KERR-McGEE CHEMICAL LLC
HENDERSON, NEVADA FACILITY

BACKGROUND INVESTIGATION WORK PLAN

Prepared for:
Nevada Division of Environmental Protection

Prepared by:
Kerr-McGee Chemical LLC

ENSR International

March 29, 2005

Document No. 04020-023-150

BACKGROUND INVESTIGATION WORK PLAN
Kerr-McGee Facility
Henderson, Nevada

ENSR Document No. 04040-023-150

March 2005

Prepared for
Nevada Division of Environmental Protection

Prepared for

Kerr-McGee Chemical LLC

Henderson, Nevada

ENSR International
1220 Avenida Acaso
Camarillo, California 93012

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Background Investigation Workplan
Kerr-McGee Facility,
Henderson, Nevada

The undersigned hereby certify that they are responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

SM Crowley

Susan M. Crowley, CEM 1428
Staff Environmental Specialist
Kerr-McGee Chemical LLC

Sally Bilodeau

Sally W. Bilodeau
Senior Program Manager, ENSR

David L. Gerry, CEM 1524
Senior Program Manager, ENSR

1.0 INTRODUCTION

This document presents a work plan to more fully assess background soil and groundwater conditions at the Kerr-McGee Chemical facility located at 8000 West Lake Mead Drive in Henderson, Nevada. The facility is owned and operated by Kerr-McGee Chemical LLC (Kerr-McGee).

The Nevada Division of Environmental Protection (NDEP), in a letter dated February 11, 2004 (NDEP, 2004), indicated that the existing background data of soil and groundwater conditions at the Kerr-McGee Henderson facility was insufficient and that additional data was necessary.

This Work Plan sets out the objectives and scope of work for the collection and analyses of background soil and groundwater data based on discussions between the NDEP and Kerr-McGee during a meeting on April 1, 2005. This investigation of background conditions applies to the 452-acre Kerr-McGee facility in Henderson, Nevada (hereafter referred to as “the Site”), as shown in Figure 1.

1.1 Site History

The Site is part of the Black Mountain Industrial (BMI) complex, formerly known as Basic Management Inc. (BMI) and Basic Metals Inc. (BMI). Originally operated as a magnesium production plant by the United States (US) Government the BMI complex has been in operation since 1942. In 1945, a portion of the complex was leased by Western Electrochemical Company (WECCO). In November 1950, a large pilot plant was constructed with operations beginning in 1951. By August 1952, WECCO had purchased several portions of the complex. In May 1953, a ten ton-per-day plant was constructed to replace the pilot plant. In June 1953, production started on high purity manganese metal. In 1955, WECCO merged with American Potash and Chemical Company (AP&CC) and this company operated at the Site through 1967. In 1962, AP&CC purchased the ammonium perchlorate plant, sodium perchlorate plant, and half of the sodium chlorate plant from the federal government. Kerr-McGee purchased AP&CC in 1967. Other companies that have operated within the BMI complex include Stauffer Management Company, Inc., U.S. Lime, Montrose Chemical Corporation, State Industries, Jones Chemical Company, Valite Industries, and Hardesty Chemical Company; currently Titanium Metals Corporation and Pioneer Chlor Alkali Company, Inc. are in operation on the BMI complex (Ecology and Environment, 1982; and Kleinfelder, 1993). Details regarding ownership and leases within the BMI complex are available in the 1993 Kleinfelder Phase I Environmental Conditions Assessment (Phase 1 ECA) report (Kleinfelder, 1993).

During the 1970s, the USEPA, the State of Nevada and Clark County investigated potential environmental impacts from the BMI companies’ operations including atmospheric emissions, groundwater and surface water discharges and soil impacts

(Ecology and Environment, 1982). From 1971 to 1976, Kerr-McGee modified their manufacturing process and constructed lined surface impoundments to recycle and evaporate industrial wastewater. In 1976, Kerr-McGee achieved zero discharge status regarding industrial wastewater management. In 1980, the USEPA requested specific information from the BMI companies regarding their manufacturing processes and their waste management practices by issuing section 308 letters. In 1994, the NDEP issued a Letter of Understanding (LOU) that identified 69 specific areas or items of interest and indicated the level of environmental investigation they wanted Kerr-McGee to conduct.

Kerr-McGee has undertaken environmental investigations to assess specific impacts in the area. A detailed discussion of the specific areas or items of interest identified in the LOU and a list the products made, years of production and approximate waste volumes for WECCO, AP&CC and Kerr-McGee are found in the Conceptual Site Model document (ENSR, 2005).

1.2 Environmental Conditions Summary

Numerous investigations have been conducted to evaluate the nature, extent, and movement of contaminants on-site and in downgradient and cross-gradient areas. A summary of the Site history, soil, and groundwater investigations is presented below.

In April 1991, Kerr-McGee was one of six companies that entered into a Consent Agreement with the NDEP (NDEP, 1991) to conduct environmental studies to assess Site-specific environmental conditions that are the result of past and present industrial operations and waste disposal practices. The six companies that entered into the Consent Agreement included those past or present entities that conducted business within the BMI complex. The Consent Agreement specified that the companies accomplish the following:

- Identify past industrial practices and waste products generated;
- Identify known or suspected waste management units or areas active on or after November 19, 1980;
- Identify known or suspected spills of any pollutant or contaminant;
- Identify all current and prior owners and operators of any part of the Site;
- Collect and summarize records or investigations that identify, document or address soil, surface water, groundwater, or air impacts; and
- Provide documentation of all measures that have been taken to monitor, characterize, mitigate or clean-up Site environmental impacts.

In April 1993, in compliance with the 1991 Consent Agreement, Kerr-McGee submitted the Phase 1 ECA (Kleinfelder, 1993) to the NDEP. The purpose of the report was to identify and document Site-specific environmental impacts resulting from past or present industrial activities. The Phase 1 ECA included a thorough assessment of the geologic and hydrologic setting, as well as historical manufacturing activities. The assessment identified 31 solid waste management units (SWMUs), 20 areas of known or suspected releases or spills and 14 miscellaneous areas where Site activities may have impacted the soil, air, or groundwater.

In response to the NDEP review of the Phase 1 ECA and discussions between the NDEP and Kerr-McGee, the NDEP prepared a Letter of Understanding (LOU) summarizing requirements for additional information and data collection (NDEP 1994). The LOU identified 69 items to be addressed further (see ENSR, 2005). Each of the LOU items was addressed by one or more of the following actions, as requested in the LOU by the NDEP.

1. Kerr-McGee provided additional information to the NDEP in a written response (35 items);
2. Kerr-McGee conducted field sampling and data collection (12 items);
3. Field investigation by the Henderson Industrial Site Steering Committee (2 items); or
4. “No further action required at this time” (20 items).

On October 2, 1996, Kerr-McGee submitted complete responses to the 35 LOU items requiring additional information or explanation (Kerr-McGee, 1996b).

In 1996 and 1997, Kerr-McGee conducted additional data collection as part of a Phase II ECA. The field investigations were conducted in compliance with a NDEP-approved work plan (Kerr-McGee 1996a). The Phase II ECA addressed the 12 LOU items that were identified as needing additional characterization. In August 1997, Kerr-McGee submitted the Phase II ECA (ENSR, 1997) report to the NDEP.

On June 10, 1998, the NDEP issued comments to the Phase II ECA report (NDEP, 1998) which conditionally approved the document subject to selected additional work and development of a site conceptual model.

On November 9, 1998, Kerr-McGee submitted a response to the NDEP comments to the Phase II ECA report and included with the responses, a Supplemental Phase II ECA Work Plan (Kerr-McGee, 1998) designed to provide the supplemental data required by the NDEP for the Phase II ECA.

On December 17, 1998, the NDEP replied to Kerr-McGee in a letter regarding the Phase II ECA Response to Comments and Supplemental Phase II ECA Work Plan. NDEP correspondence indicated that they conditionally approved Kerr-McGee’s Response to Comments and the Supplemental Work Plan. According to the NDEP, the Work Plan was approved subject to “the development of a CSM for the Site and comparing the soil sample results that were and will be obtained to the Nevada cleanup standards and actual background values”.

In March and April 1999, the NDEP-approved field work for the supplemental Phase II ECA was conducted. In April 2001, Kerr-McGee prepared a report of the findings of the field work and submitted them to the NDEP as the Supplemental Phase II ECA (ENSR, 2001).

In February 2004, the NDEP provided a response to the Kerr-McGee Supplemental Phase II ECA. NDEP indicated that yet additional work would be required including identification of all potential contaminants associated with the Site, background sampling, assessment of site-specific action levels, and identification of data gaps.

1.3 Background Investigation Objectives

The objective of the background investigation is to gather sufficient soil and groundwater chemistry data to provide a more thorough understanding of background conditions at the Site and provide a baseline of chemistry data from which subsequent environmental assessments can be compared.

1.4 Work Plan Organization

The background investigation work plan is organized as follows:

- **Section 1** is the Introduction and presents a brief history of the Site and summarizes the environmental conditions and background investigation objectives at the Site;
- **Section 2** discusses the physical setting of the Site;
- **Section 3** contains a description of the project approach and data quality objectives of this assessment;
- **Section 4** describes the field methods that will be used to perform the Background Investigation;
- **Section 5** describes the procedures by which the laboratory data will be evaluated and a description of the resulting report;
- **Section 6** contains a brief description of the project personnel and their roles and responsibilities for the Background Investigation.
- **Section 7** provides a bibliographic list for each of the references cited in this work plan.

Several appendices are included in this document including the following:

- **Appendix A** contains correspondences between the NDEP and Kerr-McGee;
- **Appendix B** contains the site-specific Health and Safety Plan (HASP) that has been prepared for the Background Investigation;
- **Appendix C** contains examples of field documentation forms that will be used during the performance of the Background Investigation.

2.0 SITE INFORMATION – PHYSICAL SETTING

2.1 Site Location

The Site is approximately 452 acres in size and is located 13 miles southeast of Las Vegas in an unincorporated section of Clark County, Nevada. Figure 1 illustrates the site plan. It is completely surrounded by the incorporated area comprising the City of Henderson. The Site is in Township 22S, Range 62E and covers portions of Sections 1, 12 and 13. The approximate center of the Site is longitude 36°02’45” W and latitude 115°00’20” N.

2.2 Topography

Elevations across the Site range from 1,677 to 1,873 feet above mean sea level. The land surface across the Site slopes toward the north at a gradient of approximately 0.023 foot per foot (ft./ft.). The developed portions of the Site have been modified by grading to accommodate building foundations, surface impoundments and access roads.

2.3 Climate

The climate of the Las Vegas Valley is arid, consisting of mild winters and dry hot summers. Average annual precipitation as measured in Las Vegas from 1971 to 2000 was 4.49 inches. Precipitation generally occurs during two periods, December through March and July through September. The winter storms generally produce low intensity rainfall over a large area. The summer storms generally produce a high intensity rainfall over a smaller area for a short duration. These violent summer thunderstorms account for most of the documented floods in the Las Vegas area. Temperatures can rise to 120^{O} F in the summer and average relative humidity is 20 percent. The mean annual evaporation from lake and reservoir surfaces ranges from 60 to 82 inches per year.

Winds frequently blow from the southwest or northwest and are influenced by nearby mountains. Strong winds in excess of 50 miles per hour are experienced occasionally.

2.4 Geology

2.4.1 Regional Geology

The Las Vegas Valley occupies a topographic and structural basin trending northwest-southeast and extending approximately 55 miles from near Indian Springs on the north to Railroad Pass on the south. The valley is bounded by the Las Vegas Range, Sheep Range and Desert Range to the north; by Frenchman and Sunrise Mountains to the east; by the McCullough Range and River Mountains to the south and southeast, and the Spring Mountains to the west. The mountain ranges bounding the east, north and west sides of the valley consist primarily of Paleozoic and Mesozoic sedimentary rocks (limestones, sandstones, siltstones, and fanglomerates), whereas the mountains on the south and southeast consist primarily of Tertiary volcanic rocks (basalts, rhyolites, andesites and related rocks) that lie directly on Precambrian metamorphic and granitic rocks (Bell, 1981).

In the Las Vegas Valley basin-fill consists of Tertiary and Quaternary sedimentary and volcanic rocks and unconsolidated deposits which can be up to 13,000 feet thick (Langenheim and others, 1998). The valley floor consists of fluvial, paludal (swamp) and playa deposits surrounded by more steeply sloping alluvial fan aprons derived from erosion of the surrounding mountains. Generally, the deposits grade finer with increasing distance from the source area and with decreasing elevation. The structure within the Quaternary and Tertiary-age basin-fill is characterized by a series of generally north-south trending faults scarps. The origin of the faults is somewhat controversial; they may be tectonic in origin or may be the response to compaction and subsidence within the basin due to groundwater withdrawal.

A detailed discussion of the geology of the Site and surrounding area is found in the Conceptual Site Model document (ENSR, 2005).

2.4.2 Local Geology

The local geology and hydrology are defined by data collected from the numerous borings and wells that have been installed in the area.

Alluvium. The Site is located on Quaternary age alluvial deposits that slope north toward Las Vegas Wash. The alluvium consists of a reddish brown heterogeneous mixture of well-graded sand and gravel with lesser amounts of silt, clay and caliche. Clasts within the alluvium are primarily composed of volcanic material. Boulders and cobbles are common. Due to their mode of deposition, no distinct beds or units are continuous over the area.

A major feature of the alluvial deposits is the stream-deposited sands and gravels that were laid down within paleochannels that were eroded into the surface of the Muddy Creek formation during infrequent flood runoff periods. These deposits are thickest within the paleochannel boundaries, which are narrow and linear. These sand and gravel deposits exhibit higher permeability than the adjacent, well-graded deposits. In general, these paleochannels trend northeastward.

The thickness of the alluvial deposits ranges from less than a foot to more than 50 feet beneath the Site. Soil types identified in boreholes on-Site include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand and silty sand. The thickness of the alluvium, as well as the surface of the underlying Muddy Creek formation, was mapped to locate these paleochannels.

Muddy Creek Formation. The Muddy Creek formation of Miocene and Pliocene(?) age occurs in Las Vegas Valley as valley-fill deposits that are coarse grained near mountain fronts and progressively finer grained toward the center of the valley (Plume, 1989). Where encountered beneath the Site the Muddy Creek formation is composed of at least two thicker units of fine grained sediments of clay and silt (the first and second fine-grained facies, respectively) interbedded with at least two thinner units of coarse-grained sediments of sand, silt and gravel (the first and second coarse-grained facies, respectively). Everywhere beneath the Site, except for the southern 1000 feet, the first fine-grained facies (MCfg1) separates the first coarse-grained facies (MCcg1) from the overlying Quaternary alluvium. Within the southern 1000 feet of the Site, the Muddy Creek formation's fine-grained facies pinches out and the coarse-grained facies directly underlies the Quaternary alluvium.

The Muddy Creek formation represents deposition in an alluvial apron environment near the mountain borders grading into fluvial, paludal (swamp), playa and lacustrine environments further out into the valley. On Site the Muddy Creek does not crop out but instead subcrops beneath a veneer of Quaternary alluvium.

In on-site borings, the contact between the Quaternary alluvium and the Muddy Creek formation is typically marked by the appearance of a well-compacted moderate brown silt to sandy silt or a stiff clay to sandy clay, whereas near the Las Vegas Wash, the contact is marked by gray-green to yellow-green gypsiferous clays and silts.

2.5 Local Hydrogeology

Alluvial Aquifer. The first groundwater encountered beneath the northern half of the Site occurs within the Quaternary-age alluvium and is more than 30 feet below ground surface (bgs) beneath the Site on the south, and is at or near the ground surface at Las Vegas Wash on the north. The flow direction of the potentiometric surface mimics the ground surface and is to the north-northeast with minor variations.

Muddy Creek Aquifer. The first groundwater encountered beneath the southern half of the Site occurs within units of the upper Muddy Creek formation and can be more than 70 feet below ground surface (bgs). The flow direction of the potentiometric surface in the upper Muddy Creek also mimics the ground surface and is to the north-northeast with minor variations. As shown on the two hydrogeologic sections B-B' and C-C' (Figures 3 and 4, respectively) the top of saturation occupies stratigraphically higher facies proceeding northward.

Within the Las Vegas Valley groundwater also occurs within the deeper coarse-grained facies of the Muddy Creek formation. This water, averaging an electrical conductivity of about 1,100 micro Siemen per centimeter (µS/cm), is of generally good quality where not impacted by industrial and residential contaminants. As sampled beneath the Site in February 2004 in well TR-9, the groundwater from the deeper coarse-grained Muddy Creek unit (MCcg2) contained 55 mg/l calcium, 180 mg/l chloride, 180 mg/l sodium and 250 mg/l sulfate. Deep wells drilled into the Muddy Creek formation all exhibit artesian conditions with some wells flowing at the surface. Most shallow wells drilled into the shallow Muddy Creek also demonstrate an upward hydraulic gradient.

3.0 BACKGROUND INVESTIGATION RATIONALE

3.1 Project Approach

The general scope of work consists of an evaluation of background soil and groundwater conditions at the Site. To assess background soil conditions, the completion of four new upgradient soil borings are proposed near the southern boundary of the Site. During drilling, soil samples would be collected at regular intervals for geologic description and laboratory analyses.

To evaluate background groundwater conditions at the Site, monitoring wells will be installed in two of the four soil borings. The two new wells will complement the six existing monitoring wells near the southern boundary of the Site. Together, these eight wells will form a series of upgradient monitoring wells that will enable a more thorough assessment of background groundwater conditions across the Site.

Once the two new wells are developed, groundwater samples will be collected from all eight upgradient wells for laboratory analyses. Selected soil samples and all groundwater samples will be analyzed for perchlorate, major ions, metals, volatile organic compounds (VOCs) including MTBE and other fuel oxygenates, total petroleum hydrocarbon (TPH), and radionuclide constituents.

A report summarizing the results of the fieldwork and analyses will be prepared and submitted to the NDEP.

The intended use of this background investigation is to compile and integrate available Site background information and to fill data gaps. Furthermore, the background investigation provides technical and regulatory personnel as well as members of the public a tool to better understand the Site, resolve issues concerning the Site, and facilitate the decision making process.

3.2 Data Quality Objectives

This section discusses the data quality objectives (DQOs) developed for the identification and quantification of chemical constituents that may occur as background constituents at the Site. The role of the DQOs is to provide the framework for making expedient decisions regarding the data needs for the Site. The DQOs also guide the use of data for later evaluation and implementation of effective and timely site remedies or no further action (NFA) as warranted.

The DQO process consists of seven key steps for the background investigation. These steps are as follows:

1. **State the Problem**. Background concentrations of naturally occurring chemicals in soil, alluvium, and groundwater upgradient of the site are not known.

2. **Identify the Decision**. The decision that will be made is what background concentrations of naturally occurring chemicals should be applied to the Site with regard to risk assessment and impact evaluation. The data obtained from the background sampling and analysis activities will be used to establish background concentrations of naturally occurring chemicals such as metals and general minerals that have not been affected by Site activities. In addition, an evaluation will be made to determine if there are impacts from upgradient off-Site activities present in soil, alluvium or groundwater at the south end of the Site.

3. **Identify Inputs to the Decision**. Inputs to the decision will include results of analytical testing of soil, alluvium and groundwater from the identified locations on the site.

4. **Study Area Boundaries**. The study area boundary is limited to the property boundaries of the 452-acre Site. For the background study, field activities are focused in the southern, upgradient portions of the Site.

5. **Develop a Decision Rule**. Decisions will be based upon laboratory results for the constituents of concern for the soil and groundwater matrix tested. The range of concentrations of a specific, naturally occurring constituent will generally be expected to be representative of background. If constituents are detected, such as MTBE or other chemicals indicative of man induced impacts, their presence will be evaluated with respect to off-Site or on-Site origin.

6. **Specify Limits of Decision Error**. The results of all analytical testing will be subjected to data validation as specified below. Data are determined to be valid if the specified limits on precision, accuracy, representativeness, comparability, and completeness are achieved. The results of any detected target constituents will be considered in evaluating the need for additional sampling.

7. **Optimize the Design**. The work plan has been designed to provide the type and quantity of data needed to satisfy the objectives. The work plan provides the specifications for the data collection activities, including the numbers of samples, respective locations, and sampling techniques. The quality of the data will be assessed through the procedures further described in this workplan.

4.0 FIELD SAMPLING PLAN

The following sections describe the sampling strategy, investigative methods and procedures, sample analysis program, sample handling, decontamination procedures, and management of investigation-derived wastes (IDW).

4.1 Rationale for Proposed Drilling Locations

Historic and current manufacturing activities including product and waste storage have been conducted on the northern portion of the Site. Historically, very little to no industrial activities have occurred along the southern portion of the Site along an area extending from the southern Site boundary northward, for approximately 1000 feet. It is within this area that the drilling locations are proposed. Six existing monitoring wells (M-103, well cluster TR-9 & TR-10, well cluster TR-7 & TR-8) and H-11 are located in this area.

Figure 2 is a map of the southern part of the facility showing topographic features, the location of the pinchout of the first fine-grained facies of the Muddy Creek formation and the location of existing and proposed background soil borings and monitor wells. Four boring locations are shown on Figure 2: Boring M-116, Well M-117, Well M-118 and Boring M-119.

Hydrogeologic cross sections A-A’, B-B’ and C-C’ (Figures 3, 4 and 5, respectively), show the third dimensional view of this area. The lithologies beneath the east-west section, A-A’, (Figure 3) consist of Quaternary alluvium overlying three alternating coarse-grained and fine-grained facies of the Muddy Creek formation. Two proposed background soil borings (borings M-117 and M-119, and well M-118) will be sited along this traverse. These two borings will be completed as monitoring wells (M-117 and M-118) and will enable groundwater samples to be collected from the previously un-sampled second fine-grained facies of the Muddy Creek formation. The position of these new wells will make a nested well-set of M-103 and proposed well M-117 (screened in subunits MCcg1 and MCfg2, respectively) and a nested well-set of TR-9, TR-10 and proposed well M-118 (screened in units MCcg1, MCcg2 and MCfg2, respectively).

Figure 4, the eastern north-south hydrogeologic dipping section B-B’, shows the pinchout of the first fine-grained facies (MCfg1) which northward separates the alluvium from the first coarse-grained facies. Existing well M-10 is screened in this fine-grained facies and contained 23 milligrams per liter (mg/l) of perchlorate (ClO_4) in February, 2005. Because M-10 contains elevated concentrations of perchlorate, it cannot be used as a background monitoring well. As shown in the section, a background soil boring (M-116) is proposed to be located between existing monitoring wells M-103 and M-10. The purpose of this boring is to assess background geochemical soil conditions along a vertical profile from the groundsurface downwards to (and including) the MCfg1 unit.

This boring cannot be completed as a monitoring well in this unit because groundwater is not encountered until the underlying MCcg1 unit.

Figure 5, the western north-south hydrogeologic dipping section C-C', also shows a pinchout of the first fine-grained facies (MCfg1) which northward separates the alluvium from the first coarse-grained facies. As in section B-B', the MCfg1 unit is dry so this proposed fourth soil boring M-119 cannot be completed as a monitoring well in this unit. As with boring M-116, the purpose of this boring is to assess background geochemical soil conditions along a vertical profile from the groundsurface downwards to (and including) the MCfg1 unit. Although it would be advantageous to complete a background monitor well in the MCfg1 unit, it cannot be accomplished because the unit only becomes saturated northward beneath the historic and/or current manufacturing and storage facilities on the Site.

Taken together, dip sections B-B' and C-C' clearly show that the top of saturation occupies stratigraphically higher facies proceeding northward.

4.2 Pre-Field Activities

The following activities will be performed prior to the start of field activities:

The proposed drilling locations will be marked and three-days before the start of drilling activities Underground Services Alert (1-800-642-2444) will be notified of the intent to drill. USA will contact all utility owners of record within the site vicinity and notify them of our intention to conduct a subsurface assessment in proximity to buried utilities. All utility owners of record, or their designated agents, will be expected to clearly mark the position of their utilities on the ground surface throughout the area designated for this assessment.

If necessary (and only after consultation with onsite Kerr-McGee staff and after reviewing as-built plans of underground utilities), an underground utility locating service will be contracted to mark underground utilities that may be near the proposed boring locations.

Because monitoring wells will be installed, the drilling contractor will file a Notice of Intent (NOI) to install monitoring wells (along with the Affidavit of Intent to Abandon Monitoring Wells) as required by the Nevada Department of Water Resources under Nevada Administrative Code (NAC) 534.320.

4.3 Field Activities

Four soil borings will be drilled and soil samples will be collected at regular intervals for laboratory analyses. Monitoring wells will be installed in two of the four borings (the remaining two borings will be abandoned); the new monitoring wells will be developed and groundwater samples collected for laboratory analyses. A description of the field activities is presented below.

4.3.1 Soil Borings

Four soil borings M-116, M-117, M-118, and M-119 will be drilled near the southern boundary of the Site at the locations shown on Figure 2. The soil borings will be drilled using sonic drilling technology from which continuous cores can be obtain for lithologic examination and logging purposes.

Borings M-117 and M-118 will be drilled through the Quaternary Alluvium (Qal) and the underlying first coarse-grained facies of the Muddy Creek Formation (MCcg1) until the second fine-grained facies of the Muddy Creek (MCfg2) is encountered – a depth estimated to be about 120 to 140 feet. Borings M-116 and M-119 will be drilled through the Quaternary Alluvium until the first fine-grained facies unit (MCfg1) is encountered – a depth estimated to be about 50 feet.

During drilling operations, organic vapors will be monitored with a Photovac™ microtip-photo-ionization detector (PID). These organic vapor readings will be recorded on boring logs prepared by the field geologist during drilling activities. The boring logs will record the following sampling information: boring number and location; sample identification numbers; date and time; sample depth; lithologic description in accordance with the Unified Soils Classification System (USCS); description of any visible evidence of soil contamination (i.e., odor, staining); and organic vapor monitor readings. An example of a boring log form is included in Appendix C.

The following section describes the soil sampling methodology that will be used at the site.

4.3.2 Soil Sampling

When the target sample depth is reached, a modified split-spoon sampler mounted to a steel pipe will be inserted through the center of the hollow sonic drill pipe and the split-spoon sampler will be driven 18-inches into the soil below the sonic drill bit in order to obtain samples of undisturbed soil for laboratory analyses. The sampler will be driven into the soil by the repeated percussive action of a 130-lb. hammer falling approximately 30-inches onto the steel rod/split-spoon assembly. The split-spoon sampler will be fitted with three 6-inch-long brass or stainless steel liners (sleeves). As the split-spoon is advanced downward, soil is driven into the sleeves.

As soon as the split-spoon sampler is removed from the borehole and disassembled, the sleeve corresponding to the target sample depth will be chosen for analysis by an off-site laboratory. Teflon™ sheets will be placed on both ends of the sleeve; the sleeve will then be capped, labeled, and placed on ice inside an ice chest for delivery to the laboratory (under chain-of-custody protocol). As an alternative, soil samples designated for analyses for non-volatile constituents may be placed in a laboratory-supplied glass jar and sent to the laboratory. An example of a chain-of-custody form is included in Appendix C.

Soil samples designated for VOC and TPH-gasoline (i.e., C_4–C_{12}) analysis will be taken from the chosen sleeve and preserved in the field using both sodium bisulfate and methanol preservatives, as prescribed under EPA Method 5035. A new, disposable syringe (T-handle) will be used to collect a roughly 5-gram aliquot directly from the sample sleeve. The sample will be placed into 40-milliliter glass vials containing pre-weighed amounts of liquid sodium bisulfate or methanol. Two vials of sodium bisulfate-preserved soil and one vial of methanol-preserved soil will be collected at each sample depth for TPH-g or VOC analyses.

If a soil sample is designated for both TPH and VOC analyses, then one set of vials (two vials with sodium bisulfate, one vial with methanol) will be collected for TPH analyses and a second set of vials will be filled for VOC analyses. The label on the filled vials will be filled out, and the vials placed in Ziploc™ plastic bags, and placed on ice in a cooler along with the rest of the samples pending delivery to the analytical laboratory. The pre-filled VOA vials containing the sodium bisulfate and methanol preservatives will be provided by the analytical laboratory. A new T-handle syringe will be used to obtain 5 mg aliquots of soil at each sample depth and then discarded to the trash.

The remaining unused portion of the soil core will be used for lithologic description, screening for VOCs with a PID, etc.

4.3.3 Soil Sample Handling

Soil samples for laboratory analyses will be placed on ice in an ice chest for shipping to the laboratory. The soil samples will be logged on a Chain-of-Custody form and the samples will be shipped to the laboratory at the end of each day of sampling. Analytical methods, types of containers, and holding times are discussed in Section 4.5.1 – Soil Testing Analytical Program.

4.3.4 Borehole Abandonment

Two boreholes (M-116 and M-119) will be abandoned once the target depth has been reached and the necessary soil samples obtained. The boreholes will be abandoned by backfilling each borehole with a bentonite/neat cement grout that will be placed into the borehole with a tremie pipe. The bentonite/neat cement grout will be placed from the bottom of the borehole to within five feet of the ground surface. A surface plug consisting of neat cement, cement grout, or concrete grout will be placed from a depth of five feet to the ground surface.

4.3.5 Monitoring Well Installation and Well Development

Two soil borings (M-117 and M-118) will be completed into background groundwater monitor wells. The wells will be constructed following the requirements of the Nevada monitor well completion statutes.

Each monitoring well will be constructed of 2-inch diameter Schedule 40 PVC blank casing and screen (0.020-inch slot size). The filter pack will consist of Lonestar # 3 sand or an appropriate size similar to the saturated zone. The screened interval will be between 10 and 20 feet long, pending site-specific conditions. The screen length and depth placement will be selected by the field geologist, pending the lithologic interpretation of the soil core.

In general, the sand pack, bentonite seal, and sanitary (grout) seal will be placed into the annular space using a tremie pipe. The top of the sand pack will extend approximately one to two feet above the top of the well screen. Following emplacement of the sand pack, a three to five-foot-thick layer of bentonite pellets will be placed on top of the sand pack. The pellets will by hydrated with potable water. A sanitary seal will be formed by placing bentonite-cement grout on top of the bentonite seal; the sanitary seal will extend upwards to within three to five feet of the ground surface.

A steel protective casing will be cemented in-place around the well. The well casing and steel protective casing will extend at least one foot above the ground surface. A cement pad will be place on the ground surface, around the steel protective casing. An example of a monitoring well construction detail log form is included in Appendix C.

Once installation has been completed, M-117 and M-118 will join the five existing monitoring wells (TR-7, TR-8, TR-9, TR-10, and M-103) to form a series of three upgradient well clusters along the southern portion of the Site. Monitoring well H-11 is a well located on the adjacent Pioneer Chemical facility, near the southwestern corner of the Kerr-McGee facility and is also considered to be an upgradient well. For the purposes of the Background Investigation, groundwater samples will also be collected from H-11 for laboratory analyses. Table 1 lists the upgradient wells for the Site.

Each monitoring well will be developed to remove sediments from the well and to improve the hydraulic communication between the well and the aquifer formation. Approximately 24 hours after the wells have been installed they will be developed by surging with a rubber surge-block. After surging, each monitoring well will be purged using a bailer or using an electric submersible pump during which water quality parameters (e.g., specific conductivity, pH, turbidity, and temperature) will be monitored. Monitoring well development will proceed until the water quality parameters have stabilized (to within 10 percent variance). An example of a well development record form is included in Appendix C. All water generated from well development activities will be placed into U.S. Department of Transportation (DOT)-approved 55-gallon drums and temporarily stored in a secure area on the site.

4.3.6 Groundwater Sampling

4.3.6.1 Groundwater Elevation Measurement

Water levels will be measured with an electric sounder prior to sampling the well. The well sounder will be equipped with an indicator light, audible buzzer or other mechanism to indicate when the water table has been contacted. The electric sounder will be decontaminated by rinsing with de-ionized water after each use. The typical procedure for obtaining depth to water is to check the sounder for audible or light activation by pressing the test button. The sounder is then carefully lowered into the well until it contacts the surface of the water and the buzzer sounds. The sampler than raises the sounder and lowers it again to verify the depth to water as measured at the marked measuring point on the well casing. When two consecutive readings are the same the sampler records the depth to water on the sampling and purging form.

Depth to water is recorded from the top of the casing reference point to the nearest 0.01 foot on the well sampling field form. The casing reference point is marked by a small notch in the top of the casing. The groundwater elevation at each monitoring well is calculated by subtracting the measured depth to water from the surveyed elevation of the top of the well casing. Total well depths for those wells scheduled for sampling are measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen is partially obstructed by silt, is recorded to the nearest 0.5 foot on the sampling and purging form.

4.3.6.2 Monitoring Well Purging

Each well will be purged by one of two methods: 1) low-flow purging using bladder pump, or 2) by electric submersible pump (or bailer) based on well volume calculations (i.e., removing three to five well volumes).

If low-flow purging is performed, the bladder pump will be placed approximately mid way along the screened interval. The water intake will be at least two feet from the top and one foot from the bottom of the screen. Portable low flow pumps will be used initially and dedicated low flow pumps may be installed in the future. The pump will be lowered slowly into the well to minimize disturbance of the formation. The water will be evacuated at 100 to 500 ml per minute. The water level will be monitored either on a continuous or periodic basis and should not vary more than 0.1 meter or 4 inches. The water quality parameters will be monitored using a periodic or continuous meter. The flow-through cell is preferred although a standard meter is also acceptable. Stabilization of water quality parameters is indicated when the following criteria are met in the final three consecutive readings: the pH is within 0.1 unit, temperature is within 1 degree Celsius and the following parameters are within 10 percent: electric conductivity, turbidity, and dissolved oxygen (Figure 4). If field parameters do not stabilize within 30 minutes, the deviation will be noted on the field sampling field sheet and a sample will be collected.

An example of a low-flow groundwater sample collection record field form is included in Appendix C.

If wells are purged based on well volume calculations, the standing water in the casing and sand pack will be purged from the well using an electric submersible pump. The amount of water purged will be from three to five casing volumes so that stagnant groundwater is removed from the well and that water representative of the aquifer is obtained for analysis. If field parameters do not stabilize, one additional well volume will be purged, the deviation will be noted on the field sampling field sheet and a sample will be collected.

Some wells may be pumped dry before the removal of three casing volumes. If this occurs, the wells will be allowed to recharge sufficiently prior to sampling. For parameters sensitive to volatilization, samples will be collected as soon as the wells have recharged to a level sufficient for sample collection. For the remaining parameters, samples will be collected within 24 hours of evacuation to dryness. If a well has not recharged within the 24-hour period, it will be recorded as dry, and not sampled during the event.

When evacuating wells screened in high yield formations (wells capable of yielding three or more casing volumes) precautions will be taken so that recharge water is not cascading down the wells. To prevent cascading, the pumps installed for purging those wells will be placed above the screened interval of the well. During purging, water will be drawn into the well and move upward through the screen eliminating the possibility of cascading.

Groundwater parameter field measurements obtained during sampling will be recorded on a Groundwater Sample Collection Record field log form, an example of which is included in Appendix C. Field data sheets will be reviewed for accuracy and completeness by the sampling coordinator after the sampling event is completed. Copies of the field sheets will be included in the monitoring report.

The pH, electric conductivity, turbidity, DO and temperature meters or flow through cells will be calibrated each day before beginning field activities. The calibration will be checked once each day to verify meter performance. The field meter calibrations will be recorded on an Instrument Calibration sheet. Copies of the calibration sheets will be included in the monitoring report.

4.3.6.3 Collection of Groundwater Samples

Upon completion of well purging, a representative groundwater sample will be withdrawn from the well. Samples will be placed in containers in the order of decreasing volatilization sensitivity. Thus, the individual containers for analyses will be filled in the following order:

1. VOCs/MTBE/Fuel Alcohols

2. TPH-light fraction (C_4-C_{12});
3. TPH-heavy fraction (C_{13+})
4. Metals (including Hexavalent Chromium)
5. Perchlorate
6. General Water Chemistry/Anions/Ions
7. pH
8. Radionuclides

If well purging is performed using low-flow bladder pump, then the bladder pump may be used to dispense the water samples into the appropriate sample container as long as static water level is maintained for the duration of bottle-filling activities.

Otherwise, groundwater samples can be collected using a bailer. In this procedure, a bailer would be lowered into the well to a depth that is equivalent to the mid-point, or lower, within the well screen. The bailer will be removed from the well and discharge directly into sample containers. When taking samples for VOCs or TPH-gasoline analyses, containers will be filled to produce a positive meniscus over the lip of the container. Upon capping, the VOC sample bottles will be inverted and tapped to check for bubbles. If bubbles are observed, a new sample will be obtained.

4.3.6.4 Groundwater Sample Containers and Preservatives

Sample containers required for the specified analyses will generally be provided by the laboratory immediately prior to the sampling event. The containers will be pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will have been added to the containers by the laboratory prior to shipment of the sample containers to the sample collector.

Analytical methods, number of samples, types of containers, preservative, and holding times are summarized in Section 4.5.2 - Groundwater Analytical Testing Program.

4.3.6.5 Sample Packaging and Shipment

To identify and manage samples obtained in the field, a sample label will be affixed to each sample container. The sample labels will include the following information:

- Project number
- Site name
- Boring number
- Sample identification number
- Sampler’s initials
- Date and time of collection
- Preservative

Following collection and labeling, samples will be immediately placed in a sample cooler for temporary storage. The following protocol will be followed for sample packaging:

- A self-adhesive custody seal supplied by the analytical laboratory will be placed across the lid of each sample container.
- Sample containers will be placed in clear, plastic, leak-resistant bags prior to placement in the ice chest. Screw caps will be checked for tightness prior to placing the sample in the bag.
- Samples to be shipped will be placed in the cooler and packed with packaging materials to minimize the potential for disturbance and/or breakage of the sample containers.
- Ice or "Blue Ice" packs will be placed in leak-resistant plastic bags and included in the coolers to keep samples at a chilled temperature during storage and transport to the analytical laboratory. When ice is used, the drain plug of the cooler will be secured with fiberglass tape to prevent melting ice from leaking out of the cooler.
- The COC form will be placed in a water-resistant plastic bag and taped on the inside of the lid of the cooler.

A temperature blank consisting of a 40-milliliter glass vial of distilled water will be included in each cooler sent to the analytical laboratory. The purpose of the temperature blank is to allow the analytical laboratory to obtain a representative measurement of the temperature of samples enclosed in a cooler without disturbing the actual samples. The field team will package and label the temperature blank like a regular water sample; however, the analytical laboratory will only measure the temperature of the blank.

Every effort will be made to transport the samples to the analytical laboratory at the end of each sampling day. However, if sampling runs late and the laboratory is closed, samples will be stored overnight in a secured location under appropriate COC procedures, and the samples will be shipped to the laboratory the next day. Prior to overnight storage, the cooler(s) will be restocked with new ice or blue ice to maintain the samples in a chilled state. The temperature blank inside each cooler will be checked by the sample collector at the beginning of the evening and in the morning and the temperature readings will be recorded in the field logbook.

4.4 Field Documentation

4.4.1 Field Logbooks

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time.

All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology that might prove inappropriate. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Corrections will be dated and initialed. No entries will be obliterated or rendered unreadable.

Entries in the field logbook will include at a minimum the following for each sample date:

- Site name and address
- Recorder's name
- Team members and their responsibilities
- Time of site arrival/entry on site and time of site departure
- Other personnel onsite
- A summary of any onsite meetings
- Deviations from sampling plans and site safety plans
- Changes in personnel and responsibilities as well as reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample identification number
- Sample location and description
- Site sketch showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (i.e., matrix)
- Type of preservation
- Type of sampling equipment used
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Instrument readings (e.g., PID, etc.)
- COC form numbers and COC seal numbers
- Transport arrangements (courier delivery, lab pickup, etc.)
- Recipient laboratory (ies).

4.4.2 Boring Logs

A lithologic description of the materials encountered and collected will be maintained on boring logs compiled by the field geologist. Soils will be classified in accordance with the USCS, and descriptions will include soil type, particle size and distribution, color (using the Munsell soil color chart), moisture content, and evidence of contamination (discoloration, unusual odors, etc.). The soil samples will be screened in the field for the presence of elevated organic vapor concentrations using a PID, and the measurements will be recorded on the boring log.

4.4.3 Chain-of-Custody Records

Chain-of-Custody (COC) records are used to document collection and shipment of samples to the laboratory for analyses. All sample shipments for analyses will be accompanied by a COC record. Form(s) will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, COC form(s) will be completed and sent with the samples for each cooler. The COC record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone’s custody if it is either in someone’s physical possession, in someone’s view, locked up, or kept in a secured area that is restricted to authorized personnel. Until receipt by the laboratory, the custody of the samples will be the responsibility of the sample collector. An example of a COC form is provided in Appendix C.

The shipping containers in which samples are stored (usually sturdy picnic cooler or ice chest) will also be sealed with self-adhesive custody seals any time they are not in someone’s possession or view before shipping. All custody seals will be signed and dated.

4.5 Analytical Testing Program

4.5.1 Soil Analytical Testing Program

The proposed soil analytical plan is shown in Table 2. Sample containers, analytical methods, and holding times for the various analytes that the soil samples will be tested for are shown on Table 3.

4.5.2 Groundwater Analytical Testing Program

For the Background Investigation, groundwater samples will be collected from a total of eight monitoring wells. Seven wells are on the Kerr-McGee facility (TR-7, TR-8, TR-9, M-118, TR-10, M-117, M-103) and the eighth well (H-11) is located just outside the southwest corner of the Kerr-McGee property boundary. The groundwater analytical program is summarized on Table 4. Sample containers, analytical methods, and holding times for the various analytes that the groundwater samples will be tested for are shown on Table 5.

4.6 Equipment Decontamination

Drilling equipment will be decontaminated prior to the beginning of each boring by steam cleaning in a designated area onsite. All non-disposable soil sampling equipment (e.g., split-spoon samplers, etc.) will be disassembled and decontaminated prior to the collection of each sample. This equipment may be decontaminated by either steam cleaning or by washing with a non-phosphate detergent solution (Alconox or similar) followed by rinsing with distilled/deionized water. Decontamination fluids will be temporarily stored on-site in Department of Transportation (DOT)-approved 55-gallon steel drums pending results of the soil analyses.

If non-dedicated groundwater sampling equipment is used to collect groundwater samples, the equipment will be decontaminated by circulating a solution of water and detergent (e.g., Alconox) through the equipment followed by rinsing with distilled water.

4.7 Management of Investigation-Derive Wastes

Soil cuttings (including unused cores), and other solid or liquid wastes (decontamination fluids, development water and purged groundwater) will be temporarily stored in DOT-approved 55-gallon drums or roll-off boxes, as appropriate. Each container will be marked with water-proof labels and water-proof markers. Each container will receive a unique identification number and will be cataloged for waste containment documentation purposes. The IDW will be disposed of in an appropriate manner based on the results of the soil and groundwater analyses.

4.8 Surveying

Soil borings M-116 and M-119 along with the new monitoring wells M-117 and M-118 will be surveyed by GPS to an accuracy of 0.01-foot vertical and 0.1-foot horizontal relative to USGS elevation and Nevada Coordinate System datums.

4.9 Quality Assurance/Quality Control Program

An integral part of the Background Investigation sampling and analysis plan is the quality assurance/quality control (QA/QC) program to ensure the reliability and compatibility of all data generated during this assessment. The following section describes the QA/QC program that will be implemented as part of the Background Investigation at the Site.

4.9.1 Field QA/QC Samples

Field QA/QC procedures will be followed to ensure viability and integrity of sample analytical data. The field investigative team will be responsible for submitting QA/QC samples to the laboratory. QA/QC samples include field duplicates, trip blanks, equipment decontamination blanks and field blanks.

4.9.1.1 Duplicate Samples

One field duplicate will be taken for every 10 samples submitted for analysis. For duplicate groundwater samples, two sets of sample containers will be filled and both submitted for analysis.

4.9.1.2 Trip Blanks

Trip blanks are provided by the laboratory. One pair of VOA trip blanks will be included in each cooler. One trip blank per day will be analyzed for the VOCs scheduled for analysis. The trip blanks for water samples will consist of laboratory reagent water shipped to and from the sample site in the same type of sample containers and with the same preservative as the collected samples. Trip blanks will not be opened or exposed to the atmosphere in the field.

4.9.1.3 Equipment Decontamination Blanks

Equipment decontamination blanks will consist of reagent water rinsed through sampling devices. This will include the soil sampling equipment and groundwater sampling equipment used in the investigation. A minimum of one equipment blank per day of sampling will be collected and analyzed for the same set of parameters as the samples collected that day (except for analyses such as general water chemistry, anions, cations, pH, EC, of which an equipment blank will not be collected). If a non-dedicated groundwater pump is used, a pump decontamination blank will be obtained for each pump used before and after use for the groundwater sampling event.

4.9.1.4 Field Blanks

Field blanks consist of the source water used in the decontamination of sampling equipment. At a minimum, one field blank from each event or work period will be collected and analyzed for the same set of parameters as samples collected during the event.

All of the above mentioned QA samples will be sent to the laboratory as blind samples with sample numbers sequenced in with actual site samples.

4.9.2 Laboratory QA/QC Procedures

Laboratory QC measures will be taken to confirm the integrity of the laboratory data generated during the background investigation program. The procedures used to assess laboratory data quality are described in this section.

Method blanks will be analyzed daily to assess the effect of the laboratory environment on the analytical results. Method blanks will be performed for each parameter analyzed.

Each sample to be analyzed for organic parameters will contain surrogate spike compounds. The surrogate recoveries will be used to determine if the analytical instruments are operating within limits. Surrogate recoveries will be compared to control limits established and updated by the laboratory based on its historical operation.

Matrix spikes will be analyzed at a frequency of approximately 10 percent of the project samples submitted. Matrix spike results will be evaluated to determine whether the sample matrix is interfering with the laboratory analysis and provide a measure of the accuracy of the analytical data. Matrix spike recoveries will be compared to control limits established and updated by the laboratory based on its historical operation.

Laboratory duplicates will be analyzed at a frequency of approximately 10 percent. Spike duplicate results will be evaluated to determine the reproducibility (precision) of the analytical method. Reproducibility values will be compared to control limits established and updated by the laboratory based on its historical operation.

Laboratory QC data will be included with the analytical results. This QC data will include method blanks, surrogate spike recoveries (for organic parameters only), matrix spike recoveries, and matrix spike duplicates.

Prior to submitting analytical results to Kerr-McGee/ENSR, the supervising chemist will check the entire data package so that the data is acceptable. These checks include:

- Project requirements for precision, accuracy and detection limits
- Analytical procedure blanks, duplicates, matrix spike recoveries, and EPA QC results
- Instrument standardization and response factors

If the data is acceptable, a written report is generated and reviewed by the senior chemist before submission to Kerr-McGee/ENSR.

4.9.3 Quality Assurance Program

Specific quality assurance objectives for measurement are defined by precision, accuracy, representativeness, reproducibility and completeness.

Specific requirements for data accuracy, precision, and completeness are based on standard laboratory and data validation methods. Definitions of accuracy, precision, and completeness as they pertain to analytical data and standard methods used to assess accuracy, precision, and completeness are given below.

4.9.3.1 Definitions

Accuracy. The degree of agreement of a measured value with the true or expected value of the quantity of concern. Accuracy measures the bias in a measurement system.

Precision. The degree of mutual agreement characteristic of independent measurements as the result of repeated application of the process under specified conditions. It is concerned with the "closeness of results", i.e., the reproducibility of measurements under a given set of conditions.

Completeness. The percentage of measurements made which are judged to be valid measurements. The completeness goal is the same for all data uses that a sufficient amount of valid data be generated to accomplish the objectives of the study.

Standard methods of evaluation will be used to assess accuracy and precision data. Completeness can be quantitatively assessed simply by calculation of the percentage of valid data obtained. Specific methods of assessing accuracy and precision will be as follows:

Accuracy will be evaluated using percent recovery data. Percent recovery is defined as:

$$\% \text{ Recovery} = (R \ S) \times 100$$

where:
S = spiked concentration
R = reported concentration

Percent recovery limits are analyte-specific.

Precision will be evaluated using duplicate samples and expressed as relative percent difference (%RPD) or relative standard deviation (%RSD). These quantities are defined as follows:

$$\%RPD = (A_1 - A_2)/(A_1 + A_2)/2 \ X100$$

where A_1 and A_2 are the reported concentrations for each duplicate sample.

4.9.3.2 Requirements

Specific data accuracy and precision goals for laboratory analyses that are necessary to fulfill the intended use of the data are described below. The goals listed are based on EPA data, laboratory-specific data, or both. Historical data on which to set specific completeness requirements for individual methods are not yet available (EPA, 1987).

4.9.4 Comparison of Data Sets

Representativeness is defined by the U.S. EPA as the degree to which sample data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is mostly concerned with the proper design of the sampling program (i.e., that the number and locations of samples are sufficient for the purposes of the investigation). Measures can be taken to achieve a high degree of representativeness. Such measures will include but are not necessarily limited to the following:

- Obtaining samples over a range of environmental conditions. In the case of groundwater sampling, this would include (a) the systematic collection of samples over time to account for temporal variations and (b) an adequate number of, and appropriately located sampling locations to account for spatial variations.

- Use of previously collected site-specific data to guide the selection of appropriate sampling locations and chemical parameters.
- Use of appropriate sample collection procedures.

Details of the sampling program design and sample collection procedures are presented in Section 4.3.

5.0 DATA EVALUATION AND REPORTING

5.1 Data Review

Data will be evaluated to verify that soil, groundwater and QA/QC samples were collected in compliance with the specifications contained in the workplan. The laboratory certified analytical reports will be reviewed to determine if samples were analyzed within holding times and that laboratory QA/QC samples, such as matrix spikes and matrix spike duplicates were within the laboratory specific acceptable ranges. Deviations, if any, will be identified.

5.2 Reporting of Results

A report will be prepared that presents the results of the background soil and groundwater sampling. The report will include a description of the field methods employed, analytical methods, analytical results, data evaluation methods, and a scale map containing the locations of the soil borings and monitoring wells installed. Typed boring logs and well completion diagrams will be included in the report. The results of laboratory analysis will be presented on tables. The laboratory certified analytical reports will be provided in Adobe Acrobat (.pdf) electronic form on a CD in an appendix. A Nevada Certified Environmental Professional will sign the report.

6.0 PROJECT MANAGMENT PLAN

The overall organization of the project includes the following individuals and agencies.

This work is being conducted as part of the Environmental Conditions Assessment under agreements with the Nevada Division of Environmental Protection. The NDEP project manager is Mr. Brian Rakvica.

The Kerr-McGee project manager is Susan Crowley. Ms. Crowley is a Nevada Certified Environmental Manager and is the person who serves as the point of contact for regulatory and environmental issues pertinent to the Site. She is located at the Kerr-McGee Henderson Facility. Her telephone number is (702) 651-2234. Ms. Crowley manages the subcontractors that will be performing the tasks described in this workplan.

ENSR International is Kerr-McGee's environmental consultant. Mr. David Gerry, Senior Program Manager, Sally Bilodeau, Senior Geologist, Edward Krish, Field Manager, Brian Ho, Quality Assurance Officer, and Reina Foxx, Staff Geologist will be assisting with this project.

MWH Laboratories (MWH) is the laboratory contractor selected by Kerr-McGee for this project. MWH is certified with the State of Nevada as an environmental testing laboratory. Andrew Eaton, Ph.D., is the point of contact at MWH. Laboratory data will be provided to Kerr-McGee in hard copy format as well as electronic data deliverable (EDD) format. The laboratory will provide sample receipt notification following samples receipt at the laboratory.

The implementation of the workplan is the shared responsibility of the ENSR Senior Program Manager, the Field Manager, the Quality Assurance Officer, the field and office personnel, and the contractor personnel. The Senior Program Manager's responsibilities include:

- Providing the field personnel with a copy of the workplan;
- Notifying the laboratory regarding site specific data quality requirements;
- Checking Chain of Custody and field logs to verify sample collection; and
- Taking corrective action if necessary.

The responsibilities of the Quality Assurance Officer and Senior Geologist include:

- Reviewing the field and laboratory data to determine if the data quality objectives were met;
- Preparing a summary of quality assurance/quality control (QA/QC) data; and
- Conducting audits and implementing corrective action as necessary.

The responsibilities of the Field Manager include:

- Noting work plan progress and corrective actions taken on daily field logs.
- Collecting and compiling the daily field logs from field personnel and providing them to the Senior Program Manager within two days.
- Keeping the Kerr-McGee Project Manager advised of project status daily.

The responsibilities of the office and field personnel include:

- Reviewing and implementing the work plan and quality assurance quality control plan;
- Field calibration of measurement and test equipment ,as needed;
- Maintaining required documentation of activities;
- Collection, labeling, handling, storage, shipping and filling out Chain of Custody forms for environmental samples collected;
- Maintaining control of samples until they are appropriately released; and
- Notifying the PM if there are deviations from or problems implementing the work plan or quality assurance procedures.

The responsibilities of the laboratory subcontractor include:

- Provide appropriate sample containers, preservatives and coolers to the Site;
- Advise the PM of delays experienced in analyzing the samples;
- Advise the PM upon receipt of samples if there are questions regarding the analysis requested or if there are quality or sample integrity issues that need to be addressed;
- Perform the requested analyses under SW-846 and/or state approved protocol;
- Conduct the required instrument calibration and QA/QC protocols specified in the laboratories internal quality assurance plans.

The responsibilities of the drilling subcontractor include:

- Provide appropriate drilling equipment and trained personnel as specified in the subcontract agreements.

7.0 REFERENCES

ASTM. 1990. Standard Practice for Description and Identification of Soils: D2488-84.

Bell, J.W., 1981, Subsidence in Las Vegas Valley: Nevada Bureau of Mines and Geology, Bulletin 95, 84p.

Ecology & Environment, 1982, Summary and Interpretation of Environmental Quality Data, BMI Industrial Complex, Henderson Nevada, November 1982.

ENSR, 1997, Phase II Environmental Conditions Assessment located at Kerr-McGee Chemical Corporation, Henderson Nevada, August 7, 1997.

ENSR, 2001, Supplemental Phase II Environmental Conditions Assessment, April 2001.

ENSR, 2005, Conceptual Site Model, Kerr-McGee Facility, Henderson, Nevada, February 28, 2005.

Kerr-McGee, 1996a, Phase II Work Plan, May 1996.

Kerr-McGee, 1996b, Response to Letter of Understanding Henderson Nevada, October 1996.

Kerr-McGee, 1998, Response to Phase II Report Comments and Supplemental Phase II Work Plan, November 9, 1998.

Kleinfelder, 1993, Environmental Conditions Assessment, Kerr-McGee Chemical Corporation, Henderson, Nevada Facility, April 15, 1993 (Final).

Langenheim, V.E., Grow, J., Miller, J., Davidson, J.D., and Robinson, E. 1998, Thickness of Cenozoic Deposits and Location and Geometry of the Las Vegas Valley Shear Zone, Nevada, Based on Gravity, Seismic-Reflection and Aeromagnetic Data: U.S. Geological Survey Open-File Report 98-576, 32p.

Mason, B. J., 1983, Preparation of Soil Sampling Protocol: Techniques and strategies, EMSL/USEPA, Las Vegas, NV, EPA-600/4-83-020

NDEP, 1991, Consent Agreement. Phase I Environmental Conditions Assessment, April 25, 1991

NDEP, 1994, Phase II Letter of Understanding between NDEP and Kerr-McGee, August 15, 1994.

NDEP, 1998, Review of Phase II Environmental Conditions Assessment, June 10, 1998.

NDEP, 2004, Response to Supplemental Phase II Report-Environmental Conditions Assessment, February 11, 2004.

Plume, R.W., 1989, Ground-Water Conditions in Las Vegas Valley, Clark County, Nevada: Part 1. Hydrologic Framework: U.S. Geological Survey Water-Supply Paper 2320-A, 14p.

US EPA 1982, Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846, 2nd Edition.

TABLES

Table 1. List of Upgradient Monitoring Wells to be Sampled.

WELL CLUSTER	WELL ID	SCREENED INTERVAL (FT.)	TOTAL DEPTH (FT.)	FORMATION SCREENED
1	TR-7	260-290	290	MCcg1
	TR-8	63-93	93	MCcg2
2	TR-9	230-250	250	MCcg1
	M-118*	120-140 est.	140 est.	MCfg2
	TR-10	80-100	101	MCcg2
3	M-117*	120-140 est.	140 est.	MCfg2
	M-103	69.5-89.5	90	MCcg1
--	H-11	95-105	107	MCcg1

* Proposed new upgradient monitoring well.

* MCfg = Muddy Creek fine grained facies

MCcg = Muddy Creed coarse grained facies

Table 2.
Proposed Soil Sample Analytical Plan
Background Investigation, Kerr-McGee Facility - Henderson, Nevada

Boring Location	**Sample ID Number**	**Sample Depths (ft, bgs)**	**Perchlorate (314.0)**	**TPH-FF (8015M/5035**)**	**VOCs / MTBE & Fuel Alcohols (8260B/5035)**	**Title 22 Metals$^{2.}$ (6010B)**	**Hexavalent Chromium (7196 or 7199)**	**Radio-nuclides$^{1.}$ (various)**
M-116	M116-0.5	0.5	X	X	X	X	X	X
	M116-0.5D	0.5	X	X	X	X	X	X
	M116-5	5	X	X	X	X	X	hold
	M116-10	10	hold	X	X	X	X	hold
	M116-20	20	--	--	--	X	X	--
	M116-30	30	hold	X	X	X	X	--
	M116-40	40	--	--	--	X	X	--
	M116-50	50	hold	X	X	X	X	X
M-117	M117-0.5	0.5	X	X	X	X	X	X
	M117-5	5	X	X	X	X	X	hold
	M117-10	10	hold	X	X	X	X	hold
	M117-20	20	--	--	--	X	X	--
	M117-20D	20	--	--	--	X	X	--
	M117-30	30	--	--	--	X	X	--
	M117-40	40	--	--	--	X	X	--
	M117-50	50	hold	X	X	X	X	--
	M117-60	60	--	--	--	X	X	--
	M117-70	70	--	--	--	X	X	--
	M117-80	80*	--	X	X	X	X	--
	M117-80D	80*	--	X	X	X	X	--
	M117-90	90*	--	X	X	X	X	--
	M117-100	100*	--	X	X	X	X	--
	M117-110	110*	--	X	X	X	X	--
	M117-120	120*	--	X	X	X	X	X
M-118	M118-0.5	0.5	X	X	X	X	X	X
	M118-5	5	X	X	X	X	X	hold
	M118-10	10	hold	X	X	X	X	hold
	M118-20	20	--	--	--	X	X	--
	M118-20D	20	--	--	--	X	X	--
	M118-30	30	--	--	--	X	X	--
	M118-40	40	--	--	--	X	X	--
	M118-50	50	hold	X	X	X	X	--
	M118-60	60	--	--	--	X	X	--
	M118-70	70	--	--	--	X	X	--
	M118-80	80*	--	X	X	X	X	--
	M118-90	90*	--	X	X	X	X	--
	M118-100	100*	--	X	X	X	X	--
	M118-110	110*	--	X	X	X	X	--
	M118-120	120*	--	X	X	X	X	X

Table 2.
Proposed Soil Sample Analytical Plan
Background Investigation, Kerr-McGee Facility - Henderson, Nevada

Boring Location	Sample ID Number	Sample Depths (ft, bgs)	Perchlorate (314.0)	TPH-FF (8015M/5035**)	VOCs / MTBE & Fuel Alcohols (8260B/5035)	Title 22 Metals[2.] (6010B)	Hexavalent Chromium (7196 or 7199)	Radio-nuclides[1.] (various)
M-119	M119-0.5	0.5	X	X	X	X	X	X
	M119-0.5D	0.5	X	X	X	X	X	X
	M119-5	5	X	X	X	X	X	hold
	M119-10	10	hold	X	X	X	X	hold
	M119-20	20	--	--	--	X	X	--
	M119-30	30	hold	X	X	X	X	--
	M119-40	40	--	--	--	X	X	--
	M119-50	50	hold	X	X	X	X	X

Notes:

*	Soil sample to be collected at a depth just above the capillary fringe.
**	Samples for TPH-gasoline analysis will be preserved in the field using sodium bisulfate and methanol preservatives.
1.	Includes: Lead-210, lead-212, uranium (isotopic), radium-226, radium-228, and thorium (isotopic) by method EML HASL 300, and uranium-(total) by method EML ASTM D5174.
2.	Includes: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc; and aluminum, boron, iron, manganese, titanium, and tungsten.
X	Sample to be collected and analyzed.
--	Sample will not be analyzed.
M116-0.5D	Duplicate soil sample of M116-0.5.
TPH-FF	Total Petroleum Hydrocarbons - Full Carbon Range (C_4 - C_{23+})

Table 3. Sample Containers, Analytical Methods and Holding Times for Soil Samples

Analyte	Method	Container (Minimum Volume)	Holding Time
Perchlorate	EPA 350.1	4-oz. glass jar	28-days
Metals* + B, Mn, Al, Ca, Fe, Mg, Na, K, and Ti	EPA 6010B	4-oz. glass jar	6 months
Tungsten	ICP-AES/ ICP (200.7)/ ICPMS (200.8)	Same jar as above	6 months
Hexavalent Chromium	EPA 3060A (prep), EPA 7199 by Ion Chromatography <u>or</u> EPA 7196 by colorometric	4-oz. glass jar	30 days for digestion
VOCs/MTBE/Fuel Alcohols	EPA 8260B/5035	(3) 40 ml glass VOA vials or (3) Encore capsules.	14 days
TPH – Full Carbon Range	EPA 8015M (EPA 5035 for TPH-G fraction)	(3) 40-ml glass VOA vials or (3) Encore capsules for TPH-G; metal sleeve or glass jar for TPH D and higher.	7 days
Radionuclides: Lead-210	EML HASL 300	4-oz. glass jar	6-months
Lead-212	EML HASL 300	4-oz. glass jar	6-months
Uranium (Isotopic)	EML HASL 300	4-oz. glass jar	6-months
Uranium (Total)	EML ASTM D5174	4-oz. glass jar	6-months
Radium-226	EML HASL 300	4-oz. glass jar	6-months
Radium-228	EML HASL 300	4-oz. glass jar	6-months
Radon-222	No Test – Too Volatile	--	--
Thorium (Isotopic)	EML HASL 300 OR A-01-R Mod/HASL 300	4-oz. glass jar	6-months

Note:

* Title 22 Metals: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc.

B = Boron, Mn = Manganese, Al = Aluminum, Ca = Calcium, Fe = Iron, Mg = Magnesium, Na = Sodium, K = Potassium, and Ti = Titanium.

Table 4.
Proposed Groundwater Analytical Plan
Background Investigation, Kerr-McGee Facility - Henderson, Nevada

Well Cluster	Well ID	Sample ID Number	Screened Interval (ft, bgs)	Perchlorate (314.0)	TPH-FF (8015M)	VOCs / MTBE & Fuel Alcohols (8260B)	Title 22 Metals[3.] (6010/7000)	Hexavalent Chromium (7196)	Radio-nuclides[1.] (various)	General Water Chemistry[2.] (various)
1	TR-7	TR-7	260-290	X	X	X	X	X	X	X
	TR-8	TR-8	63-93	X	X	X	X	X	X	X
		TR-8D	--	X	X	X	X	X	X	X
2	TR-9	TR-9	230-250	X	X	X	X	X	X	X
	MW-118	MW-118	120-140	X	X	X	X	X	X	X
	TR-10	TR-10	80-100	X	X	X	X	X	X	X
3	M-117	M-117	120-140	X	X	X	X	X	X	X
	M-103	M-103	69.5-89.5	X	X	X	X	X	X	X
--	H-11	H-11	95-105	X	X	X	X	X	X	X

Notes:

1. Includes: Lead-210, lead-212, uranium (isotopic), radium-226, radium-228, and thorium (isotopic) by method EML HASL 300, uranium-(total) by method EML ASTM D5174, and radon-222 by Method ASTM D5072.
2. Includes: Calcium, magnesium, sodium, potassium, chloride, sulfates, nitrates, nitrites as N, alkalinity, bicarbonate, carbonate, pH, and electrical conductivity.
3. Includes: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc; and aluminum, boron, iron, manganese, titanium, and tungsten.

X	Sample to be collected and analyzed.
TR-8D	Duplicate groundwater sample
TPH-FF	Total Petroleum Hydrocarbons - Full Carbon Range (C_4 - C_{23+})

Table 5. Sample Containers, Analytical Methods and Holding Times for Groundwater samples

Analyte	Method	Container	Holding Time
Perchlorate	EPA 314.0	(1) 125-ml plastic bottle	28 days
Metals* + B, Mn, Al, Ca, Fe, Mg, Na, K, and Ti	EPA 6010B	(1) 500-ml plastic bottle	6 months
Tungsten	Flame AAS/ ICP (200.7)/ ICPMS (200.8)	Same container as above	6 months
Hexavalent Chromium	EPA 7196A, EPA 218.6	(1) 250-ml plastic bottle	24 hours
VOCs/MTBE/ Fuel Alcohols	EPA 8260B	(3) 40-ml VOA vials	14 days
TPH – Full Carbon Range	EPA 8015M	(3) 40-ml VOA vials	7 days
Alkalinity	EPA 310.1	500-ml plastic no preservative	14 days
Bicarbonate	EPA 310.1	Same as above	14 days
Carbonate	EPA 310.1	Same as above	14 days
pH	EPA 150.1	125-ml plastic no preservative	7 days
Electrical Conductivity	EPA 120.1	125-ml plastic no preservative	28 days
General Water Chemistry Ions			
Chlorate	EPA 300.0	125-ml plastic bottle/ no preservative	28 days
Chloride	EPA 300.0	**(2) liter plastic bottles	28 days
Cyanide	EPA 335.1, EPA 335.2 (total)	(1) 500-ml plastic bottle	14 days
Nitrate	EPA 300.0	**Use same bottles	48 days
Nitrite as N	EPA 300.0	125-ml plastic no preservative	28 days
Perchlorate	EPA 314.0	**Use same bottles	28 days
Phosphate	EPA 300.0, EPA 365.1 (total)	125-ml plastic bottle, no preservative	48-hour
Sulfate	EPA 300, EPA 375.4	**Use same bottles	28 days
Sulfide (Total)	EPA 376.2	500-ml plastic bottle w/NaOH/Zn acetate	7 days

Table 5. Sample Containers, Analytical Methods and Holding Times for Groundwater samples

Analyte	Method	Container	Holding Time
Radionuclides:			
Lead, Pb-210	EPA 909	(1) 1-liter plastic bottle w/HNO_3	6 months
Lead, Pb-212	EPA 901.1/ SW 9310		Half-life = 10 hrs.
Uranium (Isotopic)	EML HASL 300	(10) 1-liter amber glass bottles	
Uranium (total)	EML ASTM D5174	(10) 1-liter amber glass bottles	
Radium-226	EPA 903.1	(1) 1-liter poly bottle (must be full)	
Radium-228	EPA 904.0	(2) 1-liter poly bottles (must be full)	
Radon-222	ASTM D5072, EPA 913.0	(3) 40-ml VOA vial filled under water, no headspace	72 hrs.
Thorium (Isotopic)	EML HASL 300 OR A-01-R Mod/HASL 300		

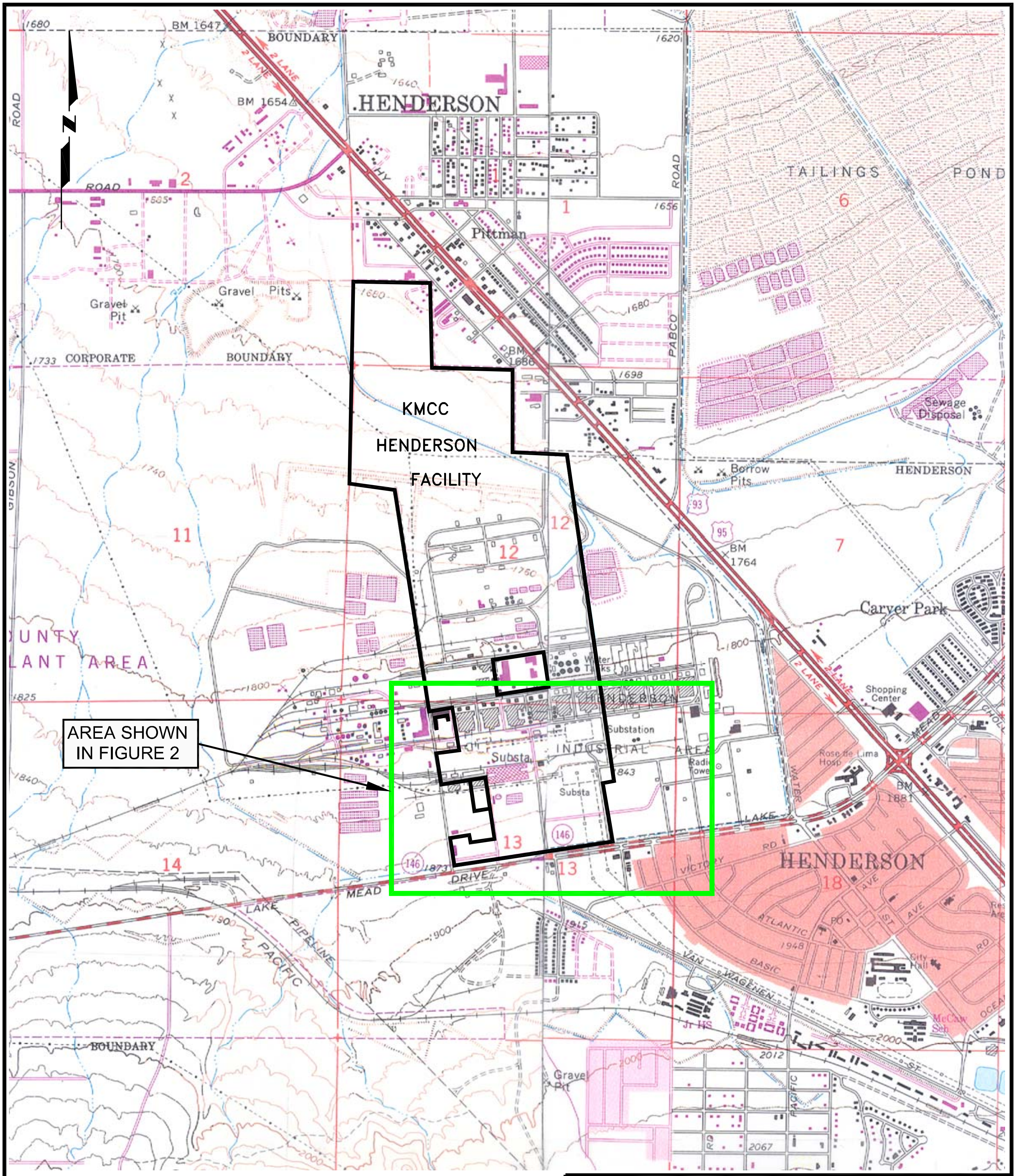
Note:

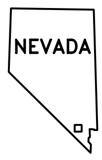
* Title 22 Metals: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molbdenum, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc.

B = Boron, Mn = Manganese, Al = Aluminum, Ca = Calcium, Fe = Iron, Mg = Magnesium, Na = Sodium, K = Potassium, and Ti = Titanium.

** Chloride, Nitrate, Perchlorate, and Sulfate use same bottle for all these samples. Sample containers are (2) liter plastic bottles.

FIGURES





QUADRANGLE LOCATION

SOURCE: USGS 7.5 Minute Topographic Quadrangle, Las Vegas SE, Nevada, 1967, Photorevised 1984

Henderson, Nevada, 1970, Photorevised 1983

FIGURE 1

SITE LOCATION MAP

Kerr-McGee Chemical LLC Facility
Henderson, Nevada

DRAWN: T. Burke	DATE: 03/28/2005	PROJECT NO. 04020-023-150	REV. 2
FILE NO. SiteLoc2Map	CHK BY: R. Foxx		

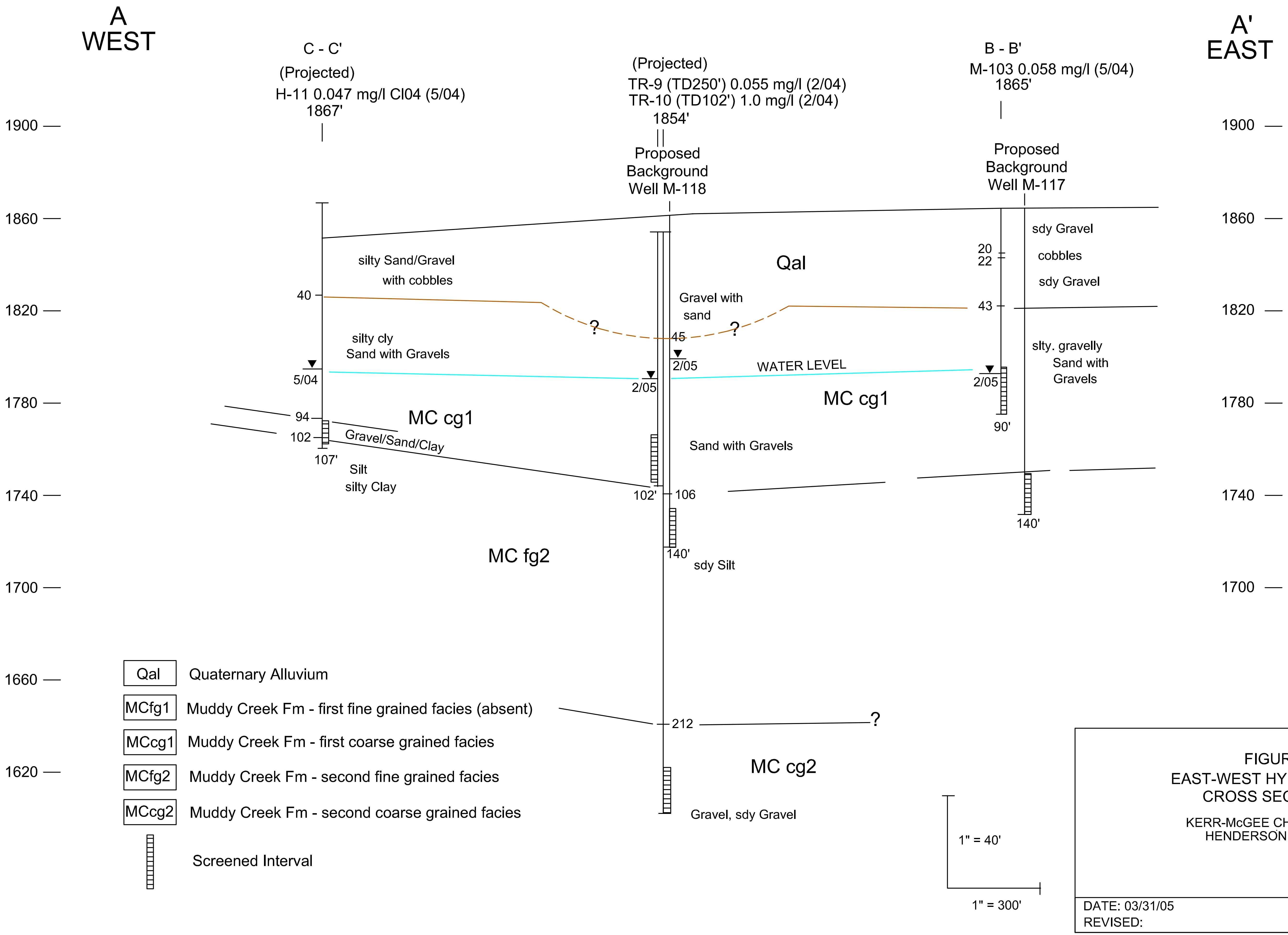
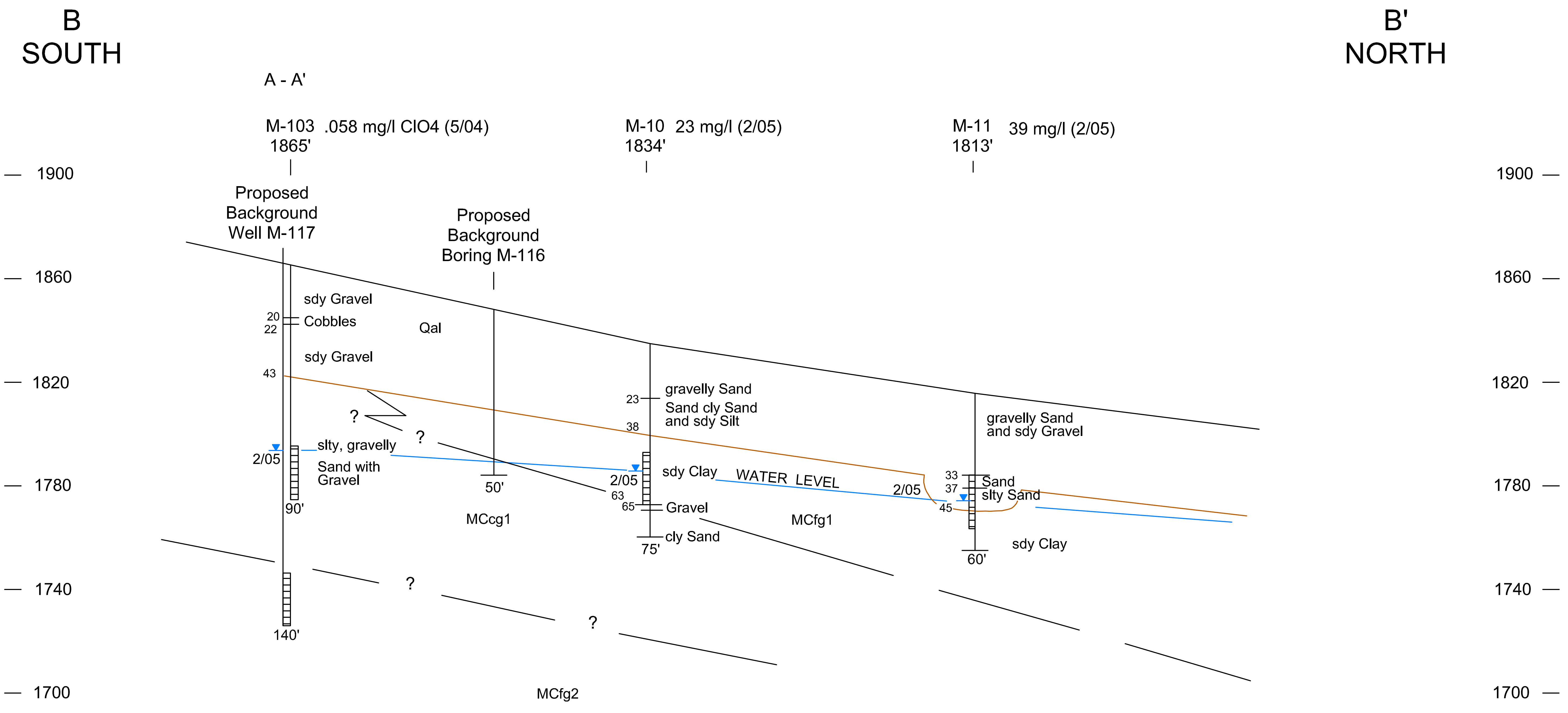


FIGURE: 3
EAST-WEST HYDROGEOLOGIC
CROSS SECTION A - A'

KERR-McGEE CHEMICAL LLC
HENDERSON, NEVEDA

DATE: 03/31/05
REVISED:

SCALE: 1" = 300' (H)
1" = 40' (V)



Qal	Quaternary Alluvium
MCfg1	Muddy Creek Fm - first fine-grained facies
MCcg1	Muddy Creek Fm - first coarse-grained facies
MCfg2	Muddy Creek Fm - second fine-grained facies
▤	Screened Interval

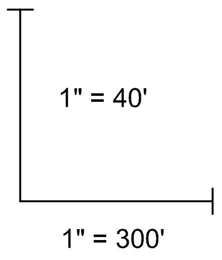


FIGURE: 4

NORTH-SOUTH HYDROGEOLOGIC CROSS SECTION B -B'

KERR-McGEE CHEMICAL LLC
HENDERSON, NEVADA

DATE: 3/31/05 REVISED:	SCALE 1" = 300' (H) 1" = 90' (V)

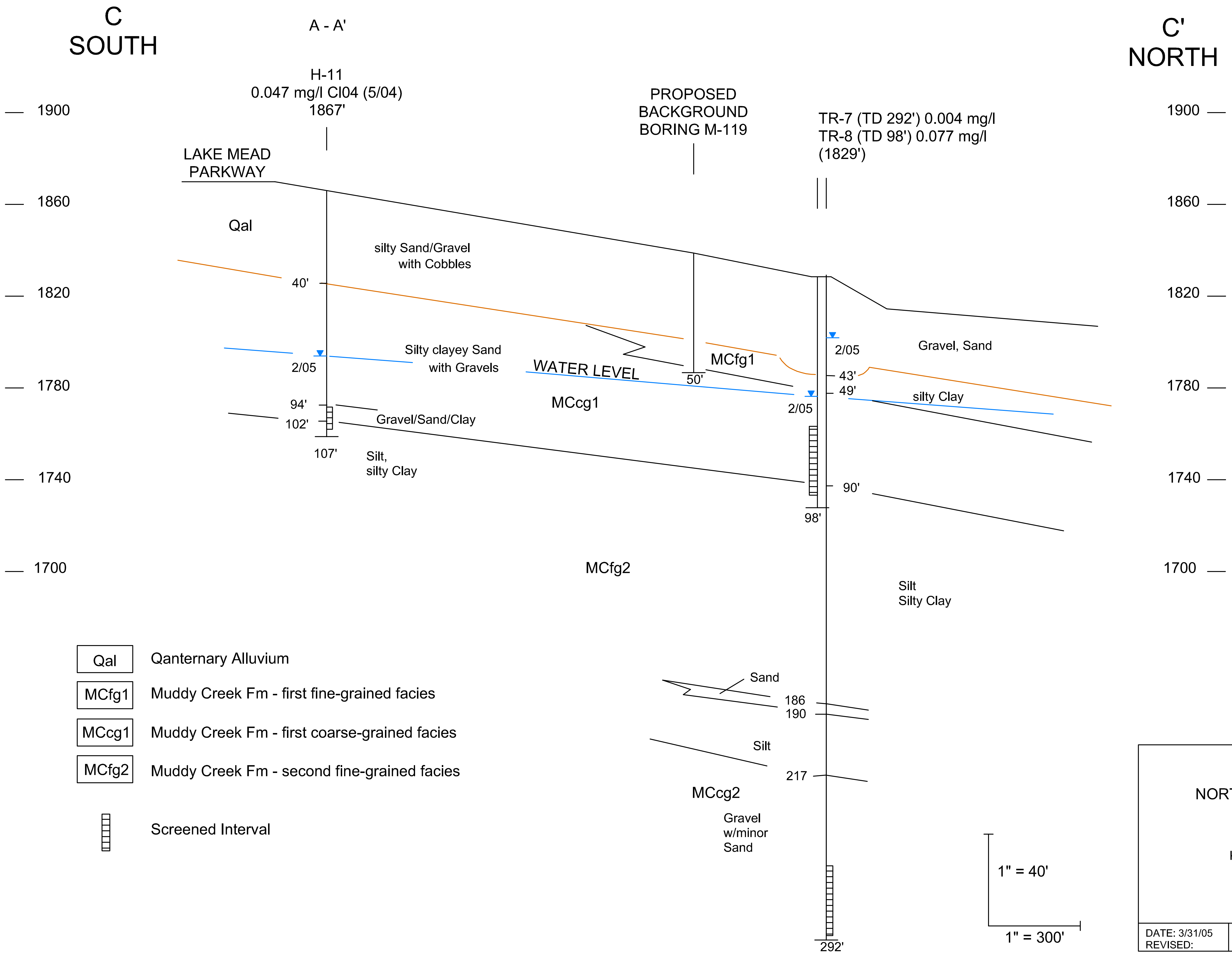


FIGURE: 5

NORTH-SOUTH HYDROGEOLOGIC
CROSS SECTION C - C'

KERR-McGEE CHEMICAL LLC
HENDERSON, NEVADA

DATE: 3/31/05
REVISED:

SCALE= 1" = 300' (H)
1" = 40' (V)

APPENDIX A

Regulatory Correspondence

ALLEN BIAGGI, *Administrator*

Administration
Water Pollution Control
Air
(702) 486-2850

STATE OF NEVADA
KENNY C. GUINN
Governor

R. MICHAEL TURNIPSEED, *Director*

Federal Facilities
Corrective Actions
Waste Management
Facsimile 486-2863

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
(Las Vegas Office)
1771 E. Flamingo Road, Suite 121-A
Las Vegas, Nevada 89119-0837

February 11, 2004

Ms. Susan Crowley
Kerr-McGee Chemical LLC
PO Box 55
Henderson, Nevada 89009

Re: **Kerr-McGee Chemical Corporation LLC (KM)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Supplemental Phase II Report – Environmental Conditions Assessment

Dear Ms. Crowley,

The Nevada Division of Environmental Protection (NDEP) has reviewed the:

Supplemental Phase II Report – Environmental Conditions Assessment; Kerr-McGee Chemical LLC, April 25, 2001.

NDEP's comments to the aforementioned report are contained in Attachment A. In summary, characterization work performed to date does not appear to be technically defensible and additional work will be required. Some specific points include: 1) a need to identify all potential contaminants associated with the site; 2) appropriate background sampling; 3) use of inappropriate action levels; and 4) existence of data gaps. Before additional work is completed, the NDEP recommends that Kerr-McGee Chemical LLC (KM) meet with the NDEP to discuss the comments and development of a plan to move forward.

30th - per Rakvica 3-4-04

By **March ~~8~~, 2004,** KM should provide to the NDEP a schedule for addressing the issues outlined herein. Should you have any questions or concerns, please do not hesitate to contact me at (702) 486-2870.

Sincerely,

Brian A. Rakvica, P.E.
Staff Engineer III
Remediation and LUST Branch
Bureau of Corrective Actions
NDEP – Las Vegas Office

BAR/bar
Encl: Attachment A

CC: Jim Najima, NDEP, BCA, Carson City
Jon Palm, NDEP, BWPC, Carson City
Todd Croft, NDEP, BCA, Las Vegas
Jennifer Carr, NDEP, BCA, Carson City
Jeff Johnson, NDEP, BCA, Carson City
Valerie King, BWPC, Carson City
Tamara Pelham, BWPC, Carson City
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlman, City of Henderson, 240 Water Street, Suite 210, Henderson, NV 89015
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Carrie Stowers, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BEC, 875 West Warm Springs Road, Henderson, Nevada 89015
Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015

Attachment A
NDEP Comments on the *Supplemental Phase II Report – Environmental Conditions Assessment*

1. **Submission of documents**
   a. Two copies of all reports should be provided to Brian Rakvica in the Las Vegas office of the NDEP and two additional copies should be provided to Mr. Jeff Johnson in the Carson City office of the NDEP.
   b. An electronic copy of all reports in PDF format should also be provided to Mr. Brian Rakvica.
   c. All laboratory data should be formatted to comply with the Division's Electronic Data Deliverable's (EDD) format. These data packages will need to be compatible with Earthsoft's EquIS Data Management System (relational database written in Visual Basic and using the Microsoft Access engine). The specific formatting requirements of this data will be provided to KM under separate cover at a later date.
2. **Project Personnel**
   a. NDEP needs to understand what personnel are being applied to this project. Please provide current resumes and/or curricula vitae for each project staff member. This is a multi-disciplinary project and the following expertise may be needed to complete this project: hydrogeologist, engineer, toxicologist, radiochemist, risk assessor, expert in fate and transport, statistician and chemist.
   b. Please provide an organizational chart for the project team.
   c. Please identify the Nevada Certified Environmental Manager (CEM) for this project.
3. **Presentation of Calculations and Data**
   a. Calculations: When a significant calculation is performed and referenced in the text an example calculation should be included in the report. The formulae used and the reference for the formulae should also be shown for the example calculation. These example calculations could be summarized in an appendix to the report, in a footnote, or in the body of the text. The NDEP is also amenable to alternate presentation forms.
   b. Data: Data for soil shall not be separated from data for groundwater. One drawing should be presented for each site-related chemical to illustrate the three dimensional extent of contamination. Information to be included on each drawing is summarized below.
      i. All soil analytical data shall be presented.
      ii. All potential source areas for the chemical being evaluated shall be clearly identified and highlighted. Potential source areas include areas where concentrations in soil exceed background and those portions of the facility where chemicals were used or stored. Source areas may include several Letter of Understanding (LOU) study areas.
      iii. All groundwater analytical data shall be presented.

    iv. Iso-concentration contours for groundwater data illustrating the extent of the groundwater plume shall be presented. Property boundaries are not to be used for termination of the delineation of the chemical plumes.
    v. Any location that is considered a background location for any chemical in soil or groundwater shall be clearly identified on all drawings.
    vi. All site features that may impact contaminant transport (surface and subsurface) shall be identified.
  c. Drawings shall be self-explanatory without the need to refer to the text to interpret what is being presented. The presentation of more than one site-related chemical on a drawing is appropriate when the chemicals are similar (e.g.: VOCs, metals, etc.), are migrating together and have common sources. The above presentation is required to complete a conceptual site model. The conceptual site model should be updated as more data is collected.

4. **Averaging of Analytical Data**
  a. In previous reports, analytical data on several tables are averaged. The NDEP can not evaluate the adequacy of site characterization work based on analytical data that are averaged. Risk assessment is the only phase of the project where analytical data should be averaged. Analytical results should be presented discretely and compared to appropriate risk based criteria; Applicable or Relevant and Appropriate Requirements (ARARs); or approved background levels.
  b. Composite soil samples are appropriate where justification is provided and NDEP approval is obtained. Composite samples may not be appropriate for risk-based closures without a rigorous statistical analysis.

5. **Phase II Consent Agreement Reporting and Public Involvement Obligations**
  a. KM is reminded that quarterly progress reports are due to the NDEP in accordance with Section XIII of the Phase II Consent Agreement.
  b. KM is further reminded that participation in the Public Involvement Plan (PIP) is required in accordance with Section V.2. of the Phase II Consent Agreement. This PIP requires a copy of all key documents to be submitted to the Public Information Repository located at the James I. Gibson Public Library in Henderson, Nevada.

6. **Site Groundwater**
  a. The Nevada Revised Statutes and the Nevada Administrative Code consider all groundwater of the State of Nevada to be potential sources of drinking water; prohibit the discharge of pollutants into the groundwater without a permit; and require the source of any pollutant to be eliminated. It has been well documented that the water beneath the KM plant site has the ability to reach the Las Vegas Wash. The Las Vegas Wash is a tributary to Lake Mead. Lake Mead and the Lower Colorado River are the drinking water supply for over 20,000,000 people. The NDEP would like to stress the importance of: elimination of the migration of pollutants from

the KM site; delineation of the extents of the off-site contamination in the form of a conceptual site model (CSM); and management and remediation of all off-site pollutants. Characterization of off-site pollutants in groundwater may require broad suite analyses. These analyses should include (at a minimum) the following chemical classes: VOCs, SVOCs, PAHs, Pesticides, Radionuclides, Metals, Inorganics, Dioxins/Furans, and PCBs. Please note that the radionuclide analyses should include (at a minimum): the uranium series, the thorium series, radium 226/228 (and all daughter products), as well as potassium 40.

b. It should also be noted that "Beneficial Use Standards" have been developed for the Las Vegas Wash and are presented in NAC 445A.144 and NAC 445A.199-NAC 445A.201.

c. The NDEP requests that KM provide a summary of the on-going monitoring of the site groundwater. This summary should include a list of the monitoring wells; the analytes that each well is monitored for; and the frequency of the analysis.

d. The Division requests that plume maps be developed for each of the site-related chemicals including data that extends off-site. See also comment 3.

7. **Pond GW-11**

a. Pond GW-11 has received effluent from the chromium mitigation system and the perchlorate remediation system. The contaminants in this effluent have been evapo-concentrating in pond GW-11. It is the Division's understanding that the contents of pond GW-11 will eventually be processed through the new fluidized bed reactor (FBR).

    i. Please provide any data on analyses that have been performed on the contents of Pond GW-11.

b. Broad suite analyses may be appropriate for pond GW-11. It is not clear to the NDEP that the contents of pond GW-11 are well characterized.

8. **Chromium Mitigation System**

a. The existing chromium mitigation system treats a limited quantity of groundwater on the plant site. From plume maps provided by KM, it is obvious that there is a large plume of chromium downgradient of the plant site slurry wall. KM has implemented a temporary remedial system to address the elevated hexavalent chromium concentrations at the Athens Road well field.

    i. Please explain KM's long-term plan for the remediation of chromium (total and hexavalent) at the Athens Road well field. It appears to the Division that the concentrations will continue to increase in this location (based on available data).

b. The existing total chromium plume maps terminate near the property boundary and are delineated to 1.0 ppm.

    i. Please provide complete mapping of the existing total chromium plume down to ND(0.05 mg/l). Also, include a 0.1 mg/l contour (current MCL for total chromium).

   - ii. It is requested that chromium plume mapping eventually be coordinated with the development of the perchlorate plume maps. Maps should be of identical orientation, scale and sampling date. Please identify a schedule by which this mapping can be coordinated with the perchlorate mapping.
   - iii. Please provide any information on sampling conducted to date for total and hexavalent chromium in the Muddy Creek Formation and Muddy Creek Aquifers.

c. Please provide any available data for the influent concentrations of total and hexavalent chromium to the on-plant site chromium mitigation system.

9. **Site-Related Chemicals**

a. The NDEP is concerned that site-related chemicals have not been adequately identified for the KM facility. Site-related chemicals include all raw materials, products processed, byproducts, waste products and any other chemical used at the facility. All degradation products associated with any chemical that may have been used at the facility are also site-related chemicals. All site-related chemicals need to be identified in accordance with USEPA guidance (see *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, EPA/540/1-89/002, December 1989*). If it is unknown whether or not chemicals are present at the site~~, or~~ if all chemicals associated with historical operations have not been adequately documented, then a broad suite analysis is warranted for those chemical classes that may be present. Please note that some chemicals associated with the site may not be covered by broad suite analyses. Site-related chemicals associated with the KM facility need to be identified and justified for each chemical class including but not limited to: metals, radionuclides, volatile organic compounds, semi-volatile organic compounds, dioxins, furans, pesticides, and polycyclic aromatic hydrocarbons (PAHs). A detailed discussion on site-related chemicals is required for any risk assessment. During risk assessment, the list of site-related chemicals is reduced to a list of chemicals of potential concern (COPC). Please note that the term COPC is specific to risk assessment and should only be used after the completion of site characterization and the development of a CSM.

b. For example, if the suite of metals associated with the site cannot be identified, then a broad suite of metals needs to be analyzed. Twenty-four metals are considered site-related chemicals for the Upper and Lower Ponds east of Boulder Highway (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium (total), chromium (VI), cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, titanium, tungsten, vanadium and zinc). These 24 metals should be included in the list of site-related chemicals for the KM facility or the abbreviated list of metals that were analyzed during the previous investigations needs to be justified.

c. Another example is the unknown chemicals and wastes at the site. In the April 1993 Phase I Environmental Conditions Assessment there are several examples of unknowns at the site.
    i. U.S. Government Activities – "Detailed records describing the quantities of waste produced and the location(s) for disposal…were not found during this study".
    ii. Other previous lessees on KM property – "The actual locations leased and operations conducted by these companies are not well documented".
    iii. Hardesty/Amecco Chemical – "residue from the manufacturing process was pumped directly into a steel tank truck and removed to a remote location and burned". The by-products from this incomplete combustion process are unknown but may include: dioxins, furans, PAHs, as well as components of the residue that were burned. KM should identify this potential source area.

d. The analytical methods for the list of site-related chemicals must be presented for review by the NDEP.

e. The development of a comprehensive list of site-related chemicals should be the <u>first</u> priority for this project.

10. **Data Quality**

a. In this report and previous reports elevated detection limits have been presented. These detection limits are at or above their (potential) corresponding screening levels. Examples include (but are not limited to): benzene, cadmium, ethylbenzene, selenium, and toluene.

b. If a risk assessment is to be performed, the usability of this data will need to be demonstrated in accordance with US EPA Guidance.

c. KM is requested to review this issue with their laboratories to determine the reasoning behind these elevated detection limits.

d. KM is requested to review these issues and the remaining part of the quality assurance program (in accordance with Section VIII of the Phase II Consent Agreement) and submit a formalized response to NDEP.

11. **Action Levels**

a. The NDEP has repeatedly stressed the importance of comparing data to appropriate action levels including letters dated June 10, 1998 and December 17, 1998.

b. Please note that if a chemical is present, but below an established action level, it will not necessarily be removed from consideration or future analysis. This chemical may need to be carried through as a contributor to cumulative risk.

c. Action levels should be protective of human health and the environment. Standards or criteria that can be used to evaluate human health or ecological risks include Maximum Contaminant Levels (MCLs), USEPA soil screening levels (SSLs), USEPA Ambient Water Quality Criteria (AWQC), ATSDR criteria, site-specific background levels, and USEPA Region IX Preliminary Remediation Goals (if used correctly, see below for additional details). KM should present a detailed evaluation of the derivation of the action levels to be used for this project.

d. Please note that although NAC 445A.2272 does allow the use of TCLP maximum concentrations as action levels where the exposure pathway is to surface water or groundwater, TCLP maximum concentrations were established Federally to classify hazardous waste for disposal purposes; they were not established to evaluate human health and ecological risk. Further, there is no basis in regulations to extrapolate these concentrations for use as human health and ecological risk criteria for soil exposure. According to NAC 445A.2272, the most restrictive action level must be used, and at an appropriate level of concentration that is based on the protection of human health and safety and of the environment. Contaminant concentrations associated with human health and ecological risk criteria are generally much lower than TCLP criteria, especially when multiple chemicals are being evaluated. Human health risk criteria, and potentially ecological risk criteria, must be addressed prior to site closure if contaminated media (above applicable target risk levels) are not removed from the site.

e. USEPA Preliminary Remediation Goals (PRGs) can be used to determine action levels if the analysis is completed correctly. If more than one contaminant exists at a site, then the use of PRGs may not be appropriate.

f. It is critical that background concentrations be appropriately evaluated. Background concentrations need to be evaluated by collecting soil samples in an area that is not impacted by site operations. Use of ASTM or USGS background levels for wide geographic areas is not acceptable per the June 10, 1998 NDEP letter to KM. A separate work plan should be submitted that describes where background samples will be collected and how background concentrations will be evaluated. It is highly recommended that an appropriate background study be completed prior to additional site characterization sampling. The development of a Remedial Alternatives Study (RAS) after site characterization is completed will depend heavily on comparisons of background concentrations to contaminant concentrations detected at the facility. The NDEP suggests that KM review the guidance documents listed below.

    i. U.S. Environmental Protection Agency, Guidance for Characterizing Background Chemicals in Soil at Superfund Sites, OSWER 9285.7-41 (EPA 540-R-01-003), June 2001.

    ii. U.S. Environmental Protection Agency, Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites, EPA/540/s-96/500, December 1995.

g. Due to the number of contaminants present at the facility, the lack of acceptable chemical-specific action levels or PRGs for many of the contaminants, and the potential that removal activities may not be cost-effective as a remedial option, KM should consider that a deterministic risk assessment might be required for site closure. A probabilistic risk assessment will not be accepted until after a deterministic risk assessment is completed and it is determined that a probabilistic risk assessment is warranted. Risk assessment, if performed, shall be completed in accordance with USEPA guidance (see references below). Tentative cleanup goals for risk assessment are listed below.

i. Non-carcinogens:	Hazard Index = 1
ii. Chemical carcinogens:	Target Risk = $1x10^{-6}$
iii. Radionuclides:	Target Risk= $1x10^{-6}$

h. Prior to performing a risk assessment, the usability of the data must be demonstrated in accordance with USEPA guidance (see reference below).

i. It is not clear what the objectives of the investigation to date are. Decision rules to guide the characterization process are not clearly laid out. Also, it is not clear how KM will sufficiently evaluate the facility to justify closure. It is highly recommended that data quality objectives (DQOs) be completed in accordance with the reference below. Ideally, DQOs should have been completed prior to any site characterization work to streamline the data collection process. A brief discussion on data quality assessment (DQA) may also be warranted (see reference below). In summary, the NDEP needs to have a better understanding of how KM proposes to close the site and recommends that KM discus the proposed DQOs with NDEP prior to submittal. Additionally, NDEP recommends submittal of DQOs as a separate, stand-alone document. It should be anticipated that these DQOs will be adjusted as the project proceeds.

j. References
    i. U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, December 1989.
    ii. U.S. Environmental Protection Agency, Guidance for Data Usability in Risk Assessment, April 1992.
    iii. U.S. Environmental Protection Agency, Guidance for the Data Quality Objectives Process, August 2000.
    iv. U.S. Environmental Protection Agency, Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, July 2000.

12. Conceptual Site Model

a. The NDEP has repeatedly stressed the importance of the development of a conceptual site model (CSM) including in letters dated June 10, 1998 and December 17, 1998.

b. Kerr-McGee has completed a significant amount of hydro-geologic investigative work for the perchlorate remediation project. This information should prove to be very helpful in the development of a CSM.

c. It is suggested that the CSM be submitted under separate cover as soon as possible. For your information, all of the BMI Companies are preparing CSMs. It is suggested that the CSM include, but not be limited to, the following elements:
    i. A list of site-related chemicals for soil and groundwater should be developed in accordance with USEPA guidance (see also comment

10). This list should identify chemicals that may have been disposed of but were not analyzed for during recent investigations. This list should also present risk-based criteria, such as USEPA Region IX PRGs, soil screening levels (SSLs), MCLs, and other criteria where appropriate. See also comment 11.

ii. A discussion pertaining to the potential for contaminants in soil to leach to groundwater should be provided. Contaminant concentrations in soil should be compared to migration to groundwater SSLs developed by the USEPA at the DAF of 1 or site-specific SSLs could be developed.

iii. Preferential migration pathways, such as paleochannels on top of the Muddy Creek Formation; the fine grained facies of the Muddy Creek Formation (e.g. channel sands); and the coarse grained facies of the Muddy Creek Formation also should be evaluated. Kerr-McGee has already completed significant work on this for the perchlorate remediation project.

iv. Cross sections showing the shallow alluvial aquifer and the next deeper water-bearing zone should also be presented.

v. It does not appear that the nature and extent of the contaminant plumes are well understood. Iso-concentration drawings for contaminant plumes in soil and groundwater (including the vertical extent of contamination) that show the entire extent of the plume (including off site data) should be provided. See also comment 8.

vi. The conceptual site model should discuss surface drainage patterns, surface migration of contaminants, and contaminant migration pathways within the vadose zone and groundwater.

vii. The CSM should discuss exposure pathways for current and future receptors, including ecological receptors.

viii. Data gaps should be identified and additional investigation work to close the data gaps should be proposed.

ix. Unqualified data may be presented, however, KM must ensure that the data are presented in a manner that allows the NDEP to differentiate between qualified and unqualified data.

13. **Soil Sampling**

a. In general, the soil sampling that has been conducted has been in the surface and near-surface. The limited sampling that was conducted is not sufficient to evaluate potential sources that may exist within the vadose zone. Soil samples need to be collected throughout the vadose zone to fully evaluate the extent of contamination in three dimensions and potential impacts to groundwater.

14. **Section 1.0, page 1-1**

a. Second paragraph – Please correct the date for NDEP's conditional approval of the Phase II Supplemental Work Plan from "*December 17, 1999*" to the correct date of December 17, 1998.

15. **Section 2.2.2, page 2-3**

a. First paragraph – In the statement "*The spacing of seven successfully drilled perimeter borings comprises a nearby equidistant...*" replace the word "*nearby*" with the word "nearly".

16. **Section 3.1, page 3-1**

a. Total chromium results for soil were compared to a 100 mg/kg level. This is not an appropriate action level or screening level. For example, the USEPA SSL (DAF 1) is 2.0 mg/kg and the USEPA TCLP is 5.0 mg/kg. Background levels may be more conservative. Using either of the above concentrations, all soil samples are grossly elevated. It appears that the depth and breadth of chromium contamination has not been properly evaluated. Please note that the NDEP is using these SSLs for discussion purposes only. KM should calculate their own SSLs or verify that the model used by the USEPA to calculate the published SSLs fits the model for the KM site. A DAF of 1 is being used for discussion purposes, assuming that there is little or no dilution or attenuation of soil leachate at the site (due to the shallow water table and the large source size).

b. The NDEP's December 17, 1998 letter to KM required comparison of sample results to actual Nevada cleanup standards and background values.

c. Soil samples also appear to indicate that there are elevated pH levels in a number of the locations and depths. Background levels for pH should be delineated in accordance with USEPA guidance (see also comment #11.f).

d. The data presented do not delineate the valences of the chromium present in soil. KM states "*elevated pH values tend to retard the mobility of chromium, especially trivalent chromium Cr(III) (Allen 1993). This implies that the mobility of chromium in soil beneath Old P-2 and P-3 Ponds is retarded, thus limiting or eliminating the ponds as an existing or future source of chromium to groundwater.*" The NDEP does <u>not</u> agree with this assessment. There are very high concentrations of chromium in groundwater in the vicinity of the P-2 and P-3 ponds. Data presented by KM indicates that a majority of this chromium may be hexavalent. Please provide further justification for the above statement.

17. **Section 3.2.1, page 3-11**

a. The detection limits presented in Table 3-2 and discussed in this section appear to be elevated. Potential screening levels for benzene, toluene and ethylbenzene in soil are at least an order of magnitude lower than the detection limits presented in table 3-2. For example, the USEPA SSL DAF 1 for benzene is 0.002 mg/kg, for toluene is 0.6 mg/kg, and for ethylbenzene is 0.7 mg/kg. KM needs to derive appropriate action levels and re-evaluate the need for additional sampling in this area.

b. For soil samples SB5-4 and SB5-5, the highest concentrations of "TEPH" are at the greatest depth. The NDEP believes that the depth and volume of soil contamination has not been appropriately evaluated. Additional deeper samples should be proposed in the next workplan.

c. It is suggested that future groundwater samples be analyzed for BTEX. Revised sampling procedures may need to be investigated due to the reported low flow conditions.

18. **Section 3.2.2, page 3-11**

a. The NDEP does <u>not</u> concur with the assessment that no further investigation is recommended or warranted for the former diesel fuel tank storage area.

APPENDIX B

Health and Safety Plan

Health and Safety Plan
Well Installation and Subsurface Investigation In Uncontaminated Soils and Groundwater
Kerr-McGee
Henderson, Nevada

Prepared by John Shepard ______________ Date: December 3, 2004
ENSR Regional Health and Safety Manager Revised: March 24, 2005

Approved by: ______________________________ Date: ______________
ENSR Project Manager

Accepted by: ______________________________ Date: ______________
Kerr-McGee

Project Number 04020-023

Table of Contents

0. EMERGENCY REFERENCES

Subsurface Investigation in Uncontaminated Soils
Kerr-McGee
Henderson, Nevada

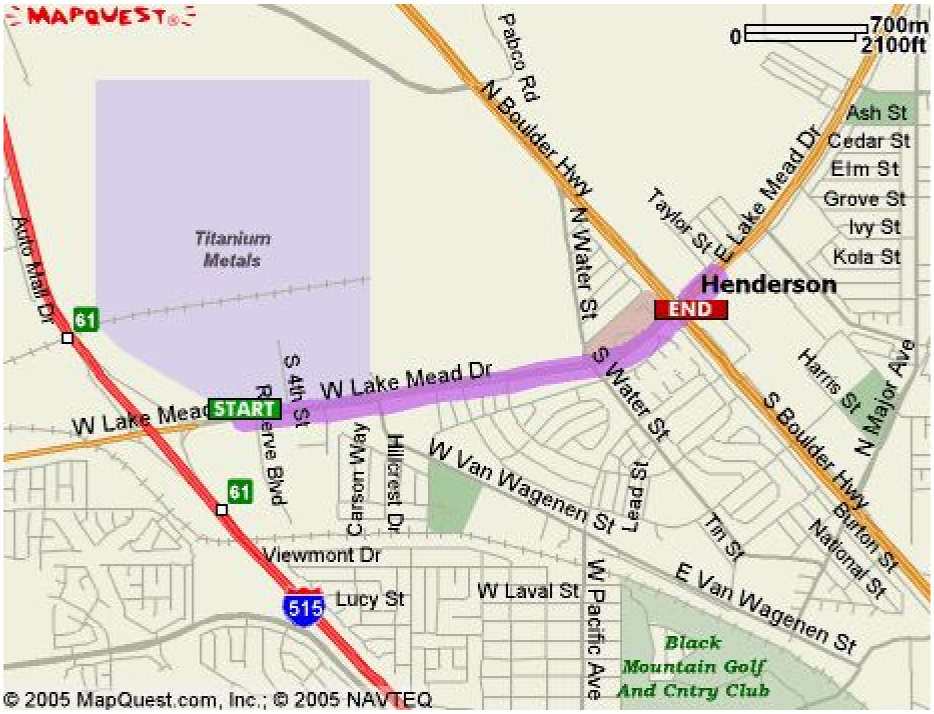
Ambulance:	911
Fire:	911
Police:	911

Medical Services:

St Rose Dominican Hospital	(702) 564-2622 or (702) 616-4560

102 E Lake Mead Pkwy, Henderson, NV 89015

	Directions	Miles
1.	Start out going EAST on **W LAKE MEAD DR/NV-146** toward RESERVE BLVD. Continue to follow W LAKE MEAD DR.	1.7
2.	Make a U-TURN at **TAYLOR ST** onto E LAKE MEAD DR/NV-564 W.	0.1
3.	End at **St Rose Dominican Hospital**	0.0



Emergency Muster Point
In case of a site/facility emergency, please meet at

____."
The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

Underground Utility Location Service:

DIG SAFE SYSTEM, INC.
Center # 1-888-DIG-SAFE (1-888-344-7233)

Client Contacts:

	Office	Cell
Susan Crowley, Site Contact	702 651-2200	
Russ Jones, Project Manager	405-270-2665	405-203-8694
Elden Cheatham, H&S.	405-270-3273	405-659-4335

ENSR Project Representatives:

ENSR /Camarillo, CA	805-338-3775
John Shepard (RHSM)	972-509-7644
Joe Sanders (alt RHSM)	970-493-8878
ENSR/ PM (Dave Gerry)	805-338-3775

HAZARD ASSESSMENT

Chemical Hazards - Perchlorate compounds

Common salts of perchloric acid are moderately toxic by ingestion and intraperitoneal routes. As a dry compound perchlorates are powerful oxidizers forming explosive mixtures with acetone, 1,3-butylene glycol, 2,3-butylene glycol, CaH2, charcoal, diaminoethane, dimethyl formamide, ethanolamine, ethylene glycol, formamide, galactose, glycerin, hydrazine, water, NH4NO3, Mg, reducing agents, SrH2, urea. When heated to decomposition it emits toxic fumes of Cl^{-} and Na2O.

Dilute solutions in water should be considered mildly toxic and a minor skin irritant.

Other Chemical Hazards

Chemical Name	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]
Inorganic Arsenic	0.01	0.002	NA	NA	?	?	NA	NA	NA
Boron as B_2O_3	15	10	NA	NA	2.5	3	NA	NA	NA
Chromium	1	0.5	NA	NA	7.2	NA	NA	NA	NA
Manganese Compounds	5 (C)	0.2	NA	NA	NA	<1	NA	NA	NA
Vanadium as V_2O_5	0.5 (C)	0.05	NA	NA	3.4	<1	NA	NA	NA

[1] Permissible Exposure Limit in mg/m^3
[2] Threshold Limit Value in mg/m^3
[3] Vapor Pressure in mm Hg
[4] Vapor Density (air = 1)
[5] Specific Gravity (water = 1)
[6] Solubility in Water in %
[7] Flash Point in °F
[8] Lower Explosive Limit in % by volume
[9] Upper Explosive Limit in % by volume
NA = Not Applicable
? = Not known

Physical Hazards

Dust
Falling objects
Flying objects
Heat
Lifting
Noise
Overhead utilities
Radionuclides
Rotating equipment
Traffic
Tripping
Underground utilities

Personal Protective Equipment

PPE Item	General	Drilling	Sample Collection
Hard Hat	1 & 2	✓	1 & 2
Traffic Vests	2	2	2
Steel Toed Safety Shoes	1	✓	✓
Safety Glasses with Sideshields	1	✓	✓
Hearing Protection		✓	3
PVC or Nitrile Gloves		4	✓
Sun Screen	✓	✓	✓

✓ Required PPE

1 All employees must comply with Kerr-McGee safety requirements.

2 Traffic vests and hardhats are required within twenty feet of any public road or any private road with active traffic.

3 Hearing protection should be worn soil boring equipment if normal conversation cannot be understood.

4 Note that chemical resistant gloves are only required of those that are likely to come in direct contact with potentially contaminated soils and/or groundwater.

Respiratory Protection

Respiratory protection (half or full face mask respirator with combination organic vapor/HEPA cartridges) should also be donned if odors become objectionable at any time or if respiratory tract irritation is noticed.

I, John Shepard certify that this hazard assessment and evaluation was performed on March 24, 2005.

1. Introduction

1.1 HASP Applicability

This site-specific Health and Safety Plan (HASP) has been developed by ENSR Corporation (ENSR), to establish the health and safety procedures required to minimize any potential risk to ENSR and contractor personnel involved subsurface investigations for Kerr-McGee in Henderson, Nevada.

The provisions of this plan apply to all ENSR personnel and ENSR subcontractor personnel who may potentially be exposed to safety and/or health hazards related to activities described in Section 2 and 3 of this document.

This HASP has been written to comply with the requirements of the Occupational Safety and Health Administration (OSHA) Personal Protective Equipment Standard (29 CFR 1910.132) for all activities and the OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) for tasks where there are potential exposures to subsurface contaminants. All activities covered by this HASP must be conducted in complete compliance with this HASP and with all applicable federal, state, and local health and safety regulations. Personnel covered by this HASP who cannot or will not comply will be excluded from site activities.

This plan will be distributed to each employee involved with investigation activity at the Site. Each employee must sign a copy of the attached health and safety plan sign-off sheet (see Attachment A).

This HASP only pertains to the tasks, which are listed in Section 3.0. A task specific HASP or addenda to this HASP will be developed at a later date for any other subsequent investigative/remedial activities at the Site.

1.2 Organization/Responsibilities

The implementation of health and safety at the Site will be the shared responsibility of the ENSR Project Manager (PM), the ENSR Regional Health and Safety Manager (RHSM), the ENSR Project Site Safety Officer (SSO) and other ENSR and contractor personnel.

1.2.1 ENSR Project Manager

The ENSR PM (Dave Gerry) is the individual who has the primary responsibility for the overall health and safety of this project. The PM therefore has the primary responsibility for implementing of the requirements of this HASP. Some of the PM's specific responsibilities include:

- Providing the RHSM with updated data regarding the types and extent of contamination at the Site;
- Assuring that all personnel to whom this HASP applies have received a copy and have submitted a completed copy of the HASP sign-off form;
- Assuring that all ENSR and subcontractor personnel submit documentation of the medical surveillance and training requirements specified in Section 10 of this HASP;
- Assuring that all personnel to whom this HASP applies have attended a pre-entry briefing prior to entering an exclusion zone;
- Maintaining a high level of health and safety consciousness among employees at the work site; and
- Maintaining regular communications with the SSO and, if necessary, the RHSM.

1.2.2 ENSR Regional Health and Safety Manager (RHSM)

The ENSR RHSM (John Shepard) is the individual responsible for the preparation, interpretation and where appropriate, modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the RHSM. Specific duties of the RHSM include:

- Writing, approving and amending the HASP for this project;
- Advising the PM and SSO on matters relating to health and safety on this site;
- Recommending appropriate personal protective equipment (PPE) and air monitoring instrumentation to protect personnel from potential site hazards;
- Conducting accident investigations; and,
- Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP.

1.2.3 ENSR Site Safety Officer (SSO)

The ENSR SSO, (to be determined by the project manager), will be on-site during all the activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once on-site work begins. By design, the SSO has the authority, and the responsibility, to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Procuring and distributing the PPE needed for this project for ENSR employees;
- Verifying that all PPE and health and safety equipment is in good working order;
- Procuring the necessary air monitoring equipment for this project and ensuring the required monitoring is conducted in accordance with this plan;
- Setting up and maintaining the contamination reduction zone adjacent to the exclusion areas and assuring proper decontamination of all site personnel and equipment;

- Notifying the PM and RHSM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Conducting on site Job Hazard Assessments if conditions or tasks change and communicating with the Regional Health and Safety Manager the results of the Job Hazard Assessment. See attachment D for an assessment form.
- Assisting with accident/incident investigations and preparing accident/incident investigation reports;
- Conducting the pre-entry briefing in accordance with Section 10 and
- Initiating emergency response procedures in accordance with Section 11 of this HASP.

1.2.4 ENSR Field Personnel and Covered Contractor Personnel

All ENSR field personnel and contractor personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work;
- Submitting a completed HASP Acceptance Form and documentation of medical surveillance and training to the ENSR PM prior to the start of work;
- Attending the required pre-entry briefing prior to beginning on-site work;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the RHSM prior to the start of work;
- Reporting all accidents, injuries and illnesses, regardless of their severity, to the ENSR SSO; and
- Complying with the requirements of this HASP and the requests of the SSO.

In addition to other requirements referenced in this HASP, all contractors are required to:

- Provide appropriate PPE for their employees;
- Ensure, via daily inspections, that their equipment is maintained in good working condition;
- Operate their equipment in a safe manner; and
- Appoint an on-site safety coordinator to interface with the ENSR SSO.

1.3 Modification of the HASP

The procedures in this HASP have been developed based on information obtained prior to commencing work at the project site. Should additional information become available regarding potential on-site hazards, it may be necessary to modify this HASP. All proposed modifications to this HASP must be reviewed and approved by the ENSR RHSM before such modifications are implemented.

Any significant modifications must be incorporated into the written document and addenda and the HASP must be reissued. The ENSR PM will ensure that all personnel covered by this HASP receive copies of all issued addenda. Sign-off forms will accompany each addendum and must be signed by all personnel covered by the addendum. Sign-off forms will be submitted to the ENSR PM. The HASP addenda should be distributed during the daily safety meeting so that they can be reviewed and discussed. Attendance forms will be collected during the meeting.

2. Site History

2.1 Site Description

The project site is on City of Henderson property along a 2,000-foot alignment to the north of Athens Avenue, west of Pabco Road. An eight-foot diameter water supply pipeline is reportedly located between ten and eighteen feet below grade to the south of the project area.

At the KMCC facility in Henderson, Nevada, groundwater has been impacted with ammonium perchlorate (AP) and hexavalent chromium as a result of current and historic business operations at this facility. Groundwater beneath the project site is impacted with perchlorate compounds in concentrations of 300 - 400 mg/l. More than 100 groundwater-monitoring wells have been installed onsite. KMCC has constructed a groundwater barrier-wall on the facility and installed roughly 22 groundwater interceptor wells to remove impacted groundwater and send the groundwater to an onsite groundwater treatment system where AP and hexavalent chromium are removed.

3. Scope of Work

3.1 Scope of Work

ENSR prepared a Background Investigation Work Plan that described the procedures necessary to collect groundwater and soil samples at the KMCC Chemical LLC, Henderson facility. Sample handling and shipping procedures (to the offsite analytical laboratory) were also described. The Work Plan lists the quality assurance/quality control samples that will be collected along with the frequency with which the QA/QC samples will be collected. The QA/QC sampling program was decided upon by KMCC, ENSR, and the analytical laboratory; these samples may consist of (but not be limited to) equipment blanks (equipment rinsates), trip blanks, field blanks, blind duplicate samples, and matrix spike/matrix spike duplicates (MS/MSDs). ENSR will also include soil sampling procedures in the Workplan.

ENSR proposes to advance borings to a depth of approximately 140 feet. ENSR will install groundwater monitoring wells, determine depth to the water table, and collect groundwater and soil samples for analysis. The wells will be located in uncontaminated soils.

4. Chemical Hazard Assessment and Controls

4.1 Potential Chemical Contaminants

The potential chemical contaminants at this site are:

- Perchlorate compounds
- Arsenic
- Chromium
- Vanadium
- Manganese
- Boron
- Chlorate compounds
- Volatile Organic Carbons (VOCs)
- Total Petroleum Hydrocarbons
- Hexavalent Chromium
- Radionuclides

4.1.1 Volatile Organic Compounds (VOCs)

Organic solvents refer to a group of volatile compounds or mixtures that are relatively stable chemically and that exists in the liquid state at temperatures of approximately 32° to 82°F.

Organic solvents are used for extracting, dissolving, or suspending materials such as fats, waxes, and resins that are not soluble in water. The removal of the solvent from a solution permits the recovery of the solute intact with its original properties. Solvents are used in paints, adhesives, glues coatings, and degreasing/ cleaning agents.

Inhalation and percutaneous absorption are the primary routes of solvent uptake into the peripheral blood, which begins within minutes of the onset of exposure. Organic solvents undergo biotransformation or they accumulate in the lipid-rich tissues such as those of the nervous system.

Solvent inhalation by workers may cause effects ranging from an alcohol-like intoxication to narcosis and death from respiratory failure, with a spectrum of intermediate symptoms that include drowsiness, headache, dizziness, dyspepsia, and nausea. The acute effects of solvent inhalation include narcosis, anesthesia, CNS depression, respiratory arrest, unconscious, and death.

4.1.2 Petroleum Hydrocarbons

Petroleum hydrocarbons are generally considered to be of moderate to low toxicity. Federal or recommended airborne exposure limits have not been established for the vapors of petroleum hydrocarbons. However, inhalation of low concentrations of the vapor may cause mucous membrane irritation. Inhalation of high concentrations of the vapor (which would only be likely to occur in confined spaces where the liquid had been significantly heated) may cause extensive pulmonary edema. Chronic direct skin contact with the liquid may produce skin irritation as a result of defatting.

4.1.3 Perchlorate Compounds

Common salts of perchloric acid are moderately toxic by ingestion and intraperitoneal routes. As a dry compound perchlorates are powerful oxidizers forming explosive mixtures with acetone, 1,3-butylene glycol, 2,3-butylene glycol, CaH2, charcoal, diaminoethane, dimethyl formamide, ethanolamine, ethylene glycol, formamide, galactose, glycerin, hydrazine, water, NH4NO3, Mg, reducing agents, SrH2, urea. When heated to decomposition it emits toxic fumes of Cl^{-} and Na2O.

Dilute solutions in water should be considered mildly toxic and a minor skin irritant.

4.1.4 Chlorates

Inorganic chlorate compounds are used as an herbicide demonstrating a ten fold increase in plant toxicity over sodium chloride. No exposure limits have been established for chlorate compounds and dusts containing chlorates should be considered irritants.

4.1.5 Inorganic Arsenic

Arsenic enters the body principally through the mouth, either in food or in water. Most ingested arsenic is quickly absorbed through the stomach and intestines and enters the bloodstream, although this varies somewhat for different chemical forms of arsenic. Arsenic, which is inhaled, is also well absorbed through the lungs into the blood stream. Small amounts of arsenic may enter the body through the skin, but this is not usually an important consideration.

Most arsenic that is absorbed into the body is converted by the liver to a less-toxic form that is efficiently excreted in the urine. Consequently, arsenic does not have a strong tendency to accumulate in the body except at high exposure levels.

Inorganic arsenic has been recognized as a human poison since ancient times, and large doses can produce death. Lower levels of exposure may produce injury in a number of different body tissues or systems: these are called "systemic" effects. When taken by mouth, a common effect is irritation of the digestive tract, leading to pain, nausea, vomiting, and diarrhea. Other effects typical of exposure by mouth include decreased production of red and white blood cells, abnormal heart function, blood vessel damage, liver and/or kidney injury, and impaired nerve function causing a "pins-and-needles" feeling in the feet and hands. There is evidence from animal studies that high oral doses during pregnancy may be damaging to the fetus, but this has not been well studied in humans.

Inhalation exposure to inorganic arsenic dusts or fumes sometimes produces the same types of systemic health effects produced by oral exposure. However, this is not common, and the effects are usually mild.

Direct dermal contact with arsenic compounds, frequently from inorganic arsenic dusts in air, may result in mild to severe irritation of the skin, eyes, or throat.

4.1.6 Boron & Borates

Boron oxide and boric acid salts of sodium and potassium are commonly found in nature. Dusts of these chemicals can be eye and respiratory tract irritants. Borates are generally considered to be of low human toxicity.

4.1.7 Chromium

Chromium compounds vary greatly in toxicity. Chrome metal, the di-valent (chromous), and the tri-valent (chromic) compounds have low to moderate toxicities. They are poorly absorbed through the skin and mucous membranes, but may cause irritation. Chrome metal, unlike nickel, does not cause allergic contact dermatitis. Nor is it known to cause pulmonary fibrosis or cancer.

Hexavalent chrome compounds (eg. chromic acid and chromates) are corrosive to the skin and mucous membranes. They cause extreme irritation to the nose, throat, and lungs, and may produce chrome sores, ulcers, nasal septum perforations, and pulmonary edema. Hexavalent chrome can cause allergic sensitization, bronchitis, and kidney damage. Cancers of the lung and nasopharynx are associated with heavy exposures.

The PEL for chrome metal, di-valent, and tri-valent chrome compounds is 0.5 mg/m^3. For hexavalent chrome, the PEL is 0.05 mg/m^3.

4.1.8 Manganese Compounds

Manganese is an essential trace element. In excess, it is of medium toxicity to humans. Manganese poisoning is rare and is limited to those exposed occupationally, in the manufacture of manganese compounds and in the pottery manufacturing. It is a respiratory irritant when inhaled and long-term exposure produces symptoms similar to those of Parkinson's disease

Manganese can exist as compounds in up to eight different valence states, which may be cations or anions. It appears that cationic manganese compounds are more toxic than anionic compounds, and that $Mn2^+$ is more toxic than $Mn3^+$. Manganese and its compounds are usually absorbed into the body by oral and respiratory routes, in the form of dust.

In excess amounts, manganese can cause irreversible nervous system damage. Studies have shown that the effects of manganese in the brain are due to the presence of lesions and degeneration in the basal ganglia. The metal is also known to block calcium channels, and with chronic intoxication the levels of dopamine in the CNS are depleted, which causes the Parkinson's-like symptoms.

4.1.9 Vanadium Compounds

Everyone is exposed to low levels of vanadium in air, water, and food. Vanadium is typically encountered as the pentoxide in nature. As a pure powder, vanadium oxide is yellow to orange and is easily dispersed in air. Exposure to the dust of vanadium oxide causes irritation of the eyes and upper respiratory tract. Breathing high levels of vanadium may cause lung irritation, chest pain, coughing, and other effects. Ingestion or high exposures by inhalation cause the tongue to become green and a strong metallic taste.

4.1.10 Radionuclides

A radionuclide is an isotope of an element that exhibits radioactivity. Radionuclides can be mane made, naturally occurring, or the product of the decay of another radioactive isotope.

Naturally occurring radionuclides including Radium, Radon, Thorium, and Uranium is present in virtually all soil, rock and water. These radionuclides are distributed throughout the environment by wind, rain and geologic processes. Rocks weather and break down to form soil, and soil can be washed by water and blown by wind, moving uranium into streams and lakes, and ultimately settling out and reforming as rock

The radionuclides of lead are produces by the decay of thorium and uranium.

A person can be exposed to radionuclides by inhaling dust in air, or ingesting water and food. The general population is exposed primarily through food and water. The greatest health risk from large intakes of radionuclides is toxic damage to the kidneys, because, in addition to being weakly radioactive, uranium, thorium and radium are toxic metals.

There is little exposure hazard when working around naturally occurring radionuclides and their decay products. If these materials are enriched or refined, exposure hazards can be created. Radon gas can pose an exposure hazard if it is allowed to accumulate in closed areas such as vaults, cellars, and wells.

4.2 Summary of Hazardous Properties of Potential Contaminants

Chemical Name	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]
Inorganic Arsenic	0.01	0.002	NA	NA	?	?	NA	NA	NA

Chemical Name	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]
Boron as B_2O_3	15	10	NA	NA	2.5	3	NA	NA	NA
Chromium	1	0.5	NA	NA	7.2	NA	NA	NA	NA
Manganese Compounds	5 (C)	0.2	NA	NA	NA	<1	NA	NA	NA
Vanadium as V_2O_5	0.5 (C)	0.05	NA	NA	3.4	<1	NA	NA	NA

[1] Permissible Exposure Limit in mg/m^3
[2] Threshold Limit Value in mg/m^3
[3] Vapor Pressure in mm Hg
[4] Vapor Density (air = 1)
[5] Specific Gravity (water = 1)
[6] Solubility in Water in %
[7] Flash Point in °F
[8] Lower Explosive Limit in % by volume
[9] Upper Explosive Limit in % by volume
NA = Not Applicable
? = Not known

4.3 Chemical Exposure Potential/Control

4.3.1 Potential Routes of Exposure

The potential routes of exposure to the contaminants of concern include:

- Dermal contact with contaminated soils during soil boring and soil sample collection;
- Dermal contact with contaminated groundwater during well installation and groundwater sampling;
- Inhalation of vapors during soil boring and soil sampling; and
- Inhalation of vapors during well installation and groundwater sampling.

4.3.2 Exposure Control

As a precaution, ENSR will be conducting air monitoring in the worker's breathing zone to determine exposures to vapors during the subsurface investigations. If exposures exceed the action levels as defined in Section 4, respiratory protection as discussed in Section 7 will be donned.

To avoid direct dermal contact with contaminated media, protective clothing as described in Section 7 will be required when collecting samples and decontaminating sampling equipment.

Although highly unlikely, exposure to all of the contaminants of concern may occur via ingestion (hand-to-mouth transfer). The decontamination procedures described in Section 9 address personal hygiene issues that will limit the potential for contaminant ingestion.

4.4 Hazardous Substances Brought On-Site by ENSR

A material safety data sheet (MSDS) must be available for each hazardous substance that ENSR bring on the property. This includes solutions/chemicals that will be used to decontaminate sampling equipment. Containers of hazardous materials must be properly labeled in accordance with OSHA's Hazard Communication Standard.

Physical Hazards and Controls

4.5 Drilling Hazards

Use of a drill rig to advance soil borings and install monitoring wells will require personnel in the vicinity of the operating rig to wear steel-toed boots, hard hats, hearing protection and safety eyewear. Personnel shall not remain in the vicinity of operating equipment unless it is required for their work responsibilities.

Additionally, the following safety requirements must be adhered to:

- Drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and geologists must be aware of the location of this device. This device must be tested prior to job initiation and periodically thereafter. The driller and helper shall not simultaneously handle augers unless there is a standby person to activate the emergency stop.

- The driller must not leave the controls while the tools are rotating unless all personnel are kept clear of rotating equipment.

- A long-handled shovel or equivalent must be used to clear drill cuttings away from the hole and from rotating tools. Hands and/or feet are not to be used for this purpose.

- A remote sampling device must be used to sample drill cuttings if the tools are rotating or if the tools are readily capable of rotating. Samplers must not reach into or near the rotating equipment. If personnel must work near any tools, which could rotate, the driller must shut down the rig prior to initiating such work.

- Driller's, helpers and geologists must secure loose clothing when in the vicinity of drilling operations.

- Only equipment, which has been approved by the manufacturer, may be used in conjunction with site equipment and specifically to attach sections of drilling tools together. Pins that protrude excessively from augers shall not be allowed

- No person shall climb the drill mast while tools are rotating.

- No person shall climb beyond 6 feet above ground on the drill mast without the use of ANSI-approved fall protection (approved belts, lanyards and a fall protection slide rail) or portable ladder which meets the requirements of OSHA standards.

4.6 Heat Stress

Types of Heat Stress

Heat related problems include **heat rash, fainting, heat cramps, heat exhaustion and heat stroke**. **Heat rash** can occur when sweat isn't allowed to evaporate; leaving the skin wet most of the time and making it subject to irritation. **Fainting** may occur when blood pools to lower parts of the body and as a result, does not return to the heart to be pumped to the brain. Heat related fainting often occurs during activities that require standing erect and immobile in the heat for long periods of time. **Heat cramps** are painful spasms of the muscles due to excessive salt loss associated with profuse sweating.

Heat exhaustion results from the loss of large amounts of fluid and excessive loss of salt from profuse sweating. The skin will be clammy and moist and the affected individual may exhibit giddiness, nausea and headache.

Heat stroke occurs when the body's temperature regulatory system has failed. The skin is hot, dry, red and spotted. The affected person may be mentally confused and delirious. Convulsions could occur. EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH. A person exhibiting signs of heat stroke should be removed from the work area to a shaded area. The person should be soaked with water to promote evaporation. Fan the person's body to increase cooling.

Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

Early Symptoms of Heat-Related Health Problems:

decline in task performance
incoordination
decline in alertness
unsteady walk
excessive fatigue
reduced vigilance
muscle cramps
dizziness

Susceptibility to Heat Stress Increases due to:

lack of physical fitness
lack of acclimation
increased age
dehydration
obesity
drug or alcohol use
sunburn
infection

People unaccustomed to heat are particularly susceptible to heat fatigue. First timers in PPE need to gradually adjust to the heat.

The Effect of Personal Protective Equipment

Sweating normally cools the body as moisture is removed from the skin by evaporation. However, the wearing of certain personal protective equipment (PPE), particularly chemical protective coveralls (e.g., Tyvek), reduces the body's ability to evaporate sweat and thereby regulate heat buildup. The body's efforts to maintain an acceptable temperature can therefore become significantly impaired by the wearing of PPE.

Measures to Avoid Heat Stress:

The following guidelines should be adhered to when working in hot environments:

Establish work-rest cycles (short and frequent are more beneficial than long and seldom).

Identify a shaded, cool rest area.

Rotate personnel, alternative job functions.

Water intake should be equal to the sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst. **DO NOT DEPEND ON THIRST TO SIGNAL WHEN AND HOW MUCH TO DRINK**. For an 8-hour work day, 50 ounces of fluids should be drunk.

Eat lightly salted foods or drink salted drinks such as Gatorade to replace lost salt.

Save most strenuous tasks for non-peak heat hours such as the early morning or at night.

Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration.

Avoid double shifts and/or overtime.

The implementation and enforcement of the above mentioned measures will be the joint responsibility of the project manager, on-site field coordinator, and health and safety officer. Potable water and fruit juices should be made available each day for the field team.

Heat Stress Monitoring Techniques

Site personnel should regularly monitor their heart rate as an indicator of heat strain by the following method:

Radial pulse rates should be checked by using fore-and middle fingers and applying light pressure top the pulse in the wrist for one minute at the beginning of each rest cycle. If the pulse rate exceeds 110 beats/minute, the next work cycle will be shortened by one-third and the rest period will be kept the same. If, after the next rest period, the pulse rate still exceeds 110 beats/minute, the work cycle will be shortened again by one-third.

4.7 Noise Exposure

The use of the drilling rig will generate noise levels that will require the use of hearing protection in the immediate vicinity. Appropriate earmuff or earplugs (i.e., with an NRR greater than 25 dB) should be worn to prevent overexposure. The general rule of thumb is that if you have to raise your voice to be understood by someone who is standing 3 to 5 feet away from you, the noise levels are likely to be above 85 dB and therefore require the use of hearing protection.

4.8 Underground Utility Hazards

Law requires that a utility clearance survey must be performed before any subsurface activities are performed. The utility clearance survey must be requested from:

DIG SAFE SYSTEM, INC.
Center # 1-888-DIG-SAFE (1-888-344-7233)

The survey must be requested at least 72 hours (i.e., 3 full business days) prior to conducting the subsurface activities. The Digsafe ticket should be updated by requesting a remark every 30 days. Remember that digging outside of your originally specified boundaries requires that a new survey be performed.

Be aware that utility companies often can not identify the exact location of their underground services once they cross onto private property. (Note: Utility clearance survey requests are still required on private property). Private property owners may have rerouted these services or installed their own.

4.9 Overhead Utility Hazards

Any vehicle or mechanical equipment, particularly the mast of the drilling rig, that is capable of having parts of its structure elevated near energized overhead lines shall be operated so that a minimum clearance of 10 feet is maintained at all times.

4.10 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment, such as drums of investigation-derived wastes, is important to reduce the potential for back injury. The following precautions should be implemented when lifting or moving heavy objects.

- Bend at the knees, not the waist. Let your legs do the lifting.
- Do not twist while lifting

- Bring the load as close to you as possible before lifting
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards
- Use mechanical devices to move objects, such as drums of investigation derived wastes or generators, that are too heavy to be moved manually
- If mechanical devices are not available, ask another person to assist you.

4.11 Traffic Safety

The following precautions should be followed to draw attention to you and to warn other people of your presence in high traffic areas.

Notify the property representative of your work location, dates of work and the anticipated work times and suggest the possibility of a detour around the work area.

Wear an orange safety vest. If work is being performed at dawn, dusk or evening, the vests must have reflective tape.

Set up traffic cones 50 feet in front of the work area. "Men at Work" signs should also be placed in a conspicuous area to warn others of your presence.

Use an employee to direct traffic in high traffic areas where the hazard may increase.

5. Air Monitoring

ENSR will not conduct air monitoring to since the expected contaminants are inorganic and not volatile.

Personal air sampling will not be conducted by ENSR during the activities covered by this HASP.

6. Personal Protective Equipment

Personal protective equipment (PPE) will be worn during these activities to prevent on-site personnel from being injured by the safety hazards posed by the site and/or the activities being performed. In addition, chemical protective clothing will be worn to prevent direct dermal contact with the site’s chemical contaminants. The following table describes the PPE and chemical protective clothing to be worn for general site activities and for certain specific tasks.

6.1 Protective Clothing

PPE Item	General	Drilling	Sample Collection
Hard Hat	1 & 2	✓	1 & 2
Traffic Vests	2	2	2
Steel Toed Safety Shoes	1	✓	✓
Safety Glasses with Sideshields	1	✓	✓
Hearing Protection		✓	3
PVC or Nitrile Gloves		4	✓
Sun Screen	✓	✓	✓

✓ Required PPE
5 All employees must comply with Kerr-McGee safety requirements.
6 Traffic vests and hardhats are required within twenty feet of any public road or any private road with active traffic.
7 Hearing protection should be worn soil boring equipment if normal conversation cannot be understood.
8 Note that chemical resistant gloves are only required of those that are likely to come in direct contact with potentially contaminated soils and/or groundwater.

6.2 Respiratory Protection

Respiratory protection (half or full face mask respirator with combination organic vapor/HEPA cartridges) should also be donned if odors become objectionable at any time or if respiratory tract irritation is noticed.

6.3 Other Protective Equipment

The following additional safety items should be available at the site:

- Portable, hand-held eyewash bottles
- First aid kit

7. Site Control

To prevent both exposure of unprotected personnel and migration of contamination due to tracking by personnel or equipment, work areas along with personal protective equipment requirements will be clearly identified.

7.1 Designation of Zones

If it is determined that there is contamination in the subsurface soil or groundwater, ENSR will designate work areas or zones as suggested in the "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/EPA, November 1985. They recommend the areas surrounding each of the work areas to be divided into three zones:

- Exclusion or "hot" Zone
- Contamination Reduction Zone (CRZ)
- Support Zone

7.1.1 Exclusion Zone

The exclusion zone will include the area that immediately surrounds the drilling activities. This zone should be sufficiently large to protect unprotected personnel from contact with vapors or dusts that may arise from these operations as well as the physical hazards associated with the operation of heavy equipment. As a minimum, the exclusion zone should include the area scribed by the shadow of the mast of the drilling rig. All personnel entering the exclusion zone must be trained in accordance with the requirements defined in Sections 10 and 11 of this HASP and must wear the level of personal protective equipment prescribed in section 7.

7.1.2 Contamination Reduction Zone

The Contamination Reduction Zone or decontamination area will be established adjacent to the exclusion zone. Personnel will remove contaminated gloves, Tyvek and other disposable items in this area and place them in a plastic bag until they can be properly disposed of in accordance with the work plan requirements.

7.1.3 Support Zone

At this site the support zone will include the area outside of the exclusion and contamination reduction zones.

7.2 Safety Practices

The following measures are designed to augment the specific health and safety guidelines provided in this plan.

- The "buddy system" will be used at all times by all field personnel. No one is to perform fieldwork alone. Standby team member must be intimately familiar with the procedures for initiating an emergency response.
- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in the immediate work area and the decontamination zone.

- Smoking is prohibited in all work areas. Matches and lighters are not allowed in these areas.
- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities.
- Beards or other facial hair that interfere with respirator fit are prohibited.
- The use of alcohol or illicit drugs is prohibited during the conduct of field operations.
- All equipment must be decontaminated or properly discarded before leaving the site in accordance with the project work plan.

8. Decontamination

8.1 Personal Decontamination

Proper decontamination is required of all personnel before leaving the site. Decontamination will occur within the contamination reduction zone.

Regardless of the type of decontamination system required, a container of potable water and liquid soap should be made available so employees can wash their hands and face before leaving the site for lunch or for the day.

After leaving the work area and before eating, smoking or drinking, employees must wash their face and hands with soap and water.

8.2 PPE Decontamination

Disposable PPE, such as Tyvek coveralls, gloves, etc. will be removed and placed in garbage bags. Final disposal of contaminated PPE will be in accordance with the work plan.

If worn, respirators will be cleaned after each use with respirator wipe pads and will be stored in plastic bags after cleaning. Respirators will be thoroughly cleaned using disinfectant material within one week following any respirator use. Refer to the cleaning instructions provided with the respirator or specified by the OSHA regulations at 29 CFR 1910.134.

8.3 Equipment Decontamination

Equipment will be decontaminated prior to being moved to other locations. Decontamination procedures will be specified by the Project Manager.

9. Medical Monitoring and Training Requirements

9.1 Medical Monitoring

All personnel performing activities covered by this HASP must be active participants in ENSR's Medical Monitoring Program or in a similar program which complies with 29 CFR 1910.120(f). Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on the site covered by this HASP.

9.2 Health and Safety Training

If it is determined that there is contamination in the subsurface soil or groundwater, all personnel performing activities covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual must have completed an annual 8-hour refresher-training course and/or initial 40-hour training course within the last year prior to performing any work on the sites covered by this HASP. All workers will have completed three days of supervised work on hazardous waste sites before being allowed to work unsupervised. Also, on-site managers and supervisors directly responsible for supervising individuals engaged in hazardous waste operations must have completed the specified 8-hour managers training course. (Note that ENSR corporate policy requires that whenever three or more ENSR employees are performing work on the same site, at least one of these individuals must have completed the manager's training course.)

9.3 Pre-Entry Briefing

Prior to the commencement of on-site activities, a pre-entry briefing will be conducted by the ENSR SSO to review the specific requirements of this HASP. HASP sign-off sheets will be collected at this meeting. Short safety refresher meetings will be conducted, as needed, throughout the duration of the project. Attendance of the pre-entry meeting is mandatory and will be documented by the ENSR SSO. An attendance form is presented in Attachment B.

10. Emergency Response

OSHA defines emergency response as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result in an uncontrolled release of a hazardous substance." According to ENSR policy, ENSR personnel shall not participate in any emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure). ENSR response actions will be limited to evacuation and medical/first aid as described within this section below. As such this section is written to comply with the requirements of 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include:

- employee training,
- alarm systems,
- escape routes,
- escape procedures,
- critical operations or equipment,
- rescue and medical duty assignments,
- designation of responsible parties,
- emergency reporting procedures and
- methods to account for all employees after evacuation.

10.1 Employee Training

Employees must be instructed in the specific aspects of emergency evacuation applicable to the site as part of the site safety meeting prior to the commencement of all on-site activities. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

10.2 Alarm Systems/Emergency Signals

An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. Each site must be assessed at the time of initial site activity and periodically as the work progresses. Verbal communications must be supplemented anytime voices can not be clearly perceived above ambient noise levels (i.e., noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight can not be easily maintained amongst all ENSR personnel because of distance, terrain or other obstructions.

Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. However, it may be difficult to maintain a clear line-of-sight with employees because of the size and remoteness of the site. Walkie-talkies or an emergency air horn must be carried by employees who are working in out of sight locations to enhance their communication with employees working on the site proper. If telephone service is not immediately available upon arrival to the site, a portable phone must be made available to facilitate emergency communications.

10.3 Escape Routes and Procedures

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

10.4 Employee Accounting Method

The SSO is responsible for identifying all ENSR personnel on-site at all times. On small, short duration jobs this can be done informally as long as accurate accounting is possible. On all other sites a formal log-in and log-out procedure must be implemented.

10.5 Rescue and Medical Duty Assignments

The phone numbers of the police and fire departments, ambulance service, local hospital, and ENSR representatives are provided in the emergency reference sheet. This sheet will be posted in the site vehicle and on-site office trailer.

In the event an injury or illness requires more than first aid treatment, the SSO will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the on-site project manager and the RHSM.

If the injured employee can be moved from the accident area, he or she will be brought to the CRZ where their PPE will be removed. If the person is suffering from a back or neck injury the person will not be moved and the requirements for decontamination do not apply. The SSO must familiarize the responding emergency personnel about the nature of the site and the injury. If the responder feels that the PPE can be cut away from the injured person's body, this will be done on-site. If this not feasible, decontamination will be performed after the injured person has been stabilized.

10.6 Designation of Responsible Parties

The SSO is responsible for initiating emergency response. In the event the SSO cannot fulfill this duty, the alternate SSO will take charge. All personnel on site are responsible for knowing the escape route from the site and where to assemble after evacuation.

10.7 Incident Reporting

All incidents must be reported to the ENSR Project Manager Dave Gerry (805-388-3775) and then to the ENSR Regional Health and Safety Manager, John Shepard (972-509-7644).

10.8 Accident Investigation

Any incident (other than minor first aid treatment) resulting in injury, illness or property damage requires an accident investigation and report. The investigation should be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An ENSR accident investigation form is presented in Attachment C of this HASP. The injured ENSR employee's supervisor and the RHSM should be notified immediately of the injury. If a subcontractor employee is injured, they are required to notify the ENSR SSO. Once the incident is under control, the subcontractor will submit a copy of their company's accident investigation report to the ENSR SSO.

Attachment A

Health and Safety Plan Acceptance Form

Health and Safety Plan Receipt and Acceptance Form

Subsurface Investigation in Uncontaminated Soils
Kerr-McGee
Henderson, Nevada

I, as an employee of ENSR Corporation or its contractors have received a copy of the Health and Safety Plan prepared for the above-referenced site and activities. I have read and understood its contents and I agree that I will abide by its requirements.

Name (Print) ____

Signature ____ Date:

Representing (Print)

Company Name

Attachment B

Health and Safety Pre-Entry Briefing Attendance

Health and Safety Pre-Entry Briefing Attendance

Subsurface Investigation in Uncontaminated Soils

Kerr-McGee

Henderson, Nevada

Date Performed: ________________________________

Printed Name	**Signature**	**Representing**

Attachment C
Supervisor's Accident Investigation Report

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Injured Employee ______________________________ Job Title

Home Office ______________________________ Division/Department

Date/Time of Accident

Location of Accident

Witnesses to the Accident

Injury Incurred? _______ Nature of Injury

Engaged in What Task When Injured? ____

Will Lost Time Occur? _______ How Long? _________ Date Lost Time Began __________________

Were Other Persons Involved/Injured?

How Did the Accident Occur?

What Could Be Done to Prevent Recurrence of the Accident? _________________________________

What Actions Have You Taken Thus Far to Prevent Recurrence? ______________________________

Supervisor's Signature _________________________ Title ___________________ Date

Reviewer's Signature __________________________ Title ___________________ Date

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed accident investigation report must be submitted to the Regional Health and Safety Manager within two days of the occurrence of the accident.

Attachment D
Job Hazard Assessment

Job Hazard Assessment Form

Subsurface Investigation in Uncontaminated Soils

Kerr-McGee

Henderson, Nevada

To be used for field assessments of new hazards

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
SAFETY EQUIPMENT	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**

Attachment E

Material Safety Data Sheets

Alconox® Material Safety Data Sheet

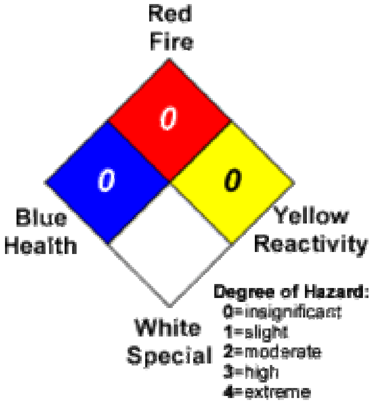
Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603

24 Hour Emergency Number - Chem-Tel (800) 255-3924

I. Identification

Product Name (shown on label):	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 1999
Chemical Family:	Anionic Powdered Detergent
Mfr. Catalog #s for Sizes:	1104, 1125, 1150, 1101, 1103, 1112

National Fire Protection Association 704 Labeling:



NJTSRN: 1100

II. Hazardous Ingredients/Identity Information

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. Physical/Chemical Characteristics

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Melting Point:	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.

IV. Fire and Explosion Data

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO2, foam

Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. Reactivity Data

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO2 on burning

VI. Health Hazard Data

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. Precautions for Safe Handling and Use

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.

Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VII. Control Measures

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

Alconox® Material Safety Data Sheet

Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603

24 Hour Emergency Number - Chem-Tel (800) 255-3924

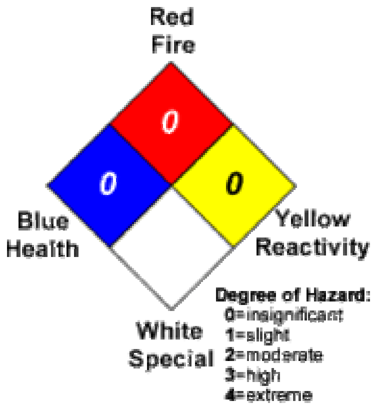
I. Identification

Product Name (shown on label):	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 1999
Chemical Family:	Anionic Powdered Detergent
Mfr. Catalog #s for Sizes:	1104, 1125, 1150, 1101, 1103, 1112

II. Hazardous Ingredients/Identity Information

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

National Fire Protection Association 704 Labeling:



NJTSRN: 1100

III. Physical/Chemical Characteristics

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Melting Point:	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.

IV. Fire and Explosion Data

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing

	apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. Reactivity Data

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO2 on burning

VI. Health Hazard Data

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. Precautions for Safe Handling and Use

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in

	accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VII. Control Measures

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

Fisher Scientific

Material Safety Data Sheet
Sodium Bisulfate Monohydrate

ACC# 20995

Section 1 - Chemical Product and Company Identification

MSDS Name: Sodium Bisulfate Monohydrate
Catalog Numbers: S80175, S240 3, S240 500, S240-3, S240-500, S2403, S240500
Synonyms: Sodium Hydrogen Sulfate
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
10034-88-5	Sodium Bisulfate Monohydrate	100	unlisted

Hazard Symbols: C
Risk Phrases: 34 37

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colourless. **Danger!** Corrosive. Water-Reactive. Causes eye and skin burns. Causes digestive and respiratory tract burns.
Target Organs: None.

Potential Health Effects

Eye: Causes eye burns.
Skin: Contact with skin causes irritation and possible burns, especially if the skin is wet or moist.
Ingestion: May cause severe gastrointestinal tract irritation with nausea, vomiting and possible burns.
Inhalation: Causes severe irritation of upper respiratory tract with coughing, burns, breathing

difficulty, and possible coma. Causes chemical burns to the respiratory tract.
Chronic: Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. SPEEDY ACTION IS CRITICAL!
Ingestion: Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Notes to Physician: Treat symptomatically and supportively.
Antidote: None reported.

Section 5 - Firefighting Measures

General Information: Wear appropriate protective clothing to prevent contact with skin and eyes. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products. Contact with water can cause violent liberation of heat and splattering of the material.
Extinguishing Media: Do NOT use water directly on fire. Use water spray to cool fire-exposed containers. Use dry chemical to fight fire.

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Do not allow contact with water. Use only in a chemical fume hood.
Storage: Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not store near alkaline substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Sodium Bisulfate Monohydrate	none listed	none listed	none listed

OSHA Vacated PELs: Sodium Bisulfate Monohydrate: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Solid.
Appearance: colourless
Odor: odorless
pH: 1.4 (0.1 solution)
Vapor Pressure: Not applicable.
Vapor Density: Not available.
Evaporation Rate: Not applicable.
Viscosity: Not applicable.
Boiling Point: Decomposes.
Freezing/Melting Point:137.3 deg F
Decomposition Temperature: Not available.
Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.
Solubility: 67% in water.
Specific Gravity/Density:2.103 @13C
Molecular Formula:$NaHSO_4.H_2O$
Molecular Weight:120.0544

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, moisture, contact with water.
Incompatibilities with Other Materials: Contact with miosture can form corrosive sulfuric acid. Incompatible with calcium hypochlorite.
Hazardous Decomposition Products: Oxides of sulfur.
Hazardous Polymerization: Has not been reported

Section 11 - Toxicological Information

RTECS#:
CAS# 10034-88-5: VZ1870000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 10034-88-5: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology: Workers exposed to industrial sulfuric acid mist showed a st atistical increase in laryngeal cancer. This data suggests a possible relationship between carcinogenisis and inhalation of sulfuric acid mist.
Teratogenicity: No data available.
Reproductive Effects: No data available.
Neurotoxicity: No data available.
Mutagenicity: No data available.
Other Studies: No data available.

Section 12 - Ecological Information

Ecotoxicity: Sulfuric acid is harmful to aquatic life in very low concentrations. It may be dangerous if it enters water intakes. The aquatic toxicity for bluegill in fresh water was 24.5 ppm/24 hr, which was lethal.
Environmental Fate: Not available.
Physical/Chemical: Not available.
Other: Not available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	No information available.				CORROSIVE SOLID NOS (SODIUM BISULFATE)
Hazard Class:					8(9.2)
UN Number:					UN1759
Packing Group:					III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 10034-88-5 is not on the TSCA Inventory. It is a hydrate and exempt from TSCA Inventory requirements (40CFR720.3(u)(2)).

Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.

Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)
None of the chemicals in this material have an RQ.

Section 302 (TPQ)
None of the chemicals in this product have a TPQ.

SARA Codes
CAS # 10034-88-5: acute, reactive.

Section 313
No chemicals are reportable under Section 313.

Clean Air Act:
This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.

STATE
CAS# 10034-88-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:
C

Risk Phrases:
R 34 Causes burns. R 37 Irritating to respiratory system.

Safety Phrases:
S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection. S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)
CAS# 10034-88-5: No information available.

Canada

None of the chemicals in this product are listed on the DSL/NDSL list. This product has a WHMIS classification of E.

CAS# 10034-88-5 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

Section 16 - Additional Information

MSDS Creation Date: 9/30/1997
Revision #1 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Fisher Scientific

Material Safety Data Sheet

Methyl Alcohol

ACC# 14280

Section 1 - Chemical Product and Company Identification

MSDS Name: Methyl Alcohol
Catalog Numbers: S75959, S75965, S75965A, S75965HPLC, S75965SPEC, A142RS200, A33F-1GAL, A408 1, A408 4, A408-1, A408-4, A4081, A4084, A408SK 4, A408SK-4, A408SK4, A411 20, A411 4, A411-20, A411-4, A41120, A4114, A412 1, A412 20, A412 20 001, A412 200, A412 4, A412 500, A412-1, A412-20, A412-200, A412-4, A412-500, A41200LC, A4121, A41220, A41220 001, A412200, A41220001, A41220003, A41220005, A412200LC, A41220LC, A4124, A4124LC, A412500, A412500002, A412500LC, A412CU1300, A412FB115, A412FB19, A412FB200, A412FB50, A412J500, A412LC, A412P 4, A412P-4, A412P4, A412P4LC, A412RB115, A412RB19, A412RB200, A412RB50, A412RS115, A412RS200, A412RS28, A412RS50, A412SK 4, A412SK-4, A412SK4, A412SS 115, A412SS-11, A412SS-115, A412SS-20, A412SS-200, A412SS-30, A412SS-50, A412SS115, A412SS50, A413-20, A413-4, A413-500, A413200, A4134, A413500, A433P 4, A433P-4, A433P4, A433S 20, A433S 200, A433S 4, A433S-20, A433S-200, A433S-4, A433S20, A433S200, A433S20001, A433S4, A434 20, A434-20, A43420, A450 4, A450-4, A4504, A4504LOT011, A4504LOT012, A452 1, A452 4, A452 SS115, A452-1, A452-4, A4521, A4524, A4524LC, A452J1, A452RS19, A452RS200, A452RS28, A452RS50, A452SK 1, A452SK 4, A452SK-1, A452SK-4, A452SK1, A452SK4, A452SS 200, A452SS 50, A452SS-11, A452SS-115, A452SS-20, A452SS-200, A452SS-30, A452SS-50, A452SS115, A452SS200, A452SS28, A452SS50, A453 1, A453 500, A453 500 001, A453 500 002, A453 500 003, A453-500, A4531, A4531LC, A4531LOT001, A453500, A453500 001, A453500 002, A453500 003, A453500 004, A453500001, A453500002, A453500003, A453500004, A453500005, A453J1, A454 1, A454 4, A454 SS115, A454 SS30, A454 SS50, A454-1, A454-4, A4541, A4541LC, A4544, A4544LC, A4544LOT012, A4544LOT014, A45450%SS-115, A454RS115, A454RS19, A454RS200, A454RS28, A454RS50, A454SS 200, A454SS115, A454SS200, A454SS28, A454SS30, A454SS50, A457 4, A4574, A497RS28, A52RS28, A52RS50, A54RS115, A54RS200, A54RS28, A54RS50, A935 4, A935-4, A9354, A935RB200, A936-1, A936-4, A947 4, A947-4, A9474, A9474LC, A9474LOT002, A947RS115, A947RS200, A947RS28, A947SS115, A947SS200, A947SS28, A947SS50, BP1105 1, BP1105 4, BP1105-1, BP1105-4, BP11051, BP11054, BP1105SS115, BP1105SS200, BP1105SS28, BP1105SS50, BP2618100, BPA947RS-115, BPA947RS-200, BPA947RS-28, FLA412RS-115, FLA412RS-200, FLA412RS-28, FLA412RS-50, FLA452RS-115, FLA452RS-28, FLA452RS-50, FLA454RS-115, FLA454RS-200, FLA454RS-28, FLA454RS-50, HC 400 1GAL, HC400 1GAL, HC4001GAL, IEAA453500A, NC9475554, NC9500047, NC9548094, NC9633361, NC9766429, NC9780216, SC95 1, SC951, SW2 1, SW21, TIA9474, TIA947P200, TIA947P200L, XXA45220LI
Synonyms: Carbinol; Methanol; Methyl hydroxide; Monohydroxymethane; Pyroxylic spirit; Wood alcohol; Wood naptha; Wood spirit; Monohydroxymethane; Methyl hydrate
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
67-56-1	Methyl alcohol	>99.0	200-659-6

Hazard Symbols: T F
Risk Phrases: 11 23/24/25 39/23/24/25

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless. Flash Point: 12 deg C. **Danger! Flammable liquid and vapor.** Causes respiratory tract irritation. Harmful if inhaled. This substance has caused adverse reproductive and fetal effects in animals. May cause central nervous system depression. May be absorbed through the skin. Poison! Cannot be made non-poisonous. Causes eye and skin irritation. May be fatal or cause blindness if swallowed. May cause digestive tract irritation with nausea, vomiting, and diarrhea. May cause liver, kidney and heart damage.
Target Organs: Kidneys, heart, central nervous system, liver, eyes.

Potential Health Effects

Eye: Produces irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. May cause painful sensitization to light.
Skin: Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
Ingestion: May be fatal or cause blindness if swallowed. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systemic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause cardiopulmonary system effects.
Inhalation: Harmful if inhaled. May cause adverse central nervous system effects including headache, convulsions, and possible death. May cause visual impairment and possible permanent blindness. Causes irritation of the mucous membrane.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. Chronic exposure may cause reproductive disorders and teratogenic effects. Laboratory experiments have resulted in mutagenic effects. Prolonged exposure may cause liver, kidney, and heart damage.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Induce vomiting by giving one teaspoon of Syrup of Ipecac.
Inhalation: Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: Effects may be delayed. Ethanol may inhibit methanol metabolism.

Section 5 - Firefighting Measures

General Information: Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Vapors can travel to a source of ignition and flash back. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Flammable Liquid. Can release vapors that form explosive mixtures at temperatures above the flashpoint. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. May be ignited by heat, sparks, and flame.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Scoop up with a nonsparking tool, then place into a suitable container for disposal. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as saw dust. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Do not ingest or inhale. Use only in a chemical fume hood. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed. Do not store in aluminum or lead containers.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use only under a chemical fume hood.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Methyl alcohol	200 ppm; 250 ppm STEL; skin - potential for cutaneous absorption	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA

OSHA Vacated PELs: Methyl alcohol: 200 ppm TWA; 260 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR §1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: alcohol-like - weak odor
pH: Not available.
Vapor Pressure: 128 mm Hg @ 20 deg C
Vapor Density: 1.11 (Air=1)
Evaporation Rate:5.2 (Ether=1)
Viscosity: 0.55 cP 20 deg
Boiling Point: 64.7 deg C @ 760.00mm Hg
Freezing/Melting Point:-98 deg C
Decomposition Temperature: Not available.
Autoignition Temperature: 455 deg C (851.00 deg F)
Flash Point: 12 deg C (53.60 deg F)
NFPA Rating: (estimated) Health: 1; Flammability: 3; Reactivity: 0
Explosion Limits, Lower:7.30 vol %
Upper: 36.00 vol %
Solubility: miscible
Specific Gravity/Density:.7910g/cm3
Molecular Formula:CH_4O
Molecular Weight:32.04

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: High temperatures, incompatible materials, ignition sources, oxidizers.
Incompatibilities with Other Materials: Acids (mineral, non-oxidizing, e.g. hydrochloric acid, hydrofluoric acid, muriatic acid, phosphoric acid), acids (mineral, oxidizing, e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic, e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), azo, diazo, and hydrazines (e.g. dimethyl hydrazine, hydrazine, methyl hydrazine), isocyanates (e.g. methyl isocyanate), nitrides (e.g. potassium nitride, sodium nitride), peroxides and hydroperoxides (organic, e.g. acetyl peroxide, benzoyl peroxide, butyl peroxide, methyl ethyl ketone peroxide), epoxides (e.g. butyl glycidyl ether), Oxidants (such as barium perchlorate, bromine, chlorine, hydrogen peroxide, lead perchlorate, perchloric acid, sodium hypochlorite)., Active metals (such as potassium and magnesium)., acetyl bromide, alkyl aluminum salts, beryllium dihydride, carbontetrachloride, carbon tetrachloride + metals, chloroform + heat, chloroform + sodium hydroxide, cyanuric chloride, diethyl zinc, nitric acid, potassium-tert-butoxide, chloroform + hydroxide, water reactive substances (e.g. acetic anyhdride, alkyl aluminum chloride, calcium carbide, ethyl dichlorosilane).
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 67-56-1 unlisted.
LD50/LC50:
CAS# 67-56-1:
Draize test, rabbit, eye: 40 mg Moderate;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, rat: LC50 = 64000 ppm/4H;
Oral, mouse: LD50 = 7300 mg/kg;
Oral, rabbit: LD50 = 14200 mg/kg;
Oral, rat: LD50 = 5628 mg/kg;
Skin, rabbit: LD50 = 15800 mg/kg;
Carcinogenicity:
CAS# 67-56-1: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology: Methanol has been shown to produce fetotoxicity in the embr yo or fetus of laboratory animals. Specific developmenta l abnormalities include cardiovascular, musculoskeletal, and urogenital systems.
Teratogenicity: Effects on Newborn: Behaviorial, Oral, rat: TDLo=7500 mg/kg (female 17-19 days after conception). Effects on Embryo or Fetus: Fetotoxicity, Inhalation, rat: TCLo=10000 ppm/7H (female 7-15 days after conception). Specific Developmental Abnormalities: Cardiovascular, Musculoskeletal, Urogenital, Inhalation, rat: TCLo=20000 ppm/7H (7-14 days after conception).
Reproductive Effects: Paternal Effects: Spermatogenesis: Intraperitoneal, mouse TDLo=5 g/kg (male 5 days pre-mating). Fertility: Oral, rat: TDLo = 35295 mg/kg (female 1-15 days after conception). Paternal Effects: Testes, Epididymis, Sperm duct: Oral, rat: TDLo = 200 ppm/20H (male 78 weeks pre-mating).
Neurotoxicity: No information available.
Mutagenicity: DNA inhibition: Human Lymphocyte = 300 mmol/L. DNA damage: Oral, rat = 10 umol/kg. Mutation in microorganisms: Mouse Lymphocyte = 7900 mg/L. Cytogenetic analysis: Oral, mouse = 1 gm/kg.
Other Studies: Standard Draize Test(Skin, rabbit) = 20 mg/24H (Moderate) S tandard Draize Test: Administration into the eye (rabbit) = 40 mg (Moderate). Standard Draize test: Administration int o the eye (rabbit) = 100 mg/24H (Moderate).

Section 12 - Ecological Information

Ecotoxicity: Not available.
Environmental Fate: Dangerous to aquatic life in high concentrations. Aquatic toxicity rating: TLm 96>1000 ppm. May be dangerous if it enters water intakes. Methyl alcohol is expected to biodegrade in soil and water very rapidly. This product will show high soil mobility and will be degraded from the ambient atmosphere by the reaction with photochemically produced hyroxyl radicals with an estimated half-life of 17.8 days. Bioconcentration factor for fish (golden ide) < 10. Based on a log Kow of -0.77, the BCF value for methanol can be estimated to be 0.2.
Physical/Chemical: No information available.
Other: None.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 67-56-1: waste number U154; (Ignitable waste).

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	METHANOL				METHANOL
Hazard Class:	3				3(6.1)
UN Number:	UN1230				UN1230
Packing Group:	II				II
Additional Info:					FLASHPOINT 11 C

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 67-56-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA

Section 302 (RQ)
CAS# 67-56-1: final RQ = 5000 pounds (2270 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 67-56-1: acute, flammable.
Section 313
This material contains Methyl alcohol (CAS# 67-56-1, 99 0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 67-56-1 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 67-56-1 can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T F
Risk Phrases:
R 11 Highly flammable. R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed. R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
Safety Phrases:
S 16 Keep away from sources of ignition - No smoking. S 36/37 Wear suitable protective clothing and gloves. S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S 7 Keep container tightly closed.
WGK (Water Danger/Protection)
CAS# 67-56-1: 1
Canada
CAS# 67-56-1 is listed on Canada's DSL/NDSL List.
This product has a WHMIS classification of B2, D1A, D2A.
CAS# 67-56-1 is listed on Canada's Ingredient Disclosure List.
Exposure Limits
CAS# 67-56-1: OEL-ARAB Republic of Egypt:TWA 200 ppm (260 mg/m3);Ski
n OEL-AUSTRALIA:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL-BELGIU
M:TWA 200 ppm (262 mg/m3);STEL 250 ppm;Skin OEL-CZECHOSLOVAKIA:TWA 10
0 mg/m3;STEL 500 mg/m3 OEL-DENMARK:TWA 200 ppm (260 mg/m3);Skin OEL-
FINLAND:TWA 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL-FRANCE:TWA 200
ppm (260 mg/m3);STEL 1000 ppm (1300 mg/m3) OEL-GERMANY:TWA 200 ppm (2
60 mg/m3);Skin OEL-HUNGARY:TWA 50 mg/m3;STEL 100 mg/m3;Skin JAN9 OEL
-JAPAN:TWA 200 ppm (260 mg/m3);Skin OEL-THE NETHERLANDS:TWA 200 ppm (
260 mg/m3);Skin OEL-THE PHILIPPINES:TWA 200 ppm (260 mg/m3) OEL-POLA
ND:TWA 100 mg/m3 OEL-RUSSIA:TWA 200 ppm;STEL 5 mg/m3;Skin OEL-SWEDEN
:TWA 200 ppm (250 mg/m3);STEL 250 ppm (350 mg/m3);Skin OEL-SWITZERLAN
D:TWA 200 ppm (260 mg/m3);STEL 400 ppm;Skin OEL-THAILAND:TWA 200 ppm
(260 mg/m3) OEL-TURKEY:TWA 200 ppm (260 mg/m3) OEL-UNITED KINGDOM:TW
A 200 ppm (260 mg/m3);STEL 250 ppm;Skin OEL IN BULGARIA, COLOMBIA, JO
RDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM ch

eck ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 7/21/1999
Revision #6 Date: 1/24/2001

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Liqui-Nox ®

MATERIAL SAFETY DATA SHEET

Alconox, Inc.
9 East 40th Street, Suite 200
New York, NY 10016

Liqui-nox® Material Safety Data Sheet

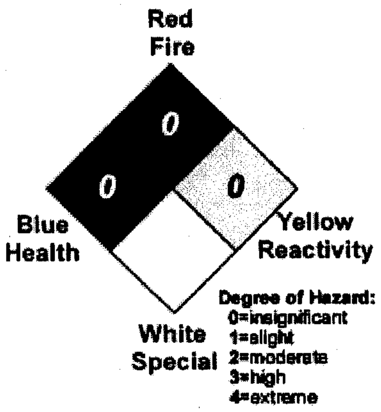
Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603

24 Hour Emergency Number - Chem-Tel (800) 255-3924

I. Identification

Product Name (shown on label):	LIQUI-NOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 1999
Chemical Family:	Anionic Liquid Detergent
Mfr. Catalog #s for Sizes:	1232, 1201, 1215, 1255

National Fire Protection Association 704 Labeling:



NJTSRN: 1200

II. Hazardous Ingredients/Identity Information

There are no hazardous ingredients in LIQUI-NOX" as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. Physical/Chemical Characteristics

Boiling Point (F):	214°F
Vapor Pressure (mm Hg):	No Data
Vapor Density (AIR=1):	No Data
Specific Gravity (Water=1):	1.075
Evaporation Rate (Butyl Acetate=1):	Slower
Melting Point:	No Data
Solubility in Water:	Completely soluble in all proportions
Appearance:	Yellow liquid, nearly odorless

IV. Fire and Explosion Data

Flash Point (Method Used):	None (Cleveland Open Cup)
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. Reactivity Data

Stability:	Stable
Hazardous Polymerization:	Will not occur.
Incompatibility (Materials to Avoid):	Oxidizing agents.
Hazardous Decomposition or Byproducts:	May release SO2 on burning.

VI. Health Hazard Data

Route(s) of Entry:	Inhalation? No Skin? Yes Ingestion? Yes
Health Hazards (Acute and Chronic):	Skin contact may prove locally irritating, causing drying and/or chapping. Ingestion may cause discomfort and/or diarrhea.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Prolonged skin contact may cause drying and/or chapping.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. Precautions for Safe Handling and Use

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. For small spills recover as much as possible with absorbent material and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.

Precautions to be Taken in Storing and Handling:	No special precautions in storing. Use protective equipment when handling undiluted material.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VII. Control Measures

Respiratory Protection (Specify Type):	None Required
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are recommended.
Eye Protection:	Goggles and/or splash shields are recommended.
Other Protective Clothing or Equipment:	Not required
Work/Hygienic Practices:	No special practices required.

APPENDIX C

Examples of Field Forms

ENSR	*Client:*		***BORING ID:***
	Project Number:		
	Site Location:		
	Coordinates:	*Elevation:*	*Sheet: 1 of 1*
	Drilling Method:		*Monitoring Well Installed:*
	Sample Type(s):	*Boring Diameter:*	*Screened Interval:*
Weather:	*Logged By:*	*Date/Time Started:*	*Depth of Boring:*
Drilling Contractor:	*Ground Elevation:*	*Date/Time Finished:*	*Water Level:*

Depth (ft)	Geologic sample ID	Sample Depth (ft)	Blows per 6"	Recovery (inches)	Headspace (ppm)	U.S.C.S	**MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known)**	Lab Sample ID	Lab Sample Depth (Ft.)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by ___________________________ Date:________________

ENSR INTERNATIONAL

ENSR International
1220 Avenida Acaso
Camarillo, CA 93012-8738
Phone (805) 388-3775
Fax (805) 388-3577

ANALYTICAL LAB: ____________________

____

____________________ SITE __________ DATE __________ PAGE _____ OF _____

CLIENT

PROJECT NAME:

PROJECT MANAGER:

JOB #:

COELT LOG CODE: YES / NO ☐ ☐ ☐ ☐

SAMPLER SIGNATURE

				ANALYTICAL METHODS																					TURN-AROUND TIME
LINE ITEM	SAMPLE NO.	DATE	TIME	8260B / 5035 Volatile Organics	8260B BTEX / MTBE / Oxygenates	8015 Diesel / Gasoline / Full Range	8081A Pesticides	CAM 17 Metals														MATRIX TYPE	CONTAINER TYPE	NUMBER OF CONTAINERS	OBSERVATIONS/ COMMENTS
1.																									
2.																									
3.																									
4.																									
5.																									
6.																									
7.																									
8.																									
9.																									
10.																									

MATRIX TYPE: S - Soil
W - Water
O - Other

CONTAINER TYPE: G - Glass Bottle
P - Plastic
O - Other

PRESERVATIVES:
All samples are preserved on ice.
Water samples are preserved as indicated on the sample labels.

TEMPERATURE BLANK EACH COOLER ☐ YES ☐ NO

RELINQUISHED BY:	SIGNATURE	**ENSR International**	DATE	TIME	TOTAL NUMBER OF CONTAINERS:
RECEIVED BY:	SIGNATURE	COMPANY	DATE	TIME	METHOD OF SHIPMENT
RELINQUISHED BY:	SIGNATURE	COMPANY	DATE	TIME	SPECIAL SHIMENT/HANDLING/STORAGE REQUIREMENTS:
RECEIVED BY	SIGNATURE	COMPANY	DATE	TIME	

DISTRIBUTION: White and Canary = Laboratory **Pink = ENSR International**

Serial No. 2626

ENSR

Client:		**WELL ID:**
Project Number:		
Site Location:		*Date Installed:*
Well Location:	*Coords:*	*Inspector:*
Method:		*Contractor:*

MONITORING WELL CONSTRUCTION DETAIL

	Depth from G.S. (feet)	Elevation(feet) Datum __________
Top of Steel Guard Pipe		
Top of Riser Pipe		
Ground Surface (G.S.)	0.0	
Bottom of Steel Guard Pipe		
Top of Bentonite		
Top of Sand		
Top of Screen		
▲ Stabilized Water Level		
Bottom of Screen		
Bottom of Tail Pipe:		
Bottom of Borehole		

Measuring Point for Surveying & Water Levels

Cement, Bentonite, Bentonite Slurry Grout, or Native Materials

______ % Cement

______ % Bentonite

______ % Native Materials

Riser Pipe:
- Length ______
- Inside Diameter (ID) ______
- Type of Material ______

Bentonite Seal Thickness ______

Screen:
- Length ______
- Inside Diameter (ID) ______
- Slot Size ______
- Type of Material ______

Type/Size of Sand ______
Sand Pack Thickness ______

Borehole Diameter: ______

Approved:

______________________ Signature

______________ Date

Describe Measuring Point:

____

ENSR

Well/Piez. ID:

Monitoring Well Development Record

Client: ____________________ Site Location: ____

Project No: ____________________ Date: __________ Developer: ____________________________________

WELL/PIEZOMETER DATA

Well ☐ Piezometer ☐ Diameter __________ Material ___________

Measuring Point Description ________________

Geology at Screen Interval (if known) ____________________

Depth to Top of Screen (ft.) ________________

Depth to Bottom of Screen (ft.) ________________

Time of Water Level Measurement __________

Total Well Depth (ft.) ________________

Calculate Purge Volume (gal.) __________

Depth to Static Water Level (ft.) ________________

Disposal Method ____________________

Wellhead PID/FID ____________________

Original Well Development ☐ Redevelopment ☐ Date of Original Development __________

DEVELOPMENT METHOD ________________ **PURGE METHOD** ____________________

Field Testing Equipment Used: Make Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _______________ Page # _______________

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other

ACCEPTANCE CRITERIA (from workplan)
Min. Purge Volume (____ well volumes) _____gallons
Maximum Turbidity Allowed _____ NTUs
Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A explain below:

Signature ____ Date: ____________________

ENSR

Well ID:

Low Flow Ground Water Sample Collection Record

Client:
Date:
Time: Start am/pm
Finish am/pm
Project No:
Site Location:
Weather Conds:
Collector(s):

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length
c. Length of Water Column (a-b)
Casing Diameter/Material
b. Water Table Depth
d. Calculated System Volume (see back)

2. WELL PURGE DATA

a. Purge Method:

b. Acceptance Criteria defined (see workplan)

- Temperature	3%	-D.O.	10%
- pH	± 1.0 unit	- ORP	± 10mV
- Sp. Cond.	3%	- Drawdown	< 0.3'

c. Field Testing Equipment used:

Make	Model	Serial Number

Time (24hr)	Volume Removed (Liters)	Temp. (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (feet)	Color/Odor

d. Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

(continued on back)

If no or N/A - Explain below.

3. SAMPLE COLLECTION:

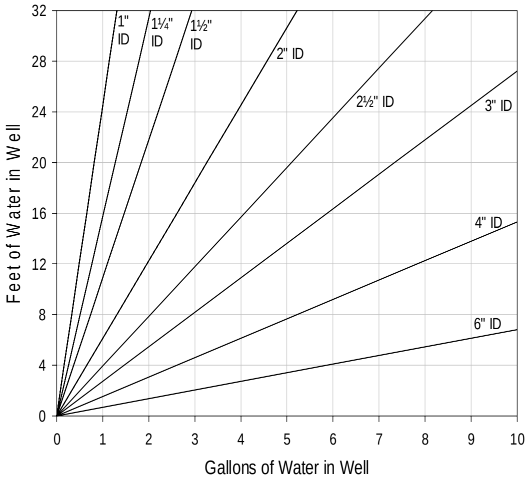
Method:

Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments

Signature
Date

Purge Volume Calculation



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (24 hr)	Volume Removed (Liters)	Temp (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (ft)	Color/Odor

ENSR

Well/Piezo ID:

Ground Water Sample Collection Record

Client: ______________________ Date: ________

Project No: ______________________ Time: Start ________ am/pm

Site Location: ______________________ Finish ________ am/pm

Weather Conds: ____________ Collector(s) ____________

WATER LEVEL DATA: (measured from Top of Casing) Well ☐ Piezometer ☐

a. Total Well Length ________

c. Casing Material _______

e. Length of Water Column ____________

b. Water Table Depth ________

d. Casing Diameter _______

f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method ____

b. Acceptance Criteria defined (from workplan)
- Minimum Required Purge Volume (@ _______ well volumes) __________________
- Maximum Allowable Turbidity ________ NTUs
- Stabilization of parameters ________ %

c. Field Testing Equipment Used: Make Model Serial Number

____

____

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _______ Page #_______

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other

e. Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

____

____

SAMPLE COLLECTION: Method: ____

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time

Comments ____

____

Signature ______________________ Date ______________________