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SCS ENGINEERS

LANDFILL ASSESSMENT WORK PLAN

SUNRISE MOUNTAIN LANDFILL
INCLUDING THE
NORTHEAST CANYON AREA,
EASTERN PERIMETER AREA,
AND WESTERN BURN PITS AREA

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CLARK COUNTY, NEVADA

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SECTION 1.0
GENERAL INFORMATION

This Work Plan has been prepared for the purpose of assessing the environmental conditions at the closed Sunrise Mountain Landfill site, located approximately 3 miles east of Las Vegas, in Clark County, Nevada (refer to Drawing 1, Site Vicinity Map). The Site includes the Sunrise Mountain Landfill, which lies on a 720-acre parcel of land that is leased to Clark County by the Bureau of Land Management (BLM); and three adjacent areas known as the Northeast Canyon Area, the Eastern Perimeter Area, and the Western Burn Pits Area. The Site is situated on the eastern edge of Las Vegas Valley, immediately southeast of Frenchman Mountain, as shown on Drawing 1. The uppermost portion of the landfill area is located within the canyon directly east of Frenchman Mountain. However, the majority of the landfill is located on a large alluvial fan that originates at the mouth of the canyon and spreads out into the adjacent valley. Elevation on the Site ranges from 1,900 to 2,275 feet above mean sea level (MSL).

Clark County has leased the property from the BLM since 1962 for the purpose of providing solid waste disposal services to county residents and businesses. Clark County contracted operation of the landfill in 1975 to DUMPCO, a recently acquired and wholly owned subsidiary of Republic Services, Inc. The acquired subsidiary is referred to as Republic DUMPCO, who retained SCS Engineers to prepare this Work Plan.

The Work Plan is in response to an Administrative Order to assess the Site, issued by the U. S. Environmental Protection Agency (EPA). The Order was largely prompted by an EPA site inspection approximately two months after a large storm/flooding event that occurred in September of 1998. During that inspection, exposed/water-transported waste was observed, as well as damage to the surface water control system. EPA inspectors also noted a hydrogen sulfide (H_2S) odor in certain areas of the landfill and several potential waste disposal areas outside the assumed limits of the landfill (including off-lease property).

The objective of this Work Plan is to detail the actions that will be taken to assess the landfill and three adjacent areas (Northeast Canyon Area, Eastern Perimeter Area, and Western Burn Pits Area) for impacts to the environment or public health. Ultimately, the assessment information will be used to develop a Groundwater Monitoring and Corrective Action Plan for the landfill.

SECTION 2.0
ADMINISTRATIVE ORDER AND REQUIREMENTS

The EPA issued the Administrative Order on April 26, 1999 (EPA Docket No. RCRA-7003-09-99-0005) to the following respondents: Republic Disposal Urban Maintenance Processing, Co., Inc. (Republic DUMPCO); Republic Silver State Disposal, Inc. ("RSSD"); Republic Industries, Inc. (RII); SSDS Liquidating Corporation; and Clark County Public Works Department ("CCPW"). The Order was issued by the Administrator of EPA, under the authority of Section 7003 of the Solid Waste Disposal Act of 1976, commonly referred to as the Resource Conservation and Recovery Act ("RCRA"). Notice of the Order was also provided to the State of Nevada, Division of Environmental Protection ("NDEP").

The Administrative Order included 24 Findings of Fact, which were ascertained from historical data, site inspection/observation results, and relevant technical information. Based on these Findings of Fact, EPA concluded the Site may present an imminent and substantial endangerment to health or the environment, and that each of the above mentioned respondents were liable.

The Order requires the respondents to submit to the EPA this Landfill Assessment Work Plan within 30 days of the effective date of the Order. By EPA request, the Work Plan addresses Sunrise Mountain Landfill, the Northeast Canyon Area, the Eastern Perimeter Area, and Western Burn Pits Area, as identified on Drawing 2. This Work Plan was developed based on specific requirements outlined in the Order (Section VI, Part B.1, items a through h).

Implementation of the landfill assessment will occur following EPA review and approval of the Work Plan. Results from the landfill assessment will be compiled in a Landfill Assessment Report, which will also be submitted to the EPA for review and approval. A Corrective Measures Plan and implementation of the corrective measures will occur sequentially following EPA approval of the Landfill Assessment Report. Specific deadlines for each of these submittals to EPA are outlined in the Administrative Order.

Concurrently with the above stated Order, the EPA also issued to the respondents a Findings of Violation and Order for Compliance pursuant to Section 309(a) of the Clean Water Act (EPA Docket No. CWA-309-9-99-14). Actions that have or will be taken to address the requirements of this particular order are the subject of a separate submittal to the EPA.

SECTION 3.0
LANDFILL ASSESSMENT WORK PLAN

3.1 — INTRODUCTION

This Landfill Assessment Work Plan is the first of five steps required by the April 26, 1999 EPA Administrative Order (EPA Docket No. 7003 - 09 - 99 - 0005). The five steps, in sequential order, are as follows.

1. Prepare a Landfill Assessment Work Plan.

2. Conduct EPA approved Landfill Assessment and prepare a Landfill Assessment Report.

3. Prepare a Landfill Corrective Measures Plan.

4. Implement EPA approved Corrective Measures.

5. Submit certification that closure has been completed in accordance with the Landfill Corrective Measures Plan

3.2 — PURPOSE AND SCOPE

The purpose of this Landfill Assessment Work Plan is to identify the scope of work required to address the Administrative Order. The Order requires this Landfill Assessment Work Plan to include, at minimum, the following:

1. Identify the location and acreage of disturbance or waste disposal. This task addresses work item VI. 1. a in the Administrative Order.

2. Assessment of the total volume by type of waste disposed in all areas. This task addresses work item VI. 1. b in the Administrative Order.

3. Evaluation of the existing final cover over all areas. This task addresses work item VI. 1. c of the Administrative Order.

4. Assessment of landfill gas levels and constituents. This task addresses work item VI. 1. d in the Administrative Order.

5. Assessment of impacts to groundwater, and run-off impacts to groundwater and surface water. This task addresses work item VI. 1. e in the Administrative Order.

6. Detailed description of sampling and analytical methods to be used. This task addresses item VI. 1. f in the Administrative Order.

7. Detailed schedule of the work to be performed. This task addresses item VI. 1. g in the Administrative Order.

8. Thorough characterization of the hydrogeologic setting for use in developing a Groundwater Monitoring and Corrective Action Program. This task addresses item VI. 1. h in the Administrative Order.

In addition to the eight specific Work Task Items listed above, the Order requires the following for all work:

- Evaluate potential impacts to Threatened and Endangered Species or Critical Habitat. Clark County has agreed to address this issue. All contractors and work will conform to appropriate work practices and procedures, as directed by Clark County.

- Use as guidance the Criteria for Municipal Solid Waste Landfills in 40 CFR 258 and the EPA "Solid Waste Disposal Facility Criteria: Technical Manual". Applicable provisions of both of these documents were used as guidance in the preparation of this Work Plan, and will be used as guidance in preparation of the Landfill Assessment Report and the Corrective Measures Plan.

3.3 — BACKGROUND INFORMATION

3.3.1 — Site Location

The location of the Site is described in Section 1.

3.3.2 — Climate and Site Hydrology

The climate of Las Vegas Valley is arid, with mean annual precipitation of about 4.3 inches. This average rainfall is irregularly concentrated in a few storm events per year, most, of which have high intensity and short duration, and tend to produce flash floods. These flash floods have produced large debris flows through geologic time, which are evident as lobate structures on the aerial photograph (Drawing 2). No evidence of permanent surface water is evident on the Site, either in the up-canyon areas or in the channels. Mesquite shrubs in some channels indicate seasonal perched water.

3.3.3 — Surface Water

As stated in Section 1, the landfill and adjacent disturbed areas occupy the throat of a canyon immediately southeast of Frenchman Mountain. Surface water run-off from the adjacent mountains is channeled through the canyon, over and around the landfill, toward the Las Vegas Wash, to the south - southwest.

A bypass channel was constructed along the northwest edge of the leased property. It conveys some of the run-off from the landfill and run-on from the mountain to the east of the landfill over and around the east edge of the landfill. According to an October 22, 1998 HLA report, this channel was designed to convey a 100-year, 6-hour storm event without freeboard, in general accordance with applicable regulations. Storms in excess of the design condition could be expected to cause damage to the channel and the adjacent landfill cover. This was demonstrated on September 11, 1998, by a storm which, according to the HLA report, "was most probably much greater than a 100-year frequency event". Apparently, failure of the channel during that storm event resulted in damage to the adjacent landfill cover, and washout of waste.

3.3.4 — Summary of Site Geology

Some work to characterize geologic and groundwater conditions at the Site has been done by Emcon (1986). The following discussion summarizes what has been developed to date, and identifies areas needing further information.

The Site is reported to be underlain by three different types of materials: about 5 to 10 feet of loose, uncemented sand, gravel, and boulders of active stream channels and surrounding areas; about 50 feet of weakly cemented alluvial-fan deposits consisting of multiple debris flow lobes, locally incised by other lobes, probably of Holocene age; and an unknown thickness of Muddy Creek formation, of Miocene age, resting on bedrock of the Frenchman Mountain group. The Frenchman Mountain group consists of hard, consolidated Paleozoic sediments that have been locally recrystallized and metamorphosed. Rock types include sandstone, limestone/dolomite/marble, and siltstone/shale. Brick-red volcanic or intrusive igneous rocks occur immediately southeast of the Site and may be present beneath the Site. Faulting and associated hydrothermal alteration, of unknown age, but believed to predate the alluvial series, was observed during the site visit. The contact between the youngest alluvium and bedrock is depositional, but the boundary between the deeper alluvium and bedrock is reported to be a fault contact, part of a regional fault system related to the Basin and Range geomorphic Province. No evidence of active faulting, such as fault-controlled springs, hydothermal activity, offset drainages, or vegetation lines, was observed on the Site during the site visit.

More information is needed on the age, thickness and lateral extent of the different alluvial deposits, location of faults, fracturing in the bedrock, and other geologic factors that affect groundwater flow. The carbonate rock types suggest that fractures are quickly resealed with calcite, and that the overall effective fracture density is unusually low. This may contribute to the tendency for the up-canyon watershed to create large debris flows.

3.3.5 — Summary of Site Hydrogeology

Little information has been developed on the occurrence of groundwater flow systems beneath the Site. The work detailed in this Plan is intended to enhance the knowledge of site hydrogeology and create a thorough characterization of the hydrogeologic setting in which the Site is located by verifying and supplementing existing data.

Because of the Site's aridity, some groundwater systems appear to be seasonally dry. Evidence for this is found in mention of hardpan deposits in the alluvial sequence. Hardpans may develop where groundwater evaporates and leaves salts behind, particularly in areas draining carbonate rocks. These salt or lime crusts may become barriers to vertical percolation, and this was observed by Emcon, who reported zones of moisture perched on hardpans. Hardpans could also indicate natural places where waste constituents could be observed from infiltrating surface water. Due to the nature of the flash floods typical of the area, and the short duration of saturated conditions, this is a likely location to assess the impacts of surface runoff on the vadose zone.

Groundwater was not observed to occur within the shallow sediments mantling bedrock within the canyon area of the Site. No riparian or phreatophyte vegetation was observed in the up-canyon area. Mesquite shrubs, in particular, are a good indicator of shallow groundwater systems, although these may be only seasonal. Permanent groundwater is known to occur within the basin alluvial series within the Las Vegas Wash to the west of the site, and is at an elevation about 200 to 300 lower than the site. Because the alluvial-fan sediments are practically dry, and they are at least 200 feet thick, it is unlikely that direct rainfall on the alluvial sediments could be a source of groundwater recharge. More likely, any groundwater recharge originates as rainfall on the bedrock, which is transmitted by fractures in continuity with the lower part of the Muddy Creek Formation, which then transmits water horizontally towards Las Vegas Wash. However, the character of the debris-flow deposits indicates that the bedrock is not particularly fractured.

Groundwater is reported to be present about 160 to 230 feet below ground surface near the southwestern property boundary, within sediments of the Muddy Creek formation. Based on topography, the hydraulic gradient is expected to be locally radial, subparallel with the topography of the alluvial fan, and merging into the general flow system of the Las Vegas wash to the southwest. Emcon (1986) estimated an average linear groundwater velocity of 1 to 10 feet per year within the Muddy Creek Formation based on a hydraulic conductivity of 1×10^{-3} to 1×10^{-4} cm/sec, a hydraulic gradient of .004, and an effective porosity of 30 percent. Because of the higher proportion of fines in the debris-flow deposits beneath the site, the porosity is unlikely to be this high beneath the site. The local gradient, however, is likely to be steeper, based on the steepness of the alluvial fan. The hydraulic conductivity is likely to be lower, also because of the higher proportion of fines and the poor sorting of debris flow deposits. Poor recovery of a previously existing well at the site was reported, but it is not known whether this is due to low hydraulic conductivity or limited storage.

3.3.6 — Summary of Site Hydro-geochemistry

Groundwater southwest of the Sunrise Mountain Landfill near Las Vegas Wash is reported to be slightly saline to saline. Total Dissolved Solids (TDS) for four wells LG-34, LG-184, LG-223, and LG-224 ranged from 3404 to 13,444 mg/L (TDS) in 1985 (Emcon, 1986). One sample from well B at the Landfill contained 3684 mg/L TDS. According to some earlier reports, nitrate has been detected in spring samples, and has been attributed by some to the landfill. However, because mesquite trees grow in the washes, and these trees are in the pea (legume) family, and harbor nitrogen-fixing bacteria in their root systems, the origin of nitrate may be debatable. The lack of available oxygen within landfills also argues against the landfill as a source of nitrate (NO_3); the typical form of nitrogen at landfills is ammonia (NH_3).

Minimum data required to characterize background groundwater quality include analyses for general mineral quality including calcium, magnesium, sodium, potassium, bicarbonate, carbonate, nitrate, sulfate, pH, iron, manganese, zinc, copper, and dissolved carbon dioxide. Landfills are a source of carbon dioxide gas; carbon dioxide gas is highly soluble in water. Changes in concentrations of carbonate species caused by leachate or landfill gas may cause changes in pH which affect metals concentrations, so measurement of general mineral quality is essential in analyzing the impacts of landfills on water quality. Because of the possibility of faulting, fluoride concentrations should be measured, since fluoride is commonly elevated in groundwater associated with hydrothermal systems associated with recent faulting. In addition, specific leachate indicators, such as detergents, boron, and synthetic organic compounds, should be evaluated.

Limited analyses for organic compounds have been obtained. Wells LG223 and LG224, about 2 miles south of the landfill were sampled on September 18 and 22, 1998, by Converse Consultants West. One sample was obtained from a water tank used to store water from a well operated by Nevada Ready Mix. The well is located about 2 miles west of the landfill. No VOCs were reported in any of the samples. The sampling protocols used are described in previous reports.

CH2M Hill reports that a sample was collected from an existing spring along the Sunrise Mountain Fault. No VOCs were detected in the sample. Previous reports describe how the sample was obtained. This sample was obtained to test the idea that leachate from the landfill could migrate along the fault and emerge at springs.

A leachate sample was collected from the landfill on September 22, 1998, during or after a major storm event. This sample consisted of surface water that had come in contact with waste and drained back into the erosion channel. No VOCs were detected in this sample. Previous reports describe sampling protocol used. Because of the lack of circumstances conducive to VOC loss, no conclusions can be drawn about the results of VOC sampling.

3.4 — SPECIFIC WORK PLAN TASKS

The work performed under Task Items a through c, described in subsection 3.4.1 through 3.4.3 below, will establish the basic condition of the landfill. Information generated by these three Tasks will be the basis for assessing what impact the landfill may be having on the groundwater and surface water, and for developing a Corrective Measures Plan. Therefore, a common, sequential approach will be used for Task Items a through c, including:

- Data Assessment.
- Summarize Findings and Identify Data Gaps.
- Develop Field Assessment Technical Memorandum, if necessary, to define that work specifically necessary to address the identified data gaps.

3.4.1 — Task Item a - Identify The Location and Acreage of Disturbance or Waste Disposal

Based on the sequential approach to the initial site assessment, described in Section 3.4 above, items 3.4.1.1, 3.4.1.2, and 3.4.1.3 are included in the data assessment phase. Items 3.4.1.4 and 3.4.1.5 are included in the summary of findings and identification of data gaps phase. A technical memorandum which establishes a scope for additional assessment work will be developed only if the initial site assessment identifies significant data gaps.

3.4.1.1 — Existing Information Search

Under this subtask, all applicable reports and operation logs will be reviewed for waste types, sources/generators, and volume/weight of waste received at the landfill. The information search will also entail a review of permits and available landfill design plans and documentation reports relative to waste boundaries and vertical extent. Examples of two available reports that will be used for this purpose are discussed below:

- The expansion plan for the Sunrise Mountain Landfill, which was prepared by EMCON Associates, dated November of 1986, includes proposed base and final cover grades for the expansion area, and also discusses a "reported limits of existing landfill". The information in this report will serve as the basis for the limits of the landfill, which can be verified through other techniques (test pits, site reconnaissance).

- The closure documentation report for the landfill, which was prepared by Vector Engineering, Inc., dated March 1995, establishes the limits of final cover soils. The information will serve as the basis for the limits of the engineered final cover soils, which can be verified through other techniques (test pits, site reconnaissance).

A listing of relevant reports/site information is provided in Appendix A. Other information not on the list, but discovered during completion of this subtask, may be discussed in the above-mentioned summary of findings and/or memorandums.

Additionally, interviews will be conducted with individuals most familiar with the Site and past filling practices at the Site. This information will be used as a screening tool for investigation purposes and to confirm that existing data is consistent and reliable.

3.4.1.2 — Assess Aerial Photographs and Topographic Mapping

A site photograph and topographic map from approximately 1952 is reportedly available at the Clark County records department. This information will provide a basis for establishing pre-landfill surface conditions and grades. Other topographic maps of the Site are also available from the 1980's and 1990's, which will be used to assess interim and final waste grades, and possibly identification of previously undocumented disposal areas.

3.4.1.3 — Detailed Site Reconnaissance

A detailed site reconnaissance will be conducted to identify erosion patterns, recently disturbed soils, evidence of waste materials/litter, discoloration of surface soils, landfill cracks, leachate seeps, and landfill gas odor. Concurrent to the site reconnaissance, an assessment of the amount and character of landfill gas will be underway on-site, as described in subsection 3.4.4. This is significant, because the presence or absence of gas, and its quality, can be an indicator of the moisture content and decomposition state of the waste. That information, in turn, can be an indicator of whether moisture (surface water or groundwater) is infiltrating the landfill.

The site reconnaissance is intended to identify specific areas which may require special attention. Field observations will be noted on a field log, with significant observation to be marked with a lath and surveyed for elevation and horizontal coordinates (based on State Plane Coordinate System). The reconnaissance information will be plotted on a site topographic map and reviewed for consistency with previous information. To the extent possible, the limits of the Landfill Area will be identified, including the Northeast Canyon Area, Eastern Perimeter Area, and Western Burn Pits Area.

3.4.1.4 — Assess Data

Information obtained through the record search and site reconnaissance will be evaluated and used to develop a conceptual model for waste limits (horizontal and vertical) and waste types. As part of this subtask, a drawing will be developed that will indicate the potential waste boundaries of the Landfill Area, Northeast Canyon Area, Eastern Perimeter Area, and Western Burn Pits Area, and possibly other areas identified during the above work activities.

3.4.1.5 — Summarize Findings and Identify Data Gaps

A detailed field assessment program and associated technical memorandum will be developed based on information obtained during completion of the above work. Special focus will be given to areas where data gaps still exist. If necessary, the assessment program/technical memorandum can be submitted to the EPA for review and approval. In short, the purpose of the field assessments is to verify/or re-establish the location and limits of waste established from existing information. Initiation of the field assessment work will occur under Work Task Item b, as discussed below.

3.4.2 — Work Task Item b - Assessment of the Total Volume by Type of Waste Disposed in All Areas

As stated in Section 3.4, this Work Task will employ a sequential approach to the initial site assessment, including:

- Data Assessment.
- Summarize Findings and Identify Data Gaps.
- Develop Field Assessment Technical Memorandum, if necessary.

Information obtained under Work Task Item a will be complimented, if required, with data obtained through field assessment to identify the types and limits (horizontal and vertical) of waste for each area. Specific subtasks to be performed under Work Task Item b may include:

- Site Access Permission
- Geophysical Survey
- Test Pits/Trenching
- Exploratory Borings (if necessary)
- Laboratory Analysis
- Data Analysis and Volume Calculation

Each of these work activities is discussed below in a general context, with some additional information on methodology and sampling technique provided in the Sampling and Analysis Plan (Appendix B). Concurrent to these activities, an investigation into the amount and character of landfill gas on-site will be conducted as described in subsection 3.4.4. The composition of the gas can be an indicator of the age and type of waste in the landfill.

3.4.2.1 — Site Access

Several of the areas identified in the Administrative Order are on non-leased property (i.e., outside the 720-acre parcel). Consequently, permission to access these areas must be obtained. Permission to access these areas will be pursued under this subtask. It is the respondent's understanding that the EPA will assume the responsibility to obtain the access agreement and other items, which may be required to complete the work. From a physical access standpoint, all of the various areas should be accessible to field assessment activities.

3.4.2.2 — Geophysical Survey

A geophysical survey may be performed in those areas where the method is appropriate and where waste is suspected or known, but little information is available regarding the aerial extent and depth. Electromagnetic conductivity is one technique that can be used which is a non-intrusive method that typically collects conductivity information within the upper 20 feet (6 meters) of material. Consequently, this technique may be well suited for finding the limits of waste. Further detailed information on the proposed geophysical survey technique is provided in Appendix B.

3.4.2.3 — Test Pits/Trenches

The field assessment program, if required, will be largely based on test pits/trenches that will be excavated at select locations to confirm or re-establish the limits of waste, including the three previously identified non-landfill areas, and any other possible disposal area discovered during Task Item a or the geophysical survey. The test pit excavations will be performed using a track backhoe, with each test pit or trench generally extending to a depth less than 8 feet, though in some instances the vertical limits of waste may require the full reach of the backhoe (i.e., approximately 12-15 feet). This type of information will be further defined to address development of the field assessment program and indicated in the associated technical memorandum.

Generally, test pit locations will extend along lines that cross perpendicular to the suspected/assumed limits of waste. However, if there is little or no previous knowledge of the waste limits (i.e., Northeast Canyon Area), then the test pits may be excavated on a grid system.

Field observations recorded during the test pit/trench excavations will include:

- Evidence of trash (including age, type, and condition)
- Discoloration of soils
- Moisture conditions
- Odor

In addition to physical observations, each test pit/trench location will be monitored for the presence of VOC's, H_2S, and methane.

Upon completion, each test pit/trench location will be surveyed for elevation and horizontal coordinates. A final limit of waste, including the adjacent areas of the landfill will be established after completion of the test pits. If the new data is consistent with past conclusions and results, then we will have established a firm understanding of the amount of waste in these areas and the potential hazards associated with it. The new tests may include TCLP, TPH, field gas measurements, and geophysics to determine whether non-surface-apparent waste exists on-site, or trenching outside burn pits in areas where past records indicated the possible presence of drums.

A more thorough discussion on the proposed test pit procedure and methods of analysis is provided in Appendix B – Sampling and Analysis Plan (SAP).

3.4.2.4 — Exploratory Borings

Though not anticipated, an alternative intrusive method, such as auger borings, may be necessary to assess the vertical extent of the waste materials. But in no cases will borings be drilled into the Sunrise Mountain Landfill, since depth information is readily available by review of topographic maps and reports. The most probable location for using the alternative method is in the Northeast Canyon Area or the Western Burn Pits Area, where waste depths could exceed the reach depth of a typical backhoe. Observations that will be noted during advancement of the auger boring will be similar to those recorded during excavation of the test pits. Each boring will be terminated when it is confirmed that the borehole has extended into native/undisturbed geologic material, which may require split-spoon sampling. Additional information on boring methodology is provided in Appendix B. The need and/or locations of the borings will be established after completion of the test pits/trenching.

3.4.2.5 — Sampling and Laboratory Analysis

While most of the areas to be evaluated will involve municipal or construction and demolition type wastes, there is the potential the waste may not be readily distinguishable in the field (e.g., in the Western Burning Pits Area). In such cases, samples of the unknown waste material will be collected and analytically tested if no previous data exists. Additionally, soil samples will be collected 1-2 feet beneath the undefined waste material and analytically tested for the same parameters as the waste samples. Sampling and testing methods are discussed in Appendix B. The new data will be used to verify existing data, and to better establish the location of the limits of waste.

3.4.2.6 — Data Assessment and Waste Volume Calculation

All the field and laboratory data will be evaluated for consistency relative to waste types and limits. Based on this analysis, the waste limits (and types) will be finalized. Ultimately the limits of waste will be established and used to estimate volumes for each area (Landfill Area, Northeast Canyon Area, Eastern Perimeter Area, and Western Burn Pits Area).

3.4.2.7 — Site Health and Safety

Currently, there is no evidence of significant levels of hazardous substances/waste on the Site or adjacent areas. Consequently, the geophysical survey, test pit excavations, and any borings will be performed in Level D protection with constant air monitoring in the breathing zone. Details of the air-monitoring program will be provided in a site-specific Health and Safety Plan (HASP) prior to initiating fieldwork.

3.4.3 — Work Task Item c – Evaluation of the Existing Final Cover Over All Areas

As stated in Section 3.4, this Work Task will employ a sequential approach to the initial site assessment, including:

- Data Assessment.
- Summarize Findings and Identify Data Gaps.
- Develop Field Assessment Technical Memorandum, if necessary.

Per the Administrative Order, the respondents are required to perform an evaluation of existing final cover over all areas. The following activities will be performed in order to satisfy the requirements of Work Task Item c.

- Identification of Final Cover Areas
- Assessment of Final Cover Area
- Data Analyses and Conclusions

As discussed in subsection 3.4.4, an investigation into the presence of landfill gas will be underway on-site concurrent with the work being performed under this task. Both tasks are related because the presence of gas can be used to assess the integrity of the landfill cover system.

3.4.3.1 — Identification of Final Cover Areas

As discussed under Work Task Item a, available reports/information will be reviewed to better understand the characteristics of the final cover soil and thickness over the landfill and adjacent areas (e.g., Northeast Canyon Area). For example, the Closure Documentation Report prepared by Vector Engineering, March 1995, documents the type of soil and limits of cover over three specific sub-areas that received waste after 1991. Consequently, the cover system in those areas should be consistent with the Subtitle D prescriptive cover. Other information is also available on the types and thicknesses of cover soils placed over pre-1991 landfill areas.

Topographic maps will be reviewed and evaluated for cover elevations and general slopes and grades.

A site reconnaissance will be performed to evaluate or make observations of the final cover soils, including the three adjacent areas. The type of information that will be collected is discussed in sub-section 3.4.1.3.

The information obtained from the three activities described above (existing information, topographic maps, and site reconnaissance) will be used to develop a preliminary model of the final cover conditions at the landfill and the three adjacent areas. The preliminary model will serve as the basis for developing a field assessment program, as discussed below.

3.4.3.2 — Assessment of Final Cover Areas

Test pits or shallow borings will be excavated into existing cover soils to assess or confirm soil types and thickness for each of the four areas. The objective is to perform the two assessments (waste limits and cover characterization) concurrently under a single field program. Therefore, the test pits or boring locations proposed for assessment of the existing final cover will be addressed during development of the detailed field investigation program.

It is a fundamental goal to rely heavily on existing/documented data in assessing the existing cover, and to use the test pits primarily as a means for confirming the preliminary cover conditions model. This is certainly the case for the Sunrise Mountain Landfill Area, for which there is a substantial amount of existing final cover data, including laboratory test results. Therefore, the number of test pits (or borings) in the Landfill Area is expected to be less than one per 40 acres. In the other three identified disposal areas, the cover conditions are less understood and/or documented and, consequently, the number of test locations may be greater. It is anticipated that test locations on a 200-foot grid should be sufficient to establish conditions in those areas to a relatively high degree of confidence.

Soil samples will be collected from the test locations and evaluated in a laboratory for engineering properties (i.e., grain size, Atterberg limits, shear strength, moisture content, saturated and unsaturated permeability, and dry density). The intent is to obtain information which can be used to assess slope stability, cover permeability, and whether infiltration may affect the groundwater.

The excavation, sampling, and testing procedures that will be used during the existing cover assessment are discussed in Section 3.0 of Appendix B.

3.4.3.3 — Data Assessment and Conclusions

The field and laboratory data will be collectively be used to assess the thickness and types of final cover materials over all identified disposal areas. In addition, a comprehensive isopach map may be developed to illustrate the cover soil thickness by contour lines. In total, the information will also be used to determine which areas of the landfill have a final cover that meets current or previously applicable regulations.

The amount of precipitation that passes through the existing cover soils will be determined by computer modeling. There are several computer models available, (e.g., UNSAT-H), that can be used for this purpose. UNSAT-H in particular uses a finite difference technique to solve unsaturated flow equations and determine an annual flow rate through the bottom of the cover. Ultimately, the modeling results will be sued to determine the adequacy of the existing cover in terms of minimizing leachate generation. Soil samples collected during the field assessment of the cover will be evaluated for soil parameters that be used as input data in the model (e.g., capillary suction vs. moisture content, porosity, and saturated permeability).

The slope stability of the existing final cover will be evaluated using the infinite slope method. This technique assumes a critical planar surface through the cover. The technique is generally regarded as a conservation approach, since most slope failure surfaces are not planar, but instead are semi-circular and three-dimensional. The value of the two most critical soil parameters used in the analysis, shear strength and unit weight, will be based on laboratory tests on samples collected during the field assessment.

The average annual sol loss on the cover (due to surface run-off) will be determined. The method of analysis will be the universal soil loss equation, which is a Soil Conservation Service method. The soil parameter values used in the equation will be based on actual laboratory test results on samples collected during the field assessment. The surface water flow characteristics that generate the erosive forces will be based on the design storm event required by regulation.

The cause or causes of erosion in the most significantly impacted areas will be ascertained from the assessment data. The cause(s) will then be examined in terms of adequacy of the surface water control system vs. the general layout and design of the existing cover materials.

The amount, distribution, and effect of exposed waste materials in the cover soils will be evaluated. Basically, this will entail a thorough review of the test pit logs to determine the amount and distribution of the waste. Areas with significant waste mixed into the cover materials will be considered waste and not capable of meeting the typical performance criteria of a final cover system (i.e., odor control, erosion control, infiltration control, vector control, and long-term slope stability). The determination that an area as significant waste will be based on engineering judgement, with performance criteria as a basis for the judgement. For instance, an occasional piece of paper litter will not effect odor control or infiltration control of the soil cover. Conversely, a cover that is fairly evenly mixed with paper or other municipal waste and soil would not be an effective barrier against odor or infiltration. The type of waste will also be a consideration during the evaluation, since certain types of waste (e.g., asbestos) would clearly be unacceptable at or very near the surface.

3.4.4 – Work Task Item d – Assessment of Landfill Gas Levels and Constituents

A prerequisite to initiation of Task Item d is the completion of Task Item a – Identify the location and acreage of disturbance or waste disposal, and Task Item b – Assessment of the total waste volume by type of waste disposed.

Landfill gas (LFG) is generated by the anaerobic decomposition of organic waste. It is believed that the Western Burn Pits Area does not contain appreciable quantities of this type of material, based on a March 1998 report entitled "Reconnaissance Investigation Report, Sunrise Landfill", produced by a BLM contractor (CCJM Environmental Consultants, Inc.). Thus, it has been assumed that the Western Burn Pits Area can be excluded from the LFG assessment unless the work under Task Items a and b (which will be performed concurrent to this task) indicates that appreciable quantities of anaerobically degradable organic waste are present in the Western Burn Pits Area. Field data collected at the time of borings or test pit excavation will confirm this assumption.

3.4.4.1 — Methodology

The LFG assessment will focus on the Sunrise Mountain Landfill (720-acre parcel), the Northeast Canyon Area, and the Eastern Perimeter Area. These three areas are contiguous and they will be evaluated concurrently under Work Task Items a, b, c, and d; and as a whole. The identified outer edge of refuse of the three areas will establish the overall boundary of the LFG assessment area. However, there are two areas within this boundary that will be excluded, unless field activities under Tasks a, b, or c indicate otherwise. These are the following:

- The asbestos disposal area, and
- The construction/demolition waste disposal area.

The area previously used for treatment of septage wastes is within the 720-acre parcel, but it is expected to be outside the boundary identified for the LFG assessment. It is not believed that significant quantities of organic material remain in the septage waste area. This area will be included within the LFG assessment only if the work under Task Items a and b indicates this belief to be incorrect.

It is currently expected that Sunrise Mountain Landfill will be required to install a LFG collection and control system. Since it is expected that a LFG collection system will be installed, LFG characterization and quantification efforts should be oriented not toward determining whether or not a LFG collection and control system is needed, but should be oriented toward how the system should be designed to obtain the best gas utilization and prevent possible off-site migration. The information collected and the analyses performed during the LFG assessment should provide information that is useful in the design of an NSPS-compliant LFG collection and control system. A compliant system will ensure no off-site migration and no current LFG-related hazards

The following subtasks will be undertaken under Task Item d:

1. Prepare LFG generation projections;
2. Characterize landfill gas;
3. Conduct surface emissions monitoring, in accordance with 40 CFR 60, Subpart WWW;
4. Conduct ambient air hydrogen sulfide monitoring;
5. Conduct methane level monitoring in structures on or near the landfill; and
6. Conduct monitoring to determine if LFG migration is occurring at the Site boundary or to groundwater (see Tasks e and h).

Speciated analyses of the trace organics in the LFG will not be undertaken. Prior reports have shown the LFG at Sunrise Mountain Landfill to contain compounds at concentrations that are typically encountered in LFG at municipal solid waste landfills. The available data will be summarized and evaluated during the LFG assessment.

3.4.4.2 — Landfill Gas Generation Projections

The EPA Landfill Air Emissions Estimation Model will be employed, using dry site modeling coefficients prescribed in EPA's "Compilation of Air Pollutant Emission Factors" (AP-42), to project current and future quantities of LFG from the waste within the LFG assessment area boundary. The overall LFG assessment area will be divided into sub-areas based on waste characteristics, to evaluate the individual contribution each makes to total LFG generation. The intent of this subtask is to quantify total LFG generation at Sunrise Mountain Landfill and to assess the relative importance of the other two areas (Northeast Canyon Area and Eastern Perimeter Area) to total LFG generation.

3.4.4.3 — Characterize Landfill Gas

SCS will evaluate data from previous investigations to characterize the trace constituent levels (non-methane organics) in the gas, and to assess whether any unusual mitigation may ultimately need to be considered. Landfill gas monitoring will be performed during boring tests, test pit excavations, as well as during the drilling of the six boreholes for groundwater monitoring well installation.

3.4.4.4 — Conduct Surface Emissions Monitoring

Surface emissions will be monitored across the entire surface of the LFG assessment area. The survey will be conducted using a portable flame ionization detector (FID) meeting the instrument specifications outlined in Section 3 of EPA Method 21. The survey methodology set forth in 40 CFR, Part 60, Subpart WWW will be employed. The monitoring probe will be held 3 inches above the surface of the landfill. The probe will not be inserted into cracks or voids, but will be held 3 inches above the point where the surface would be if the imperfection did not exist. A grid map has been developed and will be employed to establish the serpentine walk path prescribed by the regulation. A global positioning system (GPS) device will be employed to aid the surveyor in walking the serpentine path. Any point source measurement exceeding 500-ppm methane will be noted/numbered, and the location will be staked/flagged. The location will be identified using GPS. The location of all 500-ppm methane excursions will be shown on the grid map.

This surface emissions monitoring will also include the entire perimeter (i.e., the edge of the landfill [the refuse/native material interface]).

3.4.4.5 — Conduct Ambient Air Hydrogen Sulfide Monitoring

An RKI Eagle photochemical cell will be used to measure the concentration of hydrogen sulfide at a level approximately 5 feet above the landfill surface (i.e., breathing zone). The serpentine path used for the surface emissions monitoring will be employed. A reading will be recorded approximately every 100 feet. The data will be used to plot a breathing zone map of hydrogen sulfide intensity over the Site.

3.4.4.6 — Conduct Methane Monitoring in Structures

Two structures have been identified for in-structure methane monitoring. One is on the landfill (the Clark County Air Monitoring Station) and one is just off-site (the Doppler

Tower). The portable FID will be used to assess methane concentrations inside the structures by running the probe along the baseboard inside the structures and in any enclosed areas. Compliance or non-compliance with EPA's 1.25- percent methane standard will be ascertained.

3.4.4.7 — Conduct Monitoring to Assess Off-Site Migration

Subsurface methane migration monitoring is only proposed for that portion of the property boundary where structures exist within 1,000 feet of the landfill (waste placement) perimeter. Methane migration will also be tested during borings associated with the six groundwater monitoring well installations. If subsurface probes are to be installed, the probe will be designed in accordance with EPA document 530-R-93-017 for Solid Waste Disposal Facility Criteria.

Monitoring will be performed using a Landtec GEM-500 combustible gas meter (with infrared detector).

3.4.5 — Work Task Item e – Assessment of Impacts to Groundwater, and Run-Off Impacts to Groundwater and Surface Water

For the sake of clarity, the tasks which comprise this Work Plan are presented in the same sequence as the Administrative Order. There is one Work Plan task for each item listed in Section VI B of the Order. However, as is evident from the descriptions of the Work Tasks, many items are intimately related. This is particularly true for Items e (Assessment of Impacts to Groundwater, and Run-Off Impacts to Groundwater and Surface Water) and h (Thorough Characterization of the Hydrogeologic Setting) in the Order. It is not possible to assess impacts to groundwater, or run-off impacts to groundwater, without first thoroughly characterizing the hydrogeology. Thus, the scope of work described in this subsection (3.4.5) is applicable in its entirety to the hydrogeologic characterization described in subsection 3.4.8. However, for the sake of brevity, we chose not to repeat all of this subsection in the discussion of hydrogeologic characterization in subsection 3.4.8.

3.4.5.1 — General Overview and Objectives

This task will include the following work:

- Collect and review existing information describing hydrologic and hydrogeologic conditions beneath and adjacent to the Sunrise Mountain Landfill, including geology, groundwater depth, groundwater quality, and surface water quality.
- Design, drill, log, construct, develop, and sample approximately seven new exploratory boreholes to develop information on subsurface conditions including geologic materials, moisture content, groundwater quality, and groundwater levels, and to identify the uppermost aquifer.
- Perform two aquifer tests to estimate groundwater flow rates beneath the Site in order to assess the potential extent of impact.
- Evaluate data to assess whether groundwater or surface waters indicate evidence of impact by the landfill, by run-off and/or infiltration.

3.4.5.2 — Scope of Field Program

- Drill six exploratory boreholes at the downhill site perimeter outside the waste footprint.
- Drill one or two exploratory boreholes in the back canyon area in alluvial materials ending at the bedrock contact.
- Complete two aquifer or slug tests to measure hydraulic properties of saturated alluvium (transmissivity and storage coefficient and boundary conditions if detected)
- If groundwater is encountered in the test wells, obtain water levels and samples for analysis of general minerals, vadose zone gas, leachate indicators, and VOCs.

3.4.5.3 — Health and Safety Plan

A site-specific Health and Safety plan will be prepared for field activities. This plan will discuss issues such as the anticipated risks of drilling and sampling, and how to control these risks. In particular, heat stress control for the drilling crew will be addressed, because of the possibility that drilling may occur in the summer, when daytime temperatures of 40°C may occur.

Methane and VOC levels will be monitored during drilling for health and safety reasons. There is a potential for dangerous levels of explosive gases, hydrogen sulfide, or VOCs to be encountered during drilling. Occasionally, high levels of VOCs are encountered during well installation. If toxic or explosive levels of gas or high levels of organic vapors are encountered, control measures may be needed, such as improved ventilation and/or proper personal protection equipment.

3.4.5.4 — Selection of Exploratory Borehole Locations

Based on the geologic and hydrogeologic conditions described above, seven exploratory borehole locations have been selected. One is intended to represent upgradient or background water quality (no. 7) and the others (1-6) are arranged more or less radially around the alluvial fan perimeter at the site boundary. The proposed borehole locations are as described in the May 26, 1999 CH2M Hill "Phase I Hydrogeologic Investigation Work Plan."

- No. 7 is located in shallow (5 to 10 feet thick) alluvium overlying bedrock topographically above the main body of refuse. However, during the site visit, waste materials were observed near this location on the other side of the drainage channel. This well may need to be moved further upstream. It may contain water only after storms. No groundwater or phreatophyte vegetation was observed in the channel bottom where water might be expected at the base of the alluvium.

- The remaining wells are evenly spaced to provide stratigraphic control. It should be noted that in the geologic environment of the site, sediments consist of hundreds of discrete debris flow lobes of limited extent. These lobes cut across one another, and extend out into braided distributary networks. Major vertical changes in sediment size, probably related to regional climate changes during the Pleistocene and possibly the Holocene, may be recognizable.

3.4.5.5 – Exploratory Well Construction and Aquifer Testing

The following sections discuss the proposed well design and drilling plan, sampling plan, aquifer testing, and water sampling for approval by the EPA.

3.4.5.5.1 – Well Design and Drilling Method

The proposed well design includes 4-inch hybrid PVC well screens and initial risers, coupled to steel casing to the surface. The size of the borehole will be a nominal 10 inches. The design calls for 1-inch sounding tubes to be installed within the same boring outside the main casing. This design allows water levels to be measured at the well during pumping for the aquifer tests. This increases the options for use of the well, including conduct of single-well aquifer tests.

The drilling method will be air-rotary. Boreholes will be logged by an experienced field geologist, using the Unified Soil Classification System (USCS) visual-manual field method as described in ASTM D-2488-84, with bedrock logged appropriately. Drive samples will be collected as needed for stratigraphic control, near hardpan layers, and when groundwater is encountered. If LFG concentrations greater than 25 percent of the lower explosive limit are encountered in the breathing zone during drilling, field instrumentation will be used to obtain soil-vapor data for methane, CO_2, and VOCs. This would document the presence of LFG. Munsell colors will be recorded and used to aid in identifying changes in geologic materials/conditions. Particular attention will be directed to observing shallow cemented zones, moisture conditions, color (indicating oxidized or reduced conditions), and plasticity.

In order to obtain continuous sampling of the bottom 20 feet of each borehole, the following method is submitted for approval: A 24-inch California modified split-spoon sampler will be driven with a downhole 140-lb hammer ahead of the bit. The split-spoon sampler will fit down the center of the air-rotary cone drill bit. The sampler will be lined with four 6-inch brass liners. Sand or rock catchers will be used to minimize sample loss from the sampler during retrieval. The driller will attempt to drive the entire 24 inches of the sampler. If rocks are present, or the formation is too cemented to drive the sampler, refusal will be noted. The drilling will proceed to the depth reached by the sampler, the sampler will be retrieved by wireline, and the process will be repeated. This process will be used for the bottom 20 feet of the borehole. If this method of obtaining undisturbed samples is unsuccessful, then the drilling will be switched to air coring to obtain continuous core. Soil core samples will be logged into the drilling log and saved in cardboard drilling core boxes.

3.4.5.5.2 – Well Screens

In general, the deep monitoring wells will be constructed with a 20-foot screen interval placed at the top of the zone of saturation. This is consistent with RCRA practice. When possible, the borehole will be left open overnight prior to completing the well. If there are concerns with borehole stability, a temporary casing with pre-packed well screen will be installed in the borehole. If, after resting overnight, groundwater is not found, drilling will continue; if, after resting overnight, groundwater is too high, the lower part of the hole will be chipped back with bentonite.

In the event a saturated zone is encountered before reaching the anticipated drilling depth, drilling would progress another five (5) feet for confirmation. If confirmed, the borehole would be continuously sampled another 10 feet, using the methods described above. The well would then be constructed with about 5 feet of screen above, and 15 feet of screen below the water surface. Prepacked Dual Wall Well Screen would be installed into the well until the water level is confirmed. The Prepack well screen will allow the borehole to stay open for sampling and confirmation of the water level without the potential for caving, yet the unit can be withdrawn, if it is necessary, to deepen the well to intersect the water table. Once confirmed, the well would be constructed as described below.

If bedrock is encountered without finding water, or above the planned well depth, drilling will continue 5 to 10 feet into bedrock to confirm its presence. No coring will be done in bedrock. The well screen will then be set across the bedrock boundary, 5 feet below and 15 feet above.

Installing the screen 5 feet above, and 15 feet below, the saturated surface may allow migration of landfill gas, if present, up the casing to vent to atmosphere. The introduction of oxygen from the atmosphere to a zone that might normally have low concentrations of oxygen can also change groundwater chemistry in the vicinity of the well, particularly metals concentrations that are sensitive to redox conditions. Well heads will be monitored for LFG components and oxygen prior to any sample collection.

3.4.5.5.3 — Well Construction

All wells will consist of 4-inch diameter, flush-threaded schedule 40 PVC. Twenty-foot long Prepack well screen will be used, above a 5-foot blank sump and cap. If the casing string is greater than 300 feet, steel riser will be used in the upper part. Centralizers will be installed at the bottom and top of the well screen, and every 80 feet (two joints) to the surface. Based on what is known of the Muddy Creek formation, fine screen is anticipated, but the screen size will be based on conditions encountered in the field. Filter pack will be installed into the annular space with a tremie pipe below the water surface. The pack will extend about 5 feet above the screen to allow for settlement. The remaining annular space will be grouted to the surface using a tremie with a grout consisting of 6.5 gallons of water, 4 pounds of bentonite, and 1 pound of filter sand. This mix is recommended in arid areas to control shrinkage cracking of the seal that can occur when the adjacent sediments are very dry. Wells shall have a 4' x 4' x 3" concrete pad, locking security cover and lock. Four traffic posts (one removable) will be placed to protect each well. The locations and elevations of the wells will be surveyed by a licensed surveyor, and shown on a scaled plot plan. Cuttings will be stockpiled and sampled for proper disposal. If no contaminants are detected based upon a representative sample analysis, the cuttings will be disposed of at the Site.

3.4.5.5.4 – Well Development and Aquifer Testing

Because of the poor recovery at the one available well on-site, it is expected that a style of single-well aquifer test, or slug test, suited to low-permeability aquifers will be required. Constant-drawdown tests are suitable for use in wells with poor recovery to a certain point, and can give results that are superior to slug tests depending on aquifer permeability. The wells have been designed with an external sounding tube specifically so that either single-well method can be used.

After the casings are installed, the wells will be developed using a swab (surge block) and bailer until they are substantially sand-free. Field parameters will be measured during development, consisting of pH, E.C, temperature, CO_2, and alkalinity. Wells will be allowed to rest for 24 hours after development, before sampling or aquifer testing. Two aquifer tests will be run at selected wells. These tests will look for general aquifer conditions (boundaries, leakage, recharge, confined, unconfined), and will allow calculation of transmissivity and permeability. Water level sounders will be used to measure water levels. Experience has been that dataloggers add no particular value to single-well aquifer tests. Because of limitations on pumping rates caused by the size of the well, and because the aquifer is probably unconfined, the aquifer test radius-of-influence will probably be less than approximately 200 feet. Aquifer testing and field chemistry sampling procedures are attached in Appendix B.

The length of the aquifer drawdown test will be 6 hours, with the recovery measured for 2 hours. The test type will be constant-drawdown.

3.4.5.6 – Decontamination Procedures

Before the drill rig and drill stem is transported to the Site, the rig, stem, drive casing, bit, and other equipment to be used downhole will be steam-cleaned. The drill rig and ancillary equipment will be cleaned in the same manner after installation of each well.

Well development equipment will be decontaminated before use at each sampling location. This equipment includes swabs, bailers, and development pumps, if used. The following decontamination procedure will be used:

- Wash with potable water and a brush, if necessary.
- Wash with Alconox, or similar lab-grade detergent, using a brush if necessary.
- Rinse with potable water.
- Air dry.

Soil and groundwater sampling equipment (e.g., split-spoon sampler, bailers, and sampling pumps) will be decontaminated by the same general procedure with the addition of a final rinse of de-ionized or distilled water as listed below.

- Wash with potable water and a brush, if necessary.
- Wash with Alconox, or similar lab-grade detergent, using a brush if necessary.

- Rinse with potable water.
- Rinse with de-ionized/distilled water.
- Air dry.

To decontaminate a sampling pump and discharge pipe, the pump and hose will be placed into a 55-gallon drum containing the Alconox solution. The pump will then be cycled on and run for at least 5 minutes to recirculate the washwater. The pump and hose will then be removed slowly a few feet at a time so that the liquid rains back into the drum. The pump and hose will then be placed into a drum of potable water and similarly run for at least 5 minutes to recycle the rinse water. A final rinse with de-ionized or distilled water will be completed in a third drum. Care will be taken not to allow the pump or tubing to touch the ground once it has been decontaminated.

3.4.5.7 — Waste Management

Four types of waste materials will be generated during the field program, including drill cuttings, decontamination water, purge or development water, and miscellaneous equipment.

Soil cuttings will be placed on visqueen or into 20-cubic-yard roll-off bins. If the analytical results of groundwater sampling indicate the presence of contaminants, then the soil cuttings will be evaluated to characterize the waste for disposal. If groundwater sample analytical results do not indicate the presence of contamination, the soil cuttings will be considered non-hazardous and will be disposed of at the APEX Landfill.

Decontamination water, well development water, and purge water generated during field activities will be collected and held. The decontamination water and miscellaneous equipment will be profiled and disposed of based on analytical results from the groundwater samples collected during the field activities.

3.4.6 — Work Task Item f – Detailed Description of the Sampling and Analytical Methods to be Used

Sections 3.4.2 through 3.4.5 of this Work Plan provide general descriptions of the types of sampling and analysis that will be performed during the landfill assessment. Appendix B to this Work Plan is a Sampling and Analysis Plan (SAP) that provides detailed descriptions of the sampling and analytical methods that will be used. The SAP describes sampling protocols, required materials, maximum sample holding times (if applicable), QA\QC procedures, sample preservation requirements, sample packaging and shipping procedures, chain-of-custody requirements, analytical methods, statistical and non-statistical data assessment, precision and bias of specified methods, field logs and documentation, calibration, and preventive maintenance.

3.4.7 — Work Task Item g – Detailed Schedule of the Work to be Performed

A detailed schedule for the Landfill Assessment work is presented in Appendix C to this Work Plan. The schedule indicates that all work can be completed within approximately 250 working days following submittal of this Assessment Work Plan. This time frame does not include subsequent EPA review time.

3.4.8 — Work Task Item h – Thorough Characterization of the Hydrogeologic Setting for Use in Developing a Groundwater Monitoring and Corrective Action Program

An effective Monitoring Program is the key to a successful Corrective Action Plan, and effective monitoring depends on a thorough characterization of the hydrogeologic setting. Section 3.4.5 of this Work Plan provides a detailed discussion of the work required to assess impacts to groundwater, and run-off impacts to groundwater and surface water. The hydrologic, hydrogeologic, and geochemical characterization work described in Section 3.4.5, and in the SAP (Appendix B) will allow a thorough characterization of the hydrogeologic setting for use in developing a Groundwater Monitoring and Corrective Action Plan. Additional work is being performed by the respondents in addressing the other Administrative Order (EPA Docket No. CWA-309-9-99-14), which is complimentary to the work proposed herein.

The characterization work is intended to identify likely migration pathways and assess the potential rate and direction of migration. This data is used to monitor the Site. The characterization work also assesses the likelihood that the hydrologic and hydrogeologic properties of the Site may mobilize pollutants within the landfill. This assists in the design of Preventive and Corrective Action Programs.

Please refer to Section 3.4.5 and Appendix B of this Work Plan for a detailed discussion of how the hydrogeologic setting of the Site will be characterized.

DRAWINGS

OVERSIZE ITEM(S)

Due to the size of this item, it has been scanned separately.

See Document #____**2029889**____ for scanned image(s).

APPENDICES

Appendix A — Listing of Reference Materials

Appendix B — Sampling and Analysis Plan (SAP)

Appendix C — Work Schedule for Site Assessment

APPENDIX A

LISTING OF REFERENCE MATERIALS

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ATTORNEYS
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JENNIFER J. LAZOVICH

January 28, 1999

OVERNIGHT DELIVERY

David W. Basinger, WTR-7
U.S. Environmental Protection Agency, Region IX
CWA Compliance Office, Water Division
75 Hawthorne Street
San Francisco, CA 94105

Re: Sunrise Mountain Landfill, Request for Information

Dear Mr. Basinger:

This law firm represents Republic Disposal Urban Maintenance Processing Co., Inc., Republic Silver State Disposal Service, Inc., Republic Services, Inc., and Republic Industries, Inc. (collectively "Republic") in certain environmental matters. We are in receipt of a December 18, 1998, United States Environmental Protection Agency ("EPA") Request for Information regarding the Sunrise Mountain Landfill east of Las Vegas, Nevada ("RFI"). On or about December 30, 1998, EPA issued an extension of time for Republic to respond to the RFI to and through January 29, 1999.

In the course of preparing responses to each of EPA's thirteen inquiries, Republic reviewed all relevant and available Republic files, all relevant and available Bureau of Land Management ("BLM") files, and interviewed several long-time employees. Enclosed with this response is an index that identifies documents 1-4123 by Bates numbers, and indicates whether a document is particularly relevant to an EPA request number (1-13) and whether the materials are either confidential or privileged. For any document for which Republic asserts a claim of confidentiality or privilege, there is an explanation in the index.

Many documents, while partly responsive to a particular EPA RFI request number, are not particularly relevant. Therefore, there are many documents for which there is a request number referenced in the enclosed index that are not discussed specifically in this letter.

Republic responds, objects, and claims confidentiality or privilege as follows:

Request No. 1:

The exact date that the Landfill or areas surrounding or adjacent to the lease areas began accepting wastes. Provide permits, leases, memos of understanding, contracts to receive wastes or wastewater sludge, or other agreements relating to opening the landfill.

Response to Request No. 1:

Republic is not aware of the exact date that the Landfill or areas surrounding or adjacent to the lease areas began accepting waste. Republic purchased certain assets owned by Silver State Disposal Service, Inc. and Environmental Technologies of Nevada, Inc. on or about August 27, 1997. Although many employees and certain managers remain from the predecessor companies, Republic does not have an entire, historic set of files for the Sunrise Mountain Landfill (the "Landfill"), and therefore cannot provide the exact date the Landfill or areas surrounding or adjacent to the leased areas began accepting waste. Republic continues to interview various employees to further characterize historic Landfill waste disposal practices, and will make employees available to EPA upon request. However, there is adequate documentation within existing files to indicate that the Clark County Department of Public Works had special use permits from BLM as early as 1952. See BLM's July 3, 1952, Decision Re: Special Land Use Permit for "Garbage and Trash Disposal Site" on 320 acres within Section 12, Township 21 South, Range 62 East, M.D.B.&M. (Bates 154). In 1962, BLM granted an R&PP lease to Clark County Public Works for a "Public Dump Site" on the same 320 acres for a twenty year term (Bates 364). BLM extended the R&PP lease an additional twenty years on May 21, 1982 (Bates 823).

On or about August, 1985, BLM amended the original R&PP lease to include an additional 400 acres within Section 12, Township 21 South, Range 62 East, bringing the total Landfill to 720 acres (Bates 48). The lease on the additional 400 acres was set to expire on May 20, 1988. BLM extended the 400 acre lease an additional two years on or about May 21, 1988 (Bates 7). On or about May 21, 1990, BLM extended the R&PP lease on the 400 acres for an additional two years to and through May 20, 1992 (Bates 16 and 19). An additional BLM extension for the 400 acre site to and through May 20, 1994 can be found at Bates 1600.

Request No. 1 also seeks information relating to any contracts to receive wastes or waste water treatment sludge and other agreements relating to opening the Landfill. As set forth above, Republic was not privy to any such agreements or contracts. Nevertheless, a review of available files produced the following historic contracts that may helpful to EPA's review of this matter:

- December 31, 1985, Garbage Disposal Agreement between the City of Las Vegas and Silver State Disposal Company (Bates 2885);

- January 4, 1978, Refuse Removal Contract between the City of North Las Vegas and Disposal Transportation, Inc. (Bates 2897);

- June 21, 1995, Refuse Removal Contract between the City of North Las Vegas and Silver State Disposal Service (Bates 2908);

- February 5, 1975, Contract for Collection and Disposal of Garbage between Clark County and Clark Sanitation, Inc. (Bates 2924);

- November 6, 1979, Modification Agreement between Clark County and Clark Sanitation (Bates 2938);

- Modification Agreement dated August 18, 1981, between Clark County and Clark Sanitation, Inc. (Bates 2941);

- Modification Agreement dated February 2, 1988, between Clark County and Clark Sanitation, Inc. (Bates 2945);

- Assignment of Contracts Rights between Silver State Disposal Service, Inc. and Clark Sanitation, Inc. dated March 7, 1989 (Bates 2950);

- October 5, 1995, Modification Agreement to Franchise Agreement between Silver State Disposal Service, Inc. and Clark County (Bates 2990);

- April 20, 1993, Franchise Agreement between Clark County and Silver State Disposal Services (Bates 2996);

- March 19, 1991, Collection and Disposal of Garbage Contract between Clark County and Silver State Disposal Service (Bates 3039);

- December 19, 1989, Collection and Disposal of Garbage contract between Clark County and Silver State Disposal Service (Bates 3044); and

- February 5, 1975, Contract for Maintenance and Operation of Sanitary Fill Facility between CCPW and Clark Sanitation.

More current franchise agreements by and between Republic and area local governments are available upon request.

Request No. 1 also requests information regarding contracts to receive wastewater treatment sludge. Environmental Technologies received such materials at the Landfill pursuant to the contracts enclosed and marked as Bates 4099-4123. Finally, Environmental Technologies also maintained a bio-remediation area for petroleum hydrocarbon contaminated soils, which permits are attached at Bates 1954-1996.

See also any documents indicating relevance to EPA RFI No. 1.

Request No. 2:

All documentation regarding closure of the Landfill and the exact date(s) the Landfill closed, including:

The last date waste was received,
The date final closure was completed, and
Date(s) of any extensions provided, along with documentation of the basis for such extensions.

Response to Request No. 2:

Much of the enclosed material relates to Landfill closure, closure compliance, and ongoing maintenance. Documents that bear some relationship to Landfill closure are identified and cataloged within the enclosed index.

The documents most relevant to closure are as follows:

- Harding Lawson Associates' April 14, 1994, Sunrise Mountain Landfill Closure Plan (Bates 1854);
- May 9, 1994, Surface Water Management Plan prepared by Harding Lawson Associates ("HLA") (Bates 986);
- November 13, 1997, Sunrise Mountain Landfill Final Cover Evaluation prepared by Dynamac Corp. for BLM (Bates 594);
- February, 1994, Technical Review and Comments Report prepared by Dynamac Corp. for BLM (Bates 1560);
- March 22, 1994, HLA response document re: Closure Plan (Bates 1467);
- March 22, 1995, HLA Verification of Closure in Accordance with Approved Closure Plan (Bates 626);

- March 28, 1995, Vector Engineering Certificate of Compliance re: quality assurance/quality control (Bates 627);

- April 12, 1995, letter from DUMPCO to BLM re: Landfill Closure (Bates 1771);

- March 8, 1995, letter from DUMPCO to BLM re: Landfill closure (Bates 1738);

- March 3, 1995, letter from DUMPCO to Clark County Health District re: Sunrise Mountain Landfill closure (Bates 628);

- June 1, 1995, memorandum from Environmental Protection Specialist of BLM to Stateline Resource Manager of BLM re: Landfill closure (Bates 1779);

- April 14, 1994, HLA report for *DUMPCO re: Sunrise Mountain Landfill* Construction Quality Assurance Plan (Bates 1449);

- March, 1995, report prepared for DUMPCO by Vector Engineering entitled "Construction Quality Assurance Report" re: Sunrise Mountain Landfill Structural Fill and Infiltration Layer (Bates 3526);

- Correspondence relating to applicable landfill closure dates between the local solid waste management authority (the Clark County Health District), DUMPCO, BLM, the Nevada Division of Environmental Protection ("NDEP"), and Clark County Public Works ("CCPW") (Bates 3348, 3349, 3350, 3351-3354, 3355, 3356, 3357, 3358, 3374, 3375, 3383-3384, 3386-3388, 3389-3395, and 3396-3397); and

- October 5, 1995, contract between Clark County and DUMPCO re: Modification Agreement to Franchise Agreement for Collection and Disposal of Solid Waste (Bates 2990).

With respect to specific sub-inquiries, Republic responds as follows:

The last waste was received at the Landfill on October 8, 1993. See HLA Closure Report at Bates 1854.

DUMPCO completed all closure obligations on or before March 1, 1995. See HLA March 22, 1995, letter to DUMPCO (Bates 626); Vector Engineering's Certificate of Compliance (Bates 627); DUMPCO's March 3, 1995, letter to the Clark County Health District (Bates 628); and the Agreement of Parties by and between DUMPCO, Clark County Public Works, BLM, and the Clark County Health District ("CCHD") concluding the landfill had been closed in accordance with the Sunrise Mountain Landfill Closure Plan dated April 14, 1994 (Bates 1772).

As set forth in the correspondence referred to above, DUMPCO sought and received an extension of time in which to complete closure from the delegated solid waste management authority, CCHD. On September 19, 1994, CCHD approved DUMPCO s extension request to and through April 9, 1995 (Bates 3375). The basis for the request, as set forth in the above-referenced documentation was that review and approval of the closure plan by appropriate agencies, and in particular BLM, which ordered that closure activities cease and desist on March 18, 1994 (Bates 3357), caused DUMPCO to be unable to meet the schedule originally contemplated in 40 C.F.R. Part 258 (see also Bates 3351). The date required for final closure by the CCHD, therefore, was April 9, 1995 (Bates 3375).

Request No. 3:

A complete description of landfill closure, including closure certification and standards and/or data used to confirm that closure was complete.

Response to Request No. 3:

DUMPCO completed landfill closure on March 1, 1995. The closure reports, certifications, standards, and data used in landfill closure are best summarized in the following reports and documents:

- April 14, 1994, HLA Sunrise Mountain Landfill Closure Plan (Bates 1854);
- May 4, 1994, HLA Sunrise Mountain Landfill Surface Water Management Plan (Bates 986);
- April 14, 1994, HLA Sunrise Mountain Landfill Construction Quality Assurance Plan (Bates 629);
- March 22, 1995, HLA Verification of Closure (Bates 626);
- Vector Engineering's March 28, 1995, Certification of Compliance with the quality assurance/quality control plan (Bates 627);
- March, 1995, Vector Engineering Construction Quality Assurance Report for the Sunrise Mountain Landfill Structural Fill and Infiltration Layer (Bates 3527); and
- The Landfill Closure Agreement between CCPW, CCHD, BLM, and DUMPCO (Bates 1771).

See generally any documents referencing Request No. 3 within the enclosed index.

Request No. 4:

A description of the types of waste received by the Landfill, with recorded or estimated amounts, including any documents relating to disposal at areas surrounding or adjacent to the Landfill lease areas.

Response to Request No. 4:

The documents that best describe, locate, and quantify the various types of waste found at the Landfill are as follows:

- February 25, 1983, letter report from Karsten Bronken, Consulting Engineer, to CCPW (Bates 257);
- November 6, 1957, CCPW Application for Lease NEV-046208 covering 320 acres (Bates 391);
- December 1, 1959, Mineral Report covering lease NEV-046208 (Bates 378);
- HLA April 14, 1994, Landfill Closure Plan (Bates 1854);
- November 8, 1991, letter from Sara Battel of ASI to BLM re: regulatory compliance (Bates 1651);
- April 16, 1998, letter from Karl Ford, NARSC, Toxicologist to BLM (Bates 2090);
- December, 1986, Sunrise Mountain Landfill Expansion Report prepared by EMCON Associates for DUMPCO (Bates 2706);
- March 18, 1998, Reconnaissance Investigation Report prepared by CCJM for BLM (Bates 3398);

See also other documents within the enclosed index identified has having some relevance to EPA inquiry No. 4.

Request No. 5:

Any correspondence between Respondents, their employees, contractors, predecessors, agents or affiliates, and the State of Nevada Department of Environmental Protection, Bureau of Water Pollution Control, regarding the Landfill, including, but not limited to, permits, permit applications, notices of intent requesting coverage under a general permit, notices granting coverage, and notice(s) of termination, with attachments and any referenced information.

Response to Request No. 5:

DUMPCO obtained general storm water discharge permit number GNV0022233 for discharge of storm waters on or about May 14, 1993, as set forth at Bates 3206. Terms of the permit are provided at Bates 3207-3225. Prior to closure, NDEP-Bureau of Water Pollution Control indicated to DUMPCO that until DUMPCO fully closed the Landfill, there was little chance NDEP would allow the discharge permit to lapse. See NDEP's March 7, 1994, letter to Environmental Technologies at Bates 3204-3205.

See also documents identified as generally relevant to EPA inquiry number 5 in the enclosed index.

Request No. 6:

Any information regarding leachate collection or treatment system(s) and leachate discharges, including measured or estimated duration, quantity, and quality of such discharges.

Response to Request No. 6:

There is no leachate collection or treatment system at the Landfill. In 1986, however, EMCON prepared a report that included a conceptual leachate collection system design (Bates 2706).

As a result of the rainfall event on September 11, 1998, water was observed to be discharging from beneath one of the cells of the Landfill for the first time. As the seepage diminished rapidly over time, the water is assumed to be rainwater that cut into a small section of a waste cell, and then exited down-gradient from its entrance point. CCPW, CCHD, Desert Research Institute ("DRI"), and Republic each collected samples of the water exiting the cell.

On October 15, 1998, DRI submitted a "Sunrise Landfill Seep Analysis" that indicates that DRI's sampling of the storm water leachate revealed no evidence of VOCs or fecal coliform (Bates 3817). DRI"s analysis was similar to that of NEL Laboratories, commissioned by Republic (Bates 2865). Republic does not have results of the seep analysis done by CCPW or CCHD.

DRI's report estimates the flow rate for leachate exiting the cell as a result of the September 11, 1998, rainfall event (Bates 3817). The duration and quantity of the rainfall event itself, however, can be found within HLA's Evaluation of the Sunrise Mountain Landfill Surface Water Management Plan Following the September 11, 1989, Storm (Bates 3764).

See also any documents indicating relevance to inquiry number six on the enclosed index.

Request No. 7:

A Landfill facility site map including areas surrounding and adjacent to the leased areas, showing normal drainage out fall locations and patterns with leachate collection, sampling, and discharge points. Provide information of run-on and runoff during normal operations or from storm events, with measured or estimated duration, quantity, and quality of such events. Provide rainfall amounts and dates as recorded by any on-site rain gauges from 1992 to the present.

Response to Request No. 7:

The best overall facility site map covering the 720 leased acres is found at Bates 4010, and is the site plan prepared by HLA in connection with Landfill closure. With respect to the off-lease area to the northeast of the 720 leased acres, a map prepared by EMCON in 1986 appears to provide the best information available (Bates 3961). Other Landfill site maps appear throughout the reports referenced above. Other documentation that shows normal drainage out fall locations and patterns would include the following:

- HLA's August 9, 1995, correspondence to DUMPCO (Bates 1764);
- HLA's April 14, 1994, Sunrise Mountain Landfill Closure Plan (Bates 1854);
- HLA's November 5, 1998, Evaluation of the Sunrise Mountain Landfill Surface Water Management Plan Following the September 11, 1998, Storm (Bates 3764);
- DRI's "Sunrise Landfill Seep Analysis" (Bates 3817); and
- HLA's May 9, 1994, Sunrise Mountain Landfill Surface Water Management Plan (Bates 986).

Other references to storm water run-on and run-off as well as artificial and natural drainage areas may be found variously within maps marked as Bates 3961-4020.

Republic has maintained records of rainfall events at three different gauges on site. The gauges are known as the "northeast" (within the canyon), the "southeast" (on the point), and the "northwest" (by the shop). We have indicated the general location of gauges with a red mark located on the site plan at Bates 4010. In connection with performing roughly weekly formal closure inspections of the Landfill since May, 1995, Republic has logged data from each of these rain gauges. That information is found within Bates 3049-3201. There is an additional document at 3227 prepared in connection with data from the September 11, 1998, rainfall event. Republic was unable to locate rainfall data from 1992 through Landfill closure.

Request No. 8:

Any records or descriptions of inspections conducted of drainage control procedures, structures, or equipment, including inspector names, inspection dates, and actions taken as a result of the inspection.

Response to Request No. 8:

See Response to Item No. 7 for information relating to rain gauge data and Republic inspections of drainage control procedures, structures, and equipment (Bates 3049-3201). The inspector names, dates, and actions taken as a result of the inspection are indicated on the inspection reports at Bates 3050-3201.

In addition, several engineering firms have performed site inspections in connection with their services at the Landfill. See, e.g., the following reports:

- August 9, 1995, HLA Report to DUMPCO (Bates 1764);
- HLA's April 14, 1994, Sunrise Mountain Landfill Closure Plan (Bates 1854);
- HLA's May 9, 1994, report regarding Sunrise Mountain Landfill Surface Water Management Plan (Bates 986);
- HLA's April 14, 1994, Sunrise Mountain Landfill Construction Quality Assurance Plan (Bates 1449);
- April 4, 1996, letter from the CCHD to DUMPCO regarding Landfill inspection (Bates 1729);
- ASI's Regulatory Compliance Audit Report prepared as a result of April, 1990, inspections (Bates 1657);

- EMCON's December, 1986, Sunrise Mountain Landfill Expansion Report (Bates 2706); Dynamac Corp.'s November 13, 1997, Sunrise Mountain Landfill Final Cover Evaluation (Bates 594); and

- Various documents indicating some relationship to EPA inquiry number 8 on the enclosed index.

<u>Request No. 9</u>:

Description of procedures or structures designed, installed, or planned to control pollutants in storm water from either entering or discharging from the Landfill while operating or after closure.

<u>Response to Request No. 9</u>:

Republic's responses to the previous inquiries set forth the procedures and structures designed, installed, and planned to control storm water at the Sunrise Mountain Landfill, both before and after closure. None of the affected parties - the landowner, the lessee or operator - knew of the need to control pollutants in storm water until the rainfall event of September 11, 1998. The original storm water system was designed to accommodate a twenty-five year storm event, and a one-hundred year storm event with no free board. The event of September 11, 1998, exceeded the one-hundred year rainfall event.

For a complete overview of storm water structures and designs, please refer to the HLA's reports previously identified at Bates 986, 1449, 1764, 1854, and 3764.

<u>See</u> <u>also</u> any documents identified as relevant to EPA Request No. 9 in the enclosed index.

<u>Request No. 10</u>:

Any documents relating to storm water control at the Landfill including, but not limited to, sampling plans with locations and dates, any sample analyses, and procedures and frequency of training for operating and maintenance personnel.

<u>Response to Request No. 10</u>:

Documents relating to storm water control at the Landfill are referenced in Republic's Response to Request No. 9. In addition, Republic affected storm water control through an inspection and maintenance procedure as illustrated and recorded in the Sunrise Landfill Closure Inspections at Bates 3050-3201. Republic was unable to locate any further documents that might be responsive to this inquiry.

Request No. 11:

Names of persons responsible for operation and maintenance at the Landfill since January 1993.

Response to Request No. 11:

The persons who have been responsible at various times since January, 1993, for the operation and maintenance at the Landfill include former DUMPCO employees Thomas Isola, Richard Isola, and Johnnie Isola, and current Republic employees Alan Gaddy, Jim Rankin, and Bill Uri.

Request No. 12:

Name of Respondents' employees, contractors, predecessors, agents, or affiliates responsible for environmental compliance at the Landfill, with descriptions of responsibilities, for all time periods beginning January 1, 1992.

Response to Item No. 12:

Respondents' employees that have been responsible for environmental compliance at the Landfill since January 1, 1992, include the following:

Johnnie Isola, General Manager, Environmental Technologies, and member of Silver State Board of Directors through November, 1997- management capacity;

Alan Gaddy, Vice President, Environmental Technologies, and Vice President, Republic-Silver State Disposal Service - management capacity;

Stephen Kalish, President, Republic-Silver State Disposal Service - management capacity; and

Jim Rankin and Bill Uri, Co-Managers of the Landfill.

Respondents' contractors responsible for environmental compliance include the following:

1. Vector Engineering, which prepared the construction quality assurance report dated March, 1995, at Bates 3527;
2. HLA, which prepared several reports dealing with closure, surface water management, and other matters as set forth above; and

3. Environmental Technologies, which has served as an environmental consultant for Silver State and thereafter Republic since January 1, 1992.

Other parties responsible for environmental compliance at the Landfill include the United States Bureau of Land Management (owner), the Clark County Department of Public Works (R&PP lessee), historic operators of the facility including Silver State Disposal Service, Inc., Clark Sanitation, Inc., Disposal Transportation, Inc., and historic mining claimants whose operations occurred from time to time northeast of the 720-acre lease site.

Item No. 13:

Any correspondence, reports, or other information not already provided relating to storm water at the Landfill.

Response to Item No. 13:

Additional correspondence, reports, or other information not already provided related to the storm event can be found within the correspondence between Republic and CCHD, as well as between Republic and NDEP at Bates 4073-4093.

Republic remains committed to providing EPA with any information available. Should you require further information regarding any of the above-referenced inquiries, please contact either Robert Groesbeck at (702) 734-5427 or me.

Very truly yours,

Gregory J. Walch, Esq.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Dated this _______ day of January, 1999.

REPUBLIC DISPOSAL URBAN MAINTENANCE PROCESSING CO. INC., *Subsidiary of* REPUBLIC SILVER STATE DISPOSAL SERVICE, INC.

By:
Stephen Kalish
Its: President

REPUBLIC SERVICES, INC., and REPUBLIC INDUSTRIES, INC.

By:
David Barclay
Its: Senior Vice President and General Counsel

Enclosures
(all w/o encs.)
c: Stephen Kalish
James Cosman
Robert Groesbeck, Esq.
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APPENDIX B

SAMPLING AND ANALYSIS PLAN (SAP)

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SAMPLING AND ANALYSIS PLAN (SAP)

1.0 METHODS FOR IDENTIFICATION OF WASTE TYPES AND LIMITS

1.1 — GENERAL

1. The purpose of this task is to identify methods and procedures that will be used to estimate/or confirm the limits of waste and types of waste associated with the four identified disposal areas: Sunrise Mountain Landfill, Eastern Perimeter, Northeast Canyon Area, and the Western Burn Pits Area. Appropriate emergency response and health and safety procedures are provided in the Health and Safety Plan (HASP). Quality Assurance/Quality Control (QA/QC) procedures are provided within the SAP.

1.2 — METHOD DESCRIPTION

1. Existing information will be used to establish an estimated limit of waste for each of the four disposal areas.

2. If required, a geophysical survey may be performed to better estimate the limits of waste.

3. If required, intrusive field methods may be used to confirm or verify the horizontal and vertical limits of waste.

4. If required, samples of waste materials that are not visibly identifiable in the field may be collected and analytically tested in a laboratory for identification purposes.

5. If required, selected native soil samples from beneath waste may be collected and analytically tested for the presence of waste constituents.

1.3 — TOPOGRAPHIC MAPS AND AERIAL PHOTOS

<u>1.3.1 — General Requirements</u>

1. It has been reported that Clark County has topographic maps and aerial photos of the Site dating back to about 1952. This information would give an indication of baseline grades of the native area prior to any landfill operations. It has also been reported that the County has several more topographic and aerial maps available that span the Site's history and include a recent (1998) photo. Electronic copies of some of these maps are available. Others may have to be digitized into electronic form, which may take some time to complete. This existing information can be used to estimate the limits of waste and disturbed area.

1.3.2 — Estimating Limits of Waste and Disturbed Area

1. Topographic and aerial maps can, after they are in electronic format, be compared by computer software to assess the limits and depths of waste as well as the areas that have been disturbed. The areas that have been disturbed and/or have had waste placement can be placed on a drawing of the Site.

1.4 — GEOPHYSICAL SURVEY

1.4.1 — General Requirements and Equipment

1. If further identification or verification of waste limits are required, an electromagnetic (EM) terrain conductivity survey may be used to locate waste materials and boundaries between soil or rock.

2. The limits of waste established from the effort in Section 1.3 will serve as the starting point.

3. The electromagnetic (EM) method provides a means of measuring the electrical conductivity of subsurface soil, rock, and groundwater. Electrical conductivity is a function of the type of soil and rock, its porosity, its permeability, and the fluid that fills the pore space. Waste material is typically much more conductive to electromagnetic energy, and therefore is easily distinguished by an EM instrument.

4. The instrument proposed is a Geonics EM-31-D electromagnetic terrain conductivity meter. This instrument directly measures terrain conductivity in millimhos per meter (mmho/m) to a depth of approximately 6 meters (20 feet) using electromagnetic inductive techniques. The EM-31-D is an effective instrument in detecting and mapping lateral changes in subsurface conditions, e.g. location of landfill boundaries, buried metallic debris.

1.4.2 — Field Procedures and Data Collection

1. A local survey grid will be established and staked at 50-foot intervals in an area that coincides with estimated limits of waste.

2. Terrain conductivity will be measured continuously along each survey line, and a reading will be recorded in a field notebook at 50-foot intervals. By continuously monitoring terrain conductivity as surveying progresses, areas of high terrain conductivity gradients will be measured at intervals less than 50 feet.

3. By rotating the instrument 90 degrees using the operator as a pivot at each measurement station, the lateral changes in conductivity can also be recorded. In the event readings vary significantly through the 90-degree rotation, the minimum and maximum conductivity values will be recorded in the field notebook and arithmetically averaged during data reduction.

4. Data reduction will consist of inputting the grid coordinates and station terrain conductivity readings into a microcomputer data file. The data will then be computer-contoured to produce an electromagnetic contour map.

1.5 — TEST PIT/TRENCH PROCEDURES

1.5.1 — General Requirements

1. The description of the test pit/trench excavation procedures for the assessment activities at the Site is presented herein.

2. Test pits will be located in selected areas to assess the cover thickness, provide verification sampling of specifically identified waste areas (for example, the Western Burn Pits Area), and in other areas as required. Test pit excavation activities include the following:

    a. Excavating a small pit (typically 2-foot wide by 10 or 12 feet in length and depth varying from 5 to 20 feet, depending on field requirements).

    b. Collecting samples of final cover soils, and if required by field conditions, samples of the waste materials present in the pit and soils within the pit that are under the waste materials.

    c. Analyzing the samples for relevant parameters.

3. Test trenches will be located in selected areas to assess the cover thickness and continuity, provide verification of horizontal extent (waste disposal limits) and vertical extent (within 25 feet of surface) of in-place waste, provide verification sampling of identified waste areas (for example, the Eastern Perimeter Area), and in other areas as required. Test trench excavation activities include the following:

    a. Excavating a trench (typically 2 to 3-foot wide by lengths determined in the field and depth varying from 5 to 20 feet, depending on field requirements).

    b. Collecting samples of final cover soils, and if required by field conditions, samples of the waste materials present in the trench and soils within the trench that are under the waste materials.

    c. Analyzing the samples for relevant parameters.

    Detailed sampling and analytical procedures as may be required in the field techniques are described in following subsections. Both laboratory and field quality assurance requirements and procedures are provided in the following subsections.

1.5.2 — Excavation Procedure

1. Test pits/trenches will be excavated using a backhoe or hydraulic excavator capable of digging to a minimum depth of 15 feet. Soil cover material (approximately the first two feet of excavation) shall be cast to one side of the pit/trench. Soil cover materials will be kept separate from waste materials to allow backfilling of the pit/trench to maintain the integrity of the soil cover. Waste pit material deemed non-contaminated (by visual observation or by readily available field instruments) will be stockpiled on the other side of the pit/trench from the soil cover materials. Material deemed impacted will be placed on plastic sheeting, in rolloff boxes or other containment equipment to segregate and contain the waste material. In addition, the excavations will not be left open for more time than necessary. In any event, the area of excavation will be clearly marked and delineated using barricades to prevent people from falling into the excavation. Drums and large debris will be left in the test pit, if possible. If large quantities of drums or large debris are encountered, the test pit/trench will be relocated.

2. Excavation operations will be monitored by an on-site health and safety person using a Photoionization Detector (PID) or equivalent and combustible gas real-time indicator to assess health and safety conditions and potential contaminated zones in accordance with the Health and Safety Plan (HASP). Samples will only be collected from the backhoe bucket. Personnel will not enter the excavation under any circumstances.

3. Once the samples, as required, are collected, the test pits will be backfilled with any removed waste material and cover soils. The cover soils will be placed at a thickness and compaction level similar to pre-excavation conditions. The location of the backfilled test pit/trench will be surveyed using standard land surveying procedures. The approximate center of the test pit will be designated as the surveyed location. For test trenches, both ends of the trench will be located by survey. For purposes of this SAP, a test pit has a length of excavation less than or equal to 20-feet and a test trench has a length greater than 20-feet. Horizontal locations will be surveyed to the nearest foot, and vertical elevations will be surveyed to the nearest 0.1-foot.

1.5.3 — Visual Observation and Data Recording

1. During each test pit/trench excavation, the Engineering Manager or his designee will maintain a test pit or trench log. The log will detail all visual observations of where waste is encountered, visual classification of the type of waste, depth to top of waste, depth to bottom of waste, extent of waste along the linear dimension of the trench, etc.

1.5.4 — Field Sampling of Wastes

1. If required during test pit or test trench activities, samples of waste that can not be visually identified may be collected by shovel, hand trowel, or

other sampling device. Prior to sampling waste the HASP should be consulted for proper precautions and requirements for personal protective equipment

1.5.5 — Field Sampling of Soils

1. If required during test pit or test trench activities, soil samples may be taken with Shelby tube, split-spoon and/or California Drive samplers using ASTM Methods D 1587, D 1586, and/or D 3550, respectively. For soil samples collected for chemical characterization, a brass sleeve should be used in the sampler. Bulk samples will be collected by shovel.

1.6 — EXPLORATORY BORINGS

1.6.1 — General Requirements

1. Exploratory borings may be drilled in areas where the backhoe is not successful in reaching the vertical limits of waste. It is anticipated that *exploratory borings will not be performed in the Sunrise Mountain Landfill* Area, since the vertical limits of the waste in this area should be easily established by existing information.

2. The intent is to extend the boring into native soil or rock, thereby confirming the maximum vertical limit of waste at the drill location. It is anticipated that the depth of borings would probably not exceed 20 to 30 feet below the ground surface.

3. Cuttings of the waste material will be used to evaluate the type of waste.

4. Native soil at the boring termination depth will confirm the maximum vertical limits of waste.

1.6.2 — Boring Procedure

1. Each boring location will be established prior to initiating field work. Survey coordinates based on previous assessment activities will set the locations.

2. A truck-mounted drill rig equipped with hollow stem augers will be used to advance the exploratory borings.

3. Exploratory borings will be terminated in native soils or the bedrock contact.

4. Split-spoon samples will be collected at or near the boring termination depth, and if appropriate at select vertical locations within the waste mass or disturbed soils.

5. All exploratory borings will be abandoned by placing a continuous granular bentonite column in the lower five feet of the borehole, followed by drill cuttings or on-site soil, whichever is more practical

1.6.3 — Visual Observation and Data Recording

1. Each boring will be logged in accordance with general engineering practice. For the most part, drill cuttings of the waste and/or soil will be used to field log subsurface conditions. However, if conditions warrant, a split-spoon sample may be retrieved from a specific depth.

2. A split-spoon sample may be collected at the suspected vertical limits of waste. The split-spoon sample will be classified by soil type and identified on a field log. In the event the boring termination coincides with the bedrock surface, then the split-spoon sampler and associated blowcounts can be used to confirm the presence of bedrock.

3. Field observations will be noted on a field log during drilling activities. At a minimum, observations will include age, color and type of waste, odor or smell, discolored soils, moisture conditions, and type of soil or rock encountered.

4. If appropriate, a sample or samples of the waste and/or soil cuttings may be collected for possible analytical testing (which is discussed in Section 2.0).

5. Air monitoring will be conducted near the surface at the borehole and in the breathing zone. The monitoring will be conducted specifically for methane concentration, and hydrogen sulfide concentration. Air monitoring procedures and level of personal protective equipment required will be determined in accordance with the HASP.

6. All data recorded in the field from the exploratory borings will be evaluated and used to better assess the waste types and limits of waste.

1.6.4 — Field Sampling of Wastes

1. If required during test pit or test trench activities, samples of waste that can not be visually identified may be collected by shovel, hand trowel, or other sampling device. Prior to sampling waste the HASP should be consulted for proper precautions and requirements for personal protective equipment

2. In the Western Burn Pits Area, previous reports will be assessed to determine the appropriate analytical methods and locations for samples.

1.6.5 — Field Sampling of Soils

1. If required during test pit or test trench activities, soil samples may be taken with Shelby tube, split spoon and/or California Drive samplers using

ASTM Methods D 1587, D 1586, and/or D 3550, respectively. For soil samples collected for chemical characterization, a brass sleeve should be used in the sampler. Bulk samples will be collected by shovel.

2.0 METHODS FOR CHEMICAL CHARACTERIZATION OF SOIL AND WASTE

2.1 — GENERAL

1. If required, samples of waste materials that are not visibly identifiable in the field may be collected and analytically tested in a laboratory for identification purposes. Selected native soil samples from beneath waste may be collected and analytically tested, if required, for the presence of waste constituents.

2.2 — METHOD DESCRIPTION

1. Methods that will be used for the collection and chemical characterization of soil and waste samples, if required, will be in accordance with the latest edition of the EPA publication "SW-846, Test Methods for Evaluating Solid Waste.

2.3 — SAMPLE HANDLING

2.3.1 — Sample Collection Procedure

1. If required during test pit, test trench, or boring activities, soil samples may be taken with Shelby tube, split spoon and/or California Drive samplers using ASTM Methods D 1587, D 1586, and/or D 3550, respectively. Brass sleeves will be used when using the split spoon or California Drive samplers. Bulk samples will be collected by shovel, except if analyzing for VOCs.

2. Brass sleeves may be used to obtain a discrete grab sample, for instance from the bucket of the backhoe.

2.3.1 — Sample Container Requirements

1. The soil or waste sample will be compacted into the brass sleeve by hand, unless the sample is taken with a driven device, such as a split spoon. In that case, the sample should not be disturbed in the sleeve. Immediately upon obtaining the sample, both ends of the brass sleeve should be covered with a patch of Teflon and aluminum foil. Plastic end caps are then inserted on both ends and taped into place. Custody seals are added and the sample is preserved in accordance with Section 2.3.7.

2.3.3 — Sample Identification Procedures

1. Sample identification procedures will follow the protocol designated in the QA/QC requirements as discussed below.

2.3.4 — Procedures to Avoid Sample Contamination

1. Samples will be collected in unused clean Shelby tubes, containers, and soil sampling bags.

2. Split spoon sampler, drive sampler, shovel, and other sampling devices that are used to collect chemical characterization samples of soil or waste will be decontaminated between each sampling event in accordance with Section 6.2.

3. Sample containers will be closed and sealed/tied immediately after collection.

2.3.5 — Sample Packaging and Transportation Procedures

1. Proper sample packaging will be utilized to ensure that samples arrive undamaged at the testing laboratory. Samples will be packaged and shipped in accordance with applicable provisions of Section 6.7.

2. Samples will be placed in sturdy cardboard boxes or coolers. Appropriate shipping regulations (e.g., DOT) will be maintained on-site for reference. The sampler and Monitoring Foreman will refer to these, when necessary, for proper shipping procedures.

2.3.6 — Chain-Of-Custody Procedures

1. Chain-of-Custody procedures for cover soil sampling are described in the QA/QC requirements discussed below.

2.3.7 — Sample Preservation, Holding Times, Analytical Parameters and Methods

1. Sample preservation and holding times for specific chemical analyses are shown in the following table. Samples that must be stored at 4° C will be placed on ice in an insulated cooler in the field. Where required, sample preservatives will be provided by the laboratory in designated containers.

SAMPLE CONTAINERS, SAMPLE PRESERVATION METHODS, AND HOLDING TIMES FOR CHEMICAL CHARACTERIZATION OF SOIL AND WASTE

Analytical Parameter	Analytical Method	Sample Containers		Preservation Method	Holding Time
		Quantity	Type		
IGNITABILITY	1010	1	4-oz glass jar with Teflon-lined cap or brass tube	4° C	Not Applicable
CORROSIVITY	9045	1	4-oz glass jar with Teflon-lined cap or brass tube	4° C	14 days
REACTIVITY	SW846, 7.3.3.2 & 7.3.4.2	1	4-oz glass jar with Teflon-lined cap or brass tube	4° C	14 days
CYANIDE	9010	1	4-oz glass jar with Teflon-lined cap or brass tube	4° C	Not Applicable
ASBESTOS	PLM	1	8-oz plastic bag	NONE	Not Applicable
TCLP — VOCs VOCs	SW1311/8260 8240/8260	1	4-oz glass jar with Teflon-lined cap or brass tube	4° C	7 days until extraction 14 days after extraction
TCLP — SVOCs SVOCs	SW1311/8270 8270	1	8-oz glass jar with Teflon-lined cap or brass tube[1]	4° C	14 days until extraction 40 days after extraction
TCLP — Metals Total Metals	SW1311/7000 200.7/6010/7000	1	8-oz glass jar with Teflon-lined cap or brass tube[1]	4° C	28 days until extraction 180 days after extraction
TCLP — Pesticides Pesticides	SW1311/8080 8080	1	8-oz glass jar with Teflon-lined cap or brass tube[1]	4° C	14 days until extraction 40 days after extraction
TCLP — Herbicides Herbicides	SW1311/8150 8150	1	8-oz glass jar with Teflon-lined cap or brass tube[1]	4° C	14 days until extraction 40 days after extraction

Note: [1] Same 8-ounce glass jar can be used for TCLP-SVOCs, metals, pesticides, and herbicides analyses.

3.0 METHODS FOR PHYSICAL SOIL CHARACTERIZATION

3.1 — GENERAL

1. Soil will be sampled and tested for mechanical properties to determine usefulness and effectiveness as a final landfill cover system component. Appropriate emergency response and health and safety procedures are provided in a HASP. Quality Assurance/Quality Control (QA/QC) procedures are provided within the SAP.

3.2 — METHOD DESCRIPTION

1. Cover soil will be sampled at specified locations on the landfill surface. Soil samples may be tested for moisture content, grain size, Atterberg limits, expansion limits, moisture-density relationships, shear strength, hydraulic conductivity (saturated and unsaturated), capillary moisture relationships, and specific gravity.

3.3 — TEST PIT/TRENCH PROCEDURE

1. The procedures outlined in Section 1.5, in its entirety, are incorporated herein by reference.

3.4 — SHALLOW BORING PROCEDURE

1. Shallow borings may be conducted on the existing cover soils as an option or in addition to test pits. One technique that may be used is a hand held bucket type auger/sampler that is turned into the ground by manual or motor-driven means. The device, which is typically two inches in diameter or larger, is well suited for loose to medium dense soils at a thickness less than three feet.

2. Soil types and waste materials that are encountered during the shallow borings will be documented on field logs.

3. Each shallow boring location will be surveyed for horizontal coordinates and elevation.

4. Select representative samples may be collected for laboratory testing as discussed below.

3.5 — SAMPLE COLLECTION

<u>3.5.1 — Sampling Materials and Containers</u>

1. *The following sampling materials* may be required depending on the methods specified in the Field Assessment Technical Memorandum:

- Clean, 16-ounce sample jars and lids with rubber seals;
- Cardboard box case with dividers for sample jar storage/shipping;
- Split spoon, California Drive, and Shelby tube sample devices;
- Sample rings and plastic storage tubes;
- Non-shrink wax sheet squares for tube sealing;
- Plastic end caps to fit Shelby tubes, sample rings, and plastic storage tubes;
- Soil sampling bags;
- Duct tape;
- Shovel, trowel, or post hole digger;
- Twist ties;
- Self-adhesive labels;
- Field Activity Report forms and/or appropriate monitoring data sheets;
- Chain-of-Custody records; and
- Pen with indelible ink.

2. Undisturbed samples taken with a Shelby tube sampler will be retained in the tube. The tube will be sealed with nonshrinking wax on both ends and plastic caps will then be placed and taped on both ends.

3. Samples taken with a split spoon sampler and disturbed samples taken with a Shelby tube sampler will be placed in clean sample jars with rubber gasketed lids immediately after sampling.

4. Drive samples taken with the California Drive Sampler will be stored in 6-inch plastic storage tubes. The tubes will be closed at both ends with plastic caps and taped.

5. Bulk samples (i.e., those collected by shovel) will be placed in large soil sampling bags immediately after sampling.

3.5.2 — Sampling Technique

1. Samples may be taken with Shelby tube, split spoon and/or California Drive samplers using ASTM Methods D 1587, D 1586, and/or D 3550, respectively. Bulk samples will be collected by shovel and placed in large sampling bags. Discrete, representative soil samples will be placed in small bags.

2. Samples will be collected in unused clean Shelby tubes, containers, and sampling bags.

3. Split spoon sampler, drive sampler, and shovel will be wiped clean between sampling events.

4. Sampling containers will be closed and sealed/tied immediately after collection.

3.5.3 — Sample Identification Procedures

1. Sample identification procedures will follow the protocol designated in the QA/QC requirements as discussed below.

3.6 — SAMPLE HANDLING AND TRANSPORTATION

1. Proper sample packaging will be utilized to ensure that samples arrive undamaged at the testing laboratory. Samples will be packaged and shipped using the procedures described below:

   - Shelby tubes will be sealed as discussed in Subsection 3.5.1 and stored upright until shipment.
   - Sample jars will be sealed with rubber gasketed lids and placed in cardboard boxes specially made for the jar samples.
   - California Drive sample tubes will be sealed as discussed in Subsection 3.5.1 and placed in padded sample boxes.
   - Bags will be sealed with twist ties to prevent soil spillage.

2. Samples will be placed in sturdy cardboard boxes or coolers. Appropriate shipping regulations (e.g., DOT) will be maintained on-site for reference. The sampler and Monitoring Foreman will refer to these, when necessary, for proper shipping procedures.

3.7 — SAMPLE PRESERVATION, TEST PARAMETERS AND METHODS

1. Preservation of samples collected for geotechnical testing will involve capping of sample containers or wrapping the samples in plastic to preserve the moisture content, and storing the samples in a cool, dry area prior to shipment to the geotechnical testing laboratory. All split spoon liners will be sealed with pre-manufactured plastic caps sized to fit the liners and duct tape sealed to the liner.

2. Cover soils samples will be analyzed for their mechanical properties and may undergo some or all of the following tests and procedures listed in the following table:

PARAMETER	METHOD
Laboratory Determination of Water (Moisture) Content of Soil and Rock	ASTM D 2216
Particle-Size Analysis of Soils	ASTM D 422
Liquid Limit, Plastic Limit, and Plasticity Index of Soils	ASTM D 4318
Classification of Soils for Engineering Purpose	ASTM D 2487
Specific Gravity of Soils	ASTM D 854
Expansion Index of Soils	ASTM D 4829
Laboratory Compaction Characteristics of Soil Using Standard Effort	ASTM D 698
Laboratory Compaction Characteristics of Soil Using Modified Effort	ASTM D 1557
Direct Shear Test of Soils Under Consolidated Drained Conditions	ASTM D 3080
Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression	ASTM D 2850
Consolidated — Undrained Triaxial Compression Test on Cohesive Soils	ASTM D 4767
Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	ASTM D 5084
Capillary-Moisture Relationships for Coarse- and Medium-Textured Soils by Porous-Plate Apparatus	ASTM D 2325
Capillary-Moisture Relationships for Fine-Textured Soils by Pressure Membrane Apparatus	ASTM D 3152
Water Potential: Thermocouple Psychometry	Soil Science Society of America* (SSSA), 1986, Ch. 24
Water Potential: Miscellaneous Methods	SSSA* (1986), Ch. 25
Water Retention: Laboratory Methods	SSSA* (1986), Ch. 26
Hydraulic Conductivity and Diffusivity: Laboratory Methods	SSSA* (1986), Ch. 28

* Soil Science Society of America (SSSA), 1986. "Methods of Soil Analysis — Physical and Mineralogical Methods," American Society of Agronomy, SSSA Book Series No. 5.

4.0. LANDFILL GAS CHARACTERIZATION

4.1 — GENERAL

1. The landfill gas (LFG) assessment will focus on the Sunrise Mountain Landfill (720-acre parcel), the Northeast Canyon Area, and the Eastern Perimeter Area. These three areas are contiguous and they will be evaluated as a whole. The identified outer edge of refuse of the three areas will establish the overall boundary of the LFG assessment area. However, there are three areas within this boundary that will be excluded, unless field activities under Tasks a, b, or c indicate otherwise. These are the following:

   - The asbestos disposal area,
   - The septage waste area and;
   - The construction/demolition waste disposal area.

2. Speciated analyses of the trace organics in the LFG will not be undertaken. Prior reports have shown the LFG at Sunrise Mountain Landfill to contain compounds at concentrations that are typically encountered in LFG at municipal solid waste landfills. The available data will be summarized and evaluated during the LFG assessment. Given the size of the Sunrise Mountain Landfill, it is extremely unlikely that the average NMOC concentration found during such a survey would be low enough to exempt the Landfill from LFG control (i.e., that the site produces less than 50 metric tons of non-methane organic compounds (NMOCs) per year).

3. It is currently expected that Sunrise Mountain Landfill will be required to install a LFG collection and control system. Therefore, LFG characterization and quantification efforts should be oriented not toward determining whether or not a LFG collection and control system is needed, but should be oriented toward how the system should be designed. The information collected and the analyses performed during the LFG assessment should provide information that is useful in the design of an NSPS-compliant LFG collection and control system.

4.2 — METHOD DESCRIPTION

1. The landfill surface, landfill gas (LFG) probes, groundwater monitoring wells, on-site and nearby occupiable structures, test pits\trenches, and the breathing zone above or downwind of borings will be monitored for the presence of explosive gas (methane) and hydrogen sulfide. Appropriate health & safety proceedures will be presented in a Health and Safety Plan (HASP) prior to initiation of field work.

4.3 — PROCEDURE FOR SURFACE EMISSIONS MONITORING

1. Surface emissions will be monitored across the entire surface of the LFG assessment area. The survey will be conducted using a portable flame ionization detector (FID) meeting the instrument specifications outlined in

Section 3 of EPA Method 21. The survey methodology set forth in 40 CFR, Part 60, Subpart WWW will be employed. The monitoring probe will be held 3 inches above the surface of the landfill. The probe will not be inserted into cracks or voids, but will be held 3 inches above the point where the surface would be if the imperfection did not exist. A grid map will be employed to establish the serpentine walk path prescribed by the regulation. A global positioning system (GPS) device will be employed to aid the surveyor in walking the serpentine path. Any point source measurement exceeding 500-ppm methane will be noted/numbered, and the location will be staked/flagged. The location will be identified using GPS. The location of all 500-ppm methane excursions will be shown on the grid map.

2. The surface emissions monitoring will also be performed as discussed above along the entire perimeter (i.e., the edge or boundary of the landfill [the refuse/native material interface]).

4.4 — PROCEDURE FOR AMBIENT AIR HYDROGEN SULFIDE MONITORING

1. An RKI Eagle photochemical cell will be used to measure the concentration of hydrogen sulfide at a level approximately 5-feet above the landfill surface (i.e., breathing zone). The serpentine path used for the surface emissions monitoring will be employed. A reading will be recorded approximately every 100 feet. The data will be used to plot a breathing zone map of hydrogen sulfide intensity over the site.

4.5 — PROCEDURE FOR METHANE MONITORING IN STRUCTURES

1. Two structures have been identified for in-structure methane monitoring. One is on the landfill (the Clark County Air Monitoring Station) and one is just off-site (the Doppler Tower). A portable photo-ionization detector (PID), such as a Landtec GEM-500 will be used to determine methane concentrations inside the structures by running the probe along the baseboard inside the structures and in any enclosed areas. Compliance or non-compliance with EPA's 1.25- percent methane standard will be assessed.

4.6 — PROCEDURE FOR SUBSURFACE METHANE MONITORING

1. Subsurface methane migration monitoring is only proposed for that portion of the property boundary where structures exist within 1,000 ft of the landfill (waste placement) perimeter. Monitoring will be performed using a Landtec GEM-500 combustible gas meter (PID). In order to obtain a representative sample, two or three well volumes of gas will be purged from the casing prior to sample collection. Purging will be accomplished using the pump in the portable PID.

4.6.1 — Landfill Gas Probes

1. Two LFG monitoring probes may be installed. The probes will be designed in accordance with EPA guidance document 530-R-93-017 for Solid Waste Disposal Facility Criteria, and will be monitored for methane, carbon dioxide, oxygen, balance gas (assumed to be nitrogen), and pressure using a PID.

4.6.2 — Hydrogeologic Borings and Wells

1. Methane migration will also be assessed during borings associated with the seven groundwater monitoring well installations. A PID or Tedlar bag will be used for this assessment as discussed below.

2. Samples of vadose zone gases, if present, will be collected by use of a portable vacuum chamber and either a PID or Tedlar bags. In order to obtain a representative sample, two to three well volumes of gas will be purged from the casing prior to sample collection. Purging will be accomplished using a hand-held air pump with flow volume of approximately 5 liters per minute. Once the purging is accomplished the cock valve is turned off and the purge line is tied off to maintain well gas within the line.

3. The vacuum chamber consists of a standard Pelican box equipped with brass inlet/outlet ports and an air bleed valve, which releases negative pressure within the box. The SKC Vac-U-Chamber is capable of withstanding a differential pressure of up to approximately 12 inches of mercury. Following well purging, the purge line, consisting of Tygon tubing, will be attached to the cockvalve or Landtec fitting on the wellhead, and to the inlet side of an SKC Vac-U-Chamber. A Tedlar bag is placed inside the vacuum box and connected to the brass inlet port. The valve of the Tedlar bag is then opened two full turns. The vacuum box is closed and sealed shut. The hand-held air pump will then be attached to the outlet side of the vacuum box and turned on. The cock valve on the well is reopened and air within the vacuum box is evacuated. When the negative pressure within the vacuum box exceeds the pressure on the purge line, gas will begin to fill the Tedlar bag. Once the bag is filled, the cock-valve on the well is shut and the bleed valve on the vacuum box is opened. The valve on the Tedlar bag will then be shut. Immediately after the Tedlar bag is full, the PID could be used to sample thecontents of the bag. If constituent analysis is desired, the bag should be immediately placed within a cooler to prevent any photodegradation of the sample and sent to the laboratory.

4. If, during drilling operations, gases are encountered which exceed 4 to 5 percent combustible gas, a Tedlar bag (or Summa canister) sample will be obtained from the open borehole using the above method. Gases will be captured at the borehole by placing a sealed rubber collar over the borehole. Gas will be collected from the borehole space using a cockvalve installed on the collar.

5. Samples from the Tedlar bag could be analyzed for VOCs by Method TO-14, if required.

5.0 METHODS FOR GROUNDWATER CHARACTERIZATION

5.1 — GENERAL

1. The groundwater characterization will focus on the Sunrise Mountain Landfill and all the adjacent areas as one site. The bore holes for well installation will be used for collecting data on the geology under the site. After completion of the wells, the methods described herein can be used to assess the aquifer characteristics and groundwater quality.

5.2 — METHOD DESCRIPTION

1. Aquifer testing can be assessed using one of three methods. The constant discharge, the constant draw down, or the slug test. Because of the unknown nature of the aquifer below the site, all three methods are presented and may have applicability depending on site-specific conditions. Groundwater sampling and analysis methods are also discussed below. Appropriate health & safety procedures will be presented in a Health and Safety Plan (HASP) prior to initiation of field work.

5.3 — WELL DEVELOPMENT

1. Wells will be developed after construction by a combination or sequence of bailing, swabbing, and pumping. Development will be at the direction of the geologist, and will continue until the water is substantially silt-free and field parameters have stabilized, or the geologist directs development to stop. If the formation is so fine-grained that the filter pack might not completely remove fines, the decision would be based on substantial reduction in the amount of fines.

5.3.1 — Equipment

1. The following equipment will have to be available to perform groundwater sampling:

   - Bailer, bottom-filling, smaller than casing diameter.
   - Swab, of diameter that will fit loosely in casing.
   - Submersible pump, discharge piping, cable, and power for pump.
   - Equipment hoist to suspend tools in hole, and appurtenant tools.
   - Plastic sheeting, drums to contain liquids, and spill control equipment.
   - Field parameter equipment, which may include pH meter(calibrated), EC meter (calibrated), thermometer, alkalinity and CO_2 test kits, and two clean jars to observe silt content. For large production wells, a Rossum sand tester may be used, but for monitoring wells a clean jar or turbidity meter is generally sufficient.

- Well sounder.
- Miscellaneous paper towels, slop buckets, development forms, and indelible pen.
- Watch or clock.
- Personal Protective Equipment appropriate to contents of well. Assume Level D wet, but be ready to upgrade, if meters indicate that it is necessary.
- Decontamination equipment for tools and pump if pump is moved between wells.
- Monitoring equipment, if necessary: OVM (calibrated), explosimeter (calibrated) and GEM 500.

5.3.2 — Procedure

1. Bail at least one casing volume from the well before development. Bail muck from well with bottom bailer until mostly out. Do not break out the bottom cap, or drop the bailer so fast that the casing is damaged.

2. Lower the swab gently to a few feet below the water surface. Swab by gently lowering and raising the swab opposite perforations, not more than 5 to 10 feet at a stretch. Remove accumulated solids periodically. Water may be added at the direction of the Engineering Manager or Geologist. Repeat cycles until most fines are removed, or until no further improvement happens.

3. Discharged water shall be collected into 55-gallon drums, and shall be disposed of as directed.

4. Install pump. Pump should be set with bowls about even with top of sump. Pump slowly at first, then faster. After maximum rates have been achieved, surging may begin. Surging consists of stopping the pump, then increasing the pump rate quickly, then stopping the pump, letting the column of water fall back into the well.

5.3.3 — Sand Content Measurement

1. Fill a clean glass jar with water. Observe for settleable solids, color, and suspended mica particles. Let jar stand for 5 minutes and observe settled material. Repeat with second jar. Compare second jar with first. Dump and clean out first jar.

5.3.4 — Field Parameter Measurement

1. Measure EC frequently during development; pH occasionally. Measure all field parameters towards the end of development and record on field sheet.

2. At the end of development, an abbreviated step drawdown test may be performed. The steps will be decided based on the performance of the

wells during development pumping. A step drawdown test consists of pumping the well at evenly increasing flow rates, and measuring the increase in drawdown caused by the change in well efficiency at different flow rates.

3. Equipment used during development will be decontaminated as appropriate at the end of development. This includes bailers, surge blocks, sounders, lines, and other things that have come in contact with water, and that would be used in the next well.

4. Safety equipment. Minimum Level D-wet, with face shields, will be used. If environmental monitoring indicates excessive levels of methane or toxic gases, higher levels of equipment or engineering controls must be used.

5.4 — WATER LEVEL MEASUREMENT

1. Static groundwater levels measured during drilling and well development will be referenced to the top of casing and the ground surface. Water levels will be measured to the nearest 0.01 foot, using an electric well sounder. Once surveyed elevations are available, all water levels will be referenced to the surveyed point at the top of the sounding tube or well casing. The sounder and portions of the tape which enter the well will be decontaminated between wells.

5.5 — AQUFIER TESTING

5.5.1 — Purpose and Approach

1. The purpose of aquifer testing is to measure the aquifer system's ability to transmit water and yield it up to wells. The test also provides information on deviations from ideal conditions that could affect the yield of the well. Often-encountered deviations from ideal conditions include:

2. Wells that only partially penetrate the aquifer, particularly short-screened wells in thick aquifers. This introduces head losses caused by nonhorizontal flow, and can cause observation wells to measure less than complete responses to pumping.

3. Boundary effects. Aquifers in fractured rock tend to respond strongly to vertical fractures in the vicinity. Aquifers in canyon settings, or in aquifers with rapid lateral facies changes also show boundary effect.

4. Leaky conditions of three types may occur, in layered systems: leakage without storage in the leaky layer, leakage with storage in the leaky layer, and double-porosity effects from dewatering of blocks of materials to a fractured system.

5. In layered systems where the layers are not extensive, particularly alluvial-fan material, the test may show deflections caused by dewatering of lenses.

6. The aquifers tested may be horizontally and vertically anisotropic.

7. The type of test chosen will depend on the production rate of the well. Wells that can produce more than 3/4 gpm for 24 hours will be tested using a constant-discharge test. Wells that bail dry and are slow to recover, will be tested using a constant-drawdown test. In a constant-drawdown test, the water level in the well is kept constant, and the volume removed is recorded with time.

5.5.2 — Equipment

1. Pump and pump controller; power for pump. Pump column must have check valve. Other features include the following:

   - Discharge line (1-1/2 in. water hose or equal).
   - Drums or tanks to contain estimated volume of water produced during test.
   - Water level sounders (one for each well, to avoid having to decontaminate equipment during test).
   - Tape measure graduated in tenths of an inch.
   - Calibrated 2.5- or 5-gallon bucket.
   - Flowmeter (Grundfos pump controller has one).
   - Timing equipment.
   - Barometric readings from weather station to 0.01 in. Hg.
   - PPE: Level D for measuring wells; Level D wet for installing pumps and moving hoses.
   - OVM and explosimeter. If sounding tube produces a lot of gas, engineering controls or Level C may be required for person taking readings.

5.5.3 — Constant Discharge Test

1. After equipment has been installed and checked, measure and record water levels in all wells used for the test.

2. One assistant may be needed at each well for the first hour or two of the test. Afterwards, one person can make all the measurements until recovery testing begins, when one person per well may be again needed.

3. The following table lists recommended measurement intervals:

0 - 3 min.	30 sec.
3 - 15 min.	1 min.
15 - 60 min.	5 min.

60 - 120 min.	10 min.
120 min. - 600 min.	30 min.
10-24 hrs.	4 hrs.

4. Discharge rate is monitored periodically, depending on observed variability, but at least every 6 hours.

5. Accuracy should be kept within 5 percent, because 10 percent variation in discharge can cause a 100 percent change in transmissivity. Discharge variations tend to be greatest at the very beginning of the test, and can gradually decline (because of increasing pump lift) towards the end of the test. The pump rate should be enough below its rated capacity to allow it to maintain discharge with the expected change in lift.

6. Recovery measurements should be made on the same schedule as drawdown measurements, but may be stopped when 90 percent recovery has occurred. Occasionally, some wells may never fully recover, indicating permanent dewatering. This is an important hydrogeologic observation.

7. Data should be plotted during the test on a log-log scale to identify bad data or boundary conditions. This may be done on a portable PC with a spreadsheet with graphics. However, all records must be also kept on paper. Any unusual events, weather conditions, or other conditions that may bear on the test should be recorded on the field form.

8. Sounders and watches should be synchronized before the test. Sounders used at each well should be identified, and if sounders change, record the time and sounder number.

5.5.4 — Constant Drawdown Test

1. The constant drawdown test will be used if flow rates are too slow for a constant discharge test. Instead of measuring the rate of change of drawdown, the rate of change of discharge is measured on similar intervals. This can be done using appropriate measuring equipment, including calibrated measuring cups and buckets. The sounder is left in the sounding tube of the pumping well, and set at the level of the pump intake. The pump is turned on, and the total volume of water pumped is measured with a totalizing meter or bucket or cup.

2. As the well refills, the pump is manually reactivated and the volume recorded. Water levels should be kept within 5 percent to maximize accuracy of the test. Recovery is measured as usual.

3. Data analysis will use the method of Jacob and Lohman (USGS Professional Paper 708, 1972). Either the log-log method or straight-line method will be used, depending on what works. Recovery will be analyzed by totaling the volume removed during the test, averaging discharge with time, and using one of the constant-discharge recovery

methods. This method will only be used as a check on the drawdown calculation. This method is often used if the discharge has varied during the test enough to make the drawdown test questionable. Borehole storage will not be considered in the analysis. Borehole storage is only a consideration in wells that are nearly 100 percent efficient, which does not apply to wells screened in less than the full thickness of the aquifer. Results will not rely on analyses having storage coefficients exceeding 10 percent without a justifiable reason. Storage coefficients exceeding 100 percent are cause for rejection of the analysis.

5.5.5 — Analysis

1. Test results will be analyzed using log-log methods. Depending on the shape of the curve, leaky, bounded, recharge, or other conditions may be identified. Recovery data will be plotted on both semi-log and log-log plots, and checked for symmetry with drawdown data. Asymmetry of drawdown and recovery data provides information on storage conditions near the well.

2. The results of the aquifer test will be submitted as tabular data, data plots, calculations, and a summary of the results of the test, including the rationale for the analysis method and assumptions used.

5.5.6 — Slug Test

1. A slug test is a single-well hydraulic test used to determine the hydraulic conductivity of an aquifer in the immediate vicinity of the well. Because hydraulic conductivity varies spatially within and between aquifers and because slug test results reflect aquifer conditions only in the immediate vicinity of the tested well, slug tests should be conducted in as many wells as possible at a site. Slug tests can be used for both confined and unconfined aquifers that have transmissivities of less than approximately 7,000 square feet per day (ft^2/day). Slug tests are accomplished by removing a solid slug (rising head) or introducing a solid slug (falling head), and then allowing the water level to stabilize while taking water level measurements at closely spaced time intervals. The method presented herein discusses the use of falling head and rising head slug tests in sequence.

2. Slug testing should not proceed until water level measurements show that static water level equilibrium has been achieved. Unvented wells should be uncapped at least 24 hours prior to initiating the test in order to allow the static water level to come to equilibrium. The protective casing should remain locked during this time to prevent vandalism. During the slug test, the water level change should be influenced only by the introduction or removal of the slug volume. Other factors, such as inadequate well development or extended pumping, may lead to inaccurate results. It is

the Field Manager's responsibility to decide when static equilibrium has been reached in the well.

3. The following equipment is needed to conduct a slug test:

- Teflon®, PVC, or metal slug
- Nylon or polypropylene rope
- Electric water level indicator
- Pressure transducer/sensor
- Field logbook/forms
- Automatic data recorder (such as the Hermit Environmental Data Logger®, In-Situ, Inc. Model SE1000B, or equal)

4. The falling head test is the first step in the two-step slug-testing procedure. The following steps describe the recommended falling head slug test procedure:

   a. Decontaminate all downhole equipment.

   b. Record pre-test information including: well number, personnel, climatic data, ground surface elevation, measuring point elevation, equipment identifications, and date.

   c. Measure and record the static water level in the well to the nearest 0.01 feet.

   d. Lower the decontaminated pressure transducer into the well and allow the displaced water to return to within 0.01 foot of the original static level.

   e. Lower the decontaminated slug into the well to just above the water surface in the well.

   f. Start the data logger and quickly lower the slug below the water table, being careful not to disturb the pressure transducer. Follow the owner's manual for prepare operation of the data logger.

   g. Terminate data recording when the water level has recovered at least 80 percent from the initial slug displacement.

5. Immediately following completion of the falling head test, the rising test is performed.

6. The following steps describe the rising head slug test procedure:

   a. Measure the static water level in the well to the nearest 0.01 foot to ensure that it has returned to the static water level.

   b. Initiate data recording and quickly withdraw the slug from the well. Follow the owner's manual for proper operation of the data logger.

   c. Terminate data recording when the water level has recovered at least 80 percent from the initial slug displacement.

7. It is advisable to produce hard copies or backup electronic copies of the logger output (draw down vs. time) daily and before transporting the logger from the field site.

5.6 — FIELD ANALYSES

5.6.1 — Field Analysis for Carbon Dioxide

1. Field measurement for free carbon dioxide uses a method based on Standard Method 4500-CO_2 C, Titrimetric Method for Free Carbon Dioxide. Note that free CO_2 should be measured immediately at the point of sampling.

2. At least two manufacturers make test kits for direct measurement of CO_2 in water, using the titrimetric pheno-pthalien indicator methods. Either Hach or LaMotte are acceptable kits, based on field experience. This procedure uses the LaMotte test kit.

5.6.1.1 — Apparatus

1. LaMotte CO_2 test kit.
   Reagents supplied in kit.

5.6.1.2 — Method

1. Follow manufacturer's instructions. The LaMotte kit has a syringe calibrated directly in ppm CO_2. Do two replicate analyses using fresh water for each (do not let water for the second test stand around during the first test). If the color change is hard to see, one or two extra drops of pheno-pthalien may be added, but too much will interfere with the test. A 0.01N sodium bicarbonate ($NaHCO_3$) solution containing the recommended volume of pheno-pthalien in a vial may be used as a color standard until familiarity is obtained with the color at the end point. If the two replicates differ by more than 10 percent, run a third test unless obvious interference from dark water color, precipitation, or other problems occur. If CO_2 cannot be measured, note "UTM" (unable to measure) on the field data log. Follow manufacturer's recommended safety procedures (also in test kit).

5.6.1.3 — Calculation

1. No calculation required.

5.6.1.4 — Precision and Bias

1. Precision and bias of the titrimetric method are on the order of ±10 percent of the known CO_2 concentration.

5.6.2 — Field Analysis for Alkalinity

1. This procedure covers field analysis for alkalinity. Field measurement for alkalinity uses a method based on Standard Method 2320 B, Titration Method for Alkalinity. Note that alkalinity should be measured immediately at the point of sampling.

2. At least two manufacturers make test kits for direct measurement of alkalinity in water, using the titrimetric pheno-pthalien indicator methods. Either Hach or LaMotte are acceptable kits, based on field experience. This procedure uses the LaMotte test kit.

5.6.2.1 — Apparatus

1. LaMotte Alkalinity test kit.
   Reagents supplied in kit.

5.6.2.2 — Procedure

1. Follow manufacturer's instructions. The LaMotte kit has a syringe calibrated directly in ppm alkalinity. Do two replicate analyses using fresh water for each (do not let water for the second text stand around during the first test). Strongly colored water will interfere with the seeing the end point of the test. In this case, a properly calibrated pH meter may be used to titrate to an end point of 4.5 (using the bromcreosol green-methyl red indicator). A color standard using the bromcreosol indicator may be used until familiarity is obtained with the color at the end point. If the two replicates differ by more than 10 percent, run a third test unless obvious interference from dark water color, precipitation, or other problems occur. If an alkalinity sample cannot be measured, note "UTM" (unable to measure) on the field data log. Follow manufacturer's recommended safety procedures (also in test kit).

5.6.2.3 — Calculation

1. No calculation required.

5.6.2.4 — Precision and Bias

1. Precision and bias of the titrimetric method are on the order of 5 to 10 percent of the known concentration for the range of 10 to 500 mg/l.

5.7— GROUNDWATER SAMPLES FOR ANALYTICAL TESTING

1. Groundwater samples may be obtained during routine monitoring, drilling, or well development for measurement of field parameters such as pH, EC, chloride, alkalinity, turbidity, and CO_2. Grab samples will be obtained in a bailer or other container that has been field cleaned with a laboratory-grade

detergent and triple-rinsed with deionized water (EC, pH, temperature, CO_2, and turbidity). Procedures for CO_2 and alkalinity tests are included in discussions below.

2. Field parameters will also be obtained during development or purging. Stabilization of field parameters will be used to indicate that sufficient water has been purged. The volume of water purged will be recorded. Because VOC concentrations are highly correlated with CO_2 measurements, CO_2 should be measured at least twice during purging: once near the beginning, and once near the end.

3. The volume to be purged depends on whether the well recovers quickly or slowly. One casing volume will be purged with stabilization parameters (pH, EC, conductivity), measured at intervals of a few minutes. One well volume is calculated as the area of the casing times the length of the standing water column. When parameters stabilize within 10 percent of the previous reading, purging may stop. The purge rate is not critical as long as aeration and cavitation do not occur. For slow-recovery wells, the well will be purged dry and allowed to recover to 75 percent of its initial water level before sampling. Stabilization parameters should be measured.

4. Groundwater samples collected for laboratory analysis will be collected using either a bailer, if a permanent pump has not been installed, or by use of a permanent sampling pump. Bailers are to be disposable, and will not be reused between wells. One field rinseate sample (consisting of deionized purified water poured into a clean sample bailer) will be collected during each daily sampling event. In general, samples are collected in increasing order of bottle size. All bottles will be filled with zero headspace. Samples will be collected in laboratory-prepared, pre-cleaned and certified bottles, containing appropriate preservatives for the type of analysis, following procedures in EPA SW-846. Grab samples for metals will be placed in unpreserved bottles and filtered when the laboratory receives them. Other optional metals samples will be filtered in the field using 0.45-micron filters.

5.7.1 Sampling Procedure

1. Groundwater samples will be obtained after development of the wells and completion of the aquifer testing. All purge and test water will be contained in a tank or drums on site until after the results of chemical analysis have been obtained. Then it will be disposed of properly.

2. Static water levels will be measured before sampling begins, using an electric well sounder. The volume to be purged will then be calculated. The wells will be purged using either dedicated equipment, or by bailing, until field parameters pH and EC have stabilized. Two field parameters, alkalinity and carbon dioxide (CO_2), have been added to those normally measured (including pH, Electroconductivity (EC), and temperature). Carbon dioxide in particular, directly indicates the presence of LFG, and is useful when compared with Volatile Organic Compounds (VOC) concentrations. CO_2 would help to differentiate LFG-borne contamination

from that resulting from leachate. Alkalinity allows correct Langlier indices to be calculated.

3. VOC sample collection will use no particular flowrate protocol. Experience has indicated that the flowrate makes no practical difference in landfill environments, because VOCs mainly enter groundwater via LFG contact, so loss into the unsaturated zone is not an issue, rather the unsaturated zone is the source of the VOCs. Care will be taken when filling the 40-ml containers to minimize air contact and any turbulence of the samples in order to minimize loss of VOCs. One problem that has occasionally been observed near landfills is carbonation of the water. When this occurs, bubbles come out of solution like the bubbles on the side of a carbonated beverage. These bubbles are not eliminated before capping, because this will cause VOC loss. Because such samples will have a high dissolved CO_2 level measured in the field, this condition will be noted on the chain of custody forms. Samples will be placed in appropriate laboratory-supplied containers and packed in ice for shipment to the off-site EPA approved fixed laboratory.

4. Inorganic constituent samples (metals, anions, cations, and nitrate) and field parameters will be taken from the pump discharge or bailer. If the ambient air temperature is greater than 40°C, temperature should be measured in a thermal insulated vessel.

5. Purging and sampling information will be recorded in the field log. Information recorded will include, at a minimum, the well number, date, time of purging and sampling, water level and field measurements, volume purged, and notes.

6. Groundwater samples will be analyzed by the EPA approved laboratory as specified below. The laboratory is certified for such analyses by the State of Nevada, for the EPA Appendix I list consistent with the EPA requirements. Analyses include VOCs by Method 8260, major anions and cations (Ca, Mg, Na, K, HCO_3, CO_3, SO_4, NO_3, Cl), semivolatiles, metals, pesticides and PCBs. Details of sampling, bottles, holding times, and analysis methods are discussed below.

5.7.2 Sample Containers, Parameters, Holding Times, and Methods

1. The table below summarizes parameters, containers, methods, and holding times.

2. Parameters for which no method is specified in the following table, will be analyzed in accordance with the appropriate method specified in the latest edition of "Standard Methods for the Examination of water and Wastewater".

Parameter	Units	Container	Holding Time (days)
Groundwater Elevation	Ft. & Hundredths, M.S.L	Field Mt.	0
Temperature	°F.	Field Mt.	0
Specific Conductance	µmhos/cm	Field Mt.	0
PH	pH units	Field Mt.	0
Turbidity	Turbidity Units	Field Mt.	0
CO_2	mg/L	Field Mt.	0
Alkalinity	mg/L	Field Mt.	0
Total Ids. Solids	mg/L	1 L. Plastic	28
Chloride	mg/L	1 L. Plastic	28
Carbonate	mg/L	1 L. Plastic	28
Bicarbonate	mg/L	Field Mt.	0
Nitrogen as Nitrate	mg/L	100 ml. Pls.	2
Sulfate	mg/L	1 L. Plastic	28
Calcium	mg/L	1 L. Plastic	28
Magnesium	mg/L	1 L. Plastic	28
Potassium	mg/L	1 L. Plastic	28
Sodium	mg/L	1 L. Plastic	28
Volatile Organic Compounds by USEPA 8260 (extended)	µg/L	2-40 ml glass vials	14
Total Organic Carbon	mg/L	125 ml Pls.	14
Semi Volatile Compounds by USEPA 8270	µg/L	500 ml amber glass	7
Chlorophenoxy Herbicides by EPA Method 8150	µg/L	500 mL amber glass	14
Metals By ICP By EPA 6010, Hg by 7470, As by 7061, Se by 7741	µg/L	1 L glass	14
Organophosphorous Cpds by EPA Method 8141		500 mL amber glass	14

5.7.3 Sample Handling, Packaging, and Shipping

1. During the assessment, water samples will be collected for laboratory analysis. Water samples to be analyzed will be packaged in containers provided by the analytical laboratory. Analytical methods, sample containers, volumes, preservation methods, and holding times are summarized in Section 5.8. Glass bottles will be wrapped with bubble pack to minimize breakage. VOC samples will be collected in duplicate, wrapped in bubble wrap, and put in ziplock bags. Obvious highly contaminated samples will be placed in separate coolers from less contaminated samples. All water samples will be stored on ice in coolers immediately after collection and packaging. The coolers will contain double-bagged ice packages to maintain sample temperature at 4°C. Prior to shipment, the empty spaces in the cooler will be filled with bubble wrap to keep the sample containers from shifting during transport. A Chain-of-Custody Record will be placed in a zip lock plastic bag and taped to the inside of the cooler lid. The cooler will be taped shut with strapping tape, and at least two signed custody seals will be affixed over the lid openings to allow the recipient to determine whether the cooler has been opened since being sealed. Clear tape will be affixed over the custody seals to ensure that the custody seals are not broken accidentally in transport. Coolers will be shipped to the designated EPA approved laboratory.

5.8 — ANALYSES PLAN

5.8.1 — Analytical Methods

1. All laboratory analyses will be performed by an EPA contract laboratory certified by the State of Nevada to perform the analyses requested. Samples will be analyzed for parameters listed in 40 CFR. Part 258, Appendix I plus general chemistry. Groundwater levels will be measured before samples are obtained. Method detection limits (MDL) and practical quantitation limits (PQL) will be reported. Tentatively Identified Compounds (TICs) will be reported, even if they cannot be quantified.

5.8.2 Statistical and Nonstatistical Data Analysis

1. Instead of statistical data analysis methods, Schoeller semilogarithmic plots and graphical statistical methods will be used to analyze data. These plots have several advantages over statistical methods. Schoeller plots have a vertical scale measuring the log(base10) of the concentration in milliequivalents, so a great range of concentration can be plotted; also, six or more analyses can be plotted together, so subtle changes in ratios between wells or events at a single well are apparent. Unlike Piper diagrams, waters having similar ratios, but different concentrations of constituents, do not plot on top of each other.

2. Nonstatistical data analysis will be used to analyze the data obtained from laboratory analysis of groundwater samples. For inorganic data, the following sequence of analyses will occur:

3. Inspection of Data: Data will be reviewed for laboratory QA/QC, calculations, and on balance. Internal consistency of the data set will be reviewed (TDS versus the sum of major constituents, pH versus carbonate/bicarbonate, alkalinity versus bicarbonate). This step will precede use of the data in further analysis.

4. Graphical methods will be used to compare the most recent measurements with historical data for other wells, or for the same well, if data are available. This will include observations of data distribution for non-Gaussian (multi-modal or log-Pearson-type) distributions, which may limit the usefulness of some statistical methods. Means and standard deviations are strictly only valid for Gaussian distributions. Other types of presentation will include scatter plots of ratios of selected constituents, either in weight or milliequivalent format. Schoeller plots will be prepared to show "fingerprints" of ratios of selected inorganic constituents, both for single wells and between wells at the same time.

6.0 FIELD QUALITY ASSURANCE REQUIREMENTS

6.1 — DOCUMENTATION OF FIELD ACTIVITIES

6.1.1 — Field Activity Documentation

1. Field activities will be documented (in logs and notebooks), and filed with the project documentation. All of the data collected as discussed below will be summarized in Weekly Reports. Weekly Reports will be submitted with reports, etc. For each analyzed sample, the following information will be recorded and tracked:

    - Sample location,
    - Sample date,
    - Sample number,
    - Sample collector,
    - Laboratory,
    - Analytical method,
    - Temperature (if applicable),
    - pH (if applicable),
    - Specific conductivity (if applicable), and
    - Analytical results, including "not detected."

2. Groundwater and surface water elevation measurements also will be recorded and tracked by noting the following types of information as appropriate:

    - Measurement location,
    - Date,
    - Measurement personnel,
    - Depth to water,
    - Reference elevation,
    - Total well depth,

- Well screen interval,
- Top of casing elevation, and
- Notes on relevant weather conditions on the day of sampling or in the recent past.

6.1.2 — Boring Logs

1. Drilling and boring activities will be recorded on boring logs as directed by the Engineering Manager or Geologist.

6.1.3 — Monitoring Well Installation Record

1. Groundwater monitoring well construction will be documented on the Monitoring Well Installation Record as directed by the Engineering Manager or Geologist.

6.1.4 — Well Purging Logs

1. Groundwater well purging and sampling activities will be recorded on the Well Purging Log as directed by the Engineering Manager or Geologist.

6.1.5 — Groundwater Sample Collection Log

1. Groundwater sample collection (number, time, parameter, container, preservative, will be recorded on the Groundwater Sample Collection Log as directed by the Engineering Manager or Geologist.

6.1.6 — Surface Water Sample Log

1. Surface water sampling events will be recorded on Surface Water Sampling Logs as directed by the Engineering Manager or Geologist.

6.1.7 — Sediment Sample Collection Log

1. Sediment sample collection will be recorded on the Sediment Sample Collection Log as directed by the Engineering Manager or Geologist.

6.1.8 — Sample Documentation

1. Each sample will be uniquely numbered or coded. Gummed paper labels or tags will be used. At a minimum, the following will be provided:

   - Sample number,
   - Name of collector,
   - Date and time of collection,
   - Place of collection,
   - Type of sample,
   - Analysis to be performed, and
   - Preservatives, if applicable.

Labels will be affixed to sample containers prior to or at the time of sampling. The labels will be filled out at the time of collection.

6.1.9 — Landfill Gas Monitoring Data

1. Landfill gas monitoring data will be documented in a field notebook and downloaded from the GEM 500 into the LFG Monitoring Data spreadsheet format as directed by the Engineering Manager or Geologist.

6.2 — DECONTAMINATION PROCEDURES

1. Decontamination of water and soil sampling equipment will take place at sampling locations. Decontamination of drilling equipment and tools will take place in a designated area. Prior to arrival on site, all down-hole boring equipment should be steam-cleaned. Equipment used for drilling and sampling will be decontaminated prior to each use in accordance with the following cleaning procedures.

6.2.1 — Water Sampling Equipment

1. Decontamination of primary sampling equipment will be performed between each sample. Primary sampling equipment includes the bailer, sampling pump and Teflon bladder, and any other items that come into direct contact with the sample. The following decontamination procedure will be used:

   - Water rinse,
   - Non-phosphate detergent (Alkanox) solution wash,
   - Water rinse,
   - Nitric acid (10 percent solution) rinse,
   - Water rinse,
   - Alcohol (methyl, ethyl, or isopropyl) rinse, and
   - Distilled water rinse.

   All rinse water will be liberally applied. The order of this decontamination procedure will not vary. All personnel handling sampling equipment will wear gloves. Gloves will be changed between each sample, thereby minimizing the possibility of cross-contamination.

6.2.2 — Monitoring Well Installation Equipment

1. The drilling rig will be steam-cleaned prior to arrival on site. Before moving to each new boring location, the rear (working area) of the rig will be cleaned of mud and soil using a water spray and all down-hole equipment will be steam-cleaned of all extraneous matter including soil, mud, oil, grease, and hydraulic fluid.

6.2.3 — Soil and Sediment Sampling Equipment

1. The split spoon sampler used to sample borings, and the hand shovel used for sampling surface soils and sediments, will be rinsed free of soil using a water spray and decontaminated using the same procedure described above for water sampling equipment. This decontamination procedure is not required for obtaining geotechnical samples. Decontamination procedures for geotechnical samples are specified in subsection 2.3.6.

6.3 — CALIBRATION AND PREVENTIVE MAINTENANCE

6.3.1 — Calibration

1. Field instrument calibration, as an activity which affects data quality assurance, is performed in accordance with the following procedures. The calibration program will be administered by the Engineering Manager. Calibration will be performed in the field prior to each field event, at the end of each day, and following any unexpected, unusual, or suspect instrument readings. Copies of the manufacturer's calibration guidance are maintained with the respective instruments.

2. Calibration activities will be documented in a Calibration Logbook. The calibration data include: date, type and name of equipment, ambient conditions, identification or serial number, procedure, internal calibration system steps followed, results of calibration measurements, and name(s) of personnel conducting calibration. If the calibration schedules are not maintained or the specified accuracy cannot be attained, the instrument will be withdrawn for maintenance.

3. The field measurement equipment include:

   - PID/FID,
   - pH Meter,
   - Conductivity Meter,
   - Thermometer,
   - Water Level Indicator, and
   - Data Logger.
   - GEM-500
   - VO Meter
   - LEL Meter
   - H_2S Meter

   Procedures for equipment calibration are described in each of the manuals for the various equipment listed above. Specific calibration requirements will accompany each instrument.

4. Quality control (QC) check standards are analyzed for pH and conductivity at a frequency of 5 percent (at least once per batch) to assess the accuracy of these measurements in the field.

6.3.2 — Preventive Maintenance

1. Equipment and instruments are subject to the specified maintenance program. Preventive maintenance is performed and documented by the Engineering Manager or other personnel with oversight of the Engineering Manager. Field instruments, sampling equipment, and accessories are maintained in accordance with the manufacturer's recommendations and specifications, and established field practices. Maintenance is documented in an equipment maintenance log book.

2. A three-ring-binder equipment maintenance log book is kept permanently by the Engineering Manager. The Engineering Manager is responsible for maintaining the log book. The log book contains the following documentation:

   - List of all field instruments used.
   - Preventive maintenance schedule for each instrument (Exhibit 1).
   - Record of routine (preventive) maintenance to equipment.
   - Record of non-routine repairs to equipment.
   - Calibration Results

3. Should a field screening instrument be damaged and unusable for the proposed sample event, the Project Manager and Field Supervisor will discuss and decide on a course of action from several options, including:

   - Postpone and reschedule sampling event until equipment is repaired.
   - Delay completion and rent or purchase another piece of equipment.
   - Use back-up equipment.

4. Spare parts for field activities include:

   - Batteries for the pH-temperature meter,
   - Batteries for the Water Level Indicator, and
   - Spare thermometer.

5. Replacement parts or whole instruments can be obtained through express air transportation. In the event that the Engineering Manager must borrow or rent equipment in an emergency situation, the Engineering Manager will calibrate and maintain that equipment as described in this Plan and in accordance with the manufacturer's instructions.

6.4 — SAMPLE BOTTLE PREPARATION AND SAMPLE PRESERVATION

1. Sample bottles are either purchased pre-cleaned in accordance with EPA specifications or are cleaned in the laboratory to EPA specifications. Sample bottles containing pre-measured amounts of the appropriate chemical preservatives will be prepared by the contracted laboratory and will be shipped to the field office. Extra preservative will be supplied by the laboratory in a separate container in the event additional preservative

must be added to a sample to obtain the desired pH. The addition of extra preservative will be checked, and documented.

6.5 — REAGENTS AND STANDARDS

1. All chemicals that come in contact or might come in contact with a sample for chemical analysis (e.g., preservatives, decontamination liquid) will be analytical reagent grade or better. Reagent and standards utilized for field use are listed on Exhibit 2 along with the methods of storage. These reagents are transported to the field in the original containers or a container appropriately marked. Special care will be taken to prevent breakage of the bottles during transport. Incompatible reagents will not be stored in the same cabinet.

6.6 — SAMPLE CHAIN-OF-CUSTODY

1. Sample custody consists of tracing and documenting the movement of sample containers and samples from the laboratory to the sample site, back to the laboratory, through the analysis process, and then to final disposal.

2. The contracted laboratory initiates sample custody upon transmittal of the pre-cleaned sample containers using a chain-of-custody (COC) form. The sample containers and the COC are received at the Engineering Manager's office by field personnel responsible for site sampling. Sample custody then proceeds under the following field sampling operation conditions.

3. Sample numbers on all documents and correspondence, including the COC, will be consistent with those numbers assigned to the sampling locations as identified in the field logs.

4. Care will be taken to prepare the sample container surface to assure label adhesion. Waterproof ink will be used to complete sampling container labels. The original COC form will be retained by the laboratory while a copy with receipt acknowledged will become a part of the permanent file. If the samples are delivered by a messenger or shipper, the COC will be placed in a zip-lock-type bag and taped to the lid of the shipping cooler. The shipping cooler will then be sealed with strapping tape and custody seals, which must be torn to open the cooler. A copy of the COC form and of the shipping manifest will become a part of the permanent project file along with further correspondence regarding the custody of the samples (telephone log confirming receipt, forwarded copy of Record, etc.). A sample is considered in custody if it is:

   - In a person's actual possession,
   - In view after being in physical possession,

- Sealed so that no one can tamper with it after having been in physical custody,
- In a controlled area, restricted to authorized personnel, and
- In transit with the approved shipping carrier.

5. The COC form should document, at a minimum:

   - Project name and number;
   - Sample number;
   - Sample location (e.g., boring, well number, test pit and depth or sampling interval);
   - Sample type (e.g., water, soil);
   - Sampling date and time;
   - The signatures of the individual(s) performing the sampling;
   - Sample preservative used (if appropriate), pH confirmed (if appropriate), and note if additional preservative is added;
   - Analysis to be performed;
   - Total number of sample containers in the shipment; and
   - Signatures of the people involved and dates of receipt in the chain of possession.

6. In addition to documenting samples on the COC, field personnel will be responsible for signing all field sampling log documents, uniquely identifying and labeling samples, and providing proper packaging of samples to preclude breakage during shipment. Errors on all documents will be struck through with a single line and initialed by the person making the correction.

6.7 – SAMPLE SHIPMENT

1. The samples will be delivered to the laboratory for analysis within the specified allowable holding time. The samples will be accompanied by the chain-of-custody record. The samples will be delivered to the person in the laboratory authorized to receive samples.

2. Samples will either be directly transported to the lab by field sampling personnel, or will be packaged and shipped overnight express according to U.S. Department of Transportation and EPA regulations. Specifically, samples will be packed in the following manner:

   - Labeled and sealed samples will be placed in a cooler, with ice (if appropriate) to maintain the samples at 4°C during shipment.
   - Coolers will be packed with vermiculite or other absorbent material to minimize the possibility of breaking, and to absorb liquids in the event breakage occurs.
   - The completed chain-of-custody record, including the total number of sample containers, will be placed in a zip-lock plastic bag and taped to the inside lid of the cooler.
   - The coolers will be closed and latched.

- Custody seals will be placed on coolers to prevent tampering.
- Coolers will be sealed with packing tape placed over the custody seals.
- "Environmental Sample" and "This End Up" labels will be placed on coolers.

3. As soon as field personnel are ready to transport samples from the field to the laboratory, they will notify the laboratory by telephone of the shipment. If the samples are transported by field personnel, the estimated time of arrival at the laboratory will be given. If the samples are shipped by commercial carrier, the laboratory will be telephoned after the shipping containers are consigned to the shipper and advised of the shipment. Commercial carriers include but will not be limited to United Parcel Service, Federal Express, and commercial bus and airline services. The name of the carrier service will be noted in the Special Instructions/Comments section on the COC form. The shipping service selected will depend upon the holding times of the samples contained in the cooler and the quantity of ice in the cooler to maintain the desired temperature (if approriate).

6.8 — FIELD QUALITY ASSURANCE SAMPLES

1. Field QA samples will consist of field blanks, duplicates, rinseate blanks, and trip blanks.

2. One field blank will be obtained for each of the surface water and groundwater sampling rounds. The field blank will be prepared using distilled water, which will be transferred into the appropriate sample containers in the field. The same number and type of sample containers required for water samples will be used for the field blank. The field blank samples will be handled, labeled, preserved, and shipped in the same manner as the other water samples.

3. A duplicate sample will be obtained during each round of groundwater sampling. The duplicate will be collected at one of the downgradient groundwater sampling locations to be selected in the field at the time of sampling. Again, the duplicate sample will be handled, labeled, preserved, and shipped in the same manner as the other groundwater samples.

4. Rinseate blanks will be obtained after equipment has undergone decontamination and been allowed to dry. Distilled water will be used to rinse the tool, allowing the rinseate to be collected in a clean sample jar. Rinseate blanks for each parameter group will be submitted and analyzed once for each type of equipment set used during sampling activities.

5. One set of trip blanks will be analyzed for each round of VOC analysis. Trip blanks will consist of VOC sample containers.

6. Duplicate sample collection frequency and procedures are described below for soil and waste samples.

7. For at least one out of every ten samples or once per day, whichever is less, a collocated ("duplicate") sample will be collected. Collocated samples will be collected using the same equipment and type of containers as are used for routine sample collection, utilizing the standard procedures already provided herein. Care will be taken to keep the composition of both the original and collocated samples as similar as possible (i.e., from the same stratigraphic layer, moisture content, appearance, etc.). The collocated samples will be identified by similar identifiers (i.e., sample numbers) as are used for routine samples, so as not to alert the laboratory to the presence of QA samples. The collocated samples will be submitted to the laboratory to be analyzed for the same parameters and by the same methods, as are the routine samples.

8. In addition, at each sample collection location, one collocated sample may be collected, packaged, labeled, and archived on-site until testing is satisfactorily completed and the Engineering Manager or designee releases the sample(s) for disposal. As with the samples sent off-site to the analytical laboratory (see Item 7 above), care will be taken to keep the composition of both the original and collocated samples as similar as possible.

9. Duplicate sample collection will be documented in the field activity Report and/or an appropriate monitoring data sheet.

10. Additional QA/QC requirements are discussed below.

6.9 — FIELD DATA REVIEW AND STORAGE

1. Raw data collected in the field and placed in the project files will be checked routinely. At the end of each field episode (e.g., installation of wells, surveying, first round of sampling), the Engineering Manager will review the field logs.

EXHIBIT 1. PREVENTIVE MAINTENANCE SCHEDULE

Instrument	Activity	Frequency
PH Meter	Rinse electrode with tap water. Shake dry. Place KCl solution in protective cap. Replace protective cap. Refill KCl solution. Battery checks. Clean Probe. Clean Unit.	Monthly during storage and following each field use. When needed. After each use. Monthly. After each use.
Thermometer	Clean Unit.	After each use.
Conductivity Meter	Rinse electrode with distilled water. Shake dry. Store away from high voltage and transformers. Re-plating of probe. Battery Check. Clean Probe. Clean Unit.	After each field use. When needed. After each use. Monthly After each use.
Water Level Indicator	Check Battery Clean electrode	Change if needed After each field use
GEM 500 Infrared Gas Analyzer	Check Battery Calibrate CO_2, CH_4, and O_2 using CH_4/CO_2 gas mixture with zero O_2	Change if needed Before each field use
H_2S Meter	Check Battery Calibrate using standard H_2S in air mixture	Change if needed Before each field use
LEL Meter	Check Battery Calibrate using standard CH_4 in air mixture	Change if needed Before each field use

EXHIBIT 2. REAGENT AND STANDARD STORAGE

Chemical	Method of Storage	Source
Isopropanol, Methanol	Stored in original containers in vented cabinet with no other chemicals.	Baxter Scientific Products
PH Standards	Stored in cabinet maintained solely for pH and conductivity standards, plastic container	Davis Environmental Supplies
Conductivity Standards	Same as pH standards.	Davis Environmental Supplies
15% Nitric Acid Solution 1:1 HCL H_2SO_4	Stored in glass container in vented cabinet.	From the contract laboratory
NaOH Solution (50 %)	Stored in properly-labeled plastic bottle	From the contract laboratory
$Na_2S_2O_3$, Ascorbic Acid	Stored in properly-labeled glass or plastic jar.	From the contract laboratory

7.0 — PROPOSED LABORATORIES

7.1 — ANALYTICAL LABORATORY FOR SOIL AND WASTE SAMPLES

The following laboratory (or equivalent) will be used for analytical testing of soil and waste samples. The laboratory's address, phone number and certifications are as follows:

ADDRESS:

NEL LABORATORIES
Las Vegas Division
4208 Arcata Way, Suite A
Las Vegas, NV 89030

PHONE, FAX, AND CONTACT:

Phone: (702) 657-1010
Fax: (702) 657-1577

Contact: Stan Van Wagenen
Laboratory Manager

CERTIFICATIONS:

Arizona	AZ0518
California	2002
USCOE	Certified
Idaho	Certified
Montana	Certified
Nevada	NV052

7.2— GEOTECHNICAL LABORATORY FOR SOIL SAMPLES

The following laboratory (or equivalent) will be used for geotechnical testing of soil samples. The laboratory's address, phone number, and certifications are as follows:

ADDRESS:

Geotechnical & Environmental Services, Inc.
7560 W. Sahara Ave., Suite 101
Las Vegas, NV 89117

PHONE, FAX, AND CONTACT:

Phone: (702) 365-1001
Fax: (702) 341-7120

Contact: Gregory P. DeSart, P.E., C.E.M.

CERTIFICATIONS:

AASHTO Accredited In-House Laboratory

7.3— ANALYTICAL LABORATORY FOR GAS/AIR SAMPLES

The following laboratory (or equivalent) will be used for analytical testing of gas/air samples. The laboratory's address, phone number and certifications are as follows:

ADDRESS:

Performance Analytical Inc.
Air Quality Laboratory
2665 Park Center Drive, Suite D
Simi Valley, CA 93065

PHONE, FAX, AND CONTACT:

Phone: (805) 526-7161
Fax: (805) 526-7270

Contact: Michael Tuday
Laboratory Director

CERTIFICATIONS:

American Industrial Hygiene (AIHA)	Lab#11002 Certification#508
California Department of Toxic Substance	#2181
New York Department of Health Air &Emissions	#11221
Arizona Department of Health Services	#AZ0550

National Institute for Occupational Safety and Health participant in the quarterly Proficiency Analytical Testing Program

7.4 — ANALYTICAL LABORATORY FOR GROUNDWATER SAMPLES

The following laboratory (or equivalent) will be used for analytical testing of soil and waste samples. The laboratory's address, phone number and certifications are as follows:

ADDRESS:

NEL LABORATORIES
Las Vegas Division
4208 Arcata Way, Suite A
Las Vegas, NV 89030

PHONE, FAX, AND CONTACT:

Phone: (702) 657-1010
Fax: (702) 657-1577

Contact: Stan Van Wagenen
Laboratory Manager

CERTIFICATIONS:

Arizona	AZ0518
California	2002
USCOE	Certified
Idaho	Certified
Montana	Certified
Nevada	NV052

APPENDIX C

WORK SCHEDULE FOR SITE ASSESSMENT

OVERSIZE ITEM(S)

Due to the size of this item, it has been scanned separately.

See Document #_____**2029889**_____ for scanned image(s).