Well Number
212 N (S) 20 E 62 9 dcdd 1
H.A. T. R. Sec ¼S Seq

Project 11

Name ______________________ MP: +1.41? ft above ~~below~~ LSD

MP description and sketch:

Station ID (lat-long)
[illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	Status	Method	BY	REMARKS
02/01/1977	[illegible]	35.12	114.5[illegible]	113.18	☐	☐	JK	(oil) off 8 hrs.
02/[illegible]1/1978	[illegible]	[illegible]77	[illegible]	0[illegible].90	☐	☐	JK	(oil)
02/26/1979	110	13.31	96.69	95.29	☐	S	DW	[illegible]
02/26/1980	105	10.97	94.03	92.63	☐	S	DW	MP - + 0.97 ?
02/26/1981	130.0	31.73	98.27	96.87	☐	S	DW	Elec tape = 99.64 bmp
/ /19	[illegible]	6.10	93.90	92.50	☐	S	DW/LB	oil!
/ /19				.	☐	☐		
/ /19				.	☐	☐		
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34 ⑦ 44				49 ③ 56	61 ④	67 ⑥		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑥	
5 19	20	34	44	49	56	61	62	67	68

④ Site status:
- D-dry
- F-flowing
- G-nearby, flowing
- H-nearby, recently flowing
- O-obstruction
- P-pumping
- R-recently pumped
- S-nearby, pumping
- T-nearby, recently pumped
- V-foreign substance
- X-surface water effects
- Z-other

⑥ Method of measurement:
- A-airline
- C-calibrated airline
- R-reported
- S-steel tape
- T-electric tape
- Z-other

Location sketch:
Ok for DW

Punched ______ Entered ______ Checked ______

Local Well No. [illegible]

WELL DATA

WELL # 3 FACILITY # 3789

LOCATION Nellis AFB, Nv

DATE DRILLED 1962 DEPTH 802

DRILLER Pat Thompson

BOTTOM ELEVATION [illegible] WELL DIAMETER 30

GRAVEL PACK CASING DIAMETER 16

CASING PERFORATIONS ~~Location not known~~ 302 TO 778
(1/4" x 3" on 2 1/2 CENTERS (STAGGERED)

COLUMN SIZE 8" GAGE LINE

PUMP SETTING 260' PUMP STAGES 8

PUMP MANUFACTURER Johnson Pump

SERIAL # JV 2253

TYPE SHAFT LUBRICATION Oil

MOTOR MANUFACTURER U. S. Motors (Installed Apr 71) [illegible]
FRAME [illegible] 50 AMP. DESIGN B CODE C 40°C 1760 RPM SER # 3930425

HP AND VOLTAGE 40 440 TRANSFORMER CAPACITY 45 KVA

AUXILIARY ENGINE: DESCRIPTION Continental Mod M363 Spec 2309
Engine No 3791

WELL HOUSED IN BUILDING None

INITIAL PRODUCTION GPM 800 LATEST PRODUCTION 310 Dec 1971

X

WATER WELL DATA #11

Well Depth: 275'

Pump Setting: 250'

Production Column Diameter: 6"

Casing Diameter: 14" and location of perforations

Well Diameter: 20" well is gravel packed; not gravel packed

Type drive shaft lubrication: Oil or Water oil

Drive Shaft Diameter:

Electric motor: 40 HP [illegible] Voltage

Auxiliary motor, type and HP

Static water level: 98'

Well design capacity: 350 GPM

Pump Description: Vertical turbine pumps, 8 Stages
" bowl assembly with rated capacity 350 GPM
at TDH

Description of building housing the well. Does it have removable hatch?

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

(6-

Local Well Number

Project // — 212 H.A. (S) 20 E T. 62 R. 9 Sec dcdd 1 Se

Name ______ MP: +1.1? ft above ~~below~~ LSD

MP description and sketch:

Station ID (lat-long) [illegible] 5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	① Status	② Method	BY	REMARKS
[illegible]/[illegible]/1977	[illegible]	[illegible]	[illegible]	115.18			JK	[illegible] off 8 hrs.
[illegible]/ 1/19[illegible]		[illegible]	[illegible]	[illegible].90			JK	(oil)
[illegible]/[illegible]/19[illegible]	110	[illegible].31	76.[illegible]	75.29		S	DW	[illegible] 1 month
02/26/1980	105	10.97	94.03	92.63		S	DW	MP - + 0.27 ?
02/26/1981	1300	31.73	98.27	96.87		S	DW	Elec tape = 99.64 bmp
/ /19	[illegible]	6.10	92.90	92.50		S	DW/LS	oil!
/ /19				.				
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34 ② 44				49 ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤
5 19	20	34	44	49	56	61	62	67

① Site status

D-dry	O-obstruction	T-nearby, recently pumped
F-flowing	P-pumping	V-foreign substance
G-nearby, flowing	R-recently pumped	X-surface water effects
H-nearby, recently flowing	S-nearby, pumping	Z-other

② Method of measurement

A-airline	R-reported	T-electric tape
C-calibrated airline	S-steel tape	Z-other

Location sketch:

Ck for QW

Punched ______ Entered ______ Checked ______

Local Well No. ______

/ 12

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Nellis Air Force Base Driller Phelps Pump & Equipment Company

Address Nellis Air Force Base, Nevada Address 400E. College, N. Las Vegas No.

Location of well: ~~NW~~ SE ¼ ~~NW~~ SE ¼ Sec. ~~32~~ 9, T.20 N/S, R62 E, in Clark Cou

Army Coordinates: N 534,753 E 660,476 Ground Surface Elev. 1817.8 feet.

Water will be used for Domestic Total depth of well 1000 feet

Size of drilled hole 12¾ (pilot) 26½" Weight of casing per linear foot -

Thickness of casing ¼ inch Temp. of water 74 degrees F

Diameter and length of casing 14" ID , single wall ; Two feet above ground surface to 1000feet.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diamet

If flowing well give flow in c.f.s. or g.p.m. and pressure -

If nonflowing well give depth of standing water from surface

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well 31 Dec. 1962 Date of completion of well 20 Feb. 1963

Type of well rig Drilled with rotary mud type rig and swabbed with 36L cable tool rig.

Well "C" LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	10	10	SANDY SILT Brn soft; sand fine& rounded.
10	20	10	SILT& CLAY: Brn,& buff, firm.
20	40	20	CALICHE& CLAY: Buff & lt. gray, soft to indurated, few limestone gravel.
40	90	50	CLAY: Brn, soft,
90	110	20	CALICHE: Buff, soft,& indurated.
110	140	30	CLAY: Brn, soft, sticky.
140	150	10	CALICHE: Buff, soft to indurated.
150	170	20	CLAY: Brn, soft, sticky.
170	180	10	CALICHE: Buff, soft.
180	240	60	CLAY: Brn, soft to indurated.
240	300	60	CLAY & CALICH E: Buff & brn, soft to indurated, the caliche streaks are hard & cause the rig to jerk.
300	360	60	CALICHE: B uff, soft to indurated, easily drilled.
360	550	190	CLAY: Brn, soft to indurated. Jerky drill action when the indurated streaks are encountered.
550	582	32	CALICHE & CLAY: Buff& gray tan, soft to indurated, jerky drilling at times.
582	650	68	SILT WITH CLAY & GYPSUM STREAKS: Brn, soft to indurated; sugary textured gypsum .
650	680	30	CLAY WITH DECAYED WOOD: Lt. gray-green & white, soft, decayed wood

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 240 to 300 f

Other aquifers 70' to 110'
140 to 150', 300 to 36
592' to 650', 760' to 7
& 990 to 995'

First water at 96.75 feet.

Casing perforated
from 320 feet to 980 feet

Size of perforations
Horizontal louvier one/ei
x 3 inch staggered rows 2& two thirds inches apart.

LOG OF FORMATIONS—Continued

	To feet	Thickness	Type of material
680	740	60	SILT & CLAY: Lt. gray brnk brn , soft; clay is brn color & the silt is gray brn color. Few selenite gypsum streaks fom 720 to 740 feet.
740	760	20	CLAY: Gray brn, soft.
760.	780	20	SILT & CLAY: Lt. gray tan & white , soft, to indurated; clay is the white color & the silt is the lt. gray tan.
780	895	115	CLAY: Brn, soft to indurated.
895	940	45	CLAY: Gray tan, soft with some indurated streaks. Jerky drilling from to 905 feet.
940	995	55	SILT WITH CLAY STREAKS: Gray, gray brn & white, soft to indurated, fro 980 to 995 feet the clay and the silt are about equal amounts.
995	1000.	5	CLAY: Greenish gray & buff , soft to hard, greenish gray clay has a greasey feel and is very lean. Jerky drilling at time . The lean clay does not fizz wheh acid is put on it.

BOTTOM OF HOLE 1000'

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
30"	2' above G. S.	50'	52'	This surface casing is grouted in place the entire distance.
14"	2' above G. S.	1000'	1002'	Perforated from 320' to 980' below G. S.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

GPM	Pumping level	Static water level	Drawdown	Specific yield	Sand count	Remarks
230	100'	59	41'	5.61	N.L	
560	160'		101'	5.54	N.L	
750	190'		131'	5.72	N.L	
1240	271'		212'	5.85	N.L	Cap. of the test engine & pump.
665	172'		113'	5.88	N.L.	Final 12 hr. test

Pumped 4,046,000 gal during test pumping. No sanding problems.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed PHELPS PUMP AND EQUIPMENT
Well Driller

By Lloyd R. Lum

License No. 78

Dated 3/19, 1963

(Not to be filled in by Driller)

RECEIVED
MAR 26 1963
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

72

WELL DATA

WELL # C FACILITY # 1711

LOCATION Nellis AFB

DATE DRILLED 1963 DEPTH 1000'

DRILLER PHELPS PUMP & EQUIP. CO. LAS VEGAS

BOTTOM ELEVATION 818' TOP 1817.8 WELL DIAMETER 30"

GRAVEL PACK Yes CASING DIAMETER 14"

CASING PERFORATIONS 820' to 980' (1/8" x 2-1/2", 8 per round on 2-3/4" centers, staggered)

COLUMN SIZE 8" GAGE LINE

PUMP SETTING 250' PUMP STAGES 12

PUMP: MANUFACTURER Johnson Pump

SERIAL # JU 2256

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER U.S. Motor

HP AND VOLTAGE 50 220-440 TRANSFORMER CAPACITY

AUXILIARY ENGINE: DESCRIPTION None

WELL HOUSED IN BUILDING None

INITIAL PRODUCTION, GPM 600 LATEST PRODUCTION 450 December 1971

WATER WELL DATA #12

Well Depth: 1000'

Pump Setting: 250'

Production Column Diameter: 8

Casing Diameter: ________ and location of perforations

Well Diameter: 30" well is gravel packed; not gravel packed

Type drive shaft lubrication: Oil or Water OIL

Drive Shaft Diameter:

Electric motor: 50 HP 220/440 Voltage

Auxiliary motor, type and HP

Static water level:

Well design capacity: 475 GPM

Pump Description: Vertical turbine pumps, 12 Stages ________ " bowl assembly with rated capacity 475 GPM at TDH

Description of building housing the well. Does it have removable hatch?

12

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.

Rec. 19

Well No.

Permit No.

Do not fill in

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Nellis Air Force Base Driller Phelps Pump & Equipment Company

Address Nellis Air Force Base, Nevada Address 100 E. College, N. Las Vegas Lic. No.

Location of well: ~~NW~~ SE ¼ ~~NW~~ SE ¼ Sec. ~~17~~ 9, T. 20 N/S, R 62 E, in Clark Co.

~~Army~~ Coordinates: N 534,753 E 660,476 Ground Surface Elev. 1817.8 feet.

Water will be used for Domestic Total depth of well 1000 feet

Size of drilled hole 17¼ (pilot) 28½" Weight of casing per linear foot -

Thickness of casing ¼ inch Temp. of water 74 degrees F

Diameter and length of casing 14" ID , single wall ; Two feet above ground surface to 1000feet.

(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diame

If flowing well give flow in c.f.s. or g.p.m. and pressure -

If nonflowing well give depth of standing water from surface

If flowing well describe control works

(Type and size of valve, etc.)

Date of commencement of well 31 Dec. 1962 Date of completion of well 20 Feb. 1963

Type of well rig Drilled with rotary mud type rig and swabbed with 36L cable tool rig.

Well "C"

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	10	10	SANDY SILT Brn soft; sand fine & rounded.
10	20	10	SILT & CLAY: Brn, & buff, firm.
20	40	20	CALICHE & CLAY: Buff & lt. gray, soft to indurated, few limestone gravel.
40	90	50	CLAY: Brn, soft,
90	110	20	CALICHE: Buff, soft, & indurated.
110	140	30	CLAY: Brn, soft, sticky.
140	150	10	CALICHE: Buff, soft to indurated.
150	170	20	CLAY: Brn, soft, sticky.
170	180	10	CALICHE: Buff, soft.
180	240	60	CLAY: Brn, soft to indurated.
240	300	60	CLAY & CALICH E: Buff & brn, soft to indurated, the caliche streaks are hard & cause the rig to jerk.
300	360	60	CALICHE: B uff, soft to indurated, easily drilled.
360	550	190	CLAY: Brn, soft to indurated. Jerky drill action when the indurated streaks are encountered.
550	582	32	CALICHE & CLAY: Buff & gray tan, soft to indurated, jerky drilling at times.
582	650	68	SILT WITH CLAY, & GYPSUM STREAKS: Brn, soft to indurated; sugary textured gypsum .
650	680	30	CLAY WITH DECAYED WOOD: Lt. gray green & white, soft, decayed wood

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 240 to 300

Other aquifers 70' to 110'

140' to 150', 300 to 36

582' to 650', 760' to 7

& 990 to 995'

First water at 64 75 feet

Casing perforated

from 320 feet to 980 feet

Size of perforations

Horizontal louvier one/e x 3 inch staggered rows 2⅔ two thirds inches apart.

LOG OF FORMATIONS—Continued

[illegible]	To feet	Thickness	Type of material
680	740	60	SILT & CLAY: Lt. gray brn& brn , soft; clay is brn color & the silt is gray brn color. Few selenite gypsum streaks from 720 to 740 feet.
740	760	20	CLAY: Gray brn, soft.
760	780	20	SILT & CLAY: LT. gray tan & white , soft; to indurated; clay is the ~~whi~~ white color & the silt is the lt. gray tan.
780	895	115	CLAY: Brn, soft to indurated.
895	940	45	CLAY: Gray tan, soft with some indurated streaks. Jerky drilling from to 905 feet.
940	995	55	SILT WITH CLAY STREAKS: Gray, gray brn & white, soft to indurated, fr 980 to 995 feet the clay and the silt are about equal amounts.
995	1000	5	CLAY: Greenish gray & buff , soft to hard, greenish gray clay has a greasey feel and is very lean. Jerky drilling at time . The lean clay does not fizz when acid is put on it.
			BOTTOM OF HOLE 1000'

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
30"	2'above g. s.	50'	52'	This surface casing is grouted in place the entire distance.
14"	2' above g. s.	1000'	1002'	Perforated from 320' to 980' below G. S.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

GPM	Pumping level	Static water level	Drawdown	Specific yield	Sand count	Remarks
230	100'	57	41'	5.61	Nil	
560	160'	"	101'	5.54	Nil	
750	190'	"	131'	5.72	Nil	
1240	271'	"	212'	5.85	Nil	Cap. of the test engine & pump
665	172'	"	113'	5.88	Nil.	Final 12 hr. test

Pumped 4,046,000 gal during test pumping. No sanding problems.

WELL DRILLER'S STATEMENT

This well was drilled under my juriadiction and the above information is true to my best information and belief.

Signed PHELPS PUMP AND EQUIPMENT
Well Driller

By

License No. 98

Dated 3/19, 1963

(Not to be filled in by Driller)

RECEIVED
MAR 26 1963
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

WELL DATA

WELL # C FACILITY # 1711

LOCATION Nellis AFB

DATE DRILLED 1963 DEPTH 1000'

DRILLER PHELPS PUMP & EQUIP. CO. LAS VEGAS

BOTTOM ELEVATION 818' TOP 1817.8 WELL DIAMETER 80"

GRAVEL PACK Yes CASING DIAMETER 14"

CASING PERFORATIONS 320' to 980' (1/8" x 2-1/2", 8 per round on 2-3/4" centers, staggered)

COLUMN SIZE 8" GAGE LINE

PUMP SETTING 250' PUMP STAGES 12

PUMP: MANUFACTURER Johnson Pump

SERIAL # JU 2256

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER U.S. Motor

HP AND VOLTAGE 50 220-440 TRANSFORMER CAPACITY

AUXILIARY ENGINE: DESCRIPTION None

WELL HOUSED IN BUILDING None

INITIAL PRODUCTION, GPM 600 LATEST PRODUCTION 450 December 1971

WATER WELL DATA #12

Well Depth: 1000'

Pump Setting: 250'

Production Column Diameter: 8"

Casing Diameter: ____ and location of perforations

____

Well Diameter: 30" ____ well is gravel packed; not gravel packed ____

Type drive shaft lubrication: Oil or Water OIL

Drive Shaft Diameter: ____

Electric motor: 50 HP 230/460 Voltage

Auxiliary motor, type and HP ____

Static water level: ____

Well design capacity: 475 GPM

Pump Description: Vertical turbine pumps, 12 Stages ____" bowl assembly with rated capacity 475 GPM at TDH

Description of building housing the well. Does it have removable hatch?

13

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner Nellis Air Force Base Driller Phelps Pump & Equipment Co.

Address Nellis AFB, Nevada Address 400 E. College Ave. N. Las Vegas, Lic. No.

Location of well: SW ¼ NE ¼ Sec. 9 T. 20 N/S, R 62 E, in Clark C

or Army Coordinates: N532 517, E656 939 G.S. Elev. 1812.00'

Water will be used for Domestic Total depth of well 694'

Size of drilled hole 12¼" (pilot) & 28½" Weight of casing per linear foot -

Thickness of casing ¼" Temp. of water 74 ° F

Diameter and length of casing 14" ID Single wall 2' above G.S. to 694' below G.S.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside dia

If flowing well give flow in c.f.s. or g.p.m. and pressure -

If nonflowing well give depth of standing water from surface 72' below G.S.

If flowing well describe control works -
(Type and size of valve, etc.)

Date of commencement of well 5 Nov. 1962 Date of completion of well 16 Dec 1962

Type of well rig Drilled w/rotary rig(mud type); swabbed w/36L Cable tool.

LOG OF FORMATIONS of Well "B"

From feet	To feet	Thickness feet	Type of material
0'	17'	17	Clay: Tan & soft
17'	24'	7	Caliche w/gravel: White, limestone gravel to 2"
24 '	40'	16	Caliche: White to buff, firm
40'	80'	40	Clay & Caliche: White & tan, soft
80'	90'	10	Clay w/gypsum: Tan, soft sugary gypsum.
90'	100'	10	Clay: tan, soft.
100'	150'	50	Caliche: White & buff, soft.
150'	315'	165	Clay: Tan, soft & indurated.
315'	330'	15	Clay w/gypsum: Firm & soft, brn, gypsum is sugary.
330'	375'	45	Clay: Gray brn. Soft.
375'	385'	10	Silt:Gray brn, soft.
385'	410"	25	Sandy silt: Tan, soft & indurated Sand is fine.
410'	436'	26	Sandy clay w/gypsum: Gray brn, soft & indurated. Sand is fine, sugary gypsum.
436'	445'	9	Clay: Brn, soft & indurated.
445'	484'	39	Sandy Silt: Gray brn, soft; sand is fine.
484'	560'	76	Clay: Brn, soft.

Water-bearing Formation, Casi Perforations, Etc.

Chief aquifer (water-bearing formation)

from 664 to 694

Other aquifers 78 to 105;

605 to 610

First water at 78' fee

Casing perforated

from 274' to 674'

Size of perforations

Horizontal Louvier
1/8"x 3" staggered rows 2-2/3" apart.

LOG OF FORMATIONS—Continued

From feet	To feet	Thickness	Type of material
560'	620'	60	Clay: Gray brn w/lt. gray streaks, soft
620'	650'	30	Silt & clay: Brn & gray, soft. Silt is brn & clay gray & in streaks.
650'	680'	30	Clay: Lt gray & tan, soft.
680'	700'	20	Clay: Lt gray, soft & indurated streaks. Well completed @ 694'.
700'	1000'	300	Clay w/gypsum: Gray & greenish gray, soft & indurated streaks, some clay streaks are very lean. Gypsum if of the Selenite (platy) variety 694' to 1000' only opened by drilling 12¼" pilot hole. Not opened ful size due to brackish water from gypsum as shown by electric log.

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
30"	2'above G.S.	50'	52'	Surface casing grouted entire depth.
14"	2' above G.S.	694'	696'	Perforated from 274' below G.S. to 675' below G.S. Gravel packed well using 3/8" max. gravel Used 100 cubic yard of gravel.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Static W.L. 72'. Chemical analysis was made & contained 446 PPM total dissolved solids.

A little high on flouride (1.7 PPM) Ph = 7+

200 GPM w/55' DD 500 GPM w/ 129' DD

360 " " 90' " 640 " " 166' DD

420 " " 97' " 740 " " 196' DD , Sanding condition

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Phelps Pump & Equipment Co.
Well Driller

By

License No. 98

Dated March 19, 1963

(Not to be filled in by Driller)

RECEIVED
MAR 26 1963
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

13

WELL DATA

WELL # 8 FACILITY # 1713

LOCATION Nellis AFB

DATE DRILLED 1963 DEPTH 697'

DRILLER ~~Pat Thomason~~ PHELPS PUMP & EQUIP. CO., LAS VEGAS

BOTTOM ELEVATION 1116' TOP ~~1824~~ 1813 WELL DIAMETER 28"

GRAVEL PACK Yes 7" CASING DIAMETER 14"

CASING PERFORATIONS 274' to 674'

COLUMN SIZE 6" GAGE LINE No

PUMP SETTING 220' PUMP STAGES 7

PUMP: MANUFACTURER Johnson Turbine

SERIAL # IU 2265

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER U.S Motors

HP AND VOLTAGE 40 220-440 TRANSFORMER CAPACITY 3-15KVA 1ϕ

AUXILIARY ENGINE: DESCRIPTION None

WELL HOUSED IN BUILDING None

INITIAL PRODUCTION, GPM 840 1963 LATEST PRODUCTION 282 December 1971

(6-76)

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

Local Well Number: 212 N.A. (S) 20 T. E 62 R. 16 Sec 0ccb 1 Seq

Project 13

Name

MP: +1.0 ft above LSD

MP description and sketch:

Station ID (lat-long) [illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	⑪ Status	⑫ Method	BY	REMARKS
3/01/1977	[illegible]	[illegible]	111.2[illegible]	11[illegible]			TK	
2/[illegible]/197[illegible]	[illegible]	[illegible]	[illegible]	[illegible]7.87			TK	
0[illegible]/26/1979	110	8.39	101.66	100.66		S	DW	Not pumped since Saturday
02/26/1980	115	21.55	93.95	92.95		S	DW	last pumped The 23rd
02/26/1981	131.0	32.07	98.93	97.93		S	DW	no oil on tape
12/03/1982	105.0	12.6						
/ /19	106.0 120.0	13.75 [illegible]	92.24	91.24		S	DW/LS	no oil all 5 hours
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34 ③ 44				49 ③ 56	61 ④	67 ①		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

① .	R=234*T=A*235#	①	*237=	③	*238=	①	*239=
5 19	20	34	44	49	56	61	62

Location sketch:

⑪ Site status
- D-dry
- F-flowing
- G-nearby, flowing
- H-nearby, recently flowing
- O-obstruction
- P-pumping
- R-recently pumped
- S-nearby, pumping
- T-nearby, recently pumped
- V-foreign substance
- X-surface water effects
- Z-other

⑫ Method of measurement
- A-airline
- C-calibrated airline
- R-reported
- S-steel tape
- T-electric tape
- Z-other

Punched ______ Entered ______ Checked ______

Local Well No. ______

13

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Nellis Air Force Base Driller Phelps Pump & Equipment Co.

Address Nellis AFB, Nevada Address 400 E. College Ave. N. Las Vegas, Lic. No.

Location of well: SW ¼ NE ¼ Sec. 9, T 20 ~~N~~/S, R 62 E, in Clark

or Army Coordinates: N532 517, E656 939 G.S. Elev. 1812.00'

Water will be used for Domestic Total depth of well 694'

Size of drilled hole 12¼" (pilot) & 28½" Weight of casing per linear foot –

Thickness of casing ¼" Temp. of water 74 ° F

Diameter and length of casing 14" ID Single wall 2' above G.S. to 694' below G.S.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside dia.

If flowing well give flow in c.f.s. or g.p.m. and pressure –

If nonflowing well give depth of standing water from surface 72' below G.S.

If flowing well describe control works –
(Type and size of valve, etc.)

Date of commencement of well 5 Nov. 1962 Date of completion of well 16 Dec 1962

Type of well rig Drilled w/rotary rig(mud type); swabbed w/36L Cable tool.

LOG OF FORMATIONS of Well "B"

From feet	To feet	Thickness feet	Type of material
0'	17'	17	Clay: Tan & soft
17'	24'	7	Caliche w/gravel: White, limestone gravel to 2"
24 '	40'	16	Caliche: White to buff, firm
40'	80'	40	Clay & Caliche: White & tan, soft
80'	90'	10	Clay w/gypsum: Tan, soft sugary gypsum.
90'	100'	10	Clay: tan, soft.
100'	150'	50	Caliche: White & buff, soft.
150'	315'	165	Clay: Tan, soft & indurated.
315'	330'	15	Clay w/gypsum: Firm & soft, brn, gypsum is sugary.
330'	375'	45	Clay: Gray brn. Soft.
375'	385'	10	Silt:Gray brn, soft.
385'	410"	25	Sandy silt: Tan, soft & indurated Sand is fine.
410'	436'	26	Sandy clay w/gypsum: Gray brn, soft & indurated. Sand is fine, sugary gypsum.
436'	445'	9	Clay: Brn, soft & indurated.
445'	484'	39	Sandy Silt: Gray brn, soft; sand is fine.
484'	560'	76	Clay: Brn, soft.

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 664 to 694

Other aquifers 78 to 105;

605 to 610

First water at 78' feet

Casing perforated

from 274' to 674'

Size of perforations

Horizontal Louvier
1/8"x 3" staggered rows
2-2/3" apart.

LOG OF FORMATIONS—*Continued*

1 3

From feet	To feet	Thickness	Type of material
560'	620'	60	Clay: Gray brn w/lt. gray streaks, soft
620'	650'	30	Silt & clay: Brn & gray, soft. Silt is brn & clay gray & in streaks.
650'	680'	30	Clay: Lt gray & tan, soft.
680'	700'	20	Clay: Lt gray, soft & indurated Streaks. Well completed @ 694'.
700'	1000'	300	Clay w/gypsum: Gray & greenish gray, soft & indurated streaks, some clay streaks are very lean. Gypsum if of the Selenite (platy) variet 694' to 1000' only opened by drilling $12\frac{1}{4}$" pilot hole. Not opened fu size due to brackish water from gypsum as shown by electric log.

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
30"	2'above G.S.	50'	52'	Surface casing grouted entire depth.
14"	2' above G.S.	694'	696'	Perforated from 274' below G.S. to 675' below G.S. Gravel packed well using 3/8" max. gravel Used 100 cubic yard of gravel.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Static W.L. 72'. Chemical analysis was made & contained 446 PPM total dissolved solids.

A little high on flouride (1.7 PPM) Ph = 7+

200 GPM w/55' DD	500 GPM w/ 129' DD
360 " " 90' "	640 " " 166' DD
420 " " 97' "	740 " " 196' DD , Sanding condition

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Phelps Pump & Equipment Co.
Well Driller

By

License No. 98

Dated March 19, 1963

(Not to be filled in by Driller)

WELL DATA

WELL # B FACILITY # 1713

LOCATION Nellis AFB

DATE DRILLED 1963 DEPTH 697'

DRILLER ~~Pat Thompson~~ PHELPS PUMP & EQUIP. CO., LAS VEGAS

BOTTOM ELEVATION 1116' TOP ~~1829~~ 1813 WELL DIAMETER 28"

GRAVEL PACK Yes 7" CASING DIAMETER 14"

CASING PERFORATIONS 274' to 674'

COLUMN SIZE 6" GAGE LINE No

PUMP SETTING 220' PUMP STAGES 7

PUMP: MANUFACTURER Johnson Turbine

SERIAL # IU 2255

TYPE SHAFT LUBRICATION Oil

MOTOR: MANUFACTURER U.S Motors

HP AND VOLTAGE 40 220-440 TRANSFORMER CAPACITY 3-15KVA 1φ

AUXILIARY ENGINE: DESCRIPTION None

WELL HOUSED IN BUILDING None

INITIAL PRODUCTION, GPM 440 1963 LATEST PRODUCTION 282 December 1971

?

(6-[illegible]

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

Local Well Number

212 H.A. N (S) 20 T. E 62 R. 16 Sec 0ccb ~~QS~~ 1 Sec

Project 13

Name ______ MP: +1.0 ft above ~~below~~ LSD

MP description and sketch:

Station ID (lat-long) [illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	⑪ Status	⑫ Method	BY	REMARKS
3/01/1977	[illegible]	[illegible]	[illegible]	[illegible]			TK	
[illegible]/19[illegible]	[illegible]	[illegible]	[illegible]	[illegible]7.87			TK	
[illegible]/19[illegible]	110	3.34	101.66	100.66		S	DW	Not pumped since Saturday
02/26/1980	115	21.55	93.95	92.95		S	DW	last pumped The 24th
02/26/1981	131.0	32.07	98.93	97.93		S	DW	no oil on tape
12/03/1982	105.0	12.8		.				
/ /19	106.0 [illegible]	13.7[illegible]	92.24	91.24		S	DW/LS	no oil off 5 hours
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34 ② 44				49 ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤	*
5 19	20	34	44	49	56	61	62	67	68

⑪ Site status
- D-dry
- F-flowing
- G-nearby, flowing
- H-nearby, recently flowing
- O-obstruction
- P-pumping
- R-recently pumped
- S-nearby, pumping
- T-nearby, recently pumped
- V-foreign substance
- X-surface water effects
- Z-other

⑫ Method of measurement
- A-airline
- C-calibrated airline
- R-reported
- S-steel tape
- T-electric tape
- Z-other

Location sketch:

130.0
91.99

Punched ______ Entered ______ Checked ______

Local Well No. ______

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

#14

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.

Rec. 19

Well No.

Permit No.

Do not fill in

Owner Nellis AFB

Driller Phelps Pump & Equipment Co.

Address Nellis AFB, Nevada

Address 400 E. College Ave. N. Las Vegas, Ne

Lic. No.

Location of well: SW ¼ SW ¼ Sec. 9, T. 20 N/S, R. 62E, in Clark Co

or Army Coordinates: NS34, 991.66 E 6S4, 108.48 G.S. Elev. 1826.6'

Water will be used for Domestic

Total depth of well 650'

Size of drilled hole 12½ (pilot) & 28½"

Weight of casing per linear foot -

Thickness of casing ½"

Temp. of water 74° F

Diameter and length of casing 14" ID Single wall 2' above G.S. to 650' below G.S.

(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diame

If flowing well give flow in c.f.s. or g.p.m. and pressure -

If nonflowing well give depth of standing water from surface 70' below G.S.

If flowing well describe control works -

(Type and size of valve, etc.)

Date of commencement of well 19 Dec. 1962

Date of completion of well 29 Jan. 1963

Type of well rig Drilled w/rotary (mud) rig; swabbed w/36 L cable tool rig.

LOG OF FORMATIONS of Well " A "

From feet	To feet	Thickness feet	Type of material
0'	25'	25	Clay & Caliche: Tan, firm
25'	40'	15	Sand, gravel & clay: Tan, limestone gravel to 1½ " size.
40'	100'	60	Clay w/Caliche: Tan & buff, soft & indurated.
100'	120'	20	Caliche: Buff, indurated.
120'	430'	310	Clay & Caliche: Tan, white &buff, soft to indurated.
430'	530'	100	Clay w//gypsum streaks: Brn, soft to indurated. Sugary texture gypsum.
530'	560'	30	Clay: Lt brn, soft to indurated.
560'	595'	35	Clay w/gypsum: Brn & lt greenish gray, soft w/indurated streaks. Gypsum has a sugary texture.
595'	620'	25	Clay: Brn, greenish, gray, soft, lean clay, some decayed pieces of black wood.

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 562 to 621

Other aquifers 188' to 210';

292' to 316'

434' to 470'

485' to 530'

First water at 70' feet.

Casing perforated

from 290' to 630'

Size of perforations

Horizontal Louvier 1/8"x3'

staggered rows 2-2/3" apa

(OVER)

LOG OF FORMATIONS—Continued

[illegible]	To feet	Thickness	Type of material
620'	635'	15	Clay w/gypsum: Brn, & lt gray, soft; Gypsum has sugary texture.
630'	703'		Clay: Lt. greenish gray, becoming darker w/depth; lean clay, soft; only opened full size (28½") hole to depth of 650'. Bottom of 28½" hole = 650' " " 12½" (pilot) hole = 703'

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
30"	2' above G.S.	50'	52'	Surface casing grouted entire depth.
14"	2' above G.S.	650'	652'	Perforated from 240' to 630' below G.S. Gravel packed well using 3/8" max. gravel. Used 89.2 Cub yards of gravel.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

No chemical analysis at this time. Conductance 580 micromhos = approx 440 PPM

445 GPM w/249' DD - Sanding condition (fine gray)

425 " " 242' " - Sand free

350 " " 203' " " "

315 " " 174' " " "

275 " " 164' " " "

215 " " 125' " " "

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Phelps Pump & Equipment Co.
Well Driller

By

License No. 99

Dated 3/19, 19 63

(Not to be filled in by Driller)

RECEIVED
MAR 26 1963
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

(6-76)

Local Well Number
212 N (S) 22 E 02 9 ccc 1
H.A. T. R. Sec ¼¼ Seq

Project 14

Name ______ MP: +1.3 ft above ~~below~~ LSD

MP description and sketch:

Station ID (lat-long)
26 2 58 [illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	Status	Method	BY	REMARKS
[illegible]/[illegible]/1977	130	16.22	112.72	112.42			TK	lower 360' caved in. well has been off the months
3/01/1978	[illegible]	7.21	[illegible]	42.24			TK	
02/26/1979	100	9.46	90.59	89.29		S	DW	
02/26/1980	100	13.87	86.13	84.83		S	DW	
02/26/1981	130	41.49	88.51	87.21		S	DW	Elec tape meas = 90.8 bmp; oily
02/[illegible]/1982	[illegible]	1.50	83.50	82.70		S	DW/KS	off 1 month
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/ /19				.				
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34 ② 44				49 ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤	*
5–19	20	34	44	49	56	61	62	67	68

④ Site status
D-dry
F-flowing
G-nearby, flowing
H-nearby, recently flowing
O-obstruction
P-pumping
R-recently pumped
S-nearby, pumping
T-nearby, recently pumped
V-foreign substance
X-surface water effects
Z-other

⑤ Method of measurement
A-airline
C-calibrated airline
R-reported
S-steel tape
T-electric tape
Z-other

Location sketch:

ok for QW

Punched ______ Entered ______ Checked ______

Local Well No. [illegible] 2-9 [illegible] 1

(N

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

#14

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Nellis AFB
Driller Phelps Pump & Equipment Co.
Address Nellis AFB, Nevada
Address 400 E. College Ave. N. Las Vegas, N
Lic. No.
Location of well: SW 1/4 SW 1/4 Sec. 9, T. 20 ~~N~~/S, R. 62 E, in Clark Co
or Army Coordinates: N534, 991.66 E 654, 108.48 G.S. Elev. 1826.6'
Water will be used for Domestic
Total depth of well 650'
Size of drilled hole $12\frac{1}{4}$ (pilot) & $28\frac{1}{2}$"
Weight of casing per linear foot -
Thickness of casing $\frac{1}{4}$"
Temp. of water 74 °F
Diameter and length of casing 14" 1D Single wall 2' above G.S. to 650' below G.S.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diam
If flowing well give flow in c.f.s. or g.p.m. and pressure -
If nonflowing well give depth of standing water from surface 70' below G.S.
If flowing well describe control works -
(Type and size of valve, etc.)
Date of commencement of well 19 Dec. 1962
Date of completion of well 29 Jan. 1963
Type of well rig Drilled w/rotary (mud) rig; swabbed w/36 L cable tool rig.

LOG OF FORMATIONS of Well " A "

From feet	To feet	Thickness feet	Type of material
0'	25'	25	Clay & Caliche: Tan, firm
25'	40'	15	Sand, gravel & clay: Tan, limestone gravel to $1\frac{1}{2}$ " size.
40'	100'	60	Clay w/Caliche: Tan & buff, soft & indurated.
100'	120'	20	Caliche: Buff, indurated.
120'	430'	310	Clay & Caliche: Tan, white & buff, soft to indurated.
430'	530'	100	Clay w//gypsum streaks: Brn, soft to indurated. Sugary texture gypsum.
530'	560'	30	Clay: Lt brn, soft to indurated.
560'	595'	35	Clay w/gypsum: Brn & lt greenish gray, soft w/indurated streaks. Gypsum has a sugary texture.
595'	620'	25	Clay: Brn, greenish, gray, soft, lean clay, some decayed pieces of black wood.

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 562 to 621
Other aquifers 188' to 210';
292' to 316'
434' to 470'
485' to 530'

First water at 70' feet

Casing perforated
from 290' to 630'

Size of perforations
Horizontal Louvier 1/8"x
staggered rows 2-2/3" ap

LOG OF FORMATIONS—Continued

From feet	To feet	Thickness	Type of material
620'	635'	15	Clay w/gypsum: Brn, & lt gray, soft; Gypsum has sugary texture.
630'	703'		Clay: Lt. greenish gray, becoming darker w/depth; lean clay, soft; only opened full size (28½") hole to depth of 650'. Bottom of 28½" hole = 650' " " 12½" (pilot) hole = 703'

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
30"	2' above G.S.	50'	52'	Surface casing grouted entire depth.
14"	2' above G.S.	650'	652'	Perforated from 200' to 630' below G.S. Gravel packed well using 3/8" max. gravel. Used 89.2 Cu yards of gravel.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

No chemical analysis at this time. Conductance 580 micromhos = approx 440 PPM

445 GPM w/249' DD - Sanding condition (fine gray)

425 " " 242' " - Sand free

350 " " 203' " " "

315 " " 174' " " "

275 " " 164' " " "

215 " " 125' " " "

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Phelps Pump & Equipment Co.
Well Driller

By

License No. 99

Dated 3/19, 19 63

(Not to be filled in by Driller)

RECEIVED
MAR 26 1963
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

(6-

WATER LEVEL CODING FORM
PERIODIC MEASUREMENTS

Local Well Number

212 N (S) 32 E 02 9 ccc 1
H.A. T. R. Sec ¼s Se

Project 14

Name ______ MP: +1.3 ft above ~~below~~ LSD

MP description and sketch:

Station ID (lat-long)
[illegible]
5 19

DATE (mo/day/year)	HOLD	WET	WATER LEVEL, IN FT BELOW MP	BELOW LSD	① Status	② Method	BY	REMARKS
[illegible]/[illegible]/1977	150	16.22	12.73	112.42			TK	lower sec caved in. W[illegible] [illegible] bees → the [illegible]
3/01/1978	1	7.[illegible]	[illegible]	[illegible].[illegible]4			TA	
02/26/1979	[illegible]	9.46	90.[illegible]	87.25		S	DW	
02/26/1980	100	13.87	86.13	84.83		S	DW	
02/26/1981	[illegible]0	41.49	88.51	87.21		S	DW	Elec tape meas=90.8 bmp; oily
[illegible]/[illegible]/19[illegible]	[illegible]	1.50	83.50	82.20		S	DW/LS	off 1 month
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34 ② 44				49 ③ 56	61 ④	67 ⑤		

KEY PUNCHING INSTRUCTIONS: Duplicate col. 5-33 for all cards

①	R=234*T=A*235#	②	*237=	③	*238=	④	*239=	⑤
5 19	20	34	44	49	56	61	62	67

① Site status
- D-dry
- F-flowing
- G-nearby, flowing
- H-nearby, recently flowing
- Ø-obstruction
- P-pumping
- R-recently pumped
- S-nearby, pumping
- T-nearby, recently pumped
- V-foreign substance
- X-surface water effects
- Z-other

② Method of measurement
- A-airline
- C-calibrated airline
- R-reported
- S-steel tape
- T-electric tape
- Z-other

Location sketch:

ok for QW

Punched ______ Entered ______ Checked ______

Local Well No. [illegible] - 9 [illegible] 1

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No. 1747
Rec. 9/26 1951
Well No. 314
Permit No. 13765
Do not fill in

Owner Nellis Air Force Base
Address Las Vegas Nevada
Driller Allen Water Well SErvice Co.
Address 231 Maryland Pky. Lic. No. 40
Location of well: NE ¼ SE ¼ Sec. 3, T. 20 N/S, R 62 E, in Clark County
or
Water will be used for Quasi-municipal
Total depth of well 300'
Size of drilled hole 20"
Weight of casing per linear foot 41.7
Thickness of casing 3/16"
Temp. of water
Diameter and length of casing 20" I.D. 98' with 12" machine perforated liner from top to bottom (Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)
If flowing well give flow in c.f.s. or g.p.m. and pressure
If nonflowing well give depth of standing water from surface -17'
If flowing well describe control works Pump (Type and size of valve, etc.)
Date of commencement of well July 5, 1951
Date of completion of well Aug. 2, 1951
Type of well rig Star 72 Spudder

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	7	7	top soil
7	68	61	clay
68	74	6	caliche
74	77	3	gravel
77	106	29	clay
106	110	4	clay & gravel
110	116	6	water gravel
116	158	42	clay
158	175	17	caliche
175	190	15	clay
190	197	7	water gravel
197	204	7	clay
204	208	4	water gravel
208	240	32	clay
240	245	5	clay & gravels
245	250	5	water gravel
250	265	15	clay
265	268	3	water gravel
268	278	10	clay
278	282	4	water gravel
282	295	13	clay
295	298	3	water kravel
298	300	2	clay

Water-bearing Formation, Casing Perforations, Etc.

Perforated from 120'-300

Chief aquifer (water-bearing formation)
from 110 to 116 ft.
Other aquifers 110 - 116
190 - 197 204 - 208
245 - 250 265 - 268
278 - 282 295 - 298

First water at 42 feet.

Casing perforated
from 120 to 300 ft.

Size of perforations
3/16 x 1 1/4, 31/2" apart with 1 1/2" between rows

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
20"	0	98	98	3/16" Cemented in place with 100 sacks straight cement
12"	3	300	297	1/4" & 3 yards of cement grout

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Gravel packed with 3/8" x 1/4" gravel to with in 20 feet of the top.

WELL DRILLERS STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Fred B. Allen
Well Driller

By

License No. 40

Dated Aug. 20, 1951

(Not to be filled in by Driller)

106100 1747

Rec. 9/26 1951
Well No. 314
Permit No. 1[illegible]765
Do not fill in

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Owner Nellis Air Force Base
Driller Allen Water Well Service Co.

Address Las Vegas, Nevada
Address 931 Maryland Pkw. Lic. No. 40

Location of well: NE ¼ SE ¼ Sec. 3, T. 20 N/S, R 62 E, in Clark County

or

Water will be used for Quasi-municipal
Total depth of well 300'

Size of drilled hole 20"
Weight of casing per linear foot 41.7

Thickness of casing 7/16"
Temp. of water

Diameter and length of casing 20" O.D. 93' with 12" machine perforated liner from top to bottom
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface -17'

If flowing well describe control works Pump
(Type and size of valve, etc.)

Date of commencement of well July 5, 1951
Date of completion of well Aug. 9, 1951

Type of well rig Star 30 Spudder

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
[illegible]	[illegible]	[illegible]	top soil
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	[illegible]	caliche
74	77	[illegible]	gravel
77	[illegible]	[illegible]	clay
[illegible]	[illegible]	4	clay & gravel
[illegible]	[illegible]	[illegible]	water gravel
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	[illegible]	caliche
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	[illegible]	water gravel
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]		water gravel
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	[illegible]	clay & gravel
[illegible]	[illegible]	[illegible]	water gravel
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	[illegible]	water gravel
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	4	water gravel
[illegible]	[illegible]	[illegible]	clay
[illegible]	[illegible]	3	water gravel
[illegible]	300	[illegible]	clay

Water-bearing Formation, Casing Perforations, Etc.

Perforated from [illegible]

Chief aquifer (water-bearing formation)

from [illegible] to [illegible] ft.

Other aquifers [illegible]

First water at [illegible] feet.

Casing perforated

from [illegible] to [illegible] ft.

Size of perforations

[illegible]

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
[illegible]	0	[illegible]	[illegible]	3/16" Cemented in place with 100 sacks straight cement
16"	3	300	297	1/4" & 3 yards of cement grout

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Gravel packed with 3/8" x 1/4" gravel to with in 20 feet of the top.

WELL DRILLERS STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Allen
Well Driller

By

License No. [illegible]

Dated [illegible], 19[illegible]

(Not to be filled in by Driller)

Hard copy

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No. 3981
Rec. Jan 22 1958
Well No.
Permit No. 16936
Do not fill in

Owner United States Air Force ~~W. J. Mason~~ Driller J. Mason
Address ~~1005 Elm~~ Street Las Vegas, Nevada Address 1105 Elm Street Las Vegas, Nevada Lic. No. 295

Location of well NW 1/4 NW 1/4 Sec. 3, T20 S, R62 E, in Clark County

or Nellis Air Force Base Well 10

Water will be used for quasi-municipal Total depth of well 1497'

Size of drilled hole 20 inch Weight of casing per linear foot 57 pounds

Thickness of casing 1/4 wall Temp. of water 72 deg.

Diameter and length of casing 16" - 1397' 20" - 100'
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 68'

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well 8/13/56 Date of completion of well March 28, 1957

Type of well rig Rotary

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
5'	29'	24'	Caliche
29'	75'	66'	Clay + Caliche
75'	305'	230'	Brown + White Clay
305'	1000'	695	Brown + White + Gray clay
1000	1050'	50'	Brown clay with sand
1050'	1110'	60	Brown clay sand White + Blue clay
1110	1497	387'	Blue clay Brown + white clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 1020 to 1100 ft.
Other aquifers 420 to 430
740 to 755
1220 to 1230
1250 to 1260
1300 to 1320

First water at 68 feet.

Casing perforated
from 100 to 800 ft.
1000 to 1497 ft.

Size of perforations
3/16"

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
16"	100	1497	1397	Grouting from 0 to 100'
20"	0	100	100	

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Test. Pumping- Bowl setting 350'

Gals. per minute pumped - 400

Pumping Test - 93 hours

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed illiam [illegible] son
Well Driller

By

License No. ~~[illegible]~~ 295

Dated Jan 5, 1958

(Not to be filled in by Driller)

OFFICE
STATE ENGINEER

1958 JAN 22 AM 10 55

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No. 3981
Rec. Jan 22 1958
Well No.
Permit No. 16936
Do not fill in

Owner United States Air Force [illegible]
Driller [illegible]
Address [illegible] Elm Street [illegible]
Address [illegible] Elm Street [illegible]
Lic. No. [illegible]
Location of well: NW 1/4 NW 1/4 Sec. 2, T 20 N/S, R 62 E, in [illegible] County
or [illegible] Force Base [illegible]
Water will be used for [illegible]
Total depth of well [illegible]
Size of drilled hole [illegible] inch
Weight of casing per linear foot [illegible]
Thickness of casing [illegible]
Temp. of water 72 deg.
Diameter and length of casing 16" - 1397' 20" - 100'
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)
If flowing well give flow in c.f.s. or g.p.m. and pressure
If nonflowing well give depth of standing water from surface 68'
If flowing well describe control works
(Type and size of valve, etc.)
Date of commencement of well 3/13/56
Date of completion of well March 22, 1957
Type of well rig Rotary

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
5	29	24	Caliche
29	75	46	Clay & Caliche
75	336	261	Brown & white clay
336	1010	674	Brown and white & gray clay
1010	1050	40	[illegible]
1050	1110	60	Brown clay sand & White & Blue clay
1110	1497	387	Blue clay Brown & white clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 1020 to 1100 ft.
Other aquifers 420 to 430
740 to 755
1220 to 1230
1250 to 1260
1300 to 1320

First water at 68 feet.

Casing perforated
from 100 to 800 ft.
1000 to 1497 ft.

Size of perforations
3/16"

(OVER)

919

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
16"	100	1497	1397	Grouting from 0 to 100'
20"	0	100	100	

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Test Pumping- Bowl setting 350'

Gals. per minute pumped - 400

Pumping Test - 93 hours

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed [illegible]
Well Driller

By [illegible]

License No. [illegible]

Dated [illegible], 19[illegible]

(Not to be filled in by Driller)

OFFICE
STATE ENGINEER

1958 JAN 22 AM 10 55

Off-Base Well Records

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in.

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Carol Azvedo Driller S. H. McKinney & Sons, Inc.

Address 2084 Christy Lane Address 1042 S Main Las Veg Lic. No. 45

✓ Location of well: S ¼ NE ¼ Sec. 21, T. 20 N/S, R. 62 E, in Clark County

or

Water will be used for Domestic Total depth of well 200 ft.

Size of drilled hole 12" to 50 ft., 10" to 200 Weight of casing per linear foot 3/16"

Thickness of casing 3/16" Temp. of water

Diameter and length of casing 8 5/8 inch from 0 to 200 ft.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 75 ft.

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well 1-19-67 Date of completion of well 1-25-67

Type of well rig Bucyrus Erie 24 L Spudder

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	2	2	topsoil
2	6	4	clay
6	16	10	graveley clay
16	60	44	graveley clay
60	90	30	clay
90	100	10	graveley clay water
100	140	40	white clay
140	150	10	sandy white clay water
150	190	40	clay
190	200	10	sandy white clay water

Water-bearing Formation, Casing Perforations, etc.

Chief aquifer (water-bearing formation)

from 190 to 200 ft.

Other aquifers 140 to 150
90 to 100

First water at 90 feet.

Casing perforated

from 60 to 200 ft.

Size of perforations

3/16" X 10"

(OVER)

LOG OF FORMATIONS—Continued

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	REMARKS—Seals, Grouting, etc.
8 5/8	0	200	200	8 inch casing cemented down to 50 ft with $2\frac{1}{2}$ yards well grout.

GENERAL INFORMATION—Pumping Test, Quality of Water, etc.

Bailed 60 G.P.M. FROM 86 ft.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed S. H. McKinney & Sons, Inc.
Well Driller

By

License No. 45

Dated 2-1-67, 19

(Not to be filled in by Driller)

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner James R. & Ida M. Black Driller Effinger Drill & Pump Serv.

Address 4068 Judson Address Box 579 City Lic. No. 212

Location of well: SW ¼ NE ¼ Sec. 21, T. 22 ~~N~~/S, R. 62 E, in Clark County

or 4068 Judson ~~Lot 12, Blk 2 Meikle Manor #1~~

Water will be used for Domestic Total depth of well 200 feet

Size of drilled hole 12 inch Weight of casing per linear foot .1414

Thickness of casing .156 Temp. of water

Diameter and length of casing 8"ID 200 feet
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 60'

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well August 1, 1963 Date of completion of well August 5, 1963

Type of well rig "Walker-Neer 31"

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	15	15	Brown Sandy Clay
15	19	4	Gravel
19	26	7	Decomposed Lime
26	45	19	Brown Sandy Clay
45	52	7	White Clay
52	56	4	Decomposed Lime
56	64	8	White Clay
64	69	5	Decomposed Lime (Water)
69	76	7	Brown Sandy Clay
76	81	5	Decmoposed Lime (Water)
81	87	6	Brown Clay
87	93	6	Decmoposed Lime (Water)
93	102	9	Brown Clay
102	115	13	Sand & Lime (Wnter)
115	135	20	White Clay
135	148	13	Brown Clay
148	161	13	White Clay
161	180	19	Brown Sandstone (Water)
180	200	2p	White Sandy Clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 161 to 180 ft.

Other aquifers 102-115
87093
76-81
64-69

First water at 64 feet.

Casing perforated
from 100 to 190 ft.

Size of perforations
1/8" X 12" Torch

(OVER)

919

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
8"ID	0	200	200	Cemented from 0 to 50 feet 1½ yards of cement Graveled packed from 50 to 190 feet 3 yards of pea gravel

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Effinger Drill & Pump
Well Driller

By

License No. 212

Dated August 5, 19 63

(Not to be filled in by Driller)

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.

Rec. 19

Well No.

Permit No.

Do not fill in

Owner William H. Wells

Driller Effinger Drilling & Pump

Address 2052 Christy Lane

Address Box 579 City Lic. No. 212

Location of well: SW 1/4 NE 1/4 Sec. 21, T. 20 N/S, R 62 E, in Clark County

or 2052 Christy Lane

Water will be used for Domestic

Total depth of well 200 feet

Size of drilled hole 12 inch

Weight of casing per linear foot .1414

Thickness of casing 10 Guage

Temp. of water

Diameter and length of casing 8"ID 200 feet

(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface

If flowing well describe control works

(Type and size of valve, etc.)

Date of commencement of well August 2, 1965

Date of completion of well August 6, 1965

Type of well rig "Walker-Neer" 31

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	17	17	Yellow Clay
17	42	25	Yellow Clay & Gravel
42	68	26	Yellow Clay
68	85	17	Decomposed Lime (Water)
85	110	25	Decomposed Lime & Gravel (W)
110	120	10	Whie clay
120	140	20	Green Clay
140	200	60	Decomposed Lime (Water)

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 140 to 200 ft.

Other aquifers 85-110

68-110

First water at 68 feet.

Casing perforated

from 135 to 195 ft.

Size of perforations

1.8" X 12" Torch

919

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
8"ID	0	200	200	Cemented from 0 to 50 feet 2½ yards of cement Graveled packed from 50 to 195 feet 3½ yards of pea gravel Old 6" well plugged and abandonded

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

1HP Berkeley submersible pump, 220 gallon tank, 147' 1¼" riser pipe, 147' 10 cable

WELL DRILLER'S STATEMENT	(Not to be filled in by Driller)
This well was drilled under my jurisdiction and the above information is true to my best information and belief.	

Signed Effinger Drill & Pump
Well Driller

By

License No. 212

Dated August 7, 1955

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner Troy C. Brown Driller J. R. McKinney & Son

Address East college, Las Vegas Address 1042 S. Main Las Vegas Lic. No. 45

Location of well: NW 1/4 NE 1/4 Sec. 21, T. 20 N/S, R 61 E, in Clark Count

or

Water will be used for Domestic Total depth of well 100 ft.

Size of drilled hole 12" to 55 ft. 8" to 100 Weight of casing per linear foot 28 lb.

Thickness of casing 5/16" Temp. of water

Diameter and length of casing 8" I.D. to ~~xxx~~ 61' 7"
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 42 ft.

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well Nov 26, 1952 Date of completion of well Nov 27, 1952

Type of well rig Bucyrus Erie 24L Scudder

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	5	5	Soil
5	8	3	Soft caliche
8	24	16	Brown clay
24	60	36	Light brown clay Water
60	73	13	Sandy brown clay
73	100	27	White sandy clay Water

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 73 to 100 ft.

Other aquifers

First water at 42 ft. feet.

Casing perforated

from None to ft.

Size of perforations

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
" I.D.	0	61' 7"	61' 7"	Cemented 8" down to 55 ft with 1½ yds concrete

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Bailed 50 G.P.M. lowered water level to 60 ft.

WELL DRILLERS STATEMENT

This well was drilled under my jurisdiction and the ove information is true to my best information and belief.

Signed
Well Driller

By

License No. 45

ated 12-11, 1952

(Not to be filled in by Driller)

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner Bill Ayers Driller S.R. McKinney & Son

Address Sunset Trailer Park (36) L.V. Nev Address 1042 South Main, L.V. Lic. No. 45

Location of well: SE ¼ NE ¼ Sec. 21, T. 20 N/S, R. 62 E, in Clark County

or

Water will be used for Domestic Total depth of well 100'

Size of drilled hole 12" to 50, 10" to 100' Weight of casing per linear foot 10 Guage

Thickness of casing 10 Guage Temp. of water

Diameter and length of casing 8" I.D. to 100'
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 35'

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well May 21, 1955 Date of completion of well May 23, 1955

Type of well rig 72 Speed Star, Spudder

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	7	7	Brown Clay
7	23	16	Gravel
23	54	31	Brown Clay
54	58	4	Brown Sand Water
58	73	15	Brown Clay
73	77	4	White Sand water
77	87	10	~~xxxxxxxxxxxxxx~~ Brown clay
87	91	4	Brown sand water
91	100	9	Brown clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 87 to 91 ft.

Other aquifers 73-77
54' to 58'

First water at 54 feet.

Casing perforated
from 60 to 100 ft.

Size of perforations
3/16" x 10"

(OVER)

319

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
I.D.	0	100	100	8" casing cemented down to 50 ft. with 1½ yds. concrete.

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

Bailed 50 G.P.M. from 50 ft.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed S.R. McKinney & Son
Well Driller

By

License No. 45

Dated June 20, 1955

(Not to be filled in by Driller)

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner Plaz Conner
Driller Louis F.Evans

Address 2308 Crawford Ave. N. Las Vegas Nev.
Address 2020 Carroll N.Las Vegas Lic. No. 117

Location of well: ¼ N.E¼ Sec. 21, T. 20 N/S, R 62 E, in Clark County

or Lot 5

Water will be used for Domestic
Total depth of well 100 ft.

Size of drilled hole 40 ft.10 inch.60 ft.8 inch.hole
Weight of casing per linear foot 11.6 lbs.

Thickness of casing 10 gauge
Temp. of water

Diameter and length of casing 8 inch.o,d,pipe 40 ft.
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 45 ft.

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well June 24, 1953
Date of completion of well June 25, 1953

Type of well rig armstrong

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	2	2	silt
2	30	28	brown clay
30	38	8	gravel
38	50	12	gray clay
50	100	50	" sandy clay (water)

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 50 to 100 ft.

Other aquifers

First water at 50 feet.

Casing perforated
from to ft.

Size of perforations

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
3 inch.	0	40	40	cemented ½ yd.cement

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Louis F Evans
Well Driller

By Louis F.Evans.

License No. 117

Dated July 11, 1953

(Not to be filled in by Driller)

DIVISION OF WATER RESOURCES

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

1. OWNER Will L. & Mary N. Dodge ADDRESS 2101 Linn Lane

2. LOCATION SE ¼ NE ¼ Sec. 21 T. 20 N/S R. 62 E. Clark County
PERMIT NO. Lot 8, Block 3, Meikle Manor Tract #1

3. TYPE OF WORK
New Well ☐ Reconditon ☐
Deepen ☒ Other ☐

4. PROPOSED USE
Domestic ☒ Irrigation ☐ Test ☐
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☒ Rotary ☐
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Well drilled by others.				
Decomposed Lime	W	100	120	20
Brown Clay		120	140	20
Decomposed Lime & Gravel	W	140	200	60

RECEIVED
OCT 1 1975
Div. of Water Resources
Branch Office — Las Vegas, Nev.

Date started September 27, 1976
Date completed September 28, 1976

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

8. WELL CONSTRUCTION
Diameter hole 8 inches Total depth 200 feet
Casing record 6 5/8
Weight per foot 8.58 Thickness .134

Diameter	From	To
6 5/8 inches	90 feet	200 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☐ No ☐ Type
Depth of seal ? feet
Gravel packed: Yes ☐ No ☐
Gravel packed from feet to feet

Perforations:
Type perforation Torch Field
Size perforation 1/8" X 15" Four Rows
From 160 feet to 200 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 90 Feet below land surface
Flow G.P.M.
Water temperature ° F. Quality

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.

Name Effinger Drilling & Pump Service
Address Box 579 City
Nevada contractor's license number 3768
Nevada driller's license number 212
Signed A Effinger
Date September 28, 1976

USE ADDITIONAL SHEETS IF NECESSARY

5471

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

1. OWNER Samuel A. Shannon Jr. ADDRESS 217 North 9th Apt. 3,
Las Vegas, Nevada

2. LOCATION SW ¼ NE ¼ Sec. 21 T. 20 N/S R. 62 E. Clark County
PERMIT NO.

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

4. PROPOSED USE
Domestic ☒ Irrigation ☐ Test ☐
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☒ Rotary ☐
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Surface soil		0	4	4
white sandy clay		4	69	65
brown sandy clay		69	84	15
white sandy clay	XX	84	94	10
green clay & gravel	XX	94	99	5
green sandy clay	XX	99	110	11
white graveley clay	XX	110	117	7
white sandy clay		117	145	28
white graveley clay	XX	145	176	31
white sandy clay		176	182	6
white graveley clay	XX	182	194	12
white sandy clay		194	200	6

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JUL 30 1971
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

Date started Jan 27, 1971, 19
Date completed Feb. 1, 1971, 19

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. 45 Draw down to 85 ft. feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

8. WELL CONSTRUCTION
Diameter hole 10" inches Total depth 200 feet
Casing record 8 5/8" from 0 to 200 ft
Weight per foot 10 gauge Thickness

Diameter	From	To
12" hole inches	0 feet	50 feet
10" hole inches	50 feet	200 feet
inches	feet	feet
8 5/8" casing	0 feet	200 feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☒ No ☐ Type well grout
Depth of seal 50 ft feet
Gravel packed: Yes ☐ No ☒
Gravel packed from feet to feet

Perforations:
Type perforation Torch
Size perforation 3/16" X 10"
From 80 feet to 200 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 73 Feet below land surface
Flow G.P.M.
Water temperature ° F. Quality

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.

Name S. R. McKinney & Sons, Inc.
Address 1042 S. Main St. Las Vegas
Nevada contractor's license number 2065
Nevada driller's license number 45
Signed
Date Feb. 26, 1971

USE ADDITIONAL SHEETS IF NECESSARY

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
8 5/8"	0	200	200	Grouted to 50' gravel pack 200' to 50'

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Phelps Pump & Equipment co.
Well Driller

By

License No. 98

Dated , 19

(Not to be filled in by Driller)

DIVISION OF WATER RESOURCES

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

Deepening Job

1. OWNER Milton R. Linn ADDRESS 2132 Christy Lane, Las Vegas

2. LOCATION NW ¼ NE ¼ Sec. 21 T. 20 N/S R. 62 E Clark County
PERMIT NO.

3. TYPE OF WORK
New Well ☐ Recondition ☐
Deepen ☒ Other ☐

4. PROPOSED USE
Domestic ☒ Irrigation ☐ Test ☐
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☒ Rotary ☐
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
white sandy clay	XX	135	160	25
white gravele· clay		160	182	22
white sandy clay		182	186	4
white graveley clay	XX	186	198	12
white sandy clay		198	210	12
white graveley clay	XX	210	235	25

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JUL 30 1971
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

Date started Feb. 1, 1971, 19
Date completed Feb. 2, 1971, 19

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST
G.P.M. 50 Draw down to 97 ft. feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

8. WELL CONSTRUCTION
Diameter hole 8 inches Total depth 235 feet
Casing record
Weight per foot 10 gauge Thickness

Diameter	From	To
Had 8" inches	0 feet	100 feet
6 5/8 inches	95 XXX feet	235 feet
inches	feet	feet
8" hole inches	135 feet	235 feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☐ No ☐ Type
Depth of seal feet
Gravel packed: Yes ☐ No ☐
Gravel packed from feet to feet

Perforations:
Type perforation Torch
Size perforation 3/16" X 10"
From 135 feet to 235 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 82 Feet below land surface
Flow G.P.M.
Water temperature ° F. Quality

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true the best of my knowledge.

Name S. R. McKinney & Sons, Inc.
Address 1042 S. Main St. Las Vegas
Nevada contractor's license number 2065
Nevada driller's license number 45
Signed
Date Feb. 26, 1971

USE ADDITIONAL SHEETS IF NECESSARY

471

DIVISION OF WATER RESOURCES

STATE OF NEVADA
DIVISION OF WATER RESOURCES
WELL DRILLERS REPORT
Please complete this form in its entirety

DEEPENING

OFFICE USE ONLY
Log No.
Permit No.
Basin

1. OWNER Peggy Newman ADDRESS 2100 Linn Land Las Vegas, Nev.

2. LOCATION SW ¼ NE ¼ Sec. 21 T. 20 N/S R. 62 E. Clark County
PERMIT NO.

3. TYPE OF WORK
New Well ☐ Recondition ☐
Deepen ☒ Other ☐

4. PROPOSED USE
Domestic ☒ Irrigation ☐ Test ☐
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☒ Rotary ☐
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thick-ness
~~Sand & Clay~~		~~140~~	~~180~~	~~40~~
~~Sand & Gravel~~	XXX	~~180~~	~~200~~	~~20~~
White Sand		100	100	20
Red Clay Gravel	XXX	120	130	10
White Sand Clay		130	145	15
White Clay Gravel		145	165	20
White Sand Clay	XXX	165	200	35

RECEIVED
[illegible]
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

Date started 6/17/70, 19
Date completed 7/17/70, 19

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump
	40	85	

BAILER TEST
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

8. WELL CONSTRUCTION
Diameter hole 10 to 8 inches Total depth 200 feet
Casing record 6 5/8 from 0 to 200
Weight per foot 10 gauge Thickness

Diameter	From	To
6 5/8 OD casing inches	0 feet	200 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☐ No ☐ Type
Depth of seal feet
Gravel packed: Yes ☐ No ☐
Gravel packed from feet to feet

Perforations:
Type perforation Torch cut
Size perforation 3/16"X10"
From 140 feet to 200 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level 75 Feet below land surface
Flow G.P.M.
Water temperature ° F. Quality

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.

Name S.R. McKinney & Sons Inc.
Address 1042 S. Main St. Las Vegas, Nev.
Nevada contractor's license number 2065
Nevada driller's license number 45
Signed
Date 9-10-70

USE ADDITIONAL SHEETS IF NECESSARY

5471

DIVISION OF WATER RESOURCES

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

1. OWNER Fred J. Bennett ADDRESS 2051 [illegible] 89110
Las Vegas, Nevada 89110

2. LOCATION SW ¼ NE ¼ Sec. 21 T. 20 N/S R. 62 E. Clark County
PERMIT NO.

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

4. PROPOSED USE
Domestic ☒ Irrigation ☐ Test ☐
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☒ Rotary ☐
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Brown Sandy Clay		0	41	41
Gray Clay		41	58	17
Brown Sandy Clay		58	74	16
Gray Sandy Clay		74	85	11
Gray Clay & gravel		85	89	4
Brown Clay		89	106	17
Gray Sandy Clay		106	200	94

Date started Feb 17, 1970
Date completed Feb 20, 1970

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump

BAILER TEST

G.P.M. Draw down feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

8. WELL CONSTRUCTION

Diameter hole 12 inches Total depth 200 feet
Casing record 8 5/8" O.D. 200 ft.
Weight per foot 12.20 lb Thickness .134 inch

Diameter	From	To
8 5/8 O.D. inches	0 feet	200 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☒ No ☐ Type
Depth of seal 50 ft feet
Gravel packed: Yes ☒ No ☐
Gravel packed from 50 feet to 200 feet

Perforations:
Type perforation torch
Size perforation 1/4" wide 6" long
From 96 feet to 200 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL

Static water level 76' 9" Feet below land surface
Flow G.P.M.
Water temperature ° F. Quality

10. DRILLERS CERTIFICATION

This well was drilled under my supervision and the report is true to the best of my knowledge.

Name Louis F. Evans
Address 3012 Cassell N.L.V.
Nevada contractor's license number
Nevada driller's license number
Signed Louis F. Evans
Date February 23 - 1970

USE ADDITIONAL SHEETS IF NECESSARY

5471

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Allen & Doris Carbell Driller Effinger Drilling & Pump Servic
Address 2147 Christy Lane Address Box 579 City Lic. No. 212
Location of well: SW¼ NE¼ Sec. 21, T 20 N/S, R. 62 E, in Clark Coun
or 2147 Christy Lane
Water will be used for Domestic Total depth of well 200 feet
Size of drilled hole 8 inch Weight of casing per linear foot
Thickness of casing .156 Temp. of water
Diameter and length of casing 6"ID 185' liner
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter)
If flowing well give flow in c.f.s. or g.p.m. and pressure
If nonflowing well give depth of standing water from surface 57' 6"
If flowing well describe control works
(Type and size of valve, etc.)
Date of commencement of well March 11, 1964 Date of completion of well March 14, 1964
Type of well rig "Walker-Neer 31"

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
			Well was drilled to 75 feet Driller unknoweded
75	95	20	Decomposed lime
95	108	13	calichie
108	112	4	Limestone (Water)
112	128	16	Brown Clay
128	136	8	Limestone (Water)
136	155	19	Brown Clay
155	167	12	Limestone (Water)
167	185	18	White Clay
185	198	13	Limestone (Water)
198	200	2	White Clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)
from 185 to 198 ft.
Other aquifers 155-167
128-136
108-112

First water at ? feet.

Casing perforated
from 135 to 195 ft.

Size of perforations
1/8" X 12" Torch

(OVER)

919

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
6" ID		185	185	Perforated liner in 8" well

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Effinger Drill & Pump Serv.
Well Driller

By

License No. 212

Dated March 20, 1964

(Not to be filled in by Driller)

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in.

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Gus Bushong Driller Patrick H. Thompson

Address 2051 Castleberry Lane L.V. Address Las Vegas, Nevada Lic. No. 192

Location of well: SW ¼ NE ¼ Sec 21, T. 20S N/S, R 62 E, in Clark County

or

Water will be used for Domestic Total depth of well 125'

Size of drilled hole 0-50 12" 50-125 10" Weight of casing per linear foot 12#

Thickness of casing 10 Guage Temp. of water Cool

Diameter and length of casing Diameter - 8 5/8" Length - 126
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 53'

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well 5-18-64 Date of completion of well 5-21-64

Type of well rig Cable Tool

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	75	75	Drilled by Others
75	85	10	Brown Clay
85	95	10	Limestone - Water
95	110	15	Brown Clay
110	115	5	Limestone and Water
115	122	7	Brown Clay
122	125	3	White Clay

Water-bearing Formation, Casing Perforations, etc.

Chief aquifer (water-bearing formation)
from 85 to 95 ft.

Other aquifers 110-115
0-75 Unknown

First water at Unknown feet.

Casing perforated
from 75 to 125 ft.

Size of perforations
3/16 x 12 4 Rows

(OVER)

LOG OF FORMATIONS—Continued

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	REMARKS—Seals, Grouting, etc.
8-5/8	Plus 1	125	126	Grouted to 50'

GENERAL INFORMATION—Pumping Test, Quality of Water, etc.

Bailed 40 G.P.M. from 85'

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed..
Well Driller

By..

License No............................

Dated.............................., 19.......

(Not to be filled in by Driller)

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in.

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Owner Roy Fruter Driller C.R. McKinney & Sons

Address 2096 Castleberry Lane Address 1042 So. Main Lic. No. 45

✓ Location of well: NW ¼ NE¼ Sec. 21, T. 20 N/S, R. 62E, in Clark County

or

Water will be used for Domestic Total depth of well 150 ft.

Size of drilled hole 12" to 50 ', 10" to 150' Weight of casing per linear foot 10 gauge

Thickness of casing 10 gauge Temp. of water

Diameter and length of casing 8" ID from 0 to 150'
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 60'

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well 7/14/64 Date of completion of well 7/17/64

Type of well rig 24 L Bucyrus Erie

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	3	3	soil
3	30	27	clay
30	45	15	clay
45	55	10	white clay
55	70	15	white & brown clay
70	75	5	white clay little water
75	90	15	white sandy clay WATER
90	110	20	white clay
110	150	40	white sandy clay WATER

Water-bearing Formation, Casing Perforations, etc.

Chief aquifer (water-bearing formation)

from 135 to 150 ft.

Other aquifers 70 to 90

First water at 70' feet.

Casing perforated

from 60ft. to 150 ft.

Size of perforations

3/16" x 10"

(OVER)

919

LOG OF FORMATIONS—Continued

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	REMARKS—Seals, Grouting, etc.
8"ID	0	150'	150'	Cemented casing in place at 50' ith 2 yds. of cement.

GENERAL INFORMATION—Pumping Test, Quality of Water, etc.

Bailtested 100 gal. per min. at 83 ft.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed S.R. McKinney & Sons, Inc.
Well Driller

By J.L. McKinney

License No. 45

Dated June 9, 1964.

(Not to be filled in by Driller)

RECEIVED
JUL 24 1964
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

/

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.

Rec. 19

Well No.

Permit No.

Do not fill in

Owner Harry F/ Pader Driller Effinger Drilling & Pump

Address 2053 Christy Lane Address Box 579 City Lic. No. 212

/ Location of well: NW ¼ NE ¼ Sec. 21, T. 20 N/S, R. 62 E, in Clark Count

or 2053 Christy Lane

Water will be used for Domestic Total depth of well 200 feet

Size of drilled hole 8 inch Weight of casing per linear foot

Thickness of casing 6"OD Temp. of water

Diameter and length of casing 6"OD 140 feet

(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 56'

If flowing well describe control works

(Type and size of valve, etc.)

Date of commencement of well February 4, 1964 Date of completion of well February 5, 1964

Type of well rig "72 Speedstar"

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
			Well Drillled by Effinger January 29, 1953.
100	147	47	Red Sticky Clay
147	155	8	Decomposed Lime (Water)
155	171	16	Yellow Sticky Clay
171	179	8	Red Sticky Clay
179	200	21	Decomposed Lime (Water)

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 179 to 200 ft.

Other aquifers 147-155

First water at feet.

Casing perforated

from 120 to 200 ft.

Size of perforations

1/8" X 12" Torch

(OVER)

919

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
6"ID	60	200	140	6"ID perforated liner in well

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed **Effinger Drilling & Pump**
Well Driller

By A. Effinger

License No. 212

Dated February 5, 1964

(Not to be filled in by Driller)

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner VIOLET KEMP Driller LOUIS F.EVANS

Address 2176 CHRISTY LANE LAS VEGAS,NEV. Address 2020 CARROLL N.LAS VEGAS Lic. No117

Location of well: SW 1/4 NE 1/4 Sec. 21, T.20 N/S, R62 E, in CLARK Coun

or

Water will be used for DOMESTIC Total depth of well 190 ft.

Size of drilled hole 120' 8" Weight of casing per linear foot 9.56

Thickness of casing 10 ga. Temp. of water

Diameter and length of casing 6 5/8" O.D. 155'
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 52 ft.

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well May 14,1963 Date of completion of well May 16,1963

Type of well rig KEYSTONE CABLE TOOL

LOG OF FORMATIONS

DEEPENED

WELL FIRST DRILLED FOR HERSCHEL F.CHRISTY MAY 6,1952 BY LOUIS F.EVANS.

From feet	To feet	Thickness feet	Type of material
70	116	46	gray sandy clay (water)
116	131	15	gray clay
131	152	21	gray sandy clay(water)
152	173	21	gray clay
173	175	2	gravel(water)
175	181	6	gray clay (water)
181	190	9	brown sandy clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 173 to 181 ft.

Other aquifers 70 to 116

131 to 152

First water at feet.

Casing perforated

from 35 to 190 ft.

Size of perforations

¼" wide 6" long

(OVER)

919

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
5/8"	35	190	155	

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Louis F Evans
Well Driller

By LOUIS F. EVANS

License No. 117

Dated May 21, 19 63

(Not to be filled in by Driller)

RECEIVED
MAY 24 1963
DIV. OF WATER RESOURCES
BRANCH OFFICE
LAS VEGAS, NEVADA

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner ARCHIE GROFT Driller LOUIS F. EVANS

Address 2184 CHRISTY LANE LAS VEGAS, NEV. Address 2020 CARROLL N. LAS VEGAS Lic. No. 117

Location of well: SW ~~SE~~ ¼ NE ~~NW~~ ¼ Sec. 21, T. 20 N/S, R. 62 E, in CLARK County

or

Water will be used for DOMESTIC Total depth of well 160 ft.

Size of drilled hole 80' 8" Weight of casing per linear foot 9.56 lbs.

Thickness of casing 10 ga Temp. of water

Diameter and length of casing 6 5/8" ~~ØZ/~~ O.D. 85'
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 52'

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well APRIL 18, 1963 Date of completion of well APRIL 23, 1963

Type of well rig KEYSTONE CABLE TOOL

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
			DEEPENED
			WELL FIRST DRILLED FOR HERCHEL F. CHRISTY JULY 19, 1955, BY LOUIS F. EVANS.
80	123	43	gray sandy clay (water)
123	144	21	brown clay
144	160	16	gray sandy clay (water)

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 80 to 123 ft.

Other aquifers 144 to 160

First water at feet.

Casing perforated

from 80 to 160 ft.

Size of perforations

¼" wide 6" long

919

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
6 5/8"	75	160	85	

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed
Well Driller

By LOUIS F.EVANS

License No. 117

Dated MAY 21, 19 63

(Not to be filled in by Driller)

X

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner R. W. Muglezton Driller Effinger Drill & Pump Serv.

Address 2014 Christy Lane Address Box 579 City Lic. No. 212

✓ Location of well: SW ¼ NE ¼ Sec. 21, T. 20 N/S, R. 62 E, in County

or 2014 Christy Lane

Water will be used for Domestic Total depth of well 205 feet

Size of drilled hole 8 inch Weight of casing per linear foot

Thickness of casing .156 Temp. of water

Diameter and length of casing 6" ID 192 feet liner
(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure

If nonflowing well give depth of standing water from surface 49 feet

If flowing well describe control works
(Type and size of valve, etc.)

Date of commencement of well September 7, 1962 Date of completion of well September 9, 1962

Type of well rig "71 Speedstar"

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
			Depth of well 78 feet Drilled by others.
78	110	32	Gray shale
110	160	50	Decomposed limestone (Water)
160	185	25	Sand & Gravel (Water)
185	200	15	Sandy Shale
200	205	5	Brown Clay

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 110 to 185 ft.

Other aquifers

First water at feet.

Casing perforated

from 85 to 200 ft.

Size of perforations

1/8" X 12" Torch

919

(OVER)

LOG OF FORMATIONS—*Continued*

From feet	To feet	Thickness	Type of material

CASING RECORD

Diam. casing	From feet	To feet	Length	"Remarks"—Seals, Grouting, Etc.
6"ID	15	205	192	Perforated 6" liner

GENERAL INFORMATION—Pumping Test, Quality of Water, Etc.

WELL DRILLER'S STATEMENT

This well was drilled under my jurisdiction and the above information is true to my best information and belief.

Signed Effinger Drill & Pump Serv.
Well Driller

By

License No. 212

Dated September 14, 19 62

(Not to be filled in by Driller)

WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA

PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No.
Rec. 19
Well No.
Permit No.
Do not fill in

Owner Rice, Jay "Jack" Driller Phelps Pump & Equipment Co.

Address 2095 Linn Lane, N.L.V. Address 400 E.College Ave.NLV Lic. No. 98

Location of well: SW ¼ NE ¼ Sec. 21, T20 ~~N~~/S, R 62E, in Clark Count

or

Water will be used for Domestic Total depth of well 200'

Size of drilled hole 15" Weight of casing per linear foot 12.24

Thickness of casing 10 Ga. Temp. of water 70

Diameter and length of casing 8 5/8" x 200'

(Casing 12" in diameter and under give inside diameter; casing 12" in diameter give outside diameter.)

If flowing well give flow in c.f.s. or g.p.m. and pressure -

If nonflowing well give depth of standing water from surface 60

If flowing well describe control works -

(Type and size of valve, etc.)

Date of commencement of well 7/9/61 Date of completion of well 7/13/61

Type of well rig Portadrill - Rotary

LOG OF FORMATIONS

From feet	To feet	Thickness feet	Type of material
0	20	20	Soil
20	75	55	Clay
75	78	3	Sandy clay (water)
78	85	7	Clay
85	90	5	Sandy clay (water)
90	110	20	Clay & sand strata
110	125	35	white shale
125	135	10	sandy shale (water)
135	165	30	clay
165	180	15	sandy shale (water)
180	185	5	white shale
185	195	10	sandy shale (water)
195	200	5	white shale

Water-bearing Formation, Casing Perforations, Etc.

Chief aquifer (water-bearing formation)

from 125 to 195 ft.

Other aquifers

75 - 78

85 - 90

First water at 70 feet.

Casing perforated

from 60 to 200 ft.

Size of perforations

torch

6 (1/8" x 7" horizont

perforations per ft.

(OVER)

310

United States Department of the Interior

Central Laboratory
U.S. Geological Survey, WRD
5293 Ward Road
Arvada, Colorado 80002

September 28, 1976

Headquarters
Department of the Air Force
USAF/PREEU
Washington, D.C. 20333

Dear Sir:

Enclosed are the results of the chemical analysis of nineteen water samples submitted by your installation. Further distribution of these results is being made as indicated below.

Russell L. McAvoy
Chief, Central Laboratory

RLM/mc
Enclosure 141721-141739

cc:

Department of the Air Force
TAC
Langley AFB VA. 23665

Department of the Air Force
57 CES
Nellis AFB NV. 89191

Chief, Boiler Water Laboratory

District Chief, WRD, Carson City, NV.

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                         U.S. GEOLOGICAL SURVEY
                           CENTRAL LABORATORY
                         DENVER, COLORADO 80002


                             WATER ANALYSIS
                              ID #  141729


 57 CIVIL ENGINEERING SQ (TAC), ATTEN DEOU, NELLIS AFB, NEVADA 89191
 COLL SITE---WELL 5 FAC 00490 NELLIS AFB NEV     DATE---750507
 TIME---1000


                          RESULTS OF ANALYSIS

                              MAJOR IONS

        CATIONS            MG/L     ME/L          ANIONS             MG/L     ME/L


 CALCIUM                    34      1.697    BICARBONATE             224      3.671
 MAGNESIUM                  25      2.057    CARBONATE                 0      0.000
 SODIUM                     85      3.697    SULFATE                 200      4.164
 POTASSIUM                   7.0    0.179    CHLORIDE                 20      0.564
                                             FLUORIDE                  0.9    0.047
                                             NO2 + NO3 AS N            0.47   0.033


                        ADDITIONAL CONSTITUENTS


                                             DISSOLVED SOLIDS
 SILICA                   MG/L     29          RESIDUE AT 180 C     MG/L     505
 IRON                     MG/L      0.63       CALCULATED (SUM)     MG/L     513
 MANGANESE                MG/L      0.03     HARDNESS AS CACO3
 COLOR                              0          TOTAL                MG/L     190
 PH                                 7.9        NON-CARBONATE        MG/L       4
 SPECIFIC CONDUCTANCE                        ALKALINITY AS CACO3    MG/L     184
  IN UMHOS AT 25 C                802        CARBON DIOXIDE(CALC)   MG/L       4.5
                                             SODIUM ADSORP. RATIO              2.7
                                             LANGELIER INDEX --     25 C      +0.0
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                         U.S. GEOLOGICAL SURVEY
                           CENTRAL LABORATORY
                         DENVER, COLORADO 80002


                             WATER ANALYSIS
                              ID #  141730


 57 CIVIL ENGINEERING SQ (TAC), ATTEN DEOU, NELLIS AFB, NEVADA 89191
 COLL SITE---WELL 7 FAC 00489 NELLIS AFB, NEV    DATE---750507
 TIME---1055


                          RESULTS OF ANALYSIS

                               MAJOR IONS

        CATIONS           MG/L     ME/L          ANIONS             MG/L     ME/L

 CALCIUM                  27      1.347   BICARBONATE            256      4.196
 MAGNESIUM                32      2.632   CARBONATE                0      0.000
 SODIUM                   16      0.696   SULFATE                 29      0.604
 POTASSIUM                 3.4    0.087   CHLORIDE                 8.5    0.240
                                          FLUORIDE                 0.5    0.026
                                          NO2 + NO3 AS N           1.20   0.086


                        ADDITIONAL CONSTITUENTS

                                          DISSOLVED SOLIDS
 SILICA               MG/L     33            RESIDUE AT 180 C   MG/L    294
 IRON                 MG/L      0.10         CALCULATED (SUM)   MG/L    281
 MANGANESE            MG/L      0.00      HARDNESS AS CACO3
 COLOR                          0            TOTAL              MG/L    200
 PH                             7.6          NON-CARBONATE      MG/L      0
 SPECIFIC CONDUCTANCE                     ALKALINITY AS CACO3   MG/L    210
  IN UMHOS AT 25 C            496         CARBON DIOXIDE(CALC)  MG/L      6.5
                                          SODIUM ADSORP. RATIO            0.5
                                          LANGELIER INDEX --     25 C    +0.0
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                        U.S. GEOLOGICAL SURVEY
                          CENTRAL LABORATORY
                        DENVER, COLORADO 80002


                            WATER ANALYSIS
                             ID #  141731


 57 CIVIL ENGINEERING SQ (TAC), ATTEN DEOU, NELLIS AFB, NEVADA 89191
 COLL SITE---WELL 11 FAC 01011 NELLIS AFB, NEV   DATE---760507
 TIME---1035


                          RESULTS OF ANALYSIS

                              MAJOR IONS

        CATIONS           MG/L    ME/L          ANIONS              MG/L    ME/L

 CALCIUM                  20      0.998   BICARBONATE               257     4.212
 MAGNESIUM                35      2.879   CARBONATE                   0     0.000
 SODIUM                   25      1.088   SULFATE                    37     0.770
 POTASSIUM                 4.9    0.125   CHLORIDE                    5.2   0.147
                                          FLUORIDE                    0.9   0.047
                                          NO2 + NO3 AS N              0.31  0.022


                         ADDITIONAL CONSTITUENTS

                                          DISSOLVED SOLIDS
 SILICA                 MG/L     51         RESIDUE AT 180 C     MG/L     322
 IRON                   MG/L      0.11      CALCULATED (SUM)     MG/L     307
 MANGANESE              MG/L      0.00    HARDNESS AS CACO3
 COLOR                            0         TOTAL                MG/L     190
 PH                               7.8       NON-CARBONATE        MG/L       0
 SPECIFIC CONDUCTANCE                     ALKALINITY AS CACO3    MG/L     211
  IN UMHOS AT 25 C               515      CARBON DIOXIDE(CALC)   MG/L       6.5
                                          SODIUM ADSORP. RATIO              0.8
                                          LANGELIER INDEX --     25 C      -0.2
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                      U.S. GEOLOGICAL SURVEY
                        CENTRAL LABORATORY
                      DENVER, COLORADO 80002


                          WATER ANALYSIS
                           ID #  141732


57 CIVIL ENGINEERING SQ (TAC), ATTEN DEOU, NELLIS AFB, NEVADA 89191
COLL SITE---WELL 12 FAC 01711 NELLIS AFB, NEV   DATE---760507
TIME---1045


                       RESULTS OF ANALYSIS


                           MAJOR IONS


    CATIONS             MG/L    ME/L         ANIONS            MG/L    ME/L

CALCIUM                 20     0.998   BICARBONATE             233     3.819
MAGNESIUM               33     2.714   CARBONATE                 0     0.000
SODIUM                  18     0.783   SULFATE                  28     0.583
POTASSIUM                4.5   0.115   CHLORIDE                  5.2   0.147
                                       FLUORIDE                  0.9   0.047
                                       NO2 + NO3 AS N            0.67  0.048


                     ADDITIONAL CONSTITUENTS


                                       DISSOLVED SOLIDS
SILICA                  MG/L    59       RESIDUE AT 180 C   MG/L    306
IRON                    MG/L     0.00    CALCULATED (SUM)   MG/L    296
MANGANESE               MG/L     0.00  HARDNESS AS CACO3
COLOR                            0       TOTAL              MG/L    190
PH                               7.9     NON-CARBONATE      MG/L      0
SPECIFIC CONDUCTANCE                   ALKALINITY AS CACO3  MG/L    191
 IN UMHOS AT 25 C              458     CARBON DIOXIDE(CALC) MG/L      4.7
                                       SODIUM ADSORP. RATIO           0.6
                                       LANGELIER INDEX --     25 C   -0.1
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                         U.S. GEOLOGICAL SURVEY
                           CENTRAL LABORATORY
                         DENVER, COLORADO 80002


                             WATER ANALYSIS
                              ID #  141739


 57 CIVIL ENGINEERING SQ (TAC), ATTEN DEOU, NELLIS AFB, NEVADA 89191
 COLL SITE---WELL 13 FAC 01713 NELLIS AFB, NEV   DATE---760507
 TIME---1025


                          RESULTS OF ANALYSIS


                               MAJOR IONS


       CATIONS            MG/L      ME/L           ANIONS           MG/L      ME/L


CALCIUM                    20      0.998    BICARBONATE              253     4.147
MAGNESIUM                  34      2.797    CARBONATE                  0     0.000
SODIUM                     38      1.653    SULFATE                   75     1.562
POTASSIUM                   6.4    0.164    CHLORIDE                  11     0.310
                                            FLUORIDE                   1.2   0.063
                                            NO2 + NO3 AS N             0.52  0.037


                         ADDITIONAL CONSTITUENTS


                                            DISSOLVED SOLIDS
SILICA                  MG/L     78           RESIDUE AT 180 C      MG/L     410
IRON                    MG/L      0.07        CALCULATED (SUM)      MG/L     391
MANGANESE               MG/L      0.00      HARDNESS AS CACO3
COLOR                             0           TOTAL                 MG/L     190
PH                                7.8         NON-CARBONATE         MG/L       0
SPECIFIC CONDUCTANCE                        ALKALINITY AS CACO3     MG/L     208
 IN UMHOS AT 25 C               601         CARBON DIOXIDE(CALC)    MG/L       6.4
                                            SODIUM ADSORP. RATIO               1.2
                                            LANGELIER INDEX --     25 C       -0.2
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                         U.S. GEOLOGICAL SURVEY
                          CENTRAL LABORATORY
                         DENVER, COLORADO 80002


                              WATER ANALYSIS
                               ID # 141733


 57 CIVIL ENGINEERING SQ (TAC), ATTEN DEQU, NELLIS AFB, NEVADA 89191
 COLL SITE---WELL 14 FAC 01715 NELLIS AFB, NEV   DATE---760507
 TIME---1105



                         RESULTS OF ANALYSIS


                              MAJOR IONS


       CATIONS            MG/L    ME/L          ANIONS          MG/L    ME/L


CALCIUM                    20    0.998   BICARBONATE           284     4.655
MAGNESIUM                  40    3.290   CARBONATE               0     0.000
SODIUM                     18    0.783   SULFATE                31     0.645
POTASSIUM                   5.0  0.128   CHLORIDE                4.3   0.121
                                         FLUORIDE                0.8   0.042
                                         NO2 + NO3 AS N          0.30  0.021



                        ADDITIONAL CONSTITUENTS


                                         DISSOLVED SOLIDS
SILICA                 MG/L     54         RESIDUE AT 180 C   MG/L     326
IRON                   MG/L      0.20      CALCULATED (SUM)   MG/L     314
MANGANESE              MG/L      0.00    HARDNESS AS CACO3
COLOR                            0         TOTAL              MG/L     210
PH                               7.6       NON-CARBONATE      MG/L       0
SPECIFIC CONDUCTANCE                     ALKALINITY AS CACO3  MG/L     233
 IN UMHOS AT 25 C               521      CARBON DIOXIDE(CALC) MG/L      11
                                         SODIUM ADSORP. RATIO             0.5
                                         LANGELIER INDEX --    25 C      -0.3
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APPENDIX B

LABORATORY AND FIELD INVESTIGATION QUALITY CONTROL PROGRAMS

APPENDIX B

LABORATORY QUALITY CONTROL PROGRAM

UBTL is an accredited laboratory of the American Industrial Hygiene (AIHA) Association (No. 17) and, as such, participates in an extensive interlaboratory proficiency analytical testing program sponsored by the National Institute for Occupational Safety and Health (NIOSH). In addition, UBTL is currently licensed by the Center for Disease Control (CDC) to perform chemical and clinical analyses of biological specimens and is State of Utah/USEPA approved for environmental analyses. The comprehensive internal quality control program at UBTL is detailed as follows.

INTRODUCTION

UBTL has implemented an effective system for Quality Control (QC) for samples analyzed from Nellis AFB. Procedures that are employed include:

1. Services of a full-time Quality Control/Quality Assurance Section;
2. Preparation of internal quality control samples;
3. Collection and evaluation of quality control data;
4. Generation of quality control charts; and
5. Instrument calibration and maintenance.

SAMPLE ANALYSES

At least one blank sample and one reagent blank are included with each set of analyses and processed through the complete analytical procedure in order to detect any contamination in either collection media or reagents. In addition, duplicate analyses are accomplished on a minimum of 10 percent of all samples submitted from the field. Internal quality control samples, generated in the laboratory and containing known quantities of specified analyte(s), are run at the rate of 10 percent of the total field sample workload. At the completion of the analysis of a sample set, each chemist calculates his results and reports the results on the Analytical Report Form. Results for replicated samples and internal quality control samples are reported on the computer-generated Quality Control Data Sheet. Before the results are submitted to the Group Leader, another peer chemist analyst is assigned to check results for possible errors in the calculations. He must approve results reported on both the quality control sheet and the sample sheet. The Group Leader, after his evaluation of the data, gives the report sheets to the Quality Assurance Specialist (QAS) for his evaluation and implementation of any required action.

Specific steps are followed when any one QC sample result is determined to be out of control in connection with the analysis of a field sample set. QC charts with adjusted control limits of ± 3 standard deviations will generally be used to determine whether a result is out of control. If QC results are in control, the QAS signs off the report. It is then reviewed by the Section Head for accuracy of the results. Upon final approval of the reports by the QAS and the Section Head, the reports are sent to the sponsor.

The paperwork containing the raw data for a sample set (i.e., chart paper, computer readouts, paper tapes, calibration curves, tables of data, etc.) is collected and placed in an 8½-inch by 11-inch envelope that has been labeled with sample numbers, analyst, date, and other pertinent information. The envelopes are filed by laboratory number for possible future reference and data retrieval. Raw data for each sample analysis are therefore readily available, if needed.

QUALITY CONTROL SAMPLE DATA ANALYSIS

A record of the preparation of internal QC samples is detailed in the QC log book maintained by the QAS. As appropriate, a set of QC samples is distributed to the chemist along with each sample set at an average rate of at least 10 percent of the submitted samples. The analyses and data evaluations are performed for these QC samples, along with the submitted samples, and results are tabulated on the computer-generated Quality Control Data Sheet. At least duplicate results are reported for each internal QC sample.

QC charts are generated for each analyte through the analysis of QC sample results. Each result is divided by the theoretical value to standardize results so that data from all concentrations can be directly compared for accuracy and precision. When a control data set of N sample results has been accumulated, the following statistics are calculated: mean percent recovery, replicate standard deviation, and set standard deviation. These statistics are then used to determine accuracy and precision QC limits.

The control data set is updated after evaluation of 20 successive QC samples and includes data on the 50 most recent results. Any control sample analysis that is beyond accuracy or precision limits is not used in the subsequent determination of new limits.

EXTERNAL QUALITY CONTROL PROGRAMS

In addition to internally generated QC data, other information concerning QC is provided by the participation of UBTL in four interlaboratory QC programs: NIOSH Proficiency Analytical Testing (PAT) Program; two CDC Blood Lead QC Programs; and State of Utah Environmental Quality Control Program. The PAT Program and the CDC Blood Lead Programs involve the participation of more than 100 laboratories on a nationwide basis. The PAT Program addresses the analysis of filter samples for lead, cadmium, zinc, free silica, and asbestos and the analysis of charcoal tubes for various organic solvents.

LABORATORY DATA REDUCTION

A significant fraction of the Chemistry Department's work involves data processing. Mathematical models, based upon analysis of standard solutions or samples, are generated in order to determine the quantity of analyte present in the samples. Considerable time and effort are saved by the utilization of automated data processing procedures. Data processing by the computer can include, for example, calculations, generation of standard calibration curves, mathematical modeling of standard curves, statistical analyses, and the generation of hard copy output. Advantages intrinsic to the use of an automated system include more accurate calculations, immediate and accurate generation of data plots, fewer transcription errors, and no calculation errors after programs have been verified and documented. In general, the types of data that are processed are those derived from the following techniques: atomic absorption and flame emission spectroscopy, gas and liquid chromatography, optical absorbance spectrophotometry, specific ion electrode, fluorescence spectroscopy, and wet chemistry determinations. Similar functions are employed for QC data. In addition, the data system is utilized to store QC data, provide statistical analyses, and generate and update QC charts. The advantage of the provision for statistical analyses and the production of QC charts by automation is that the charts may be easily updated with minimal effort. QC data and any required action may, therefore, be provided on a daily basis.

REPORTING PROCEDURES

The analytical data are reported to the sponsor at the completion of each sample set. The report includes the following items:

1. A memorandum describing the sample set; the condition and appearance (i.e., homogeneity, integrity, etc.) of the samples upon receipt at UBTL; the method, equipment, and technique used in the determination; any interferences that were observed; and any unusual circumstances that may have occurred during the analysis. [The limit(s) of detection are also reported.]

2. UBTL Analytical Report Form, including field ID number, laboratory ID number, identification of the analytes, results of each determination, limit(s) of detection, and comments.

3. Other items, such as copies of strip chart recorder output, computer printout sheets, and other raw data (to be included as required).

INSTRUMENTATION

Each major equipment item at the UBTL Chemistry Department undergoes a routine preventive maintenance check on a regular schedule. This check is accomplished by a trained engineer. In addition, performance checks are made by the analyst prior to the analysis of each set of samples. This involves the analysis of one or more standards and a comparison of the values obtained with previous results and conditions. This information is recorded in an instrumentation log.

When an instrument or apparatus malfunctions and the problem is not readily corrected, the appropriate Section Head is notified. If it is determined that a visit by the service representative is required, a service call is scheduled and the QAS is notified. Action by the service representative is recorded by the QAS in the Instrument Maintenance Log, and the appropriate customer field and service order forms are filed, by instrument, in the Instrument Maintenance Log Supplement File. In an effort to monitor and maintain instrument specifications, logs for each of the AA spectrophotometers, the gas chromatographs (GC), the X-ray degractometer (X-ray), and the mass spectrometers (MS) have been provided for the analytical chemists' use each time an analysis is performed. The AA instrumentation logs contain entries for date, analyst, lamp number (if more than one lamp is available), standard concentration (recommended in manual), reading in milliabsorbence units, and a column for when instrumental parameters differ from the recommended conditions listed in the manual. The GC, X-ray, and MS logs contain entries for date, time, analyst, set identification number, and comments on parameters or performance.

A comprehensive analytical chemistry equipment list is included at the end of this document.

TRAINING

UBTL has established a continuing program of training of current personnel with respect to QC procedures. In addition, an intensive program for the training of recently recruited personnel in both analytical methods and techniques and QC policies has been implemented. It is the responsibility of the QAS and the Laboratory Director to train all laboratory personnel.

RESULTS OF THE LABORATORY QC PROGRAM

The results of the QC analyses for soil and ground water samples are listed in Tables B-1, B-2, and B-3.

Soil Analyses

The laboratory QC program for soil samples included analyses of three duplicates and three spiked samples. Table B-1 lists the results of the spiked sample analyses. No listing of the duplicate sample analyses was necessary because the concentrations of each constituent in all the duplicates and original samples were below detection limits. Two spike concentrations were used: 0.01 and 0.025 µg/l. Recovery of the 0.01 µg/l spikes was generally poor, averaging about 71 percent. The recoveries were low because the 0.01 µg/l spike was the same concentration as the detection limit. Recovery of the 0.025 µg/l spike was satisfactory, averaging about 100 percent.

Ground Water Analyses

The laboratory QC program for ground water samples included a single duplicate sample and one spiked sample. Table B-2 summarizes the analyses of spiked samples. The overall average was 113 percent, although it was 100 percent for pesticides alone. This indicates that the reported concentrations of halocarbons and aromatics may be up to 30 percent above the actual sample concentration. Thus, the analyses probably overestimate the amount of contaminants present in ground water samples. Table B-3 summarizes the analyses of duplicate samples. In general, there was satisfactory agreement between replicates of the same sample.

FIELD INVESTIGATION QUALITY CONTROL PROGRAM

Quality control of field activities consists of following established procedures during the conduct of the work. In those cases that require the drilling of test borings, installation of piezometers or monitor wells, and taking of soil and water samples, the procedures include the preparation of records to document the compliance with these procedures. These field records include boring logs, monitor well installation records, daily field memoranda, sample shipment and test instruction forms for soil sample testing, and chain-of-custody records for all soil and water samples intended for chemical analyses. The nature of water sample tests was established in advance so that plans could be made to ship samples in an appropriate and timely manner.

The pH and specific conductivity meters used for field water quality measurements (see Table B-4) were calibrated with known standards immediately before the measurements were made. The HNU photoionization detector and explosimeter used to monitor vapors generated while drilling have internal calibration routines that were followed when the meters were turned on. A detailed description of sampling procedures is located in Section III.

TABLE 8-1

SUMMARY OF SPIKE RECOVERY FOR SOIL SAMPLES

CONSTITUENT	LIMIT OF DETECTION (µg/g)	SPIKE CONCENTRATION	% SPIKE RECOVERED	SPIKE CONCENTRATION	% SPIKE RECOVERED	SPIKE CONCENTRATION	% SPIKE RECOVERE
Purgeable Halocarbons and Aromatics							
		Sample No. 4258		Sample No. 4269		Sample No. 4275	
Chloromethane	0.01	0	0	0	0	0	0
Bromomethane	0.01	0.01	71	0.025	93	0.025	93
Dichlorodifluoromethane	0.01	0	0	0	0	0	0
Vinyl Chloride	0.01	0	0	0	0	0	0
Chloroethane	0.01	0.01	51	0.025	88	0.025	78
Methylene Chloride	0.01	0	0	0	0	0	0
Trichlorofluoromethane	0.01	0	0	0	0	0	0
1,1-Dichloroethene	0.01	0.01	18	0.025	98	0.025	102
1,1-Dichloroethane	0.01	0	0	0	0	0	0
Trans-1,2-dichloroethene	0.01	0	0	0	0	0	0
Chloroform	0.01	0.01	51	0.025	107	0.025	92
1,2-Dichloroethane	0.01	0	0	0	0	0	0
1,1,1-Trichloroethane	0.01	0	0	0	0	0	0
Carbon Tetrachloride	0.01	0.01	37	0.025	100	0.025	128
Bromodichloromethane	0.01	0	0	0	0	0	0
1,2-Dichloropropane	0.01	0	0	0	0	0	0
Trans-1,3-dichloropropene	0.01	0	0	0	0	0	0
Trichloroethene	0.01	0	0	0	0	0	0
Dibromochloromethane	0.01	0	0	0	0	0	0
1,1,2-Trichloroethane	0.01	0.01	71	0.025	92	0.025	99
Cis-1,3-dichloropropene	0.01	0	0	0	0	0	0
2-Chloroethylvinylether	0.01	0	0	0	0	0	0
Bromoform	0.01	0.01	75	0.025	82	0.025	113
1,1,2,2-Tetrachloroethane	0.01	0	0	0	0	0	0
1,1,2,2-Tetrachloroethene	0.01	0	0	0	0	0	0
Chlorobenzene	0.01	0.01	66	0.025	83	0.025	108
1,2-Dichlorobenzene	0.01	0	0	0	0	0	0
1,3-Dichlorobenzene	0.01	0	0	0	0	0	0
1,4-Dichlorobenzene	0.01	0.01	130	0.025	104	0.025	118
		Sample No. 4225		Sample No. 4241		Sample No. 4244	
Ethyl Benzene	0.01	0.025	86	0.025	130	0.025	114
Benzene	0.01	0.025	96	0.025	158	0.025	115
Toluene	0.01	0.025	86	0.025	127	0.025	111
1,2-Dichlorobenzene	0.01	0.025	78	0.025	141	0.025	111
1,3-Dichlorobenzene	0.01	0.025	75	0.025	132	0.025	110
1,4-Dichlorobenzene	0.01	0.025	72	0.025	152	0.025	110
Chlorobenzene	0.01	0.025	81	0.025	112	0.025	109
		Sample No. 4203(b)		Sample No. 4207(c)		Sample No. 4213(a)	
Oil and grease	0.05 mg/g	0.51079	61	0.51079	67	0.51079	47

Notes:
(1) All concentrations in µg/g except oil and grease.
(2) Initial concentration of each parameter in all above samples was less than detection limits.
(3) "0" indicates concentration was below detection limits or no spike was added.

TABLE B-2

SUMMARY OF SPIKE RECOVERY FOR GROUND WATER SAMPLES

CONSTITUENT	LIMIT OF DETECTION (µg/l)	SPIKE CONCENTRATION	% SPIKE RECOVERED
Purgeable Halocarbons and Aromatics			
		Sample No. 4161 or 4152*	
Chloromethane	0.5	0	0
Bromomethane	0.5	2.5	104
Dichlorodifluoromethane	0.5	0	0
Vinyl Chloride	0.5	0	0
Chloroethane	0.5	2.5	120
Methylene Chloride	0.5	0	0
Trichlorofluoromethane	0.5	0	0
1,1-Dichloroethene	0.1	2.5	117
1,1-Dichloroethane	0.1	0	0
Trans-1,2-dichloroethene	0.1	0	0
Chloroform	0.1	2.5	116
1,2-Dichloroethane	0.1	0	0
1,1,1-Trichloroethane	0.1	0	0
Carbon Tetrachloride	0.1	2.5	132
Bromodichloromethane	0.1	0	0
1,2-Dichloropropane	0.1	0	0
Trans-1,3-dichloropropene	0.5	0	0
Trichloroethene	0.1	0	0
Dibromochloromethane	0.5	0	0
1,1,2-Trichloroethane	0.1	2.5	133
Cis-1,3-dichloropropene	0.5	0	0
2-Chloroethylvinylether	1.0	0	0
Bromoform	0.1	0	0
1,1,2,2-Tetrachloroethane	0.5	0	0
1,1,2,2-Tetrachloroethene	0.5	0	0
Chlorobenzene	0.1	2.5,10*	128, 113*
1,2-Dichlorobenzene	0.5	0 ,10*	0, 104*
1,3-Dichlorobenzene	0.5	0 ,10*	0, 111*
1,4-Dichlorobenzene	0.5	2.5,10*	113, 105*
Ethyl Benzene	0.5	10*	126*
Benzene	0.5	10*	121*
Toluene	0.5	10*	125*
Pesticides (µg/l)			
		Sample No. 4155	
Aldrin	0.01	0.8	96
Dieldrin	0.01	0.8	103
Chlordane	0.1	-	-
DDT isomers	0.01	0.8	111
Endrin	0.01	0.8	113
Endrin Aldehyde	0.01	-	-
Heptachlor	0.01	0.8	86
Lindane	0.01	0.8	93
Others (mg/l)			
Lead	0.01	-	-
Nitrate (as N)	0.02	0.481	102 (QC15994 average)
Oil and grease	0.5	12	54 (QC16723 average)
Phenol	0.005	-	-

Note: Sample 4152 analyses are designated by an asterisk.

TABLE B-3

SUMMARY OF DUPLICATE ANALYSES FOR GROUND WATER SAMPLES

CONSTITUENT	LIMIT OF DETECTION (µg/1)	SAMPLE NUMBER	REPORTED CONCENTRATION	REPLICATES		SAMPLE NUMBER	REPORTED CONCENTRATION	REPLICATES	
				1	2			1	2
Pesticides (µg/1)									
Aldrin	0.01	4142	<0.01	<0.01	<0.01	4155	<0.01	<0.01	<0.01
Dieldrin	0.01	4142	<0.01	<0.01	<0.01	4155	<0.01	<0.01	
Chlordane	0.1	4142	<0.1	<0.1	<0.1	-	-	-	-
DDT isomers	0.01	4142	<0.01	<0.01	<0.01	4154	<0.01	<0.01	<0.01
Endrin	0.01	4142	<0.01	<0.01	<0.01	-	-	-	-
Endrin Aldehyde	0.01	5155A	<0.01	<0.01	<0.01	5155S	<0.01	<0.01	<0.01
Heptachlor	0.01	4142	<0.01	<0.01	<0.01	4142	<0.01	<0.01	<0.01
Lindane	0.01	4142	<0.01	<0.01	<0.01	4155	<0.01	<0.01	<0.01
Others (mg/1)									
Lead	0.01	4127	<0.001	<0.001	<0.001	4145	<0.001	<0.001	<0.001
Nitrate (as N)	0.02	4146	0.67	0.667	0.664	QC15994	-	0.361	0.363
Oil and grease	0.5	QC16723	-	6.4319	6.4319	-	-	-	-
Phenol	0.005	4130	<0.005	0.00152	0.00472	4147	0.800	0.798	0.807

TABLE B-4

GROUND WATER QUALITY DATA FOR PARAMETERS MEASURED IN THE FIELD

WELL	DATE	pH	SPECIFIC CONDUCTIVITY (µmhos/cm)	TEMPERATURE (°C)	CASING VOLUMES PUMPED BEFORE SAMPLING
DM-1	11-3-83	6.5	1950	21	9.5
DM-2	11-3-83	6.6	1950	21	9.5
DM-3	11-3-83	6.6	1950	21	20
No. 6	11-8-83	7.3	680	21	12.4
No. 11	11-7-83	6.8	500	21.5	17.6
No. 12	11-7-83	7.2	460	21	9.3
No. 13	11-7-83	7.0	500	23	13
No. 14	11-8-83	7.1	520	22	9.9

APPENDIX C

CHAIN-OF-CUSTODY FORMS

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client DM-3,2,1 Monitoring Wells, U.S Air Force

Project Title U.S. Air Force - Nellis AFB

Job No. 1016-179-22

Field Personnel (Signature)

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11-3-83	10:50	DM-3	Grab	Seven	Well Head	Oil and Grease, Lead,
						Phenol, Pesticides,
						Nitrate, Volatile
						Aromatics, Volatile
						Halocarbons
11-3-83	12:00	DM-2	Grab	Seven	Well Head	Same
11-3-83	1:00	DM-1	Grab	Seven	Well Head	Same

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	11/3/83	2:05		11/3/83	1612		11/4	1305		11/4/83	1305
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis AFB Production Wells

Project Title US Air Force - Nellis AFB

Job No. 1016-179-22

Field Personnel (Signature)

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11-7-83	10:00	Well # 12	Grab	Seven	Well Head	Oil and Grease, Lead, Phenol,
						Pesticides, Nitrates,
						Volatile Aromatics,
						Volatile Halocarbons
11-7-83	10:50	Well # 13	Grab	Seven	Well head	Same
11-7-83	11:40	Well # 11	Grab	Seven	Well head	Same

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	11/7/83	1:35 P.M		11/7/83	1335					11-8-83	11:30
Relinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**
Relinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Base Production Wells, Nellis AFB, USAF

Project Title US Air Force - Nellis AFB

Job No. 1016-179-22

Field Personnel (Signature) Jol J. Dudley

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11-8-83	11:00	Well #6	Grab	3	Well Head	Oil and grease, volatile
						aromatics, volatile
						halocarbons
11-8-83	11:35	Well #14	Grab	3	Well Head	Same

Relinquished by: (Signature) Jol J. Dudley	Date 11-8-83	Time 1:50	Received by: (Signature)	Date 1350	Time 11/8/83	Relinquished by: (Signature)	Date	Time	Received by: (Signature) M. Reese	Date 11-9	Time 9:00 am
Relinquished by: (Signature) M. Reese	Date 11-9	Time 10:10 A.M.	Received by: (Signature) AB Jorgenson	Date 11-9	Time 10:10 A.M.	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client *Nellis Air Force Base Site # 20 Existing Fire Training*

Project Title *U.S.A.F.*

Job No. *01016-179-22*

Field Personnel (Signature) Thomas Lee

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/8/83	7:00.	B1 S1	JAR	1	Existing Fire Training Area	
	7:15	B1 S2	"	"		
	7:20	B1 S3				SELECTED TEST SAMPLE
	7:25	B1 S4				
	7:30	B-1 S5				SELECTED TEST SAMPLE
	7:40	B1 S6				
	7:50	B1 S7				
	8:00	B1 S-8				
	8:10	B1 -S9				
	8:20	B1 S10				
	8:30	B1 S11				
	8:35	B1 S-12				SELECTED TEST SAMPLE
	8:40	B1 S-13				
	8:50	B1 S-14				
		~~B1 S15~~				

Relinquished by: (Signature) Thomas LEE	Date 11/8/83	Time 23:30	Received by: (Signature) Jol G. Dolly	Date 11/8/83	Time 23:30	Relinquished by: (Signature) Jol G. Dolly	Date 11/9/83	Time 1^{15} PM	Received by: (Signature) Sim D. Lessley	Date 11/9/83	Time 1^{15} PM
Relinquished by: (Signature) Sim D. Lessley	Date 11/9/83	Time 3^{00} PM	Received by: (Signature) AB [illegible]	Date 11/9/83	Time 3:00 PM	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

2

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force Base, U.S.A.F.

Project Title U.S.AF.

Job No. 01016-179-22

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/8/83	9:00	B-1 S15	JAR	1	EXISTING FIRE TRAINING AREA	
11/8/83	9:10	B-1 S-16				
	9:15	B-1 S-17				
	9:20	B-1 S-18				SELECTED TEST SAMPLE
	9:25	B-1 S-19				
	9:40	B-1 S-20				
	10:10	B-2 S-1				
	10:15	B-2 S-2				SELECTED TEST SAMPLE
	10:20	B-2 S-3				
	10:25	B-2 S-4				
	10:30	B2 S-5				
	10:35	B-2 S-6				SELECTED TEST SAMPLE
	10:40	B-2 S-7				
	10:45	B-2 S-8				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Thomas LEE	11/8/83	23:24		11/8/83	23:24		11/9/83	1:15 PM		11/9/83	1:15 PM
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	11/9/83	3:00 PM		11/9/83	3:00 P.M.						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

3

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force Base · U.S.A.F.

Project Title U.S.A.F.

Job No. 01016-179-22

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/8/83	10:50	B2 S-9	JAR	1	EXISTING FIRE TRAINING AREA	
↓	10:55	B2 S-10	↓	↓	↓	SELECTED TEST SAMPLE
	11:00	B-2 S-11				
	11:10	B-2 S-12				
	11:15	B-2 S-13				
	11:20	B-2 S-14				
	11:25	B-2 S-15				SELECTED TEST SAMPLE
	11:30	B-2 S-16				
	11:35	B-2 S-17				
	11:40	B-2 S-18				
	11:50	B-2 S-19				
	13:00	B3 S-1				SELECTED TEST SAMPLE
	13:05	B-3 S-2				
	13:10	B-3 S-3				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Thomas LEE	10/8/83	23:30		11/8/83	23:30		11/9/83	1^{15} PM		11/9/83	1^{15} PM
	11/9/83	3^{00} PM		11/9/83	3:00 p.m						

4

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force Base U.S.A.F.

Project Title U.S.A.F.

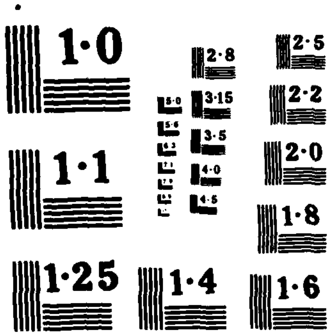
Job No. 01016-179-22

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/8/83	13:15	B-3 S-4	JAR	1	EXISTING FIRE	~~SELECTED FOR TEST SAMPLE~~
	13:20	B-3 S-5			TRAINING AREA	
	13:30	B-3 S-6				
	13:35	B-3 S-7				
	13:40	B-3 S-8				
	13:45	B3 3-9				SELECTED TEST SAMPLE
	13:50	B3 3-10				
	13:55	B-3 S-11				
	14:00	B-3 S-12				
	14:05	B-3 S-13				SELECTED TEST SAMPLE
	14:10	B-3 S-14				
	14:15	B-3 S-15				
	14:20	B-3 S-16				
	14:25	B3 S-17				SELECTED TEST SAMPLE

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Thomas LEE	11/8/83	22:30		11/8/83	23:30		11/9/83	1:15 PM		11/9/83	1:15 pm
	11/9/83	3:00 pm		11/9/83	3:00 P.M.						

AD-A162 920   INSTALLATION RESTORATION PROGRAM PHASE II   3/5
CONFIRMATION/QUANTIFICATION STA..(U) DAMES AND MOORE
PARK RIDGE IL   09 AUG 85 F33615-83-D-4002
UNCLASSIFIED   F/G 13/2   NL



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

5

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force Base U.S.A.F.

Project Title U.S.A.F.

Job No. 01016-179-22

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/8/83	14:30	B-3 S-18	JAR	1	~~Nell~~ EXISTING FIRE	
	14:40	B-3 S-19			TRAINING AREA	
	14:45	B-3 S-20				
	15:10	B-4 S-1				
	15:15	B-4 S-2				
	15:20	B4 S-4				
	15:25	B-4 S-5				
	15:30	B-4 9-6				
	15:35	B-4 S-7				SELECTED TEST SAMPLE
	15:40	B-4 S-8				
	15:45	B-4 S-9				
	15:50	B4 S10				
	16:05	B-4 S-11				SELECTED TEST SAMPLE
	~~16:45~~	B-4 S-3				SELECTED TEST SAMPLE
	15:17					

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Thomas LEE	11/8/83	23:20		11/8/83	23:30		11/9/83	1 15 P.M.		11/9/83	1 15 PM
Relinquished by: (Signature)	Date 11/9/83	Time 3 00 PM	Received by: (Signature)	Date 11/9/83	Time 3:00 P.M	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

6

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis AirForce Base, USAF

Project Title U.S A.F.

Job No. 1016-179-22

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/8/83	16:10	B4 S-12	JAR	1	EXISTING FIRE TRAINING AREA	
↓	16 15	B-4 S-13	↓	↓	↓	
	16 20	B-4 S-14				
	16:30	B-4 S-15				
11/9/83	7:17	B-4 S16				SELECTED TEST SAMPLE
↓	7:25	B-4 S-17				
	7:30	B-4 S-18				
	7:35	B-4 S-19				
	7:40	B-4 S-20				
	7:45	B-5 S-1			STORM SEWER GULLY	
	7:50	B-5 S-2			↓	
	8:00	B-5 S-3				
	8:05	B-5 S-4				
	8:10	B-5 S-5				SELECTED TEST SAMPLE

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
LEE	11/11/83	10:00	AB Torgersen	11/12/83	12:30 p.m.						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

7

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

mple Source & Client Nellis Air Force Base USAF

roject Title USAF

Job No. 1016 179

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/85	6:50	B-5 S-6	JAR	1	STORM DRAIN GULLY	
	6:55	B5 S-7	↓	↓	↓	
	7:00	B5 S-8	↓	↓	↓	
	7:05	B5 S-9	↓	↓	↓	
	7:10	B5 S-10	↓	↓	↓	Selected Test Sample
	7:15	B5 S-11	↓	↓	↓	
	7:20	B5 S-12	↓	↓	↓	
	7:25	B5 S-13	↓	↓	↓	
	7:30	B5 S-14	↓	↓	↓	
	7:35	B5 S-15	↓	↓	↓	SELECTED TEST SAMPLE
	7:40	B-5 S-16	↓	↓	↓	
	7:45	B5 S-17	↓	↓	↓	
	7:50	B5 S-18	↓	↓	↓	
	7:55	B5 S-19	↓	↓	↓	

Relinquished by: (Signature) Thomas LEE	**Date** 11/11/85	**Time** 10	**Received by: (Signature)** AB Torgerson	**Date** 11/12/85	**Time** 12:00 P.M.	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**
elinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**
elinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date.**	**Time**	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**

Q

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

ample Source & Client Nellis Air Force Base USAF

Field Personnel (Signature) Thomas Lee

oject Title USAF

Job No. 1016-179

ate	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
/85	8.05	~~B-6~~ B5 S20	JAR	1	STORM DRAIN GULLY	SELECTED TEST SAMPLE
	8:30	B6 S1				
	8.25	B6 S2				
	8.30	B6 S-3				
	8:35	B6 S4				SELECTED TEST SAMPLE
	8 40	B6 S5				
	8.45	B6 S6				
	8.50	B6 S7				
	8.55	B6 S8				~~SELECTED TEST SAMPLE~~
	9.00	B6 S-9				SELECTED TEST SAMPLE
	9.05	B6 S-10				
	9.10	B6 S-11				
	9:15	B6 S-12				
	9:20	B6 S-13				

elinquished by: (Signature) Thomas Lee	Date 11/11/85	Time 10:00	Received by: (Signature) AB Freeman	Date 11/12/85	Time 12:30 p.m.	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
elinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
linquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

9

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

mple Source & Client Nellis Air Force Base USAF.

roject Title USAF

Job No. 1016-173

Field Personnel (Signature) Thom Lee

ate	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
/83	9:~~30~~25	B-6 S 14	JAR	1	STORM DRAIN GULLY	SELECTED TEST SAMPLE
	9:30	B6 S 15	↓	↓	↓	
	9:32	B-6 S 16				
	9:35	B 6 S-17				
	9:40	B6 S 18				
	9:45	B6 S 19				SELECTED. TEST SAMPLE
	9:48	B6 S-20				
	10:18	B-7 S-1				SELECTED TEST SAMPLE
	10:25	B-7 S-2				
	10:30	B-7 S 3				
	10:35	B7 S 4				
	10:40	B-7 S-5				SELECTED TEST SAMPLE
	10:45	B-7 S-6				
↓	10:50	B-7 S 7	↓	↓	↓	

Relinquished by: (Signature) Tom LEE	Date 11/11/83	Time 10:00	Received by: (Signature) AB Torgensen	Date 11/12/83	Time 2:30 pm	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

10

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force Base USAF

Project Title USAF

Job No. 1016-179

Field Personnel (Signature) Thomas LEE

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
1/10/83	10:55	B-7 S-8	JAR	1	STORM DRAIN GULLY	
↓	11:00	B-7 S-9	↓	↓	↓	
	11:10	B-7 S-10				SELECTED TEST SAMPLE
	11:20	B-7 S-11				
	11:25	B-7 S-12				
	11:30	B-7 S-13				
	11:35	B-7 S-14				
	11:40	B-7 S-15				SELECTED TEST SAMPLE
	11:50	B-7 S-16				
	11:55	B-7 S-17				
	12:05	B-7 S-18				
	12:15	B-7 S-19				
	12:25	B-7 S-20				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Thomas Lee	11/11/83	10:00	AB Torgersen	11/12/83	12:30 p.m						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Chest containing 88-S1 thru S13 [illegible]
Samples inside were jumbled. Some were upside down. None were
broken. The packing was not between the jars.
AB Torgensen 11/12/83

11

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force ~~Base~~ USAF
Project Title USAF
Job No. 1016-179
Field Personnel (Signature) Thomas Lee

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/83	13:30	B8 S-1	JAR	1	STORM DRAIN ~~@~~ GULLY	
↓	13-35	B-8 S-2	↓	↓	↓	
	13 45	B8 S-3				SELECTED TEST SAMPLE
	13 50	B8 S-4				
	13 55	B8 S5				
	14:00	B8 S6				
	14 05	B8 S7				
	14 08	B8 S8				SELECTED TEST SAMPLE
	14-10	B8 S9				~~SELECTED TEST SAMPLE~~
	14:15	B8 S10				
	14-18	B8 S11				
	14:25	B8 S12				
	14 30	B8 S13				SELECTED TEST SAMPLE
	14-35	B8 S14				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Thomas Lee	11/11/83	10:00	AB Torgensen	11/12/83	12:30 p.m						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

12

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air Force Base U.S.A.F.

Field Personnel (Signature) Thomas LEE

Project Title USAF

Job No. 1016-179

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/11/83	14:40	B-8 S-15	JAR	1	STORM DRAIN GULLY	
	14:45	B8 S-16				
	14:50	B8 S-17				
	14:55	B8 S-18				SELECTED TEST SAMPLE
	15:00	B-8 S 19				
	15:05	B-8 S-20				
	15:20	B-9 S 1				
	15:25	B-9 S-2				SELECTED TEST SAMPLE
	15:30	B-9 S-3				
	15:35	B9 S-4				
	15:40	B9 S-5				
	15:45	B9 S-6				
	15:50	B9 S-7				SELECTED TEST SAMPLE
	15:55	B9 S-8				

Relinquished by: (Signature) Thomas, LEE	**Date** 11/11/83	**Time** 10:00	**Received by: (Signature)** AB Jorgensen	**Date** 11/12/83	**Time** 12:30 pm	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**
Relinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**
Relinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**	**Relinquished by: (Signature)**	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**

13

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Nellis Air force Base USAF

Project Title USAF

Job No. 1016-179

Field Personnel (Signature)

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
11/10/83	16:05	B9 S9	JAR	1	STORM DRAIN GULLY	
↓	16:15	B9 S10	↓	↓	↓	
	16:20	B9 S11				
	16:25	B9 S12				SELECTED TEST SAMPLE
	16:30	B9 S13				
	16:35	B9 S14				
	16:40	B9 S15				
	16:45	B9 S16				
	16:55	B9 S17				SELECTED TEST SAMPLE
	17:00	B9 S18				
	17:05	B9 S19				
	17:10	B9 S20				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	11/11/83	10.00		11/12/83	12:30 Am.						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

APPENDIX D

ANALYTICAL DATA

UBTL
520 WAKARA WAY · SALT LAKE CITY, UTAH 84108 · 801 581-8267

DAMES & MOORE
JAN 1[illegible] 1983
Park Ridge, Illinois

January 11, 1984
Refer to: 84C046

Dr. Kenneth J. Stimpfl
Dames & Moore
1550 Northwest Highway
Park Ridge, Illinois 60068

RE: Analytical Services in Support of USAF Contract F3316-83-D-4002
Nellis AFB Survey

Dear Ken:

Enclosed with this letter are the following:

- Soil Sample Handling and Moisture Determination Protocols
- Chain of Eustody Records for:
  - Soil Samples (719 total)
  - Water Samples (DM-1,2, & 3)
  - Water Samples (Wells 11, 12 & 13)
  - Water Samples (Wells 6 & 14)
- EPA Comment Sheet for Oil & Grease QC Samples
- Analytical Reports for Soil and Water Samples

UBTL has furnished a moisture determination for the soil samples at no additional cost. If that data is useful to you, we would like to add in the cost of a soil moisture determination for future jobs as they are bid. The results of the EPA 601 and 602 analyses were delayed because both analyses had to be done on one instrument; and that instrument developed problems. UBTL has purchased the hardware to equip two gas chromatographs for these analyses. This measure is expected to resolve the problems which delayed the EPA 601 and 602 analyses.

There was some confusion in the laboratory regarding the specific nature of the OC program. This resulted in less than 10% splits and 10% spikes being performed for some analyses. The problem was found and additional samples were requested for the Davis-Monthan AFB work. In some cases EPA QC samples were analyzed with the Nellis AFB samples to compensate.

The results from the EPA QC sample for Oil and Grease did not agree well with the target value. This is attributed to a difference between the standard used in the analysis and the material used to prepare the QC sample. A sheet from the EPA which discusses this is enclosed.

The spikes for the EPA methods 601 and 602 were quite close to the detection limits. At such low levels greater variation in spike recoveries is to be expected.

One set of Davis-Monthan AFB samples was analyzed with the Nellis AFB samples. The report is included for your reference.

Sincerely,

Sim

Sim D. Lessley, Ph.D.
Technical Manager

xc: George Condradt

601 [illegible]
6-6,14,11,12,13
OM-1,2,3

December 23, 1983

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

A DIVISION OF
THE UNIVERSITY OF UTAH
RESEARCH INSTITUTE

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

ANALYTICAL REPORT

SUBMITTED TO: George Condradt

SUBMITTED BY: James R. Baxter

REFERENCE DATA:

Analysis of: EPA 601 Purgeable Halocarbons

Identification No.: 451, 454, 459, 489

Sample(s): 11 Analyses: 319

UBTL Laboratory No.: SA-4139 through SA-4141,
SA-4148 through SA-4150,
SA-4161 through SA-4162,
SA-4426 through SA-4428

The above numbered samples were analyzed using EPA Test Method 601 for purgeable halocarbons. A 5 mL aliquot of sample was purged with helium and any analytes present were collected on a trap consisting of activated charcoal, Tenax, and silica gel. The trap was then heated to 180°C and any analytes were flushed onto an 8' x 2mm I.D. glass chromatographic column packed with 1% SP-1000 on Carbopack B. A thermal program starting at 50°C and proceeding at 8°C/minute to 220°C was used to separate the analytes. A Hall 700A electroconductivity detector in the halogen mode was used for detection and quantification of the analytes.

Samples SA-4150 and 4427 were analyzed in duplicate and sample SA-4161 was analyzed neat and then reanalyzed with a 2.5 µg/liter spike containing bromomethane, chloroethane, 1,1-dichloroethene, chloroform, carbon tetrachloride, 1,1,2-trichloroethane, bromoform, chlorobenzene, and 1,4-dichlorobenzene.

The limits of detection for each analyte are as follows:

Analyte	Limit of Detection (µg/liter)
Chloromethane	0.5
Bromomethane	0.5
Dichlorodifluoromethane	0.5
Vinyl Chloride	0.5
Chloroethane	0.5
Methylene Chloride	0.5
Trichlorofluoromethane	0.5
1,1-Dichloroethene	0.1
1,1-Dichloroethane	0.1
Trans-1,2-dichloroethene	0.1
Chloroform	0.1

1,2-Dichloroethane	0.1
1,1,1-Trichloroethane	0.1
Carbon Tetrachloride	0.1
Bromodichloromethane	0.1
1,2-Dichloropropane	0.1
Trans-1,3-dichloropropene	0.5
Trichloroethene	0.1
Dibromochloromethane	0.5
1,1,2-Trichloroethane	0.1
Cis-1,3-dichloropropene	0.5
2-Chloroethylvinylether	1.0
Bromoform	0.1
1,1,2,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethene	0.5
Chlorobenzene	0.1
1,2-Dichlorobenzene	0.5
1,3-Dichlorobenzene	0.5
1,4-Dichlorobenzene	0.5

The results are tabulated on the following page(s).

James R. Baxter

James R. Baxter

Sim D. Lessley

Sim D. Lessley, Ph.D.

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 sal

UBTL Identification Number 459

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 9, 1983

Analysis

Method of Analysis GC/Hall Detector - Halogen Mode

Date(s) of Analysis Dec 11-13 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results ug/liter
			VOLATILE HALOCARBONS EPA METHOD 601
W 6	SA 4161	WATER	all analytes less than LOD
W 14	SA 4162	↓	" " " " "
limit of detection			as listed on the memo

Comments

James R Baxter
Analyst

Patrick R. Meyer
Reviewer

Edward H Sanders
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 ldl

UBTL Identification Number 454

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 8, 1983

Analysis

Method of Analysis GC / Hall Detector - Halogen Mode

Date(s) of Analysis 12/11 → 12/13 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results ug/liter
			VOLATILE AROMATICS EPA METHOD 601
W 11	SA 4148	WATER	all analytes less than LOD
W 12	SA 4149	↓	1,1,1 trichloroethane - 2.5, all other analytes < LOD.
W 13	SA 4150		all analytes less than L.O.D.
limits of detections			as listed on the memo

Comments

James R. Baxter
Analyst

Patrick R. Mey
Reviewer

E[illegible] C. H. Sander
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 JM

UBTL Identification Number 451

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis GC/Hall Detector Halogen Mode

Date(s) of Analysis 12/11-12/13 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results ug/liter VOLATILE HALOCARBONS EPA METHOD 601
DM 3	SA 4139	WATER	1,1,1-Trichloroethane - 0.95 [illegible]
DM 2	SA 4140	↓	1,1,1-Trichloroethane 3.5 " " "
DM 1	SA 4142	↓	1,1,1-Trichloroethane - 0.34 " " "
limit of detection			listed on memo ✱

Comments ✱ the LOD for methylene chloride has been raised to 10ug/liter for these three samples because of in house contamination

Jame, R. Barton

Analyst

Patrick R. Meyer

Reviewer

Laboratory Supervisor

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analytical Laboratory
Quality Control Data Sheet

Analyte CHLOROMETHANE

Matrix WATER

Analyst BAXTER

Instrument Ch. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10 ddL

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte BROMOMETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 – 12/13

Results in μg/LITER

uplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		~~2.6~~ 2.5		104			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte DICHLORODIFLUOROMETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
~~SA 4148~~								
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10 SAL

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte VINYL CHLORIDE **Matrix** WATER

Analyst BAXTER **Instrument** CH. 0

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/liter

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0	0		0	0	0	
SA 4427	0	0	0		0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		~~0~~			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
11658	0	0		0	0	0		

Checked by: PRM **Limit of Detection:** 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analytical Laboratory

Quality Control Data Sheet

Analyte CHLOROETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0		~~0~~	0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		~~20~~ 2.5		120			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16656	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

Analyte METHYLENE CHLORIDE **Matrix** WATER

Analyst BAXTER **Instrument** CH. 0

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #: 459, 489, 451, 454
Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analytical Laboratory
Quality Control Data Sheet

Analyte TRICHLOROFLUOROMETHANE **Matrix** WATER

Analyst BAXTER **Instrument** CH. 0

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #: 457, 489, 451, 454

Analytical Laboratory
Quality Control Data Sheet

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,1-DICHLOROETHENE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		~~[illegible]~~ 25		117			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
[illegible] 58	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10 SAL

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,1 - DICHLOROETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10 sdl

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analytical Laboratory
Quality Control Data Sheet

Analyte TRANS-1,2-DICHLOROETHENE **Matrix** WATER

Analyst BAXTER **Instrument** CH. 0

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0	0		0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10 sdl

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte CHLOROFORM

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		[illegible]2.5		116			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	42.233	39.476		40.854	2.757	0.067	[illegible]	

Checked by: PRM

Limit of Detection: 0.1

Remarks:

[illegible]

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory
Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454
Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,2- DICHLOROETHANE **Matrix** WATER

Analyst BAXTER **Instrument** CH. O

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	24.188	22.07		23.09	2.033	.088	20.0	

Checked by: PRM **Limit of Detection:** 0.1

Remarks:

1/10 AAL

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,1,1-TRICHLOROETHANE **Matrix** WATER

Analyst BAXTER **Instrument** CH. 0

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0		~~0~~	0	0	0	
SA 4427	0	0		~~0~~	0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
~~16658~~	~~0~~	~~0~~		~~0~~	~~0~~	~~0~~		
16658	12.832	10.882		11.857	1.95	0.164	140	

Checked by: PRM **Limit of Detection:** 0.1

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte CARBON TETRACHLORIDE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		~~230~~ 25		132			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	10.942	10.068		10.505	0.874	0.083		

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

NHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte BROMODICHLOROMETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in µg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	9.813	8.735		9.274	1.078	0.116	9.6	

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,2-DICHLOROPROPANE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Remarks:

1/9

Limit of Detection: 0.1

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte TRANS-1,3-DICHLOROPROPENE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4156	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
SA								
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10 ul

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,1,2 TRICHLORETHENE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	11.081	10.746		10.914	0.335	0.030	13.0	

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte DIBROMOCHLOROMETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11- 12/13

Results in µg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16653	9.954	9.023		9.489	0.931	0.098	12.0	

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10 ML

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analytical Laboratory
Quality Control Data Sheet

Analyte 1,1,2- TRICHLOROETHANE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		2.5		133			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10 ul

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory
Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454
Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte CIS-1,3-DICHLOROPROPENE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 2-CHLOROETHYLVINYL ETHER

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

uplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 1.0

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analytical Laboratory
Quality Control Data Sheet

Analyte BROMOFORM

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16458	10.622	10.339		10.486	0.283	0.027	10.4	

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #: 459, 489, 451, 454

Analytical Laboratory

Quality Control Data Sheet

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,1,2,2-TE[illegible]NE Tetrachloroethene gjs

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

uplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	5.440	5.229		5.334	0.211	0.040	5.6	

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte ~~TETRACHLOROETHENE~~ JRB 1,1,2,2 Tetrachloroethane **Matrix** WATER

Analyst BAXTER **Instrument** CH. 0

Method EPA 601 **Date Analyzed** 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
1658	0	0		0	0	0		

Checked by: PRM **Limit of Detection:** 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte CHLOROBENZENE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		2.5		128			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
1658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.1

Remarks:

1/10 LOL

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,3-DICHLOROBENZENE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #: 459, 489, 451, 454

Analytical Laboratory

Quality Control Data Sheet

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,2-DICHLOROBENZENE

Matrix WATER

Analyst BAXTER

Instrument CH. O

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

! ple #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4161	0		0		—			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
1658	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 459, 489, 451, 454

Sequence #: SA 4148-4150
SA 4139-4141
SA 4426-4428
SA 4161-4162

Analyte 1,4-DICHLOROBENZENE

Matrix WATER

Analyst BAXTER

Instrument CH. 0

Method EPA 601

Date Analyzed 12/11 - 12/13

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4150	0	0			0	0	0	
SA 4427	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4161	0		2.52 ~~[illegible]~~		112.6			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
[illegible]	0	0		0	0	0		

Checked by: PRM

Limit of Detection: 0.5

Remarks:

1/9 1/10

602 Kellie

6-11,12,13

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

November 28, 1983

ANALYTICAL REPORT

SUBMITTED TO: George Condradt

SUBMITTED BY: Patrick Merz

REFERENCE DATA:

Analysis of: Benzene, Toluene, Ethyl Benzene, Chlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene

Identification: 455

Sample(s): 3 Analyses: 21

UBTL Laboratory No.: SA-4151 through SA-4153

The above indicated water samples were analysed for the analytes listed using EPA Test Method 602 for Purgeable Aromatics.

Method: A 5 milliliter sample of water was purged with helium for 13 min and any analytes were collected on a 10-inch Tenax trap. The trap was heated to 180°C and the analytes were desorbed onto a 6 ft x 1/8 inch stainless steel column packed with 5% SP-1200 and 1.75% Bentone -34. The gas chromatograph was operated with thermal programing, 50°C for 2 minutes, increasing at a rate of 4°C/min to 110°C, and held there for 16 min.

The limit of detection for each analyte was 0.5 μg/L.

The results are tabulated on the following page(s).

P. Merz

P. Merz

Sim D. Lessley

Sim D. Lessley, Ph. D.

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 sdl

UBTL Identification Number 455

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 8, 1983

Analysis

Method of Analysis Purge and Trap

Date(s) of Analysis November 19, 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			VOLATILE HALOCARBONS EPA METHOD 602
W 11	SA 4151	WATER	all analytes < 0.5 ug/Liter
W 12	SA 4152		all analytes < 0.5 ug/Liter
W 13	SA 4153	↓	Toluene - 7.1 ug/Liter
Limit of Detection			all analytes < 0.5 ug/Liter

Comments

Patrick M

Analyst

Reviewer

Edward H Sanders

Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:
Sequence #:

Analyte BENZENE **Matrix** WATER

Analyst PATRICK MERZ **Instrument** CH 0

Method EPA 602 - PURGE & TRAP **Date Analyzed** NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		121			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	12.08						12.3	

Checked by: ____________ **Limit of Detection:** 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte TOLUENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

I licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		125			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
1659	37.53					[illegible]	37.1	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:
Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte ETHYL BENZENE
Matrix WATER
Analyst PATRICK MERZ
Instrument CH O
Method EPA 602 - PURGE & TRAP
Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		126			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	33.9						32.9	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:

Analytical Laboratory

Sequence #:

Quality Control Data Sheet

Analyte CHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in μg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		113			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	not present

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #:

Sequence #:

Analyte 1,4-DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH 0

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		105			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	not present

Checked by: __________

Limit of Detection: 0.5

Remarks:

1/4 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte 1,3-DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in μg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	not present

Checked by:

Limit of Detection: 0.5

Remarks:

1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:
Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte 1,2-DICHLOROBENZENE
Matrix WATER
Analyst PATRICK MERZ
Instrument CH O
Method EPA 602 - PURGE & TRAP
Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

ple #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4161	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4152	0		10.0		104			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	not present

Checked by: ____________

Limit of Detection: 0.5

Remarks:

1/6 1/10

602 wells
w-6, 14

November 28, 1983

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

ANALYTICAL REPORT

SUBMITTED TO: George Cordradt

SUBMITTED BY: Patrick Merz

REFERENCE DATA:

Analysis of: Benzene, Toluene, Ethyl Benzene, Chlorobenzene, 1,2,-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene

Identification No.: 458

Sample(s): 2 Analyses: 14

UBTL Laboratory No.: SA 4159 through SA 4160

The above indicated water samples were analyzed for the analytes listed using EPA Test Method 602 for Purgeable Aromatics.

Method: A 5 milliliter sample of water was purged with helium for 13 min. and any analytes were collected on a 10-inch Tenax trap. The trap was heated to 180°C and the analytes were desorbed onto a 6 ft x 1/8 inch stainless steel column packed with 5% SP-1200 and 1.75% Bentone -34. The gas chromatograph was operated with thermal programing, 50°C for 2 minutes, increasing at a rate of 4°C/min to 110°C, and held there for 16 min.

The limit of detection for each analyte was 0.5 mg/sample

The results are tabulated on the following page(s).

P. Merz
P. Merz

Sim D. Lessley
Sim. D. Lessley, Ph. D.

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84

UBTL Identification Number 458

Corporate/Agency Name Dames & Moore

Address

Attention

Telephone

Sampling Collection and Shipment

Sampling Site

Date of Collection

Date Samples Received at UBTL November 9, 1983

Analysis

Method of Analysis Purge and Trap

Date(s) of Analysis November 19, 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			VOLATILE AROMATICS EPA METHOD 602
W 6	SA 4159	WATER	toluene 0.7 ug/liter
W 14	SA 4160	↓	all analytes < 0.5 ug/liter
limit of detection			all analytes - 0.5 ug/liter

Comments

Patrick Mey
Analyst

Reviewer

Edward H Sander
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

+ 450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte BENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in µg./LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		121			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	12.08						12.3	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:

Analytical Laboratory

Sequence #:

Quality Control Data Sheet

Analyte TOLUENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH 0

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in µg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		125			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
1659	37.53						37.1	

Checked by: __________

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

NHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte ETHYL BENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in μg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		126			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	33.9						32.9	

Checked by: __________

Limit of Detection: 0.5

Remarks:

LME 1/6 1/10 ML

* 450
455
458

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte CHLOROBENZENE **Matrix** WATER

Analyst PATRICK MERZ **Instrument** CH O

Method EPA 602 - PURGE & TRAP **Date Analyzed** NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		113			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by: ____________

Limit of Detection: 0.5

Remarks: 1/6 1/10

★ 450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte 1,4- DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug / LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		105			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte 1,3-DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH 0

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by: ____________

Limit of Detection: 0.5

Remarks:

1/10

+ 450
455
458

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte 1,2-DICHLOROBENZENE **Matrix** WATER

Analyst PATRICK MERZ **Instrument** CH 0

Method EPA 602 - PURGE & TRAP **Date Analyzed** NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
A4161	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4152	0		10.0		104			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	not present

Checked by:

Limit of Detection: 0.5

Remarks:

1/10 sal

602 wells
DM-1,2,3

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

November 23, 1983

ANALYTICAL REPORT

SUBMITTED TO: George Cordradt

SUBMITTED BY: Patrick Merz

REFERENCE DATA:

Analysis of: Benzen, Toluene, Ethyl Benzene, Chlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene

Identification: 450

Sample(s): 3 Analyses: 21

UBTL Laboratory No.: SA-4136 through SA-4138

The above indicated water samples were analysed for the analytes listed using EPA Test Method 602 for Purgeable Aromatics.

Method: A 5 milliliter sample of wter was purged with helium for 13 min and any analytes were collected on a 10-inch Tenax trap. The trap was heated to 180°C and the analytes were desorbed onto a 6 ft x 1/8 inch stainless steel column packed with 5% SP-1200 and 1.75% Bentone -34. The gas chromatograph was operated with thermal programing, 50°C for 2 minutes, increasing at a rate of 4°C/min to 110°C, and held there for 16 min.

The limit of detection for each analyte was 0.5 µg/L.

The results are tabulated on the following page(s).

P. Merz
P. Merz

Sim D. Lessley
Sim D. Lessley, Ph. D.

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84

UBTL Identification Number 450

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis Purge and Trap

Date(s) of Analysis November 17, 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			VOLATILE AROMATICS EPA METHOD 602
DM 3	SA 4136	WATER	all analytes <0.5 ug/Liter
DM 2	SA 4137	↓	Toluene - 12.77 ug/Liter
DM 1	SA 4138		all analytes <0.5 ug/Liter
Limit of Detection			all analytes: 0.5 ug/Liter

Comments

Patrick Mez
Analyst

Reviewer

Edward H Sander
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte BENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in μg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		121			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	12.08						12.3	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10 LDL

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory
Quality Control Data Sheet

MHE/TA #:
Sequence #:

Analyte TOLUENE
Matrix WATER
Analyst PATRICK MERZ
Instrument CH 0
Method EPA 602 - PURGE & TRAP
Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		125			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	37.53						37.1	

Checked by:

Limit of Detection: 0.5

Remarks:

✓ 1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte ETHYL BENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		126			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	33.9						32.9	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte CHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

I licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		113			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by:

Limit of Detection: 0.5

Remarks:

1/6 1/10

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #:

Sequence #:

Analyte 1,4-DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in mg/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		105			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by: __________

Limit of Detection: 0.5

Remarks:

1/6 1/10 ml

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte 1,3-DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH O

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4151	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA 4152	0		10		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by: ____________

Limit of Detection: 0.5

Remarks:

1/10 sol

450
455
458

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #:

Sequence #:

Analyte 1,2-DICHLOROBENZENE

Matrix WATER

Analyst PATRICK MERZ

Instrument CH 0

Method EPA 602 - PURGE & TRAP

Date Analyzed NOV. 19, 1983

Results in ug/LITER

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
#4161	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4152	0		10.0		104			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16659	0						0	

Checked by: ______________

Limit of Detection: 0.5

Remarks:

WE 1/6 1/10 sol

Pesticides W-11, 12, 13

December 1, 1983

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Ellen Jenkins

REFERENCE DATA:

Analysis of: Aldrin, Dieldrin, Chlordane, DDT isomers, Endrin, Endrin Aldehyde, Heptachlor, Lindane

Identification No.: 456

Sample(s): 3 Analyses: 33

UBTL Laboratory No.: SA-4154 through SA-4156

The above numbered water samples were prepared for analysis by EPA Method 608. The samples were analyzed on a Tracor 222 gas chromatograph equipped with an electron capture detector. A 6' x 2 mm i.d. glass column packed with 3% OV-17 and 3% QF-1 on 100/120 mesh chromQ was used isothermally at 190°C and with a gas flow of 75 mL per minute.

The limits of detection were 0.01 μg/L for Aldrin, Dieldrin, o,p,-DDT, DDD, DDE, Endrin, Endrin Aldehyde, Heptachlor, and Lindane and 0.1 μg/L for Chlordane.

The results are tabulated on the following page(s).

Ellen Jenkins
Ellen Jenkins

Sim D. Lessley
Sim D. Lessley,/Ph. D.

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 12/29/83

UBTL Identification Number 456

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 9, 1983

Analysis

Method of Analysis [illegible]

Date(s) of Analysis [illegible]

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			FOUND PESTICIDES
W 11	SA 4154	WATER	[illegible] OTHER
W 12	SA 4155	↓	NONE OTHER
W 13	SA 4156		[illegible] OTHER
			[illegible]
			[illegible]
		LOD	[illegible]

Comments

Analyst

Reviewer

Edward H Sanders
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL Analytical Laboratory

Quality Control Data Sheet   ID # DM456

Analyte ALDRIN

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
QC16685	.056	.056	2	.056	.056	.000	.005	
SA4142	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.770	.773	2	.771		.003	.003	

Limit of detection 0.01   Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	ENDRINALDEHYDE		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4155A	-.001	-.001	2	-.001		0.000	0.000	
SA4155B	-.001	-.001	2	-.001		0.000	0.000	

Limit of detection 0.01

Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte OPDDT

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
SA4142	.000	.000	2	.000		0.000	0.000	
`A4155B	.895	.894	2	.894		.001	.001	

Limit of detection 0.01 Checked by RB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte DIELDRIN

Analyst name EEJ

Analyst number 457

Method ECGC

Matrix WATERS

Instrument 222

Date 16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
C16685	.112	.112	2	.112	.114	.001	.006	
SA4142	-.001	-.001	2	-.001		0.000	0.000	
SA4144A	-.001	-.001	2	-.001		0.000	0.000	
SA4144B	-.001	-.001	2	-.001		0.000	0.000	
SA4155A	-.001	-.001	2	-.001		0.000	0.000	
SA4155B	.832	.829	2	.830		.003	.004	

Limit of detection 0.01

Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet   ID #   DM456

Analyte   ENDRIN

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.910	.914	2	.912		.003	.004	

Limit of detection 0.01   Checked by JKB

12/7   12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	CHLORDANE		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	.001	.001	2	.001		0.000	0.000	

Limit of detection 0.1 Checked by JRB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte LINDANE

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
SA4142	.000	.000	2	.000		0.000	0.000	
SA4155A	.000	.000	2	.000		0.000	0.000	
A4155B	.726	.746	2	.736		.020	.027	
SA4156	.000	.000	2	.000		0.000	0.000	

Limit of detection 0.01 Checked by JRB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet   ID # DM456

Analyte HEPTACHLOR

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
QC16685	.026	.026	2	.026	.028	.000	.005	
SA4142	-.000	-.000	2	-.000		0.000	0.000	
SA4143	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.686	.702	2	.694		.016	.023	
SA4156	-.000	-.000	2	-.000		0.000	0.000	

Limit of detection 0.01

Checked by JRB

12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	PPDDT		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	.000	.000	2	.000		0.000	0.000	
SA4154	.000	.000	2	.000		0.000	0.000	
SA4155A	.000	.000	2	.000		0.000	0.000	
SA4155B	.890	.886	2	.888		.004	.004	

Limit of detection 0.01

Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	DDD		
Analyst name	EEJ	Matrix	WATERS
Analyst number	157	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
BA4142	.000	.000	2	.000		0.000	0.000	
A4155A	.000	.000	2	.000		0.000	0.000	
A4155B	.000	.000	2	.000		0.000	0.000	

Limit of detection .001

Checked by JCB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM436

Analyte	DDE		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
A4142	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.872	.863	2	.867		.009	.010	

Limit of detection 0.01

Checked by JB

12/7 12/29

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte pp-DDT

Matrix Waters

Analyst PEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4152	<0.01	<0.01						
SA4154	<0.01	<0.01						
SA4144	<0.01							
4144B	<0.01							
SA4155	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155S	<0.01		0.8		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by:

Limit of Detection: 0.01

12/29 SDL

Remarks:

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Analytical Laboratory

Sequence #:

Quality Control Data Sheet

Analyte Chlordane

Matrix Waters

Analyst EGT

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/l

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.1	<0.1						
SA4144	<0.1							
SA4146	<0.1							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by:

Limit of Detection: 0.1

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte Endrin Aldehyde

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA5155A	<0.01	<0.01						
SA5155B	<0.01	<0.01						
SA4144A	<0.01							
SA4144B	<0.01							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ____________

Limit of Detection: 0.01

12/29

Remarks:

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte op-DDT

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in µg/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144	<0.01							
SA4144B	<0.01							
SA4155	<0.01							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4553	<0.01		0.8		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ____________

Limit of Detection: 0.01

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

HME/TA #:

Analytical Laboratory

Sequence #:

Quality Control Data Sheet

Analyte Endrin

Matrix Waters

Analyst PEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144a	<0.01							
SA4144B	<0.01							
SA4155	<0.01							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155B	<0.01		0.8		113			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ____________

Limit of Detection: 0.01

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte Dieldrin

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	**No. 1**	**No. 2**	**No. 3**	**No. 4**	**Average**	**Range**	**Range/Ave**	**Comment**
SA4142	<0.01	<0.01						
SA4144	<0.01							
SA4144B	<0.01							
SA4155	<0.01	<0.01						

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155S	<0.01		0.8		103			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16685	0.112	0.112		0.112	0.001	0.006	0.114	

Checked by:

Remarks:

Limit of Detection: 0.01

12/29

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte DDE

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in μg/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4147								
SA4144								
SA4144R								

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155	<0.01		0.8		109			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by:

Limit of Detection: 0.01

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory
Quality Control Data Sheet

HHE/TA #:
Sequence #:

Analyte Aldrin
Matrix Waters
Analyst EEJ
Instrument Tracor 222
Method ECGC
Date Analyzed 11/16/83

Results in µg/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA442	<0.01	<0.01						
SA444	0.01							
SA444C	0.01							
SA455	<0.01	<0.01						

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA455 S	<0.01		0.8		96			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16685	0.056	0.056		0.056	0.00	0.005	0.056	

Checked by: ____________

Limit of Detection: 0.01

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte Lindane

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4143	<0.01							
SA4144B	<0.01							
SA4155	<0.01	<0.01						
SA4156	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155S	[illegible]		0.8		93			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by:

Limit of Detection:

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte Heptachlor

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144	<0.01							
SA4144B	<0.01							
SA4155	<0.01	<0.01						
SA4156	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155 S	<0.01		0.8		86			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16685	0.026	0.026		0.026	0.00	.005	0.028	

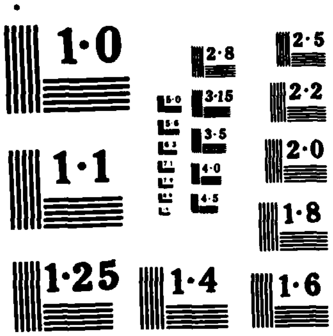
Checked by:

Limit of Detection: 0.01

Remarks:

12/29

AD-A162 920 INSTALLATION RESTORATION PROGRAM PHASE II 4/5
CONFIRMATION/QUANTIFICATION STA..(U) DAMES AND MOORE
PARK RIDGE IL 09 AUG 85 F33615-83-D-4002
UNCLASSIFIED F/G 13/2 NL



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

Pesticides
W.W-1,2,3

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

December 1,,1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Ellen Jenkins

REFERENCE DATA:

Analysis of: Aldrin, Dieldrin, Chlordane, DDT isomers, Endrin, Endrin Aldehyde, Heptachlor, Lindane

Identification No.: 452

Sample(s): 3 Analyses: 33

UBTL Laboratory No.: SA-4142 through SA-4144

The above numbered water samples were prepared for analysis by EPA Method 608. The samples were analyzed on a Tracor 222 gas chromatograph equipped with an electron capture detector. A 6' x 2 mm i.d. glass column packed with 3% OV-17 and 3% QF-1 on 100/120 mesh Chrom Q was used isothermally at 190°C and with a gas flow of 75 mL per minute.

The limits of detection were 0.01 µg/L for Aldrin, Dieldrin, o,p-DDT, DDD, DDE, Endrin, Endrin Aldehyde, Heptachlor, and Lindane and 0.1 µg/L for Chlordane.

The results are tabulated on the following page(s).

Ellen Jenkins
Ellen Jenkins

Sim D. Lessley
Sim D. Lessley, Ph. D.

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

ANALYTICAL REPORT FORM

Date 12/29/83 SDL

UBTL Identification Number 452

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis [illegible]

Date(s) of Analysis [illegible] -83- [illegible] -83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results [illegible]
			FOUND Analyte level FOUND Analyte level PESTICIDES Surrogate [illegible]
DM 3	SA 4142	WATER	NONE [illegible] [illegible]
DM 2	SA 4143	↓	NONE [illegible] [illegible]
DM 1	SA 4144	↓	aldrin 0.01 [illegible] [illegible]
	SA44[illegible]	[illegible]	aldrin 0.01 opDDT 0.06 [illegible] [illegible]
		LOD	[illegible] DDTs [illegible]
			[illegible] 0.[illegible]
		LOD	Chlordane [illegible]

Comments

Analyst

K Barta

Reviewer

Edward H Sander

Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	ALDRIN		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
QC16685	.056	.056	2	.056	.056	.000	.005	
A4142	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.770	.773	2	.771		.003	.003	

Limit of detection 0.01

Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	ENDRINALDEHYDE		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	St
SA4155A	-.001	-.001	2	-.001		0.000	0.000	
SA4155B	-.001	-.001	2	-.001		0.000	0.000	

Limit of detection 0.01 Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	OPDDT		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	.000	.000	2	.000		0.000	0.000	
SA4155B	.895	.894	2	.894		.001	.001	

Limit of detection 0.01

Checked by JKB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte DIELDRIN

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
QC16685	.112	.112	2	.112	.114	.001	.006	
A4142	-.001	-.001	2	-.001		0.000	0.000	
SA4144A	-.001	-.001	2	-.001		0.000	0.000	
SA4144B	-.001	-.001	2	-.001		0.000	0.000	
SA4155A	-.001	-.001	2	-.001		0.000	0.000	
SA4155B	.832	.829	2	.830		.003	.004	

Limit of detection 0.01 Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte ENDRIN

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.910	.914	2	.912		.003	.004	

Limit of detection 0.01 Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet   ID #   DM456

Analyte	CHLORDANE		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
SA4142	.001	.001	2	.001		0.000	0.000	

Limit of detection 0.1   Checked by JLB

12/7   12/29

UBTL Analytical Laboratory

Quality Control Data Sheet   ID # DM456

Analyte   LINDANE

Analyst name   EEJ   Matrix   WATERS
Analyst number   457   Instrument   222
Method   ECGC   Date   16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
SA4142	.000	.000	2	.000		0.000	0.000	
SA4155A	.000	.000	2	.000		0.000	0.000	
A4155B	.726	.746	2	.736		.020	.027	
SA4156	.000	.000	2	.000		0.000	0.000	

Limit of detection 0.01   Checked by

12/7   12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte HEPTACHLOR

Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	16 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
QC16685	.026	.026	2	.026	.028	.000	.005	
SA4142	-.000	-.000	2	-.000		0.000	0.000	
SA4143	-.000	-.000	2	-.000		0.000	0.000	
SA4155A	-.000	-.000	2	-.000		0.000	0.000	
SA4155B	.686	.702	2	.694		.016	.023	
SA4156	-.000	-.000	2	-.000		0.000	0.000	

Limit of detection 0.01

Checked by SKB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte PPDDT

Analyst name EEJ Matrix WATERS
Analyst number 457 Instrument 222
Method ECGC Date 17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	.000	.000	2	.000		0.000	0.000	
SA4154	.000	.000	2	.000		0.000	0.000	
SA4155A	.000	.000	2	.000		0.000	0.000	
SA4155B	.890	.886	2	.888		.004	.004	

Limit of detection 0.01 Checked by

12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte DDD

Analyst name	EEJ	Matrix	WATERS
Analyst number	157	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean Si
SA4142	.000	.000	2	.000		0.000	0.000
A4155A	.000	.000	2	.000		0.000	0.000
A4155B	.000	.000	2	.000		0.000	0.000

Limit of detection 0.01 Checked by JRB

12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	PPDDT		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4142	.000	.000	2	.000		0.000	0.000	
SA4154	.000	.000	2	.000		0.000	0.000	
SA4155A	.000	.000	2	.000		0.000	0.000	
SA4155B	.890	.886	2	.888		.004	.004	

Limit of detection 0.01 Checked by

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet ID # DM456

Analyte	DDD		
Analyst name	EEJ	Matrix	WATERS
Analyst number	157	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
SA4142	.000	.000	2	.000		0.000	0.000	
A4155A	.000	.000	2	.000		0.000	0.000	
A4155B	.000	.000	2	.000		0.000	0.000	

Limit of detection 0.01

Checked by JRB

12/7 12/29

UBTL Analytical Laboratory

Quality Control Data Sheet   ID #   DM456

Analyte	DDE		
Analyst name	EEJ	Matrix	WATERS
Analyst number	457	Instrument	222
Method	ECGC	Date	17 NOV., 1983

Results in UG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Stat
DA4142	-.000	-.000	2	-.000		0.000	0.000	
DA4155A	-.000	-.000	2	-.000		0.000	0.000	
DA4155B	.872	.863	2	.867		.009	.010	

Limit of detection 0.01   Checked by

12/7   12/29

UTAH BIOMEDICAL TEST LABORATORY

BHE/TA #:
Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte pp-DDT
Matrix Waters
Analyst EEJ
Instrument Tracor 222
Method ECGC
Date Analyzed 11/16/83

Results in µg/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4154	<0.01	<0.01						
SA4144	<0.01							
4144B	<0.01							
SA4155	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
S 1553	<0.01		0.8		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ______________

Limit of Detection: 0.01

Remarks:

12/29 ldc

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:
Sequence #:

Analytical Laboratory
Quality Control Data Sheet

Analyte Chlordane
Matrix Waters
Analyst SEA
Instrument Tracor 222
Method ECGC
Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SR4142	<0.1	<0.1						
SR4144	<0.1							
SR4146	<0.1							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ______________

Limit of Detection: 0.1

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

NHE/TA #:
Sequence #:

Analyte Endrin Aldehyde

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA5155A	<0.01	<0.01						
SA5155B	<0.01	<0.01						
SA4144A	<0.01							
SA4144B	<0.01							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ______________

Limit of Detection: 0.01

Remarks:

12/29 LAL

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #:

Analyte op-DDT

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144	<0.01							
SA4144B	<0.01							
SA4155	<0.01							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155S	<0.01		0.8		111			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ____________

Limit of Detection: 0.01

Remarks:

12/29 ML

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #:

Sequence #:

Analyte Endrin

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144a	<0.01							
SA4144B	<0.01							
SA4155	<0.01							

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155B	<0.01		0.8		113			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ____________

Limit of Detection: 0.01

12/29

Remarks:

UTAH BIOMEDICAL TEST LABORATORY

WHE/TA #:

Analytical Laboratory

Sequence #:

Quality Control Data Sheet

Analyte Dieldrin

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144	<0.01							
SA4144B	<0.01							
SA4155	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155S	<0.01		0.8		103			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16685	0.112	0.112		0.112	0.001	0.006	0.114	

Checked by:

Limit of Detection: 0.01

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #:

Sequence #:

Analyte DDE

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142								
SA4144								
SA4148								

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155	<0.01		0.8		109			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: ____________

Limit of Detection: 0.01

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte Aldrin

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in µg/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA442	<0.01	<0.01						
SA444	0.01							
SA444B	0.01							
SA455	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA455S	<0.01		0.8		96			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16685	0.056	0.056		0.056	0.00	0.005	0.056	

Checked by: ____________

Limit of Detection: 0.01

12/29

Remarks:

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Analytical Laboratory

Sequence #:

Quality Control Data Sheet

Analyte Lindane

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4148	<0.01							
SA4144B	<0.01							
SA4155	<C.01	<0.01						
SA4156	<0.01	<C.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155S	<0.01		0.8		93			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by:

Limit of Detection:

Remarks:

12/29

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #:

Analytical Laboratory

Quality Control Data Sheet

Analyte Heptachlor

Matrix Waters

Analyst EEJ

Instrument Tracor 222

Method ECGC

Date Analyzed 11/16/83

Results in ug/L

i licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4142	<0.01	<0.01						
SA4144	<0.01							
SA4144B	<0.01							
SA4155	<0.01	<0.01						
SA4156	<0.01	<0.01						

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4155 S	<0.01		0.8		86			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
16685	0.026	0.026		0.026	0.00	.005	0.028	

Checked by:

Limit of Detection: 0.01

Remarks:

12/27

O/G OM-1,2,3

UBTL
520 WAKARA WA
SALT LAKE CITY
UTAH 84108
801 581-8267

A DIVISION OF
THE UNIVERSITY OF
RESEARCH INSTITUTE

MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

December 16, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Dave McGlochlin

REFERENCE DATA:

Analysis of: Oil & Grease in water

Identification No.: 446

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA 4124 through SA 4126

The above-numbered water samples were analyzed for Oil & Grease according to the methods published in "EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes."

The method number for Oil & Grease by IR Spectrophotometry is 413.2 according to the above reference. For these samples the Limit of Detection was 0.5 mg/L.

The results are tabulated on the following page(s).

Dave McGlochlin

Sim D. Lessley

Sim D. Lessley, Ph.D.

UBTL

ANALYTICAL REPORT FORM

Date 12/29/83

UBTL Identification Number 446

Corporate/Agency Name Dames & Moore

Address

Attention   Telephone

Sampling Collection and Shipment

Sampling Site   Date of Collection

Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis SPECTROPHOTOMETRIC (I.R.)

Date(s) of Analysis 12/10/83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			OIL & GREASE mg/L
DM 3	SA 4124	WATER	<.5
DM 2	SA 4125	↓	<.5
DM 1	SA 4126	↓	<.5
		L.O.D.	.5

Comments

Analyst

Reviewer

A Brent Jorgensen
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Sequence #: 446

Analytical Laboratory

Quality Control Data Sheet

Analyte Oil & Grease

Matrix Water

Analyst D.B.M.

Instrument Beckman 20A

Method Spectrophotometric

Date Analyzed 12/10/83

Results in mg

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
Q.C.16723	6.4319	6.4319		6.4319	0.0	0.0	12.0mg/L	

Checked by: ____________

Limit of Detection: .5mg.

Remarks:

12/16

12/29

C/G w-6,14

December 16, 1983

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Dave McGlochlin

REFERENCE DATA:

Analysis of: Oil & Grease in water

Identification No.: 457

Sample(s): 2 Analyses: 2

UBTL Laboratory No.: SA 4157 through SA 4158

The above-numbered water samples were analyzed for Oil & Grease according to the methods published in "EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes."

The method number for Oil & Grease by IR Spectrophotometry is 413.2 according to the above reference. For these samples the Limit of Detection was 0.5 mg/L.

The results are tabulated on the following page(s).

Dave McGlochlin

Sim D. Lessley

Sim D. Lessley, Ph.D.

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MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 12/29/83 *sdl*

UBTL Identification Number 457

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 9, 1983

Analysis

Method of Analysis SPECTROPHOTOMETRIC (I.R.)

Date(s) of Analysis 12/10/83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			OIL & GREASE mg/l
W 6	SA 4157	WATER	<.5
W 14	SA 4158	↓	<.5
		LOD.	.5

Comments

David W. [illegible]
Analyst

Reviewer
A. Brent Jorgenson
Laboratory Supervisor

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #: 457

Analyte OIL & GREASE

Matrix WATER

Analyst D.B.M.

Instrument BECKMAN 20A

Method SPECTROPHOTOMETRIC

Date Analyzed 12/14/83

Results in mg

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
Q.C. 16723	6.4319	6.4319		6.4319	0.0	0.0	12.0mg/L	

Checked by:

Limit of Detection: .52 mg

Remarks:

12/16

12/29

O/G, Pb, NO3, phenol

W-11, 12, 13

UBTL
520 WAKARA W
SALT LAKE CITY
UTAH 84108
801 581-8267

December 16, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Dave McGlochlin

REFERENCE DATA:

Analysis of: Oil & Grease in water

Identification No.: 453

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA 4145 through SA 4147

The above-numbered water samples were analyzed for Oil & Grease according to the methods published in "EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes."

The method number for Oil & Grease by IR spectrophotometry is 413.2 according to the above reference. For these samples the limit of detection was 0.5 mg/L.

The results are tabulated on the following page(s).

David McGlochlin
Dave McGlochlin

Sim D. Lessley
Sim D. Lessley, Ph.D.

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UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

December 7, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: David McGlochlin

REFERENCE DATA:

Analysis of: Phenol

Identification No.: 453

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA-4145 through SA-4147

The above numbered water samples were analyzed for phenol according to the methods published in "EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes."

The method number for phenol, according to the above reference, is 420.2. For this set of samples the limit of detection was 5. µg/L.

David McGlochlin

Sim D. Lessley

Sim D. Lessley, Ph. D.

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UBTL
520 WAKARA W
SALT LAKE CITY
UTAH 84108
801 581-8267

November 18, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Ken Bilak

REFERENCE DATA:

Analysis of:	Nitrate
Identification No.:	453
Sample(s): 3	Analyses: 3
UBTL Laboratory No.:	SA-4145 through SA-4147

The above numbered water samples were analyzed for nitrate according to method 353.2, published in "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020 publication.

The limit of detection for nitrate is 0.02 milligrams per liter.

The results are tabulated on the following page(s).

Ken Bilak
Ken Bilak

Sim D. Lessley
Sim D. Lessley, Ph. D.

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UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

November 14, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames and Moore

SUBMITTED BY: Clint Merrell

REFERENCE DATA:

Analysis of: Lead

Identification: 453

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA-4145 through SA-4147

The above numbered water samples were analyzed according to the EPA - 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes." Method Number 239.2. The analyses were performed with an atomic absorption spectrophotometer.

The limit of detection for each analyte is as follows:

Lead: 0.01 mg/L

The results are tabulated on the following page(s).

Clint Merrell
Clint Merrell

Sim D. Leesley for
Rand Potter

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ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 12/29/83 LPL

UBTL Identification Number 453

Corporate/Agency Name Dames & Moore

Address

Attention   Telephone

Sampling Collection and Shipment

Sampling Site   Date of Collection

Date Samples Received at UBTL November 8, 1983

Analysis

Method of Analysis AA-HGA, Visible Spectroscopy

Date(s) of Analysis 11-18-83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results			
			NITRATE mg/L	ug/L PHENOL	mg/L LEAD	mg/L OIL & GREASE
W 11	SA 4145	WATER	0.45	<5.	<0.01	<0.5
W 12	SA 4146	↓	0.67	<5.	<0.01	<0.5
W 13	SA 4147	↓	0.39	800.	<0.01	<0.5
		LOD	0.02 mg/L	5. ug/L	0.01 mg/L	0.5 mg/L

Comments

Clint Merrell, Ken Bilak, David Mc[illegible]
Analyst

Reviewer

A. Brent Jorgensen
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL Analytical Laboratory

Quality Control Data Sheet ID # #

Analyte em ~~AS~~ Pb

Analyst name	NCLM	Matrix	XFILTERS
Analyst number	#432	Instrument	#751 IL2
Method	EAAS	Date	10 NOV., 1983

Results in ~~LUG~~ mg/liter

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
SA4127	-.001	.000	2	-.000		.001	-5.080	
SA4145	-.000	.000	2	.000		.000	74.762	

Limit of detection [illegible] Checked by

12/16 12/29

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Analytical Laboratory

Sequence #: 453

Quality Control Data Sheet

Analyte Oil & Grease

Matrix Water

Analyst D.B.M.

Instrument Beckman 20A

Method Speztrophotometrik

Date Analyzed 12/14/83

Results in mg/L

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
QC.16723	6.4319	6.4319		6.4319	0.0	0.0	12.0 mg/L	

Checked by:

Limit of Detection: .5 mg/L

Remarks:

12/16 12/29

UBTL ID # 453

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~IHE/TA #~~:

~~Sequence #~~:

Analyte Nitrate

Matrix Water

Analyst Ken Bilak

Instrument Autoanalyzer II

Method Visible Spectroscopy

Date Analyzed 11-18-83

Results in mg/L

uplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA 4146	.664	.667			.6655	.003	.0045	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
QC 15994	.488	.491		.4895	.003	.0061	.481	
QC 16657	.361	.363		.362	.002	.0055	.357	

Checked by: ____________

Limit of Detection: .02 mg/L

Remarks:

1/4

12/29

UBTL ID # 45
~~HHE/TA #:~~
~~Sequence #~~:

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

Analyte Phenol

Matrix Water

Analyst Dave McGlochlin

Instrument Autoanalyzer II

Method Visible Spectroscopy

Date Analyzed 11-18-83

Results in ug/L

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4147	798.	807.			802.5	9	.0112	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: __________

Limit of Detection: 5 ug/L

Remarks:

12/29

Phenol
DM-1,2,3

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

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December 2, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Dave McGlochlin

REFERENCE DATA:

Analysis of: Phenol

Identification No.: 448

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA 4130 through SA 4132

The above-numbered water samples were analyzed for Phenol according to the methods published in "EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes."

The method number for Phenol according to the above reference is 420.2. For these samples the limit of detection was 5 µg/L.

The results are tabulated on the following page(s).

David McGlochlin
Dave McGlochlin

Sim D. Lessley
Sim D. Lessley, Ph. D.

UBTL
ANALYTICAL REPORT FORM

Date 12/29/83
UBTL Identification Number 448

Corporate/Agency Name Dames & Moore
Address
Attention
Telephone

Sampling Collection and Shipment

Sampling Site
Date of Collection
Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis COLORIMETRIC
Date(s) of Analysis 11/18/83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			PHENOL ug/L
DM 3	SA 4130	WATER	< 5.
DM 2	SA 4131	↓	< 5.
DM 1	SA 4132	↓	< 5.
		L.C.D.	5. ug/L

Comments

Analyst

Reviewer

A. Brent Jorgensen
Laboratory Supervisor

UTAH BIOMEDICAL TEST LABORATORY

HHE/TA #:

Analytical Laboratory

~~Sequence #~~:

Quality Control Data Sheet

UBTL ID #: 448,453

Analyte PHENOL

Matrix WATER

Analyst D.B.M.

Instrument TECHNICON AA II

Method COLORIMETRIC

Date Analyzed 11/18/83

Results in ug/L

ample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4130	1.52	4.72			3.120	3.2	1.0256	
SA4147	798.	807.			802.5	9.0	0.0112	
QC Samp.								

Checked by: ______________

Limit of Detection: 5. ug/L

Remarks:

12/29

Pb PM-1,2,3

November 14, 1983

UBTL
520 WAKARA WA
SALT LAKE CITY
UTAH 84108
801 581-8267

ANALYTICAL REPORT

SUBMITTED TO: Dames and Moore

SUBMITTED BY: Clint Merrell

REFERENCE DATA:

Analysis of: Lead

Identification: 447

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA-4127 through SA-4129

The above numbered water samples were analyzed according to the EPA - 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes." Method Number 239.2. The analyses were performed with an atomic absorption spectrophotometer.

The limit of detection for each analyte is as follows:

Lead: 0.01 mg/L

The results are tabulated on the following page(s).

Clint Merrell
Clint Merrell

Sim D. Lessley
Sim D. Lessley, Ph. D.

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UBTL

ANALYTICAL REPORT FORM

Date 12/29/83 LNL

UBTL Identification Number 447

Corporate/Agency Name Dames & Moore

Address

Attention Telephone

Sampling Collection and Shipment

Sampling Site Date of Collection

Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis AAS- Graphite Furnace

Date(s) of Analysis 11/10/83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			mg/Liter LEAD
DM 3	SA 4127	WATER	<0.01
DM 2	SA 4128	↓	<0.01
DM 1	SA 4129		<0.01
Limit of Detection			0.01 mg/Liter

Comments

Clint Merrell
Analyst

Reviewer

A. Brent Jorgensen
Laboratory Supervisor

UBTL Analytical Laboratory

Quality Control Data Sheet ID # #

Analyte em ~~As~~ Pb

Analyst name	NCLM	Matrix	XFILTERS
Analyst number	#432	Instrument	#751 IL2
Method	EAAS	Date	10 NOV., 1983

Results in ~~UG~~ mg/Liter

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean
SA4127	-.001	.000	2	-.000		.001	-5.080
SA4145	-.000	.000	2	.000		.000	74.762

Limit of detection 0.01mg/Liter Checked by

12/2 12/29

NO3 DM-1,2,3

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

November 18, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Ken Bilak

REFERENCE DATA:

Analysis of: Nitrate

Identification No.: 449

Sample(s): 3 Analyses: 3

UBTL Laboratory No.: SA-4133 through SA-4135

The above numbered water samples were analyzed for nitrate according to method 353.2, published in "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020 publication.

The limit of detection for nitrate is 0.02 milligrams per liter.

The results are tabulated on the following page(s).

Ken Bilak
Ken Bilak

Sim D. Lesseley
Sim D. Lesseley, Ph. D.

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UBTL

ANALYTICAL REPORT FORM

Date 12/29/83

UBTL Identification Number 449

Corporate/Agency Name Dames & Moore

Address

Attention   Telephone

Sampling Collection and Shipment

Sampling Site   Date of Collection

Date Samples Received at UBTL November 4, 1983

Analysis

Method of Analysis Visible Spectroscopy

Date(s) of Analysis 11-18-83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results, mg/L
			NITRATE
DM 3	SA 4133	WATER	16.
DM 2	SA 4134	↓	9.2
DM 1	SA 4135		9.8
Limit	of de	tection	.02 mg/L

Comments

Ken Bilak
Analyst

Reviewer

A. Brent Jorgensen
Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL Analytical Laboratory

Quality Control Data Sheet ID # 525.

Analyte NITRATE

Analyst name	KPB	Matrix	WATER
Analyst number	436	Instrument	2,AA
Method	VISIBLE SPECTROSCOPY	Date	5 DEC., 1983

Results in MG/L

Sample	Value1	Value2	Num	Mean	Target	Range	Rng/Mean	Sta
QC15994	.361	.363	2	.362	~~-999.000~~ .357	.002	.006	**
QC16657	.491	.488	2	.489	-~~999.000~~ .4806	.003	.006	XX
SA4146	.667	.664	2	.666		.003	.005	

Limit of detection .02 mg/L Checked by

12/5 12/29

% moisture
soil

UBTL
520 WAKARA WA
SALT LAKE CITY
UTAH 84108
801 581-8267

December 21, 1983

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: David McGlochlin

REFERENCE DATA:

Analysis of: % Moisture

Identification: 464

Sample(s): 28 Analyses: 28

UBTL Laboratory No.: SA 4167 through SA 4194

The above numbered soil samples were analyzed for moisture according to the procedure described below.

Beakers were dried in an oven at 105°C for 1 hr., dessicated for 1 hr. and weighed. Approximately 10 grams of sample was added to each respective beaker and the weight of the beaker plus the sample was recorded. The samples were than dried at 105°C for 16 hrs, dessicated for 1 hr. and weighed.

For each sample the weight of the soil before drying and its moisture weight were calculated from weights obtained through the above procedure. The moisture weight was then divided by the weight of the sample before drying to find the percent moisture of each sample.

The results are tabulated on the following page(s).

David McGlochlin
David McGlochlin

Sim D. Lessley
Sim D. Lessley, Ph.D.

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UBTL

ANALYTICAL REPORT FORM

Date 12/29/83

UBTL Identification Number 464

Corporate/Agency Name Dames & Moore

Address

Attention Mr. Yogi Kunze

Telephone 602 274-5548

Sampling Collection and Shipment

Sampling Site Nellis AFB

Date of Collection

Date Samples Received at UBTL November 12, 1983

Analysis

Method of Analysis GRAVIMETRIC

Date(s) of Analysis 12/13/83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			% Moisture
B1-S3	SA 4167	SOIL	8.1
B1-S5	SA 4168		8.9
B1-S12	SA 4169		4.3
B1-S18	SA 4170		2.0
B2-S2	SA 4171		14.
B2-S6	SA 4172		4.6
B2-S10	SA 4173		4.7
B3-S1	SA 4174		6.6
B3-S9	SA 4175		5.0
B4-S3	SA 4176		13.
B4-S7	SA 4177		5.4
B4-S11	SA 4178		6.2

Comments

Analyst

Reviewer

Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

UBTL
ANALYTICAL REPORT FORM

Date 12/29/83

UBTL Identification Number 464

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			% MOISTURE
B5-S5	SA 4179	SOIL	12.
B5-S10	SA 4180		8.4
B6-S4	SA 4181		11.
B6-S9	SA 4182		15.
B6-S14	SA 4183		19.
B7-S1	SA 4184		19.
B7-S5	SA 4185		23.
B7-S10	SA 4186		14.
B7-S15	SA 4187		28.
B8-S3	SA 4188		16.
B8-S8	SA 4189		16.
B8-S13	SA 4190		20.
B9-S2	SA 4191		13.
B9-S7	SA 4192		13.
B9-S12	SA 4193		21.
B9-S17	SA 4194	↓	21.

Comments

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #:

Sequence #: ID#464

Analyte % Moisture

Matrix Soil

Analyst D.B.M.

Instrument Mettler AE 163

Method Gravimetric

Date Analyzed 12/19/83

Results in %

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
SA4175	7.31	7.24		-	7.275	0.07	0.0096	
SA4179	11.74	11.55			11.65	0.19	0.0163	
SA4185	22.28	22.64			22.46	0.36	0.0160	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by:

Limit of Detection:

Remarks:

12/22

12/29

601 soils

UBTL
520 WAKARA WA
SALT LAKE CITY
UTAH 84108
801 581-8267

December 29, 1983

ANALYTICAL REPORT

SUBMITTED TO: Yogi Kunze

SUBMITTED BY: James R. Baxter

REFERENCE DATA:

Analysis of: EPA 601 Purgeable Halocarbons

Identification No.: 467

Sample(s): 28 Analyses: 812

UBTL Laboratory No.: SA-4251 through SA-4278

The above numbered samples were analyzed using a modification of EPA Test Method 601 for purgeable halocarbons. A 1 gram sample of soil was diluted with 5 mL of organic free water and purged with helium. Any analytes present were collected on a trap consisting of activated charcoal, Tenax, and silica gel. The trap was then heated to 180°C and any analytes were flushed onto an 8' x 2mm I.D. glass column packed with 1% SP-1000 on Carbopack B. A thermal program starting at 50°C and proceeding at 8°C/minute to 220°C was used to separate the analytes. A Hall 700A electroconductivity detector in the halogen mode was used for detection and quantification of the analytes.

Samples SA-4253, 4262, 4273 were analyzed in duplicate and samples SA-4258, 4269, 4275 were analyzed neat and then reanalyzed with a spike consisting of bromomethane, chloroethane, 1,1-dichloroethene, chloroform, carbon tetrachloride, 1,1,2-trichloroethane, bromoform, chlorobenzene, and 1,4-dichlorobenzene. The results of the duplicate and spike analyses are on the QC sheets.

The limits of detection for each analyte are as follows:

Analyte	Limit of Detection (μg/gram)
Chloromethane	0.01
Bromomethane	0.01
Dichlorodifluoromethane	0.01
Vinyl Chloride	0.01
Chloroethane	0.01
Methylene Chloride	0.01
Trichlorofluoromethane	0.01
1,1-Dichloroethene	0.01
1,1-Dichloroethane	0.01
Trans-1,2-dichloroethene	0.01
Chloroform	0.01
1,2-Dichloroethane	0.01
1,1,1-Trichloroethane	0.01

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Carbon Tetrachloride	0.01
Bromodichloromethane	0.01
1,2-Dichloropropane	0.01
Trans-1,3-dichloropropene	0.01
Trichloroethene	0.01
Dibromochloromethane	0.01
1,1,2-Trichloroethane	0.01
Cis-1,3-dichloropropene	0.01
2-Chloroethylvinylether	0.01
Bromoform	0.01
1,1,2,2-Tetrachloroethane	0.01
1,1,2,2-Tetrachloroethene	0.01
Chlorobenzene	0.01
1,2-Dichlorobenzene	0.01
1,3-Dichlorobenzene	0.01
1,4-Dichlorobenzene	0.01

The results are tabulated on the following page(s).

James R Baxter
James R. Baxter

Sim D Lessley
Sim D. Lessley, Ph.D.

UBTL
ANALYTICAL REPORT FORM

Date 1/10/84

UBTL Identification Number 467

Corporate/Agency Name Dames & Moore

Address 5055 E. BROADWAY, SUITE C214
TUCSON, AZ 85711

Attention Mr. Yogi Kunze Telephone 602 274-5548

Sampling Collection and Shipment

Sampling Site Nellis AFB Date of Collection

Date Samples Received at UBTL November 12, 1983

Analysis

Method of Analysis GC / Hall Detector - Halogen Mode

Date(s) of Analysis Dec 19 - 22 1983

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results ug/gram EPA 601
B1-S3	SA 4251	SOIL	all analytes less than LOD.
B1-S5	SA 4252		" " " " "
B1-S12	SA 4253		" " " " "
B1-S18	SA 4254		" " " " "
B2-S2	SA 4255		" " " " "
B2-S6	SA 4256		" " " " "
B2-S10	SA 4257		" " " " "
B3-S1	SA 4258		" " " " "
B3-S9	SA 4259		" " " " "
B4-S3	SA 4260		" " " " "
B4-S7	SA 4261		" " " " "
B4-S11	SA 4262		" " " " "

Comments

Analyst

Reviewer

Laboratory Supervisor

520 Wakara Way / Salt Lake City, Utah 84108 / 1-800-453-5653 ext. 8267

Page 2 of 2

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 sml

UBTL Identification Number 467

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results ug/gram EPA 601
B5-S5	SA 4263	SOIL	all analytes less than L.O.D.
B5-S10	SA 4264	│	" " " " "
B6-S4	SA 4265	│	" " " " "
B6-S9	SA 4266	│	" " " " "
B6-S14	SA 4267	│	" " " " "
B7-S1	SA 4268	│	" " " " "
B7-S5	SA 4269	│	" " " " "
B7-S10	SA 4270	│	" " " " "
B7-S15	SA 4271	│	" " " " "
B8-S3	SA 4272	│	" " " " "
B8-S8	SA 4273	│	" " " " "
B8-S13	SA 4274	│	" " " " "
B9-S2	SA 4275	│	" " " " "
B9-S7	SA 4276	│	" " " " "
B9-S12	SA 4277	│	" " " " "
B9-S17	SA 4278	√	" " " " "
limit of detection			0.01 ug/gram for each analyte

Comments

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~HRE/TA #~~: 467

Sequence #: SA 4251-4278

Analyte BROMOMETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		71			
4269	0		0.025		93			
75	0		0.025		93			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

~~IRE/TA #~~: 467

Analytical Laboratory

Quality Control Data Sheet

Sequence #: SA 4251-427

Analyte CHLOROMETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in μg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
[illegible]69	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

~~HHE/TA #~~: 467

Sequence #: SA 4251-4[illegible]7

Analytical Laboratory

Quality Control Data Sheet

Analyte VINYL CHLORIDE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in µg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10 ML

UTAH BIOMEDICAL TEST LABORATORY

~~IBE/TA #~~: 467

Sequence #: SA 4251-4276

Analytical Laboratory

Quality Control Data Sheet

Analyte DICHLORODIFLUOROMETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0		0	0	0	0	
4262	0	0		0	0	0	0	
4273	0	0		0	0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
_ ,75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10 ul

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~**IHE/TA #:**~~ 467

Sequence #: SA 4251-427

Analyte CHLOROETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		51			
69	0		0.025		88			
4275	0		0.025		78			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~WBE/TA #:~~ 467

Sequence #: SA 4251 - 4278

Analyte Methylene Chloride

Matrix Soil

Analyst Baxter

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in µg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY ~~HRE/TA #:~~ 467

Analytical Laboratory **Sequence #:** SA 4251-4 78

Quality Control Data Sheet

Analyte TRICHLOROFLUOROMETHANE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. O

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

[illegible] 1/10 ADL

UTAH BIOMEDICAL TEST LABORATORY

~~[illegible]/TA #~~: 467

Analytical Laboratory

Quality Control Data Sheet

Sequence #: SA 4251-4278

Analyte 1,1-DICHLOROETHENE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ~~ug~~/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		18			
4269	0		0.025		98			
4275	0		0.025		102			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

[illegible] 1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

~~IOE/TA #:~~ 467

Analytical Laboratory

Sequence #: SA 4251-4 7

Quality Control Data Sheet

Analyte 1,1-DICHLOROETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. O

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

~~HBE/TA #:~~ 467

Analytical Laboratory

Quality Control Data Sheet

Sequence #: SA 4251-427

Analyte TRANS-1,2-DICHLOROETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0		0		0	0	0	
4262	0		0		0	0	0	
4273	0		0		0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
[illegible]75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY ~~IHE/TA #~~: 467

Analytical Laboratory **Sequence #:** SA 4251-4278

Quality Control Data Sheet

Analyte CHLORO FORM **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in µg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		51			
4[illegible]9	0		0.025		107			
4275	0		0.025		92			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY

~~HHE/TA #~~: 467

Sequence #: SA 4251-4278

Analytical Laboratory

Quality Control Data Sheet

Analyte 1,2-DICHLOROETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. O

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

✓ ug/g 1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

~~IBE/TA #~~: 467

Analytical Laboratory

Sequence #: SA 4251-4.72

Quality Control Data Sheet

Analyte 1,1,1-TRICHLOROETHANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10 sol

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~**MHE/TA #**~~: 467

Sequence #: SA 4251-427

Analyte CARBON TETRACHLORIDE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		37			
" 69	0		0.025		100			
4275	0		0.025		128			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY ~~IDE/TA #:~~ 467

Analytical Laboratory **Sequence #:** SA 4251-4278

Quality Control Data Sheet

Analyte BROMODICHLOROMETHANE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~UBE/TA #~~: 467

Sequence #: SA 4251-4272

Analyte 1,2-DICHLOROPROPANE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY ~~IRE/TA #:~~ 467

Analytical Laboratory **Sequence #:** SA 4251-427

Quality Control Data Sheet

Analyte CIS-1,3-DICHLOROPROPENE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in μg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

~~[illegible]/TA #~~: 467

Sequence #: SA 4251-427

Analytical Laboratory

Quality Control Data Sheet

Analyte TRICHLOROETHENE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		~~0.010~~		0 ~~71~~			
4269	0		~~0.0250~~		0 ~~92~~			
4275	0		~~0.0250~~		0 ~~99~~			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

~~IBE/TA #:~~ 467

Sequence #: SA 4251-4278

Analyte TRANS-1,3-DICHLOROPROPENE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY ~~IBE/TA #:~~ 467

Analytical Laboratory **Sequence #:** SA 4251-427

Quality Control Data Sheet

Analyte 1,1,2-TRICHLOROETHENE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked	% Spike Recovered			Comment
4258	0		0.01	071			
4269	0		0.025	092			
,75	0		0.025	099			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY ~~UBE/TA #~~: 467

Analytical Laboratory **Sequence #:** SA 4251-472

Quality Control Data Sheet

Analyte DIBROMOCHLOROMETHANE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

LWR 1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY

~~IHE/TA #~~: 467

Analytical Laboratory

Sequence #: SA 4251 - 427

Quality Control Data Sheet

Analyte 2-CHLOROETHYLVINYL ETHER **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in µg/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
[illegible]75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10 ml

~~IOE/TA #:~~ 467

UTAH BIOMEDICAL TEST LABORATORY

Sequence #: SA 4251-4 7

Analytical Laboratory

Quality Control Data Sheet

Analyte BROMOFORM

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0		0		0	0	0	
4262	0		0		0	0	0	
4273	0		0		0	0	0	

<u>Spikes</u>

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		75			
4269	0		0.025		82			
4275	0		0.025		113			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

Lot 9 1/10 AAL

UTAH BIOMEDICAL TEST LABORATORY

~~HHE/TA #~~: 467

Analytical Laboratory

Sequence #: SA 4251-427

Quality Control Data Sheet

Analyte TETRACHLOROETHENE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0	0		0	0	0	
4262	0	0	0		0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY

~~HBE/TA #~~: 467

Analytical Laboratory

Sequence #: SA 4251-47.

Quality Control Data Sheet

Analyte 1,1,2,2-TETRACHLORUETHANE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in μg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
4275	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1 μg/g 1/10 [illegible]

UTAH BIOMEDICAL TEST LABORATORY ~~IHE/TA #~~: 467

Analytical Laboratory **Sequence #:** SA 4251-427

Quality Control Data Sheet

Analyte CHLOROBENZENE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. 0

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in µg/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4269	0		0.01		66			
4269	0		0.025		83			
4275	0		0.025		108			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM **Limit of Detection:** 0.01

Remarks:

1/9 1/10

UTAH BIOMEDICAL TEST LABORATORY

~~USE/TA #~~: 467

Analytical Laboratory

Sequence #: SA 4251-4-7

Quality Control Data Sheet

Analyte 1,2-DICHLOROBENENE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

[illegible]/g 1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

~~NDE/TA #:~~ 467

Analytical Laboratory

Sequence #: SA 4251-427

Quality Control Data Sheet

Analyte 1,3-DICHLOROBENZENE **Matrix** Soil

Analyst BAXTER **Instrument** Ch. O

Method EPA 601 (soils) **Date Analyzed** 12/19-22/83

Results in μg/gram

plicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0		0			
4269	0		0		0			
[illegible]75	0		0		0			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10

UTAH BIOMEDICAL TEST LABORATORY

~~IHE/TA #:~~ 467

Analytical Laboratory

Sequence #: SA 4251-4-7

Quality Control Data Sheet

Analyte 1,4-DICHLOROBENZENE

Matrix Soil

Analyst BAXTER

Instrument Ch. 0

Method EPA 601 (soils)

Date Analyzed 12/19-22/83

Results in ug/gram

licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4253	0	0			0	0	0	
4262	0	0			0	0	0	
4273	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4258	0		0.01		130			
4269	0		0.025		104			
75	0		0.025		118			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

VME 1/9 1/10 SAL

O/G soil

December 16, 1983

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

ANALYTICAL REPORT

SUBMITTED TO: Dames & Moore

SUBMITTED BY: Dave McGlochlin

REFERENCE DATA:

Analysis of: Oil & Grease in soil

Identification No.: 465

Sample(s): 28 Analyses: 28

UBTL Laboratory No.: SA 4195 through SA 4222

The above-numbered water samples were analyzed for Oil & Grease according to the methods published in "EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes."

The method number for Oil & Grease by IR Spectrophotometry is 413.2 according to the above reference. For these samples the Limit of Detection was .05 mg/g.

The results are tabulated on the following page(s).

Dave McGlochlin

Sim D. Lessley

Sim D. Lessley, Ph.D.

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MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 12/29/83 ML

UBTL Identification Number 465

Corporate/Agency Name Dames & Moore

Address 5055 E. BROADWAY, SUITE C214
TUCSON, AZ 85711

Attention Mr. Yogi Kunze Telephone 602 274-5548

Sampling Collection and Shipment

Sampling Site Nellis AFB Date of Collection

Date Samples Received at UBTL November 12, 1983

Analysis

Method of Analysis I.R. SPECTROPHOTOMETRIC

Date(s) of Analysis 12/10/83, 12/12/83, 12/13/83

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results
			OIL & GREASE mg/g
B1-S3	SA 4195	SOIL	<.05
B1-S5	SA 4196		<.05
B1-S12	SA 4197		<.05
B1-S18	SA 4198		<.05
B2-S2	SA 4199		<.05
B2-S6	SA 4200		<.05
B2-S10	SA 4201		<.05
B3-S1	SA 4202		<.05
B3-S9	SA 4203		<.05
B4-S3	SA 4204		<.0
B4-S7	SA 4205		<.05
B4-S11	SA 4206	↓	<.05

Comments

Analyst

Reviewer

A. Brent Jorgensen
Laboratory Supervisor

Page 2 of 2

UBTL

ANALYTICAL REPORT FORM

Date 12/29/83

UBTL Identification Number 465

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results OIL & GREASE mg/g
B5-S5	SA 4207	SOIL	<.05
B5-S10	SA 4208		<.05
B6-S4	SA 4209		<.05
B6-S9	SA 4210		<.05
B6-S14	SA 4211		<.05
B7-S1	SA 4212		<.05
B7-S5	SA 4213		<.05
B7-S10	SA 4214		<.05
B7-S15	SA 4215		<.05
B8-S3	SA 4216		<.05
B8-S8	SA 4217		<.05
B8-S13	SA 4218		<.05
B9-S2	SA 4219		<.05
B9-S7	SA 4220		<.05
B9-S12	SA 4221		<.05
B9-S17	SA 4222		<.05
		L.O.D.	.05 mg/g

Comments

UTAH BIOMEDICAL TEST LABORATORY

MHE/TA #:
Sequence #: 465

Analytical Laboratory
Quality Control Data Sheet

Analyte OIL & GREASE
Matrix SOIL
Analyst D.B.M.
Instrument BECKMAN 20A
Method SPECTROPHOTOMETRIC
Date Analyzed 12/14/83

Results in mg.

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
SA4203(b)	<.1		.51079		61			
SA4207(c)	<.1		.51079		67			
SA4213(a)	<.1		.51079		47			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment
Q.C. 16723	6.4319	6.4319		6.4319	0.0	0.0	12.0 mg/L	

Checked by: ____________

Limit of Detection: .1 mg

Remarks:

12/16

12/29

602
soil

UBTL
520 WAKARA WAY
SALT LAKE CITY,
UTAH 84108
801 581-8267

January 4, 1984

ANALYTICAL REPORT

SUBMITTED TO: Yogi Kunze

SUBMITTED BY: James R. Baxter

REFERENCE DATA:

Analysis of: Benzene, Toluene, Ethyl Benzene, Chlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene

Identification No.: 466

Sample(s): 28 Analyses: 196

UBTL Laboratory No.: SA-4223 through SA-4250,

The above numbered samples were analyzed using a modification of EPA Test Method 602 for Purgeable Aromatics. A 1 gram sample of soil was diluted with 5 mL of organic free water and purged with helium. Any analytes present were collected on a 10 inch trap consisting of Tenax. The trap was heated to 180°C and the analytes were desorbed onto a 6' x 1/8" stainless steel column packed with 5% SP-1200 and 1.75% Bentone-34. The gas chromatograph was operated with thermal programming, 50°C for 2 minutes, increasing at a rate of 4°C/minute to 110°C, and held there for 16 minutes. The analytes were selectively detected by a Photoionization detector equipped with a 10.2 eV ultraviolet lamp.

Samples SA-4226, 4233, and 4242 were analyzed in duplicate and samples SA-4225, 4241 and 4244 were analyzed neat and then reanalyzed with a spike consisting of benzene, toluene, ethyl benzene, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene. The results of the duplicate and spike analyses are on the QC sheets.

The limit of detection for each analyte was 0.01 µg/gram of soil.

The results are tabulated on the following page(s).

James R Baxter
James R. Baxter

Sim D. Lessley
Sim D. Lessley, Ph.D.

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MEDICINE
BIOENGINEERING
CHEMISTRY

RESEARCH
DEVELOPMENT
ANALYSIS

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 LDL

UBTL Identification Number 466

Corporate/Agency Name Dames & Moore

Address 5055 E. BROADWAY, SUITE C214
TUCSON, AZ 85711

Attention Mr. Yogi Kunze Telephone 602 274-5548

Sampling Collection and Shipment

Sampling Site Nellis AFB Date of Collection

Date Samples Received at UBTL November 12, 1983

Analysis

Method of Analysis GC / PID Detector

Date(s) of Analysis Dec 30 - Jan 5

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results ug/gram
			EPA 602
B1-S3	SA 4223	SOIL	all analytes less than 0.01
B1-S5	SA 4224		" " " " "
B1-S12	SA 4225		" " " " "
B1-S18	SA 4226		" " " " "
B2-S2	SA 4227		" " " " "
B2-S6	SA 4228		Benzene - 0.015
B2-S10	SA 4229		all analytes less than 0.01
B3-S1	SA 4230		" " " " "
B3-S9	SA 4231		" " " " "
B4-S3	SA 4232		" " " " "
B4-S7	SA 4233		" " " " "
B4-S11	SA 4234		" " " " "

Comments

James R. Barta
Analyst

Patrick R. Mey
Reviewer

Edward H Sandler
Laboratory Supervisor

Page 2 of 2

UBTL

ANALYTICAL REPORT FORM

Date 1/10/84 SAL

UBTL Identification Number 466

Analytical Results

Field Sample Number	UBTL Lab Number	Sample Type	Results mg/gram EPA 602
B5-S5	SA 4235	SOIL	all analytes less than 0.01
B5-S10	SA 4236		" " " "
B6-S4	SA 4237		" " " "
B6-S9	SA 4238		" " " " "
B6-S14	SA 4239		" " " " "
B7-S1	SA 4240		" " " " "
B7-S5	SA 4241		" " " " "
B7-S10	SA 4242		" " " "
B7-S15	SA 4243		" " " " "
B8-S3	SA 4244		" " " " "
B8-S8	SA 4245		" " " "
B8-S13	SA 4246		" " " " "
B9-S2	SA 4247		" " " " "
B9-S7	SA 4248		" " " "
B9-S12	SA 4249		" " " "
B9-S17	SA 4250	√	" " " " "
limit of detection			0.01 for each analyte

Comments

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 466

Sequence #: SA 4223-4250

Analyte BENZENE

Matrix SOIL

Analyst BAXTER

Instrument CH O

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4225	0		0.025		96.4			
241	0		0.025		158.			
4244	0		0.025		115.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/9

1/10

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 466

Sequence #: SA 4223-4250

Analyte TOLUENE

Matrix SOIL

Analyst BAXTER

Instrument CH O

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

Replicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked	% Spike Recovered			Comment
4225	0		0.025	86.0			
4241	0		0.025	127.			
4244	0		0.025	111.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/9

1/10 sal

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 466

Sequence #: SA 4223-4250

Analyte ETHYL BENZENE

Matrix SOIL

Analyst BAXTER

Instrument CH 0

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

I licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4225	0		0.025		86.4			
4241	0		0.025		130.			
44	0		0.025		114.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PAM

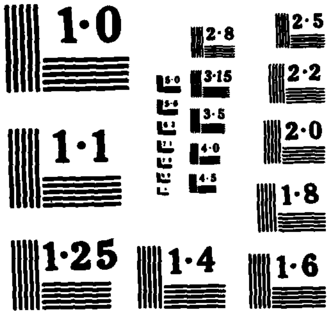
Limit of Detection: 0.01

Remarks:

1/10 ml

AD-A162 920   INSTALLATION RESTORATION PROGRAM PHASE II   5/5
CONFIRMATION/QUANTIFICATION STA..(U) DAMES AND MOORE
PARK RIDGE IL 09 AUG 85 F33615-83-D-4002
UNCLASSIFIED   F/G 13/2   NL

END
FILMED
DTIC



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 466

Sequence #: SA 4223-4250

Analyte CHLOROBENZENE

Matrix SOIL

Analyst BAXTER

Instrument CH O

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4225	0		0.025		80.8			
4241	0		0.025		112.			
. 44	0		0.025		109.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/10 dil

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

HHE/TA #: 466

Sequence #: SA 4223-4250

Analyte 1,4-DICHLOROBENZENE

Matrix SOIL

Analyst BAXTER

Instrument CH 0

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4225	0		0.025		72.4			
4241	0		0.025		152.			
4244	0		0.025		110.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

1/9

1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

NHE/TA #: 466

Sequence #: SA 4223-4250

Analyte 1,3-DICHLOROBENZENE

Matrix SOIL

Analyst BAXTER

Instrument CH 0

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

Duplicates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4225	0		0.025		75.2			
4241	0		0.025		132.			
4244	0		0.025		110.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

[illegible] 1/10 ml

UTAH BIOMEDICAL TEST LABORATORY

Analytical Laboratory

Quality Control Data Sheet

MHE/TA #: 466

Sequence #: SA 4223-4250

Analyte 1,2-DICHLOROBENZENE

Matrix SOIL

Analyst BAXTER

Instrument CH 0

Method EPA 602

Date Analyzed 12/31/83- 1/5/84

Results in ug/gram

licates/Splits

Sample #	No. 1	No. 2	No. 3	No. 4	Average	Range	Range/Ave	Comment
4226	0	0			0	0	0	
4233	0	0			0	0	0	
4242	0	0			0	0	0	

Spikes

Sample #	Initial Conc.		Conc. Spiked		% Spike Recovered			Comment
4225	0		0.025		77.6			
4241	0		0.025		141.			
44	0		0.025		111.			

In House Audits

QC Samp.	No. 1	No. 2		Average	Range	Range/Ave	Target	Comment

Checked by: PRM

Limit of Detection: 0.01

Remarks:

[illegible] 1/10 ml

APPENDIX E

REFERENCES

APPENDIX E

REFERENCES

1. CH_2M Hill, 1982, Installation Restoration Program Records Search for Air Force Engineering and Services Center Directorate of Environmental Planning Tyndall Air Force Base, Florida 32403, and Tactical Air Command Directorate of Engineering and Construction, Langley Air Force Base, Virginia 23665, April.

2. Federal Register, November 28, 1980, Water Quality Criteria Documents; Availability, p. 79318-79379.

3. Harrill, J. R., 1976, Pumping and Ground Water Storage Depletion in Las Vegas Valley, Nevada, 1955-74. State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources, Water Resources Bulletin No. 44, 70p.

4. Kaufmann, Robert F., 1976, Land and Water Use Effects on Ground Water Quality in Las Vegas Valley, Water Resources Center Project Report 47A, Desert Research, Institute, Las Vegas, Nevada, December.

5. Malmberg, G. T., 1965, Available Water Supply of the Las Vegas Ground-Water Basin, Nevada. U.S. Geological Survey, Water Supply Paper No. 1780.

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9. Theis, C. V., Brown, R. H. and Meyer, R. R., 1963, Estimating the Transmissivity of Aquifers from the Specific Capacity of Wells, U.S. Geological Survey Water Supply Paper 1536-I.

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11. USEPA, 1984, Telephone Conversation with Ila Cote, Toxicologist, Denver Water Supply Branch, February 14.

12. USEPA, 1979, Water-Related Environmental Fate of 129 Priority Pollutants, prepared by Versar, Incorporated, Springfield, Virginia, Report No. EPA 440/4-79-029a&b, 2 volumes, December.

13. USEPA, 1978, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

APPENDIX F

BIOGRAPHIES OF KEY PERSONNEL

Curriculum Vitae

KENNETH J. STIMPFL

Title

Partner

Expertise

Environmental Analysis
Impact Assessment
Site and Route Selection
Aquatic Ecology

Experience With Firm

Principal-in-Charge/Project Director

- Site selection and evaluation study for additions to existing fossil power plants, Michigan.
- Environmental assessment, permits and hearing for a new manufacturing plant in Michigan.
- Environmental baseline studies for a fossil-fueled power plant, Michigan.
- Environmental and geohydrological assessment of inactive industrial waste site, Michigan.
- Geohydrological assessment of chemically contaminated site, Michigan.
- Environmental assessment and defense in litigation for oil well development, Michigan.
- Environmental and engineering evaluation of manufacturing plant sites in Iowa, Indiana, Missouri, Michigan, Wisconsin, and Ontario.
- Ecological assessment of potential chemical contamination in the Menominee River, Wisconsin.
- Environmental assessment, preliminary containment design, and negotiation of consent judgment with state and federal agencies for a contaminated chemical plant site, Michigan.
- Site selection study for a new fossil or nuclear power plant, Michigan.
- Preparation of a regulatory compliance plan for a proposed synfuels project, Illinois.
- Radiation survey, assessment, decontamination and health physics monitoring for NRC release of contaminated plant site, Michigan.
- Wetland assessment, development of alternative layouts and agency negotiations regarding a denied 404 permit for a dock in Wisconsin.
- Assessment of environmental enhancement potential through selective dredging of the Little Calumet River for the Chicago District, Corps of Engineers.
- Assessment of potential economic impacts from a proposed regulation to ban landfill disposal of chlorinated solvents for the Illinois Department of Energy and Natural Resources.
- Assessment of aquatic impacts and effects on low-level hydroelectric potential for a variety of proposed dam modifications on the Fox River for the Chicago District, Corps of Engineers.

Project Manager

- Aquatic ecology baseline study and impact assessment for nuclear power plant in Wisconsin, Wisconsin Electric Power Company.

- Environmental baseline studies and impact assessment for copper/zinc mine in Wisconsin, Exxon Minerals Company.
- Power plant site selection study.

Past Experience

Sargent & Lundy Engineers, Chicago, Illinois

- Power plant site selection and evaluation studies in Illinois, Iowa Wisconsin, Indiana, and Oklahoma.
- Ecological baseline studies and impact assessments for thirteen fossil and nuclear power plants.
- Impact assessment, route selection and evaluation of alternative designs for transmission line in West Virginia.
- Evaluation of alternate cooling systems for nuclear power plant.

Faculty Appointment, Indiana University

Assistant Professor of Zoology, Colorado State University

Academic Background

B.S., zoology, Northern Illinois University
M.S., zoology, Colorado State University
Ph.D., limnology, Indiana University

Professional Affiliations

Ecological Society of America; American Society of Limnology and Oceanography; Freshwater Biological Association; Societas Internationalis Limnologiae; Illinois Association of Environmental Professionals; Consulting Engineers Council of Illinois

Registration

Certified senior ecologist (Ecological Society of America)

Publications

Numerous technical reports, environmental assessments and environmental reports

◆ ◆ ◆

Curriculum Vitae

GEORGE W. CONDRAT

Title	Senior Engineer
Expertise	Ground Water Hydrology Engineering Geology Mining Engineering
Experience With Firm	Project Manager/Principal Investigator • Ground water contamination evaluations including detailed site investigations, baseline and operational monitoring, predictive modelling and control measures. • Numerical modelling of ground water flow and chemical contaminant transport from liquid and solid waste disposal sites. • Preparation of computer programs for management of ground water and geologic data including storage and retrieval, statistical evaluation, plotting and contouring. • Principal investigator for report of state-of-the-art of uranium tailings disposal. • Preparation of environmental impact assessments. • Principal investigator for ground water portion of preliminary safety analysis report for proposed nuclear power plant in Maryland. • Studies of deep shaft dewatering requirements for uranium mines. • Siting, design and preparation of environmental assessments for mining, milling, tailings disposal, deep well injection, and heap and in-situ leaching projects in Wyoming, Colorado, Utah, and New Mexico. • Site selection, investigation and design of earth and tailings dams. • Engineering geology, soils and geologic hazards investigations. • Regional and site specific geologic, seismologic and tectonic studies for dams, power plants and other critical facilities.
Past Experience	Senior Officer, Sverdrup & Parcel Officer, U.S. Army Corps of Engineers in the United States and Vietnam Assistant Geologist, Guggenheim Exploration Company
Academic Background	Professional Degree of Geological Engineer, Colorado School of Mines B.S., mining engineering, University of Utah M.S. candidate, mining engineering, University of Utah
Professional Affiliations	Association of Engineering Geologists; Society of Mining Engineers of AIME; National Water Well Association; Utah Geological Association
Registration	Professional engineer, Utah, Colorado and Wyoming

Publications Coauthor, "Ground Water Contamination and Tailings Ponds" and "Depressurization of a Multilayered Artesian System for Water and Grout Control During Mine Shaft Development"

◆ ◆ ◆

Curriculum Vitae

LUTZ "YOGI" KUNZE

Title Associate

Expertise

Geotechnical/Civil Engineering
Tailings and Earth Dam Design
Soil and Foundation Engineering

Experience With Firm

Managing Principal-In-Charge, Tucson Office

- Responsible for marketing and performance of geotechnical projects.

Principal-in-Charge, Lexington Office

- Responsible for marketing and performance of geotechnical projects.

Senior Engineer, Chicago Office

- Management of large-scale multidiscipline projects both in the United States and overseas, including the University of Riyadh, Saudi Arabia project and the Semen Padang Cement Plant Expansion in Sumatra, Indonesia.

Project Engineer, Chicago Office

- Foundation investigations for U.S. Steel's Minntac mining facilities.
- Soil and foundation investigations for high rise buildings, industrial plants and power plants.

Staff Engineer, Los Angeles Office

- Soils and foundation investigations for numerous residential and office buildings, refineries and industrial plants.
- Foundation investigation for offshore oil drilling platforms in Santa Barbara Channel.
- Field explorations for various elements of Disney World near Orlando, Florida.

Past Experience

Manager of Geotechnical Engineering

- Responsible for the management and execution of design studies for tailings dams, waste dumps and sedimentation facilities in the Philippines, Dominican Republic, Mexico, and the United States.

Principal Engineer

- Management and direction of complex geotechnical projects, including nuclear power plant siting studies, tailings dams in Missouri, dam safety inspections for U.S. Army Corps of Engineers.

Academic Background	M.S.E., Civil Engineering, Arizona State University, 1973 B.S.E., Civil Engineering, University of Connecticut, 1966 Short Course, Embankment Dams, University of Missouri, 1974
Professional Affiliations	American Society of Civil Engineers, National Society of Professionel Engineers, Arizona Society of Professional Engineers, Society of Mining Engineers of AIME, U.S. National Society of the I.S.S.M.&F.E.
Registration	Professional Engineer: Arizona, California, Illinois, Kentucky, Maine, Missouri, Ohio, Tennessee, Virginia, Washington, Nevada.
Publications	Coauthor, "Waste Disposal - Planning and Environmental Protection Aspects" to be published in the 1983 AIME Mudd Series Book on Surface Mining.

Curriculum Vitae

STEVEN B. JOHNSON

Title Staff Hydrologist

Expertise Ground Water Hydrology

Experience With Firm As an assistant and staff hydrologist, STEVEN B. JOHNSON has been responsible for the organization and analysis of ground and surface water data. As a principal investigator, he has conducted ground water contamination studies and operated in situ permeability apparatus. In addition, Mr. Johnson has contributed to the hydrologic analyses of siting, baseline, environmental, and final safety analysis reports for several large utilities. Some of his more pertinent experience is as follows:

- Hydrogeological investigation of industrial site, West Virginia.
- Ground water contamination study of industrial site, Michigan.
- In situ permeability study, Missouri.
- Fossil fuel power plant siting study, Wisconsin.
- Deep well sampling project, Wisconsin.
- Baseline ground water and surface water study for fossil fuel plant, Michigan.
- Baseline ground water study for nickel-zinc mine, Wisconsin.
- Nuclear final safety analysis report, ground water section, Kansas.
- Nuclear environmental report, ground water section, Kansas.
- Nuclear preliminary safety analysis report, geology section, Illinois.
- Ground water contamination study of industrial site, Ohio.
- Underground natural gas storage study, Illinois.
- Preparation of RCRA and Arizona hazardous waste permits.
- Site selection for fossil fuel power plant wastes, Wisconsin.
- Installation of ground water monitoring system for uranium tailings pond, Wyoming.
- Investigation of nitrate contamination of ground water, Oklahoma.
- Ground water investigation and RCRA compliance at refinery, New Mexico and Utah.
- Investigation of gasoline spill at service station, Utah.
- Investigation of seepage from fertilizer tailings pond, Utah.
- Conducted pumping tests at a proposed landfill site, Utah.

Academic Background	1975, B.A., Geology, Macalester College, St. Paul, Minnesota. 1977, M.S., Geology, Arizona State University, Tempe, Arizona. M.S. Thesis Topic: Delayed Yield in Unconfined Aquifers.

Curriculum Vitae

WILLIAM R. HIGHLAND

Title	Project Engineer
Expertise	Ground Water Hydrology Solid Waste Disposal

Experience With Firm

Project Manager/Principal Investigator

- Detailed seepage investigations for subgrade disposal of uranium mill wastes. Studies include mass transport modelling, detailed field and geochemical investigations and evaluation of synthetic and natural lining materials, Wyoming, New Mexico.
- State-of-the-art evaluation of ground water monitoring and liners for management of uranium mill wastes, for an international corporation.
- Investigation of ground water contamination and design of a cut-off/collector system for a major oil refinery, North Dakota.
- Mathematical modelling of ground water-surface water interactions for a proposed open-pit uranium mining reclamation plan, Wyoming.
- Preliminary design of evaporation ponds and evaluation of seepage control methods for tailings disposal alternatives, uranium mill waste, Colorado.

Past Experience

Hydrogeologist, Barr Engineering Company

- Design and evaluation of seepage control systems for mine waste disposal, water retention dams and fly ash disposal, Minnesota, Missouri. These projects included detailed investigations of the physical and chemical suitability of synthetic liners for seepage control.
- Application and development of analytical and finite difference models for dewatering, seepage through dams, and water well supply.
- Design of monitoring systems for evaluation of ground water contamination from sanitary landfills, mine waste disposal, fly ash disposal and a coal tar refining plant, Minnesota.

Academic Background

B.S., geology, University of Illinois
M.S., hydrogeology, University of Minnesota
Course work toward Ph.D., emphasis on mass transport in ground water, University of Illinois

Professional Affiliations

American Society of Civil Engineers; National Water Well Association; Utah Geological Association

Registration

Civil engineer, Minnesota

◆ ◆ ◆

Curriculum Vitae

JOHN G. DUDLEY

TITLE Hydrogeologist

EXPERTISE Ground Water and Vadose Zone Monitoring
Contaminant Transport

EXPERIENCE WITH FIRM

- Hydrogeologic investigation to characterize vadose zone contamination beneath crude oil separation sumps. Design of subsurface soil and water sampling and laboratory testing programs.
- Subsurface investigation of water quality impacts, and contaminant migration from waste disposal facilities at a major defense installation.

PAST EXPERIENCE

Senior Hydrologist, HDR Sciences, Santa Barbara, CA

- Investigation of hydrologic impacts resulting from planned deployment of a major military defense system in large areas of Nevada and Utah.
- Investigation of surface water and ground water impacts resulting from planned stream diversions in small watersheds in Southern California.
- Assessment of hydrologic and water resources impacts associated with construction of oil and gas processing facilities and pipelines in California.

Geohydrologist, State of New Mexico, Santa Fe, New Mexico

- Design and implementation of large surface water/ground water investigation to evaluate water quality impacts attributable to uranium industry activities.
- Preparation and presentation of technical testimony at numerous public hearings held by Water Quality Control Commission to promulgate water quality regulations, or to evaluate the compliance of specific industrial and mining industry waste disposal plans.
- Numerous subsurface investigations to assess baseline hydrogeologic conditions, contaminant migration, ground water pollution, and remedial measures at industrial, hazardous waste and nuclear waste disposal sites.

ACADEMIC BACKGROUND

B.A., Geology, University of Wisconsin, Madison, 1969.

M.S., Water Resources Management, University of Wisconsin, Madison, 1972.

M.S., Geology, University of Wisconsin, Madison, 1973.

MEMBERSHIP

Ground-water Technology Division, National Water Well Association.

Curriculum Vitae

HON-WOO T. (Thomas) LEE

Title Staff Engineer

Expertise
Geotechnical/Civil Engineering
Mine Tailings Disposal
Earth/Rock Dam Design

Experience with Firm
Staff Engineer

- Design studies, stability analyses, and seepage analyses for several tailings dams, flood control levees, and earth dams in Arizona, California, and New Mexico.
- Engineering design for drilled caissons for highway bridge in Arizona.
- Remedial design for highway embankments in Arizona includes stability analyses, evaluation and design of internal reinforced earth structures such as Reinforced Earth, Welded Wire Wall, Tensar, and Cribwall.
- Conceptual design and cost estimate for on-site stabilization of inactive uranium tailings piles in Colorado.
- Site planning, pavement design and design drawing for waste management facility in Ohio.
- Stability analyses, seepage analyses, construction cost estimates, design drawings, and construction monitoring for an earthen dam and water supply reservoir in Arizona.
- Feasibility study, site selection, and cost estimate for mine leaching operation in New Mexico.
- Site investigation and sampling of hazardous waste contaminant for contamination studies in Arizona and Nevada.
- Supervision of field explorations including drilling and sampling of subsurface soils, installation of piezometer and in situ testing.
- Blast vibration monitoring.
- Construction inspection for earth dams, synthetic lining materials, earthfills and installation of caissons.

Past Experience
Geotechnical Engineer

- Construction inspection on various foundations and earthworks for natural gas and oil refinery plants in Texas and Saudi Arabia.
- Standard Laboratory Soil Testings.

Academic Background	B.S. and M.S. in civil engineering (B.S. with honor), Texas A&M University, College Station, Texas, 1978 and 1980, respectively. U.S.G.S.-sponsored research on development of methods to prevent blow-out in off-shore drilling.
Professional Affiliations	American Society of Civil Engineers; Tau Beta Pi; Chi Epsilon
Professional Registration	Civil Engineer, Arizona, 1983
Countries Worked In	United States, Saudi Arabia
Language Proficiency	Chinese

APPENDIX G

DAMES & MOORE HEALTH AND SAFETY PLAN

DAMES & MOORE
HEALTH AND SAFETY PLAN

Job Number: 01016-185-07 and 01016-179-22
Project Name and Site Location: Nellis Air Force Base, Nevada
Project Manager: Lutz Kunze
On-Site Safety Officer:
Plan Preparer: Michael W. Ander
Plan Reviewer: Kim Petschek
Date of Preparation: October 12, 1983

Plan Approvals:

Kim Petschek 10/24/83
Kim Petschek (date)
Program Director-Industrial Hygiene and Safety

for Perry W Fisher 10/12/83
A. Peter Campbell, MPIC (date)

Lutz Kunze 10/16/83
Lutz Kunze, Project Manager (date)

I. PURPOSE

The purpose of this Plan is to assign responsibilities, establish personnel protection standards, specify mandatory operating procedures, and provide for contingencies that may arise while operations are being conducted at the site.

II. APPLICABILITY

The provisions of the Plan are mandatory for all on-site Dames & Moore employees and subcontractors engaged in hazardous material management activities including but not limited to initial site reconnaissance, preliminary field investigations, mobilization, project operations, and demobilization.

III. RESPONSIBILITIES

A. Project Manager

The PM shall direct on-site investigation and operational efforts. At the site, the PM, assisted by the on-site Safety Officer, has the primary responsibility for:

1. Assuring that appropriate personnel protective equipment is available and properly utilized by all on-site personnel.

2. Assuring that personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and in planned procedures for dealing with emergencies.

3. Assuring that personnel are aware of the potential hazards associated with site operations (see Tables 1 and 2).

4. Monitoring the safety performance of all personnel to ensure that the required work practices are employed.

5. Correcting any work practices or conditions that may result in injury or exposure to hazardous substances.

6. Preparing any accident/incident reports (see attached Accident Report Form).

7. Assuring the completion of Plan Acceptance and Feedback forms attached herein.

B. Project Personnel

Project personnel involved in on-site investigations and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.

2. Implementing Project Health and Safety Plans, and reporting to the PM for action any deviations from the anticipated conditions described in the Plan.

3. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the PM.

IV. BACKGROUND

Based on preliminary site evaluations of the Nellis Air Force Base, there appear to be five (5) areas that may have generated some environmental contamination over the lifetime of the facility. Although suspected contaminants have been identified, none has been quantified. However, we anticipate that only relatively low levels of contaminants will be encountered in the proposed drilling and soil and water sampling.

Site No. 1, Main Base Landfill, has accepted solid waste since 1942. These wastes may have included paint, thinners, solvents such as methyl ethyl ketone (MEK) and trichloroethylene (TCE), and waste petroleum, oils, and lubricants (POL).

Site No. 17, STP Percolation Ponds, was operated from 1952 to 1972. Although some hazardous materials may have passed through this system, it appears that, except for heavy metals, there is little concern for field personnel to encounter hazardous materials.

Site No. 24, Fuel Tank Sludge Area, was used at various times from 1942 through 1976 for STP sludge and leaded fuel storage tank cleaning residue. Hazardous materials that may be encountered here include heavy metals and fuel residue.

Site No. 15, Storm Drain Gully, apparently has received unauthorized waste fuel and hydraulic fluid. The storm drain also carried shop wastes including paint strippers, solvents, and carbon removers.

Site No. 20, Existing Fire Training Area, has received as much as 10,000 gallons per month of waste POL since the early 1950s and prior to 1972. This was reduced to 300 gallons per month after 1972. Since the area is landfarmed, biological decomposition has significantly reduced potential contamination. Heavy metals may be the primary contaminants of concern.

A. Dames & Moore Activity

Dames & Moore will drill soil borings at Sites 15 and 20 and collect soil samples. Monitoring wells will be installed at Sites 1, 17, and 24 and water samples will be collected.

B. Suspected Hazards

Suspected hazards are presented above in as much detail as is currently available.

V. EMERGENCY CONTACTS AND PROCEDURES

Should any situation or unplanned occurrence require outside or support services, the appropriate contact from the following list should be made:

Agency	Person to Contact		Telephone
D&M Project Manager	L. Kunze	(office) (home)	602-790-5813 602-299-5876
D&M Industrial Hygiene and Safety Director	K. Petschek	(office) (home)	914-761-6323 212-724-6414
Police			2311
Fire			117
Ambulance			2333
Hospital			2498/2343
Command Post			2446

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on scene.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

a. In the event that any member of the field crew experiences any adverse effects or symptoms of exposure while on scene, the entire field crew should immediately halt work and act according to the instructions provided by the Project Manager.

b. The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation of the field team and reevaluation of the hazard and the level of protection required.

c. In the event that an accident occurs, the PM is to complete an Accident Report Form for submittal to the MPIC of the office, with a copy to the Health and Safety Program Office. The MPIC should assure that followup action is taken to correct the situation that caused the accident.

VI. HAZARD CHARACTERISTICS, MONITORING METHODS, AND PROTECTION REQUIRED

Exposure Limits and Recognition Qualities

Information concerning exposure limits and recognition qualities of the contaminants that are suspected to be on site is presented in Table 1.

Symptoms of Overexposure, Potential Chronic Effects and First Aid Treatment

Symptoms of overexposure to the suspected contaminants, potential chronic effects of these substances, and first aid treatment information are presented in Table 2.

Monitoring Methods, Action Levels and Protective Measures

Methods for monitoring for suspected contaminants, action levels, and protective measures to be used for various contaminant concentration levels are presented in Table 3.

Protective Equipment Required for On-Site Activities

The protective equipment required may vary, depending on the concentrations and dispersion of contaminants encountered during each phase of the work. Table 4 specifies protective equipment required for each on-site activity.

FORM #IHST-1

REVIEW RECEIPT

PROJECT HEALTH AND SAFETY PLAN

Instructions: This form is to be completed by each person to work on the site and returned to the Program Director-Industrial Hygiene and Safety.

Job No. 01016-185-07

Project: Nellis Air Force Base, Nevada

Rev. No. 0 Date 10/12/83

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

Signed

10-16-83

Date

TABLE 1

EXPOSURE LIMITS AND RECOGNITION QUALITIES

Compound	Exposure Standard[a]	IDLH[b] Level	Recognition Qualities		
			Color	Odor	State
MEK	200 ppm	3000 ppm	Colorless	Quality: sweet, sharp Hedonic tone: neutral to unpleasant	Liquid
TCE	50 ppm	1000 ppm	Colorless	Soft, solventy, etheral, chloroform-like	Gas

[a] OSHA permissible exposure limit or ACGIH Threshold Limit Value.

[b] IDLH = immediately dangerous to life or health.

TABLE 2

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS AND FIRST AID TREATMENT

Compound	Symptoms of Overexposure			Potential Chronic Effects
	Eye	Skin	Inhalation/Ingestion	
MEK	Irritation	Irritation, dermatitis	Numbness of fingers and arms, nausea, headache, throat irritation, vomiting, dizziness, loss of coordination.	None specified as yet.
TCE	Irritation	Irritation	Drowsiness, dizziness, tremor, loss of coordination, mental confusion, vomiting, abdominal cramps.	Suspected carcinogen, liver and kidney damage, cardiac arrhythmias.

General First Aid Treatment

Eye	Irrigate immediately
Skin	Soap wash promptly
Inhalation	Move to fresh air
Ingestion	Get medical attention

TABLE 3

HAZARD MONITORING METHOD, ACTION LEVELS, AND PROTECTIVE MEASURES

Hazard	Monitoring Method	Action Level	Protective Measures
Explosive atmosphere	Explosimeter or combustible gas meter	<10% LEL*	Continue working.
		10 - 25% LEL	Continue working with continuous monitoring.
		>25% LEL	EVACUATE the area; EXPLOSION HAZARD.
Toxic atmosphere	HNU continuous recorder	Depends on species for which the HNU is calibrated.	See Table 1 for exposure standards.

*Lower Explosive Limit (LEL) for MEK = 1.8%; for TCE = 12.5%.

TABLE 4

PROTECTIVE EQUIPMENT

Level	Protective Equipment	Criteria for Use
C	Half-face respirator with air-purifying cartridges for gas/dusts, organic vapors/dusts and mists Disposable coveralls Rubber boots Hard hat with splash shield or safety glasses/goggles Nitrile gloves	When drilling or sampling where dusts become airborne, when organic odors are noticeable, or when the HNU reads 5 or more units.
D	Rubber boots Disposable coveralls (optional) Nitrile gloves Safety glasses or goggles Hard hat	During sampling activities other than those mentioned above

ATTACHMENT 1

PROTECTIVE EQUIPMENT

I. INTRODUCTION

When field investigation activities are conducted where atmospheric contamination is known or suspected to exist, where there is a potential for the generation of vapors or gases, or where direct contact with toxic substances may occur, equipment to protect personnel must be worn. Respirators are used to protect against inhalation and ingestion of atmospheric contaminants. Protective clothing is worn to protect against contact with and possible absorption of chemicals through the skin. In addition to protective clothing and respiratory protection, safe work practices must be followed. Good personal hygiene practice prevents ingestion of toxic materials.

Personnel equipment to be used has been divided into two categories commensurate with the degree of protection required, namely Levels C and D protection.

II. LEVELS OF PROTECTION

A. Level C

1. Personal Protective Equipment

- o Air-purifying respirator (MSHA/NIOSH approved)
- o Disposable chemical resistant coveralls
- o Gloves, outer, working gloves
- o Gloves, inner, chemical resistant
- o Boots, steel toe and shank
- o Hard hat (face shield)
- o Rubber boots, outer, chemical resistant (disposable)

2. Criteria for Selection

a. Air concentrations of identified substances are such that reduction to at or below the substance's exposure limit is necessary and the concentration is within the service limit of the cartridge.

b. Atmospheric contaminant concentrations do not exceed the Immediately Dangerous to Life or Health (IDHL) levels.

c. Contaminant exposure to unprotected areas (head and neck) are within skin exposure guidelines, or dermal hazards do not exist.

d. Job functions have been determined not to require a higher level of protection.

B. Level D

1. Personal Protective Equipment

- Coveralls
- Boots/shoes, safety or chemical resistant, steel toe and shank
- Boots, outer (chemical resistant disposables)
- Hard hat (face shield)
- Gloves

2. Criteria for Selection

a. No indication of any atmospheric hazards.

b. Work function precludes dusting, splashes, immersion, or potential for exposure to any chemicals.

3. Guidance on Selection Criteria

a. Level D protection is primarily a work uniform and should not be worn in any area where the potential for contamination exists.

b. In situations where respiratory protection is not necessary, but site activities are needed, chemical resistant garments — high quality or disposable — must be worn.

III. RESPIRATORY PROTECTION

The following procedures should be used for respiratory protection:

A. Inspect all washers, diaphragms, and facepiece-to-face seal area for any tears, pinholes, deformation, or brittleness. Should any of these exist, use a different respirator.

B. Place the respirator on the face, tighten and use both a positive and a negative pressure test, prior to entering the site, to assure a proper fit. Checking for proper fit involves the following:

1. Negative Pressure Test

Close off the inlet opening of the cartridge or the breathing tube by covering it with the palm of the hand or by replacing the tap seal. Gently inhale so that the facepiece collapses slightly, and hold the breath for 10 seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is satisfactory.

2. Positive Pressure Test

Remove the exhalation valve cover. Close off the exhalation valve with the palm of the hand. Exhale gently so that a slight positive pressure is built up in the facepiece. If no outward leakage of air is detected at the periphery of the facepiece, the face fit is satisfactory. (Note: With certain devices, removal of the exhaust valve cover is very difficult, making the test almost impossible to perform.)

ATTACHMENT 2

DAMES & MOORE STANDARD OPERATING PROCEDURES

WORK PRACTICES

1. Smoking, eating, drinking and chewing tobacco are prohibited in the contaminated or potentially contaminated area.
2. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surface (i.e., ground, etc.).
3. All field crew members should make use of their senses (<u>all senses</u>) to alert them to potentially dangerous situations (i.e., presence of strong and irritating or nauseating odors).
4. Prevent, to the extent possible, spillages. In the event that a spillage occurs, contain liquid if possible.
5. Prevent splashing of the contaminated materials.
6. Field crew members shall be familiar with the physical characteristics of investigations, including:
    - wind direction
    - accessibility to associates, equipment, vehicles
    - communication
    - hot zone (areas of known or suspected contamination)
    - site access
    - nearest water sources
7. The number of personnel and equipment in the contaminated area should be minimized consistent with site operations.
8. All wastes generated during D&M and/or subcontractor activities on site should be disposed of as directed by the Field Activity Leader.

Half-face Respirators

Inspection Procedure

1. Look for breaks or tears in the headband material. Also stretch to check the elasticity.

2. Make sure all headbands, fasteners and adjusters are in place and not bent.

3. Check the facepiece for dirt, cracks, tears or holes. The rubber should be flexible not stiff.

4. Look at the shape of the facepiece for possible distortion that may occur if the respirator is not protected during storage.

5. Check the exhalation valve located near the chin between the cartridges by the following:.
   - unsnap the cover
   - lift the valve and inspect the seat and valve for cracks, tears, dirt and distortion.
   - replace the cover, it should spin freely.

6. Check both inhalation valves (inside the cartridges holders). Look for same signs as above.

7. Check the yoke for cracks.

8. Make sure the cartridge holders are clean. Make sure the gaskets are in place and the threads are not worn. Also look for cracks and other damage.

9. Check the cartridges for dents or other damage, especially in the threaded part.

Donning Procedure

1. Screw the cartridge into the holder hand tight so there is a good seal with the gasket in the bottom of the holder...but don't force it. If the cartridge won't go in easily back it out and try again.

   Always use cartridges made by the same manufacturer who made the respirator.

2. Place the facepiece over the bridge of your nose and swing the bottom in so that it rests against your chin.

3. Hold the respirator in place and fasten the top strap over the crown of your head.

4. Fit the respirator on your face and fasten the strap around your neck. Don't twist the straps. Use the metal slide to tighten or loosen the fit...but not too tight.

5. Test the fit by:

   - lightly covering the exhalation valve with the palm of your hand. Exhale...if there is a leak, you will feel the air on your face.

   and

   - covering the cartridges with the palms of your hands. Again don't press too hard. Inhale...the face piece should collapse against your face.

   - If there is a leak with either test adjust the headbands or reposition the facepiece and test until no leakage is detected.

Sanitizing Procedures

1. Remove all cartridges plus or seals not affixed to their seats.

2. Remove elastic headbands.

3. Remove exhalation cover.

4. Remove speaking diaphragm or speaking diaphragm-exhalation valve assembly.

5. Remove inhalation valves.

6. Wash facepiece and breathing tube in cleaner/sanitizer powder mixed with warm water, preferably at 120° to 140° F. Wash components separately from the facemask, as necessary. Remove heavy soil from surfaces with a hand brush.

7. Remove all parts from the wash water and rinse twice in clean warm water.

8. Air dry parts in a designated clean area.

9. Wipe facepieces, valves, and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

Environmental Samples

Environmental samples must be packaged and shipped according to the following procedure:

Packaging

1. Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag.
2. Place sample in a fiberboard container or metal picnic cooler which has been lined with a large polyethylene bag.
3. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.
4. Seal large bag.
5. Seal or close outside container.

Environmental samples may also be packaged following the procedures outlined later for samples classified as "flammable liquids" or "flammable solids". Requirements for marking, labeling, and shipping papers do not apply.

Marking/Labeling

Sample containers must have a completed sample identification tag and the outside container must be marked "Environmental Sample". The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No DOT marking and labeling is required.

Shipping Papers

No DOT shipping papers are required.

Transportation

There are no DOT restrictions on mode of transportation.

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (include area code)

NAME OF INJURED OR ILL EMPLOYEE

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT

NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check One)

FATAL	LOST WORK DAY WITH DAYS AWAY FROM WORK	LOST WORK DAY WITH DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY	FIRST AID ONLY
☐	☐	☐	☐	☐

CORRECTIVE ACTION TAKEN BY REPORTING UNIT

CORRECTIVE ACTION WHICH REMAINS TO BE TAKEN (By whom and by when)

NAME OF SUPERVISOR	TITLE
SIGNATURE	DATE

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for future revisions:

PLEASE RETURN TO THE FIRMWIDE HEALTH AND SAFETY OFFICE-WP

APPENDIX H

SCOPE OF WORK

INSTALLATION RESTORATION PROGRAM
PHASE IIB FIELD EVALUATION
NELLIS AFB, NEVADA

I. DESCRIPTION OF WORK

The purposes of this task are to determine if environmental contamination has resulted from waste disposal practices at Nellis AFB, Nevada; to provide estimates of the magnitude and extent of contamination, should contamination be found; to identify potential environmental consequences of migrating pollutants; and to identify any additional investigations and their attendant costs necessary to identify the magnitude, extent, and direction of movement of discovered contaminants.

The presurvey report (IRP Phase IIA survey report) (mailed under separate cover) and Phase I IRP report (mailed under separate cover) incorporated background and description of the sites for this task. To accomplish the survey effort, the contractor shall take the following steps. (Ambient air monitoring of hazardous and/or toxic material for the protection of contractor and Air Force personnel shall be accomplished when necessary, especially during the drilling operations.)

A. General

1. Water sampling shall be accomplished only once at each location.

2. Sampling, maximum holding time, and preservation of samples shall strictly comply with the following references: (a) Examination of Water and Wastewater, 15th Ed., pp. 35-42 (1980); (b) ASTM, Part 31, pp. 72-82, Method D-3370 (1976); and (c) Methods for Chemical Analysis of Waters and Wastes, USEPA Manual 600/4-79-020, pp. xiii-xix (1979).

3. Ground water monitoring wells installed during this effort shall be completed to a depth of 20 feet below the surface of the ground water table. Inspection of drill cuttings for soil characteristics shall be accomplished as the wells are installed.

4. All wells shall be developed, water levels measured, and locations recorded on a project map and specific zone map. Ground water monitoring wells shall, as a minimum, comply with USEPA Publication 330/9-81-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazardous Waste Sites, or State of Nevada requirements for monitoring well installation, whichever is more stringent. Only screw-type joints shall be used. No glue fittings are permitted.

5. Boreholes shall be monitored for organic vapors with an HNU and explosimeter throughout drilling, and readings thus obtained shall become part of the boring logs.

B. In addition to items delineated above, conduct the following specific actions at sites identified on Nellis AFB.

1. Zone No. 1 (Sites 1, 17, and 24 - the Base Landfill, STP Percolation Ponds, and Fuel Tank Storage Area)

   a. The contractor shall construct three new water table monitor wells in such a manner as to locate a contaminant plume, if any. All wells shall be downgradient of the site and generally located as follows: one well downgradient to the southwest of the area near the southern base boundary; one well downgradient due south of the area along the southern base boundary; and one well downgradient southeast of the area along the southeastern base boundary. Estimated maximum well depths are 175 feet.

   b. Each monitoring well shall be sampled. Samples shall be shipped to the contractor laboratory for analysis. Each sample shall be analyzed for oil and grease (by USEPA Method 413.2), lead, phenol, pesticides, nitrates, and (using GC techniques) volatile aromatics and volatile halocarbons.

   c. Three base production wells — one north, one northeast, and one southwest of the golf course — and the USGS monitoring well shall be sampled and analyzed for oil and grease (by USEPA Method 413.2), lead, phenol, pesticides, nitrates, and (using GC techniques) volatile aromatics and volatile halocarbons.

2. Zone No. 2 (Site 15 - Storm Drain Gully)

   a. The contractor shall install five soil borings 20 feet deep in the area where the site is believed to be located. Representative samples of each 1-foot increment (a total of 20) shall be collected from each boring and shipped to the contractor laboratory. A maximum of four samples from each boring shall be selected for analysis. A maximum of 16 samples total shall be analyzed from this zone. Those samples not analyzed shall be frozen for possible future analyses. Samples shall be analyzed for oil and grease by USEPA Method 413.2 and for volatile aromatics and volatile hydrocarbons utilizing GC techniques.

   b. Water samples shall also be collected from two base production wells: one north and one northwest of the discharge outfall to Zone 2. The water samples shall be analyzed for oil and grease by USEPA Method 413.2 and for volatile aromatics and volatile hydrocarbons utilizing GC techniques.

3. Zone No. 3 (Site 20 - Existing Fire Training Area)

   The contractor shall install four soil borings 20 feet deep in the area where the site is believed to be located. Representative samples of each 1-foot increment (a total of 20) shall be collected from each boring and shipped to the contractor laboratory. A maximum of four samples from each boring shall be selected for analysis. A maximum of 12 soil samples total shall be analyzed from this zone. Those samples not analyzed shall be frozen for possible future analyses. Samples shall be analyzed for oil and grease by USEPA Method 413.2 and for volatile aromatics and volatile hydrocarbons utilizing GC techniques.

C. Well and Boring Installation and Cleanup

Upon completion of each boring, the borehole shall be pressure-grout backfilled with a bentonite-cement mixture. Each well head shall be completed with the installation of a lockable cap and the sanitary concrete pad and seal required by Nevada regulations. The well and boring area shall be cleaned following the completion of each well and boring. Drill cuttings shall be removed and the general area cleaned. Disposal of drill cuttings is not the responsibility of the contractor. A total of nine borings and three wells shall be accomplished. The exact locations of borings and wells shall be determined in the field.

D. Data Review

Results of sampling and analysis shall be tabulated and incorporated in the monthly R&D Status Report and forwarded to the USAF OEHL for review as soon as they become available as specified in Item VI below.

E. Reporting

1. Draft reports delineating all findings of the field investigations shall be prepared and forwarded to the USAF OEHL as specified in Item VI below for Air Force review and comment. The reports shall include a discussion of the regional hydrogeology, well logs of all project wells, data from water level surveys, boring logs from all project borings, soil test results and conclusions, water quality analysis results, and laboratory quality assurance information. The reports shall follow USAF OEHL supplied format (mailed under separate cover).

2. Estimates shall be made of the magnitude, extent, and direction of movement of contaminants discovered. Potential environmental consequences of discovered contamination must be identified or estimated. Where data are insufficient to properly determine or estimate the magnitude and extent of movement of discovered contaminants, specific recommendations, fully justified, shall be made for additional efforts required to properly evaluate contamination migration.

3. Specific requirements, if any, for additional soil borings or for future ground water monitoring must be identified.

F. Cost Estimates

The contractor shall provide cost estimates for all additional work recommended to permit proper determination of contaminants. The recommendations provided shall include all efforts required to determine the magnitude, extent, and direction of movement of discovered contaminants, along with an estimate of the time required to accomplish the proposed effort. This information shall be provided in a separately bound appendix to the draft final report.

II. SITE LOCATION AND DATES

Nellis AFB NV
USAF Hospital Nellis/SGPB
Dates to be established

III. BASE SUPPORT: None

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT

1. Dee Ann Sanders
USAF OEHL/ECQ
Brooks AFB TX 78235
(512) 536-3305
AV 240-3305

2. 2LT David Gibson
USAF OEHL/ECQ
Brooks AFB TX 78235
(513) 536-3305
AV 240-3305

3. Maj Nic Farinacci
USAF Hospital Nellis/SGPB
Nellis AFB NV 89191
(702) 643-3316
AV 682-3316

4. Col Jerry Dougherty
HQ TAC/SGPAE
Langley AFB VA 23665
(804) 764-2180
AV 432-2180

VI. In addition to sequence numbers 1, 5, and 10 listed in Attachment 1 to the contract, which are applicable to all orders, the reference numbers below are applicable to this order. Also shown are data applicable to this order.

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
4	ONE/R	84MAR15	84APR03	84JUN12	*

*Contractor shall supply the USAF OEHL with 20 copies of the draft report and 50 copies plus the original camera ready copy of the final report.

VII. The ceiling price of Items 0001 and 0002 of this order as contemplated by the "Payments" clause of the General Provisions is $219,853.25.

ATTACHMENT 1

DESCRIPTION/SPECIFICATIONS
REQUIRED SAMPLE DETECTION LIMITS

	CONCENTRATION			
COMPOUND	WATER		SOIL	
Volatile Organic Compounds	*	L	*	
Nitrates	0.1	mg/L	--	
Arsenic	10.	µg/L	0.1	µg/g
Cadmium	50.	µg/L	0.5	µg/g
Chromium	100.	µg/L	1.0	µg/g
Copper	50.	µg/L	0.5	µg/g
Lead	20.	µg/L	0.2	µg/g
Mercury	1.	µg/L	0.01	µg/g
Nickel	100.	µg/L	1.0	µg/g
Selenium	10.	µg/L	0.1	µg/g
Silver	10.	µg/L	0.1	µg/g
Zinc	50.	µg/L	0.5	µg/g
Phenol	10.	µg/L	--	
Oil and Grease	0.3	mg/L	100.	µg/g
Polychlorinated Biphenyls	0.25	µg/L	1.	µg/g
Aldrin	0.02	µg/L	0.02	µg/g
Dieldrin	0.02	µg/L	0.02	µg/g
Chlordane	0.02	µg/L	0.02	µg/g
DDT Isomers	0.02	µg/L	0.02	µg/g
Endrin	0.02	µg/L	0.02	µg/g
Endrin Aldehyde	0.02	µg/L	0.02	µg/g
Heptachlor	0.02	µg/L	0.02	µg/g
Lindane	0.02	µg/L	0.02	µg/g

*Detection limits for volatile organic compounds shall be as specified for the compounds by USEPA Methods 601-602.

APPENDIX I

WELL LOCATION AND ELEVATION SURVEY

DEPARTMENT OF THE AIR FORCE
USAF HOSPITAL NELLIS (TAC)
NELLIS AIR FORCE BASE NV [illegible]

SGPB

Land Survey of Ground Water Sampling Points

JAN 25 1984

Mr. George Condrat
Dames & Moore
250 E Broadway, Suite 200
Salt Lake City UT 841112480

Enclosed are two copies of the US Army Corps of Engineers section map (sheets 1-5) number 15-06-24, "Survey Ties", March 1951 (atch 1). These are provided to you at the request of Mr. Stimpfl. I have also enclosed (atch 2 and 3) a copy of the survey data and the scope of work requested of the surveyor (USAF).

If you have any questions, please call me at (702) 643-3316.

NICK A. FARINACCI, Major, USAF, BSC
Chief, Bioenvironmental Engineering Services

3 Atch
1. USACOE maps
2. 820 CES/DES Ltr, 18 Jan 84
3. Scope of Work

Readiness is our Profession

DEPARTMENT OF THE AIR FORCE
820TH CIVIL ENGINEERING SQ HR (RED HORSE)
NELLIS AIR FORCE BASE, NV 89191

JAN 18 1984

REPLY TO ATTN OF: DES (MSgt Biehl, 4401)

SUBJECT: Water Well Survey

** Elevation of measuring point on the steel standpipe from which water levels are measured.*

TO: SGPB

1. The following information is supplied as per your request (Letter dated 12 December 1983).

a. Ground Water Monitoring Wells:

WELL	HORZ CONTROL	VERTICAL CONTROL*	Ground surface
(1) DM-1	N529,621.18 E656,743.17	1804.00	1801.
(2) DM-2	N529,607.76 E658,261.31	1799.98	1797.9
(3) DM-3	N529,975.11 E659,441.55	1801.85	1799.

b. Base Water Production Wells:

WELL	HORZ CONTROL	VERTICAL CONTROL
(1) No. 6	N538,969.60 E654,678.38	1840.34
(2) No. 11	N534,938.33 E658,090.97	1820.07
(3) No. 12	N534,752.74 E660,477.66	1816.74
(4) No. 13	N532,516.81 E656,938.64	1814.40
(5) No. 14	N534,992.47 E654,107.75	1827.91

NOTE: Grid coordinates were computed from field work and information taken from Army Corps of Engineers drawing 15-06-24 sheets 1-5 dated March 1951, and using transverse mercator projection State of Nevada East Zone Central Meridian 115°35' 00.000" N.A. Datum (1927).

2. Copies of field work and computations will be furnished to you after they have been transcribed from our field books and preliminary computations. If additional information is required by the contractor, 820th POC's are MSgt Biehl, SSgt Dupuis or MSgt Armijo.

JOHN H. CUNNINGHAM, Lt Colonel, USAF
Commander

1 Attachment
Request For Survey

Readiness is our Profession

APPENDIX J

GLOSSARY OF TERMS, ACRONYMS, ABBREVIATIONS, AND SYMBOLS

APPENDIX J

GLOSSARY OF TERMS, ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AFB	Air Force Base
alluvium	Unconsolidated sediments deposited during comparatively recent geologic time by a stream or other body of running water.
alluvial fan	Alluvial material deposited as a cone or fan at the base of a mountain slope.
aquifer	A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.
aquiclude	A body of relatively impermeable rock that is capable of absorbing water slowly but functions as an upper or lower boundary of an aquifer and does not transmit ground water rapidly enough to supply a well or spring.
aquitard	A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer.
aromatic	Designating cyclic organic compounds characterized by a high degree of stability in spite of their apparent unsaturated bonds and best exemplified by benzene and related structures, but also evident in other compounds.
artesian	Ground water confined under hydrostatic pressure.
as N	As weight of nitrogen
AVGAS	Aviation gasoline
caliche	An opaque, reddish brown to buff or white calcareous material of secondary accumulation (in place), commonly found in layers on, near, or within the surface of stony soils of arid and semiarid regions, but also occurring as a subsoil deposit in subhumid climates. The cementing material is essentially calcium carbonate, but may contain magnesium carbonate, silica, or gypsum.
cone of depression	A depression in the potentiometric surface of a body of water that has the shape of an inverted cone and develops around a well from which water is being withdrawn.
conglomerate	The consolidated equivalent of gravel, both in size range and in the essential roundness and sorting of its constituent particles.
DEQPPM	Defense Environmental Quality Program Policy Memorandum

DESEP	Civil Engineering/Environmental Planning
DOD	Department of Defense
downgradient	In the direction of decreasing hydraulic static head; the direction in which ground water flows.
effluent	A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.
°F	Degrees Fahrenheit
ft	Foot, feet
gpd/ft	Gallon(s) per day per foot
gpm	Gallon(s) per minute
HNU	A type of photoionization detector for measurement of organic vapors
hydraulic gradient	In an aquifer, the rate of change of pressure head per unit of distance of flow at a given point and in a given direction.
in.	Inch, inches
IRP	Installation Restoration Program
mg/g	Milligram(s) per gram
mg/L	Milligram(s) per liter
ml	Milliliter(s)
µg/g	Microgram(s) per gram
µg/L	Microgram(s) per liter
MOGAS	Motor gasoline
monitoring well	A well used to measure ground water levels and to obtain samples.
No.	Number
NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
pH	Negative logarithm of hydrogen in concentration; measurement of acids and bases.

PCB	Polychlorinated biphenyl; highly toxic to aquatic life; PCBs persist in the environment for long periods of time and are biologically accumulative.
PCBs	Polychlorinated biphenyls
PDWS	Primary drinking water standard(s)
percolation	Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.
permeability	The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.
phenols	Any of various acidic compounds analogous to phenol and regarded as hydroxyl derivatives of aromatic hydrocarbons.
POL	Petroleum, oil and lubricants
porosity	The property of a rock, soil, or other material of containing interstices.
potentiometric surface	An imaginary surface representing the static head of ground water and defined by the level to which water will rise in a well.
Precambrian age	Geologic time before the beginning of the Paleozoic; it is equivalent to about 90 percent of geologic time and ended approximately 570 million years ago.
PVC	Polyvinyl chloride
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RED HORSE	Rapid Emergency Deployable Heavy Operational Repair Structural Engineering
specific capacity	The rate of discharge of a water well per unit of drawdown, commonly expressed as gallons per minute per foot.
specific conductivity	With reference to the movement of water in soil, a factor expressing the volume of transported water per unit of time in a given area.
STP	Sewage treatment plant
TAC	Tactical Air Command
TCE	Trichloroethylene

TDS	Total dissolved solids
Tertiary	The first period of the Cenozoic era, thought to have covered the span of time between 66 and 3 to 2 million years ago.
TFWC	Tactical Fighter Weapons Center
TOC	Total organic carbon
TOX	Total organic halogens
transmissivity	The rate at which water is transmitted through a unit width under a unit hydraulic gradient.
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
wash	A term applied in the western United States to the broad, shallow, gravelly or stony, normally dry bed of an intermittent stream, often situated at the bottom of a canyon; it is occasionally filled by a torrent of water.
water table	That surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

END

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