NM2 - ____4_______

GENERAL CORRESPONDENCE YEAR(S):

__2008 - 2010_____

BMG

BENSON~MONTIN~GREER DRILLING CORP

4900 College Boulevard Farmington, NM 87401 Office: 505.325.8874 Fax: 505.327.9207

RECEIVED
2008 AUG 29 PM 12 34

August 27, 2008

Mr. Brad Jones
New Mexico Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Re: Benson-Montin-Greer Centralized Surface Waste Management Facility
NWNW Sec. 20, T25N, R1E, Rio Arriba County, NM

Dear Mr. Jones:

Benson-Montin-Greer will be installing the new primary liner at the referenced Evaporation Pond the week of September 2 or September 8, 2008. As you may recall, we have determined the integrity of the secondary liner has not been compromised and will install a new 60-mil HDPE liner as the primary.

Please let us know of any questions or requirements you need.

Sincerely,

Mike Dimond

Mike Dimond
President

AES

Animas Environmental Services, LLC

624 E. Comanche . Farmington, NM 87401 . Tel 505-564-2281 . Fax 505-324-2022 . www.animasenvironmental.com

RECEIVED

2008 MAY 2 PM 1 43

April 29, 2008

Wayne Price
New Mexico Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

RE: Submittal of Revised Sampling and Analysis Plan (SAP) and Project Notification for Site Investigation Activities at BMG's Evaporation Pond at the Centralized Surface Waste Management Facility, Rio Arriba County, New Mexico

Dear Mr. Price:

Enclosed please find the Revised Sampling and Analysis Plan (SAP) prepared by Animas Environmental Services, LLC (AES) for site investigation activities at Benson-Montin-Greer Drilling Corporation's (BMG's) Evaporation Pond located at the BMG Centralized Surface Waste Management Facility in Rio Arriba County, New Mexico.

This letter also serves as project notification for installation of groundwater monitor wells at the site. AES has scheduling site drilling for May 5 and 6, 2008, and the project manager on-site will be Ross Kennemer.

If you have any questions regarding the enclosed Revised SAP or scheduled site activities, please do not hesitate to contact me or Ross Kennemer at (505) 564-2281.

Sincerely,

Elizabeth McNally, P.E.

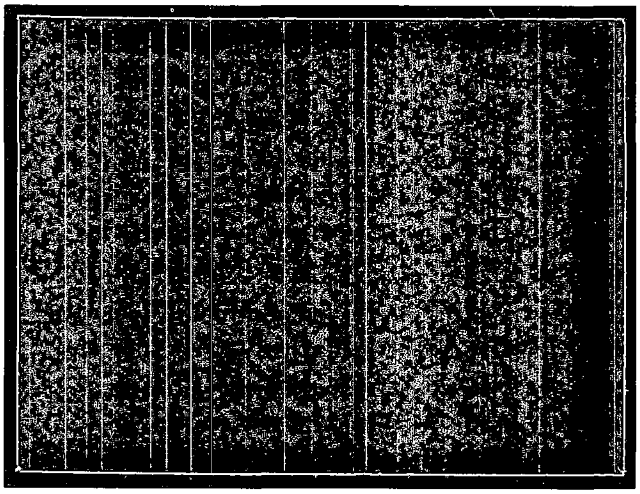
Enclosure: Revised Sampling and Analysis Plan

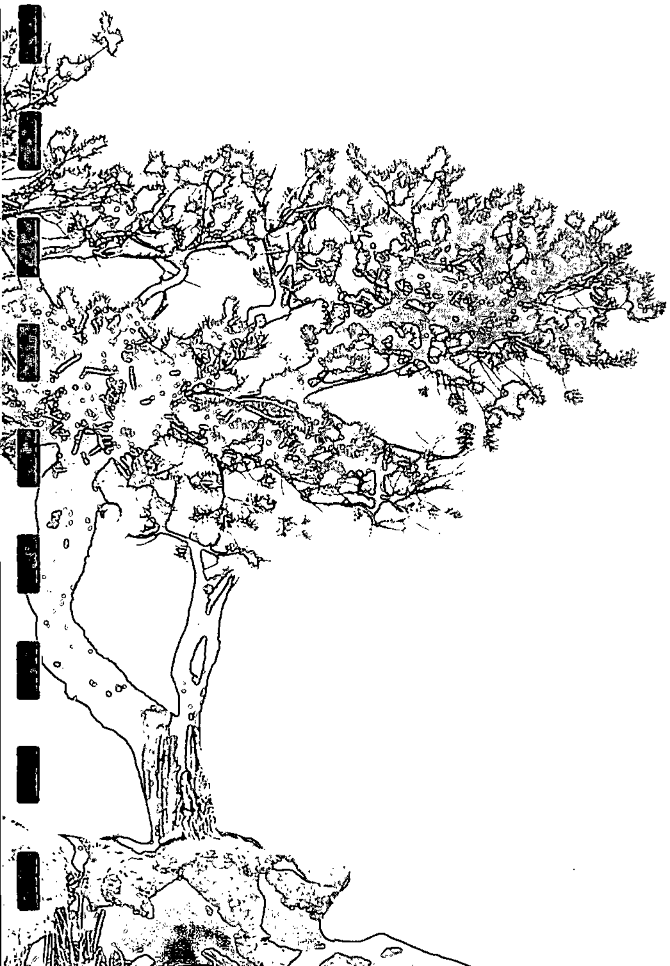
Cc: Mike Dimond
Benson-Montin-Greer Drilling Corporation
4900 College Blvd
Farmington, New Mexico 87402

Brandon Powell
New Mexico Oil Conservation Division
1000 Rio Brazos Rd.
Aztec, New Mexico 87410

Files:2008/BMG/Evaporation Pond/gc NMOCD 042908

AES Animas Environmental Services, LLC





AES Animas Environmental Services, LLC

624 E. Comanche . Farmington, NM 87401 . TEL 505-564-2281 . FAX 505-324-2022 . www.animasenvironmental.com

Prepared for:
Wayne Price
New Mexico Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

Brandon Powell
New Mexico Oil Conservation Division
1000 Rio Brazos Road
Aztec, New Mexico 87410

REVISED SAMPLING AND ANALYSIS PLAN

Centralized Surface Waste Management Facility Evaporation Pond

Benson Montin Greer
NW¼ NW¼ of Section 20, T25N, R1E
Rio Arriba County, New Mexico

Date of Plan: April 28, 2008

Prepared on behalf of:
Benson-Montin-Greer Drilling Corporation
4900 College Blvd.
Farmington, New Mexico 87402

Prepared by:
Animas Environmental Services, LLC
624 E. Comanche
Farmington, New Mexico 87401

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Appendix A. Standard Operating Procedures – Drilling
Standard Operating Procedures – Equipment Decontamination
Standard Operating Procedures – Subsurface Soil Sampling
Standard Operating Procedures – Field Measurement of Organic Vapors
Standard Operating Procedures – Soil Sampling Procedures at Petroleum Storage Tank Sites
Standard Operating Procedures – Packing and Shipping Samples
Standard Operating Procedures – Design and Installation of Monitoring Wells
Standard Operating Procedures – Well Development and Purging
Standard Operating Procedures – Groundwater Monitoring Well Measurement
Standard Operating Procedures – Groundwater Sampling Using Bailers
Standard Operating Procedures – Investigation Derived Waste Handling

1.0 Introduction

Animas Environmental Services, LLC (AES), on behalf of Benson Montin Greer Drilling Corporation (BMG), submits this Sampling and Analysis Plan (SAP) for the BMG Centralized Surface Waste Facility's Evaporation Pond subsequent to electronic correspondence between BMG and Wayne Price of the New Mexico Oil Conservation Division (NMOCD) on April 21, 2008. A leak from the evaporation pond was confirmed when AES observed water within the interstitial monitoring well between the primary and secondary pond liner on April 14, 2008.

2.0 Site Information

2.1 Site Location

The evaporation pond is located in the northeast corner of the BMG Centralized Surface Waste Facility located in the NW¼ NW¼ of Section 20, Township 25N, Range 1E, Rio Arriba County, New Mexico. A topographic site location map and a general site map are included as Figure 1 and Figure 2, respectively. The location of the interstitial monitoring well is shown on Figure 3.

3.0 Proposed Scope of Work

Site investigation activities will be initiated in order to determine whether the integrity of the secondary pond liner has been compromised, resulting in pond contents leaking into the subsurface. The investigation procedures are designed to be protective of both soil and groundwater and are based upon protocols outlined in the USEPA documents, *Expedited Site Assessment Tools for Underground Storage Tank Sites*, March 1997, and *Site Characterization for Subsurface Remediation*, November 1991.

3.1 Utilities Notification

AES will utilize the New Mexico One-Call system to identify and mark all underground utilities at the site before the start of any field activities which could impact buried utilities. Any local utilities not participating in the New Mexico One-Call system will be contacted separately by AES for utility locations.

3.2 Health and Safety Plan

AES has a Health and Safety Program in place to ensure the health and safety of all AES employees. The Health and Safety Program defines safety practices and procedures to be instituted in all AES work places, as applicable. The program meets the requirements promulgated by the Occupational Safety and Health Act (OSHA). All AES personnel are appropriately trained in accordance with OSHA 40 CFR 1910.120.

A comprehensive site-specific Health and Safety Plan (HASP) addressing the site investigation and associated sampling will be prepared prior to the start of the field work. All employees and subcontractors will be required to read and sign the HASP to acknowledge their understanding of the information contained within it. The HASP will be implemented and enforced on site by the assigned Site Safety and Health Officer. Daily tailgate meetings will be held and documented during field activities and will address specific health and safety concerns or issues.

3.3 Installation of Soil Borings

AES proposes to install four soil borings, each of which will be completed as a groundwater monitoring well, along the perimeter of the evaporation pond in order to determine whether or not groundwater has been impacted by a potential release from the pond's secondary liner. The locations of the soil borings/monitor wells will be determined in the field based on the observations and best judgment of the AES project manager in consultation with BMG and NMOCD representatives that may be on-site. It is anticipated that groundwater will be encountered between 30 and 50 feet below ground surface. Possible locations of the soil borings/monitor wells are shown on Figure 3.

Soil borings will be advanced with a CME 75 hollow stem auger drill rig, utilizing 7.25 inch outside diameter augers. Drilling will be provided by Envirodrill, Albuquerque, New Mexico. All drilling will be completed in strict accordance with the Standard Operating Procedure (SOP) for hollow stem auger drilling included in Appendix A. Strict decontamination procedures for drilling and sampling equipment will be maintained in accordance with the SOP included in Appendix A.

3.4 Soil Sampling and Analyses

3.4.1 Soil Sample Collection

Soil samples will be collected from continuously driven core-barrel samplers during advancement of the soil borings, and for each soil boring, a Soil Boring Log will be completed. These logs will record observations of soil moisture, color, density, grain size, plasticity, contaminant presence, and overall stratigraphy. Soil sample collection will be completed in strict accordance with the SOP included in Appendix A.

3.4.2 Field Screening

Soil samples will be collected from each boring at intervals of five feet and field screened for volatile organic vapors utilizing a photo-ionization detector (PID) organic vapor meter (OVM) calibrated with isobutylene gas to obtain preliminary data regarding potential petroleum hydrocarbon-impacted soil.

Once collected, the soil sample to be field screened will be immediately placed in a clean 16 ounce glass jar, filled approximately half full, and sealed with a threaded ring lid and a sheet of aluminum foil. The sample jar will then be placed in a warm water bath where it will be warmed to approximately 80°F. Approximately ten minutes will be allowed for the soil to be heated and for any VOCs in the soil to accumulate in the head space of the jar. During the initial stages of headspace development, the sample will be gently shaken for one minute to promote vapor development and disaggregate the sample. Volatile gases will then be measured by piercing the aluminum foil with the sample probe of the PID-OVM. The highest (peak) measurement will be recorded.

The action level for PID-OVM readings will be considered to be any reading that is above a concentration of 10 parts per million (ppm). The extent of soil contamination will continue to be defined in either a vertical and/or horizontal direction until non-detectable field screening concentrations are reached. PID-OVM readings will be recorded onto the Soil Boring Logs. All field screening will be completed in strict accordance with the SOP included in Appendix A.

3.4.3 Laboratory Analyses - Soil

AES will collect at least two soil samples from each soil boring for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), total petroleum hydrocarbons (TPH), and chlorides. At least one sample will be collected from the depth at which the highest soil vapor reading is observed and one sample will be collected from the final boring depth, or if groundwater is encountered, from just above the capillary fringe. Soil sample collection will be completed in strict accordance with the SOP included in Appendix A.

Analytical samples collected from soil borings will be submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 1. Soil Analytical Parameters

Parameter	*Analytical Method*	*Analyzing Laboratory*
BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Total Petroleum Hydrocarbons (TPH) (C_6-C_{36})	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

Once collected, sample containers will be packed with ice in insulated coolers and shipped via UPS or Greyhound Bus to the analyzing laboratory. Typical laboratory regular turn around time is 12 to 15 business days. Sample handling and shipping will be completed in strict accordance with the SOP included in Appendix A.

For all laboratory samples, quality assurance and quality control (QA/QC) procedures, sample preservation, apparatus required, and analyses performed will be in accordance with USEPA Document EPA-600, "Methods for Chemical Analysis for Water and Wastes" dated July 1982; and USEPA document SW-846, 3rd Edition, "Test Methods for Evaluating Solid Waste: Physical Chemical Methods", dated November, 1986.

3.5 *Groundwater Monitor Well Installation*

3.5.1 Groundwater Monitor Well Installation and Construction

Two-inch diameter groundwater monitoring wells will be installed within each of the four soil borings. The screened interval will extend 15 feet across the water table, with 5 feet above and 10 feet below the water table. The wells will be constructed of 2-inch PVC well screen (0.010-inch slot) and 2-inch PVC blank casing. A filter pack of 10/20 Colorado silica sand well placed from the bottom of the well to one foot above the upper most screen slot. A bentonite seal will be placed above the sand pack, and concrete grout with approximately five percent bentonite will be poured from the top of the bentonite plug up to within a foot of ground surface. An above grade locking steel protective casing, enclosed with a shroud of concrete, will be installed on the well to prevent unauthorized access and damage. A proposed monitoring well construction schematic is included on Figure 4. Monitoring wells will be designed and installed in strict accordance with the SOP included in Appendix A.

3.5.2 Groundwater Monitor Well Development

Following monitor well installation and completion, each well will be developed by a combination of surging and bailing techniques. Monitoring wells will be developed in strict accordance with the SOP included in Appendix A.

Groundwater purged from the wells will be contained in labeled and sealed 55-gallon drums. Development water will be drummed and labeled and will remain on-site in a secure location until proper disposal as described below in Section 3.6.2.

3.5.3 Groundwater Monitor Well Monitoring and Sampling

Upon completion and development, the monitor wells will be allowed to sit undisturbed for a minimum of one week. The groundwater monitor wells will then be gauged to determine water table elevation and direction of groundwater flow. The wells will then be purged of a minimum of three well volumes, and a groundwater sample will be collected from each well.

Groundwater samples will be collected from each well with a dedicated aqua-bailer. Purging data, including pH, temperature, conductivity, oxidation-reduction potential, and dissolved oxygen, will be measured with a YSI water quality meter and documented on a Water Sample Collection Form along with purged water volume. All sampling equipment will be thoroughly decontaminated between uses.

Duplicate groundwater samples will be collected from each monitoring well and held in the event that further laboratory analyses are required. All sample collection data, including sample collection depth, will be documented on a Water Sample Collection Form. A Chain of Custody Record will be completed in the field as samples are being collected. Samples will be stored in a chilled, insulated cooler at 4°C until delivered to the analyzing laboratory.

Groundwater gauging, sampling, and shipping will be completed in strict accordance with the SOPs included in Appendix A.

3.5.4 Professional Survey

The location and elevation of the top of each well casing will be surveyed to the nearest 0.01 foot with reference to mean sea level by a licensed surveyor in order to accurately determine the local groundwater depth and flow direction beneath the site. Each well will be tied to an existing USGS benchmark. AES will arrange with a New Mexico Licensed Professional Surveyor to complete the survey upon completion of the monitoring well installation.

3.5.5 Laboratory Analyses - Groundwater

All groundwater analytical samples collected from the monitoring wells will be submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 2. Groundwater Analytical Parameters

Water Sample Location	*Parameter*	*Analytical Method*	*Analyzing Laboratory*
All Monitoring Wells	BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Total Dissolved Soilds	SM 2540C	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

A travel blank and field blank will be analyzed for BTEX per EPA Method 8021B. Once collected, sample containers will be packed with ice in insulated coolers and shipped via UPS or Greyhound Bus to the laboratory. Typical laboratory regular turn around time is 12 to 15 days.

For all laboratory samples, QA/QC procedures, sample preservation, apparatus required, and analyses performed will be per USEPA Document EPA-600, "Methods for Chemical Analysis for Water and Wastes" dated July 1982; and USEPA document SW-846, 3rd Edition, "Test Methods for Evaluating Solid Waste: Physical Chemical Methods", dated November 1986, as amended by Update One, July 1992.

3.6 Investigation Derived Waste - Waste Acceptance Criteria

All investigation derived waste will be managed in accordance with applicable State and Federal regulations and in strict accordance with the SOP included in Appendix A.

3.6.1 Investigation Derived Waste - Soil

All drill cuttings will be placed within 55-gallon DOT approved drums, which will then be marked with identification and sealed. Samples of the drummed drill cuttings will be collected and submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 3. Investigation Derived Waste – Soil Analytical Parameters

Water Sample Location	*Parameter*	*Analytical Method*	*Analyzing Laboratory*
Each Drum	BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Paint Filter	SW 9095A	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

The final disposition of the drill cuttings will be based on the results of the above analyses and the following criteria:

1. Hydrocarbon contaminants are of a type that can be remediated, as determined by NMOCD
2. "Passing" result of Paint Filter Test
3. Chloride concentration of less than 500 ppm

If all of the three criteria above are met, drill cuttings will then be disposed of at the BMG Landfarm, an NMOCD approved facility. In the event that any of the three criteria is not met, an alternative disposal facility will be selected based on consultation with the NMOCD. Disposal manifests will be included within the assessment report.

3.6.2 Investigation Derived Waste - Groundwater

Groundwater obtained from monitoring well development and pre-sample purging will be stored on-site within 55-gallon DOT approved drums, which will then be marked with identification and sealed. Samples of the drummed groundwater will be collected and submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 4. Investigation Derived Waste – Groundwater Analytical Parameters

Water Sample Location	*Parameter*	*Analytical Method*	*Analyzing Laboratory*
Each Drum	BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

The final disposition of the purged groundwater will be based on the results of the above analyses and the following criteria:

1. Hydrocarbon contaminants are of a type that can be remediated, as determined by NMOCD
2. Chloride concentration of less than 500 ppm

If each of the two criteria above is met, purged groundwater will then be disposed of at the BMG evaporation pond, an NMOCD approved facility, following either repair or replacement of the ponds primary liner. In the event that either of the two criteria is not met, an alternative disposal facility will be selected based on consultation with the NMOCD. Disposal manifests will be included within the assessment report.

3.6.3 Investigation Derived Waste – Equipment Decontamination Water

All investigation derived decontamination and rinse water will be managed, sampled, analyzed, and disposed in accordance with those methods described Section 3.6.2.

3.6.4 Pond Liner Disposal

In the event the pond liner is to be replaced rather than repaired, the damaged liner will be disposed of at the San Juan County Landfill, Crouch Mesa, New Mexico. Determination of repair or replacement will be made in consultation with the NMOCD.

3.7 *Quality Assurance/Quality Control and Chain of Custody Procedures*

3.7.1 Quality Control Samples

Field quality control samples will be collected in order to assess variability of the media being sampled and to detect contamination and sampling error in the field. Field QC samples will include field duplicates and trip blanks.

- One field duplicate sample will be collected for every ten field samples collected for laboratory analysis in order to check for reproducibility of laboratory and field procedures.

- One trip blank sample will be utilized per sampling event to check for contamination of volatile organic samples during handling and shipment from the field to the analyzing laboratory.

Laboratory QC samples will be analyzed by the laboratory and will consist of matrix spike and matrix spike duplicates for organic samples in order to identify, measure, and control the sources of error that may be introduced from the time of sample bottle preparation through analysis.

3.7.2 Sample Quality Assurance Elements

Sample quality assurance elements will include the following:

1. *Sample documentation (location, date and time collected, batch, etc.)*
2. Complete chain of custody records
3. Initial and periodic calibration of field equipment
4. Determination and documentation of applicable detection limits
5. Analyte(s) identification
6. Analyte(s) quantification

3.7.3 Chain of Custody Record

A Chain of Custody Record will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for, and a copy of the record will be kept by each individual who has signed it. The Chain of Custody Record will include the following information:

1. Sample identification
2. Sample location
3. Sample collection date
4. Sample information, i.e., matrix, number of bottles collected, etc.
5. Names and signatures of samplers
6. Signatures of all individuals who have had custody of the samples

When samples are not under direct control of the individual currently responsible for them, they will be stored in a locked container which has been sealed with a Custody Seal.

3.7.4 Custody Seal

Custody seals demonstrate that a sample container has not been opened or tampered with. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

4.0 Deliverables

Within 60 days of the completing the SAP, a Site Assessment Report (SAR) summarizing the SAP activities will be submitted to the NMOCD. The SAR will include the following:

1. A summary of all work conducted in the implementation of the SAP;
2. Maps of all soil boring/monitoring well locations, sampling results, geologic cross sections, and soil and groundwater contamination plumes;
3. All laboratory data and quality assurance and quality control information; and
4. Recommendations of further sampling which needs to be conducted as a result of the sampling pursuant to the SAP.
5. Recommendations for further remediation measures

5.0 Implementation Schedule

AES proposes to install and develop the monitoring wells during the week of May 5, 2008. AES personnel will return to the site the following week to collect groundwater samples. AES will prepare the SAR, which will be submitted to the NMOCD within 30 days of receipt of the analytical results.

6.0 Certification

AES has prepared this Sampling and Analysis Plan on behalf of Benson Montin Greer Drilling Corporation to determine whether the integrity of the secondary liner of the evaporation pond has been compromised resulting in a release to the environment.

Respectfully submitted,

Landrea R. Cupps
Lany Cupps
Project Manager

Ross Kennemer
Senior Environmental Scientist

7.0 References

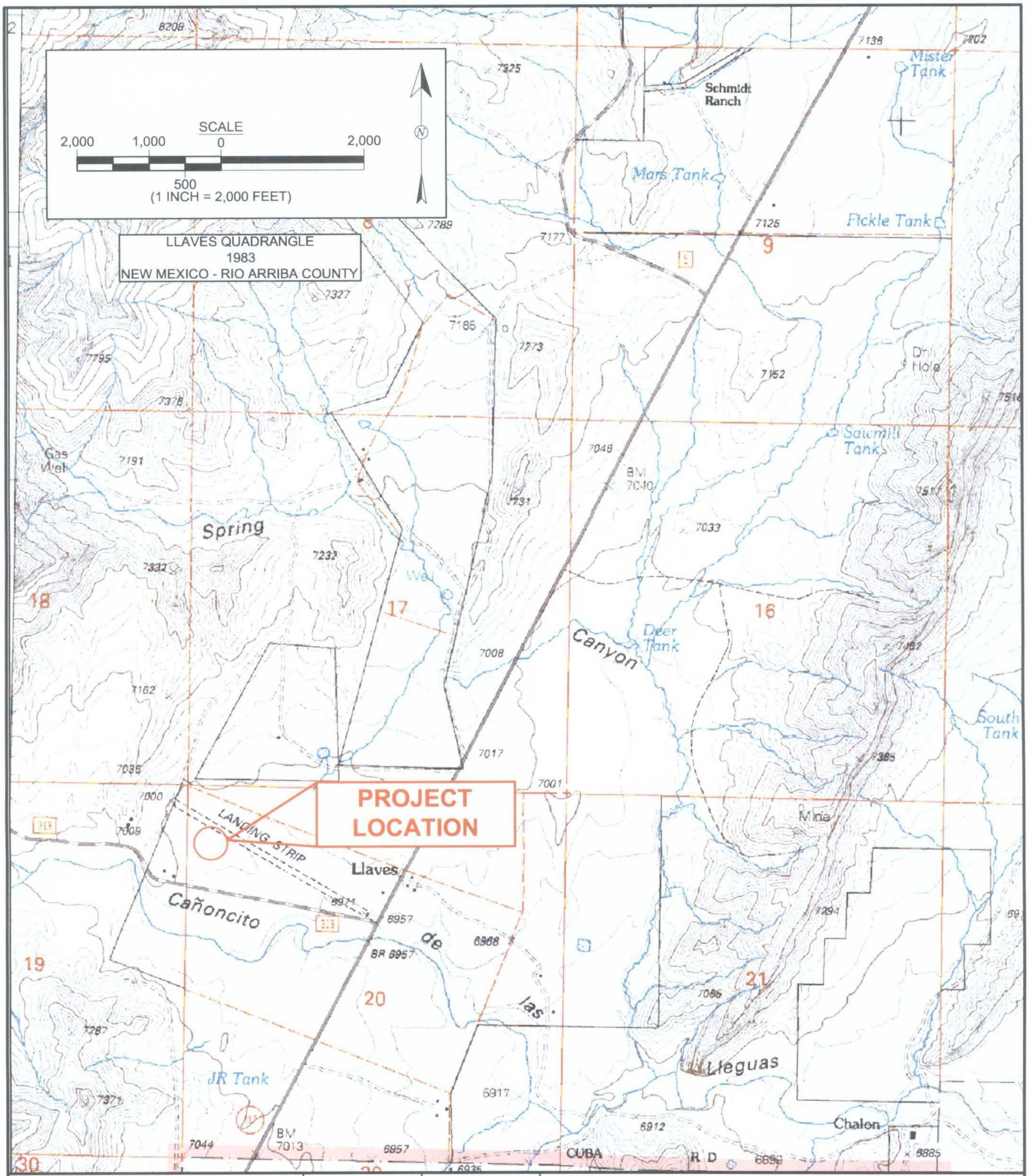
U.S. Environmental Protection Agency (USEPA). 1982. *Methods for Chemical Analysis for Water and Wastes.* Document EPA-600, July, 1982.

USEPA. 1992. SW-846, 3rd Edition, *Test Methods for Evaluating Solid Waste: Physical Chemical Methods*, dated November, 1986, and as amended by Update One, July, 1992.

USEPA. 1991. *Site Characterization for Subsurface Remediation*, EPA 625/4-91-026, November, 1991.

USEPA. 1997. *Expedited Site Assessment Tools for Underground Storage Tank Sites.* OSWER 5403G and EPA 510B-97-001, March, 1997.

USEPA. 2001. Contract Laboratory Program (CLP) Guidance for Field Samplers. OSWER 9240.0-35, EPA 540-R-00-003. June, 2001.



DRAWN BY:	DATE DRAWN:
R. Kennemer	April 28, 2008
REVISIONS BY:	DATE REVISED:
R. Kennemer	April 28, 2008
CHECKED BY:	DATE CHECKED:
L. Cupps	April 28, 2008
APPROVED BY:	DATE APPROVED:
E. McNally	April 28, 2008

AES
Animas Environmental Services, LLC

FIGURE 1
TOPOGRAPHIC SITE LOCATION MAP
BENSON-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW ¼, NW ¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 1 TOPO LOCATION MAP

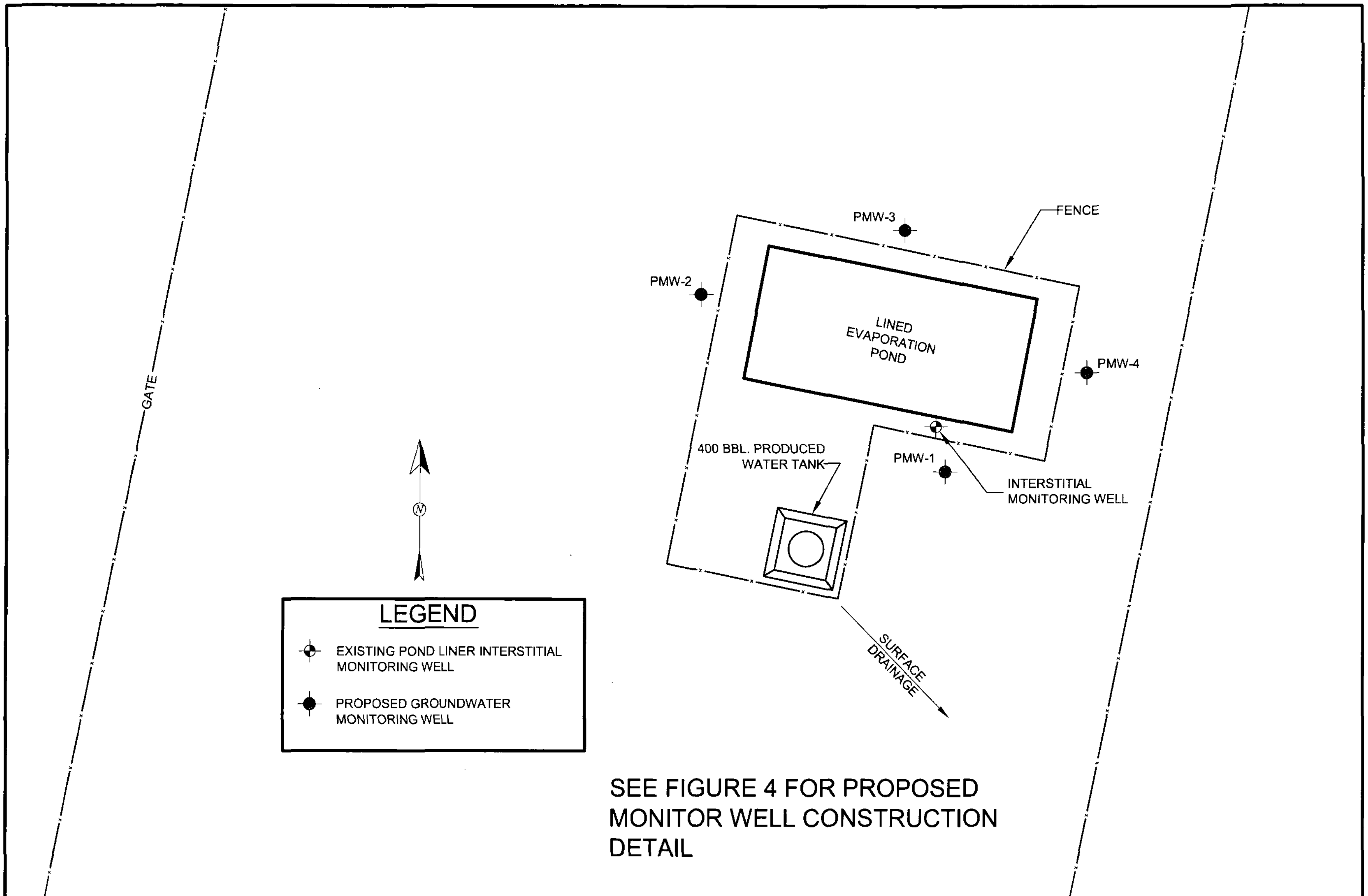
AES
Animas Environmental Services, LLC

DRAWN BY:	DATE DRAWN:
R. Kennemer	April 28, 2008
REVISIONS BY:	DATE REVISED:
R. Kennemer	April 28, 2008
CHECKED BY:	DATE CHECKED:
L. Cupps	April 28, 2008
APPROVED BY:	DATE APPROVED:
E. McNally	April 28, 2008

SCALE
100 50 0 100
25
(1 INCH = 100 FEET)
N

FIGURE 2
GENERAL SITE PLAN
BENS0N-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW ¼, NW ¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 2 SITE PLAN



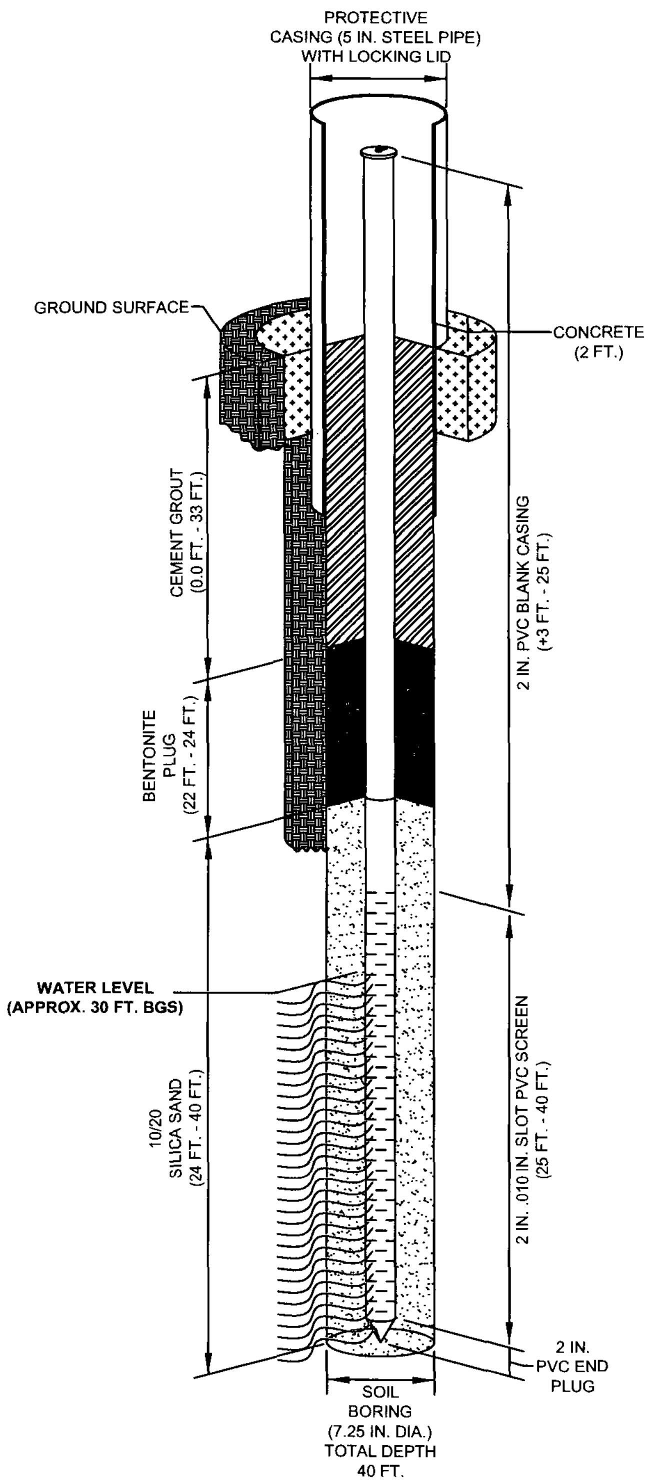
AES
Animas Environmental Services, LLC

DRAWN BY:	DATE DRAWN:
R. Kennemer	April 28, 2008
REVISIONS BY:	DATE REVISED:
R. Kennemer	April 28, 2008
CHECKED BY:	DATE CHECKED:
L. Cupps	April 28, 2008
APPROVED BY:	DATE APPROVED:
E. McNally	April 28, 2008

SCALE
50 30 0 50
10
(1 INCH = 50 FEET)

FIGURE 3
EVAPORATION POND
AND PROPOSED MONITOR WELL LOCATIONS
BENSON-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW ¼, NW ¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 3 EVAPORATION POND AND PROPOSED MONITOR WELLS



MONITORING WELL CONSTRUCTION DETAIL
NOT TO SCALE

AES
Animas Environmental Services, LLC

DRAWN BY:	DATE DRAWN:
N. Willis	November 15, 2007
REVISIONS BY:	DATE REVISED:
R. Kennemer	April 28, 2008
CHECKED BY:	DATE CHECKED:
L. Cupps	April 28, 2008
APPROVED BY:	DATE APPROVED:
E. McNally	April 28, 2008

FIGURE 4
PROPOSED MONITOR WELL CONSTRUCTION SCHEMATIC
BENSON-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW¼, NW¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 4 PROPOSED MONITORING WELL CONSTRUCTION SCHEMATIC

DRILLING STANDARD OPERATING PROCEDURES
HEALTH AND SAFETY PLAN

Drill Rig:

- Evaluate the drill rig's safety as a vehicle. Make sure that the brakes work and that the tires have tread.
- The rig's gauge board should be clean. All gauges and controls should be operational.
- Have the driller show you how the kill switch works. If the switch does not stop the rig, do not allow the rig on-site.
- Check all cables and ropes for frays, wear, and especially, spots that look "squashed". Damaged lines should be replaced.
- Each wire rope loop should be secured with two wire clamps. Damaged hoses should be replaced.
- Check for whip-checks on the high-pressure hose connection. Each fitting should have one.
- Require a guard or housing on the impact of any automatic split spoon hammer.
- Check for a fire extinguisher and first aid kit in the rig.
- Examine the doughnut type rod clamps. Wear on the inside edges can cause the clamp to release under load.

Site Preparation:

- Have all buried utilities checked by the appropriate utility companies before drilling.
- Mast must be at least ten feet (plus 1/30 foot for every KV over 50KV) from overhead power lines.
- Remove sticks, brush, and trash from working area.
- Define an exclusion zone that includes all points less than radius of 1.5 times the mast height distant from the borehole.

- Locate your sample processing table at least one mast height from the borehole.

Mechanical Safety During Drilling:

- Whenever possible, stay at least one mast height away from the borehole, especially when the hammer, augers, or rods are being hoisted.
- If you must stand near the borehole to observe or perform air monitoring:

  a. When drilling - stand as far around passenger side corner of rig as possible;

  b. When pounding - stand as far around driver's side corner of rig as possible.

- Never stand on or near the cat head rope. If the cat head shares hydraulic power with other operating parts, the cat head can start turning without notice.

Bad Weather:

- If an electrical storm occurs, stop work. The mast of the drilling rig is a good ground for lightening kills.
- Under rainy conditions, the rope can stick to the cat head and rapidly thread through the pulley at the top of the mast. The object at the end of the rope will then free fall from the top of the mast. Therefore, during rainy weather, the driller, crew, and AES personnel shall take caution.

FIELD EQUIPMENT DECONTAMINATION
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to describe the general procedures required for decontamination of field equipment. This SOP serves as a guide and is applicable at most sites; however, it should be noted that site-specific conditions (i.e. type of contamination, type of media sampled) and the governing agency (i.e. EPA, DOE, USACE) may require modifications to the decontamination procedures provided in this SOP.

2.0 Background

2.1 Definitions

Acid Rinse - A solution of 10 percent nitric or hydrochloric acid made from reagent grade acid and analyte-free water.

Analyte-Free Water - Tap water that has been treated so that the water contains no detectable heavy metals or other inorganic compounds. Analyte-free water should be stored only in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Clean - Free of visible contamination and when decontamination has been completed in accordance with this SOP.

Cross Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or noncontaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

Organic-Free/Analyte-Free Water - Tap water that has been treated so that the water meets the analyte-free water criteria and contains no detectable organic compounds. Organic-free/analyte-free water should be stored only in clean glass, Teflon, or stainless steel containers that can be closed when not in use.

Potable Water - Tap water may be obtained from any municipal system. Chemical analysis of the water source may be required before it is used.

Soap - Low-sudsing, nonphosphate detergent such as Liquinox 1M.

Solvent Rinse - Pesticide grade, or better, isopropanol, acetone, or methanol.

2.2 Discussion

Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants offsite.

3.0 Responsibilities

Field Team Leader (FTL) – The FTL ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this procedure. The FTL may also be required to collect and document rinsate samples to proved quantitative verification that these procedures have been correctly implemented.

4.0 Required Equipment

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Soap
- Nalgene or Teflon sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes, rags, or paper towels
- Potable water*
- Analyte-free water
- Organic-free/analyte-free water
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g., 10 percent and/or 1 percent nitric acid [$HN0_3$], acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks (as required)
- Pallets for drums or tanks holding decontamination water (as required)

* Potable water may be required to be tested for contaminants before use. Check field plan for requirements.

5.0 Procedures

All reusable equipment (non-dedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at a central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally located decontamination station will include an appropriately sized bermed and lined area on which equipment decontamination will occur and shall be equipped with a collection system and storage vessels. In certain circumstances, berming is not required when small quantities of water are being generated and for some short duration field activities (i.e., pre-remedial sampling), Equipment should be transported to the decontamination station in a manner to prevent cross contamination of equipment and/or area. Precautions taken may include enclosing augers in plastic wrap while being transported on a flatbed truck.

The decontamination area will be constructed so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) or within the berms of the decontamination area that then drains into a collection system. Water from the collection system will be transferred into 55-gallon drums or portable tanks for storage. Typically, decontamination water will be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined. The exact procedure for decontamination waste disposal should be discussed in the field plan. Also, solvent and acid rinse fluids may need to be segregated from other investigation-derived wastes.

All items that will come into contact with potentially contaminated media will be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they will be covered either with clean plastic or aluminum foil depending on the size of the item. All decontamination procedures for the equipment being used are as follows:

General Guidelines

- Potable, analyte-free, and organic-free/analyte-free water should be free of all contaminants of concern. Following the field plan, analytical data from the water source may be required. Sampling equipment that has come into contact with oil and grease will be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or client requirements regarding solvent use will be stated in the field plan.
- All solvents and acids will be pesticide grade or better and traceable to a source. The corresponding lot numbers will be recorded in the appropriate logbook. Solvents and acids are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents should never be used in a closed building. See the site-specific health and safety plan and/or the chemical's Material

Safety Data Sheet (MSDS) for specific information regarding the safe use of the chemical.

- Decontaminated equipment will be allowed to air dry before being used.
- Documentation for all cleaning will be recorded in the appropriate logbook.
- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment will be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs and backhoes. Follow these steps when decontaminating this equipment:

- Establish a bermed decontamination area that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be used; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads should be upwind of the area under investigation.
- With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated soils using a hot water high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.
- Use brushes, soap, and potable water to remove dirt whenever necessary.
- Remove equipment from the decontamination pad and allow it to air dry before returning it to the work site.
- Record the equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the field plan. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment includes hollow-stem augers, drill pipes, rods, stems, etc. Follow these steps when decontaminating this equipment:

- Set up a centralized decontamination area, if possible. This area should be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.
- Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads should be upwind of any areas under investigation.
- Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports. The objects to be cleaned should be at least 2 feet above the around to avoid splashback when decontaminating.
- Using soap and potable water in the hot water high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside

the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt

- If using soapy water, rinse the equipment using clean, potable water. If using hot water, the rinse step is not necessary if the hot water does not contain a detergent. If the hot water contains a detergent, this final clean water rinse is required.
- Using a suitable sprayer, rinse the equipment thoroughly with analyte-free water.
- Remove the equipment from the decontamination area and place in a clean area upwind to air dry.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Sampling equipment is defined as equipment that comes into direct contact with the sample media. Such equipment includes split spoon samplers, well casing and screens, and spatulas or bowls used to homogenize samples. Follow these steps when decontaminating this equipment:

- Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment. At minimum, clean plastic sheeting must be used to cover the ground, table, or other surfaces that the decontaminated equipment is placed for drying.
- Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.
- Wash the items with potable water and soap using a stiff brush as necessary to remove particulate matter and surface films. The items may be steam cleaned using soap and hot water as an alternative to brushing. Note that polyvinyl chloride or plastic items should not be steam cleaned. Items that have come into contact with concentrated and/or oily contaminants may need to be rinsed with a solvent such as hexane and allowed to air dry prior to this washing step.
- Thoroughly rinse the items with potable water.
- If sampling for metals, thoroughly rinse the items with an acid solution (e.g., 10 percent nitric acid) followed by a rinse using analyte-free water. If sampling for organic compounds, thoroughly rinse the items with solvent (e.g., isopropanol) followed by a rinse using analyte-free water. The specific chemicals used for the acid rinse and solvent rinse phases should be specified in the work plan. The acid rinsate and solvent rinsate must each be containerized separately. Acids and solvents are potentially hazardous materials and care must be exercised when using these chemicals to prevent adverse health affects (e.g., skin bums, irritation to the eyes and respiratory system, etc.). Appropriate personal protective equipment must be worn when using these chemicals. These chemicals (including

spent rinsate) must be managed and stored appropriately. Special measures such as proper labels, paperwork, notification, etc. may be required when transporting or shipping these chemicals.

- Rinse the items thoroughly using organic-free/analyte-free water.
- Allow the items to air dry completely.
- After drying, reassemble the parts as necessary and wrap the items in clean plastic wrap or in aluminum foil.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable personal protective equipment. Place the contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. Refer to site-specific plans for labeling and waste management requirements.

5.4 Pump Decontamination

Follow the manufacturer's recommendation for specified pump decontamination procedures. At minimum, follow these steps when decontaminating pumps:

- Set up the decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up four containers: the first container shall contain dilute (nonfoaming) soapy water, the second container shall contain potable water, the third container shall be empty to receive wastewater, and the fourth container shall contain analyte-free water.
- The pump should be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first container. Place the discharge outlet in the wastewater container above the level of the wastewater. Pump soapy water through the pump assembly until it discharges to the waste container. Scrub the outside of the pump and other wetted parts with a metal brush.
- Move the pump assembly to the potable water container while leaving discharge outlet in the waste container. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
- Move the pump intake to the analyte-free water container. Pump the water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes will be required.
- Decontaminate the discharge outlet by hand, following the steps outlined in Section 4.3.
- Remove the decontaminated pump assembly to the clean area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.

- Record the equipment type, serial number, date, time, and method of decontamination in the appropriate logbook.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements such as pH meters, conductivity meters, etc. will be decontaminated between samples and after use with analyte-free, or better, water.

5.6 Waste Disposal

Refer to site-specific plans for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as investigation-derived waste. Small quantities of decontamination solutions may be allowed to evaporate to dryness.
- If large quantities of used decontamination solutions will be generated, each type of waste should be contained in separate containers.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste.
- Waste liquids should be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 Restrictions/Limitations

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics respectively. These steps should not be used, unless required, because of the potential for acid burns and ignitability hazards.

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with your EPA region, state, and client for approved decontamination solvents.

7.0 References

American Society for Testing and Materials. 2002. *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites,* ASTM D5088-02. January 10.

Department of Energy. Hazardous Waste Remedial Actions Program. 1996. *Standard Operating Procedures for Site Characterization,* DOE/HWP-100/R1. September.

__________. Hazardous Waste Remedial Actions Program. 1996. *Quality Control Requirements for Field Methods,* DOE/HWP-69/R2. September.

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001.1.

__________. Region 2. 1989. *CERCLA Quality Assurance Manual,* Revision 1.

__________. Region 4. 2001. *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual.* November.

SUBSURFACE SOIL SAMPLING
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to define the techniques and requirements for collecting soil samples from the unconsolidated zone. Techniques include use of hand augers, Shelby tubes, continuous core samplers, and split-spoon samplers.

2.0 Background

2.1 Definitions

Unconsolidated Zone - The layer of soil above bedrock that exists in a relatively loose state.

Hand Auger - A stainless steel cylinder (bucket) approximately 7 to 10 centimeters (cm) (3 to 4 inches) in diameter and 30 cm (1 foot) in length, open at both ends with the bottom edge designed to twist into the soil and cut out a soil core. The bucket collects the soil sample. The auger has a T-shaped handle (for hand operation) attached to the top of the bucket by extendable stainless steel rod(s).

Shelby Tube - A cylindrical sampling device, generally made of steel, that is driven into the subsurface soil through the hollow-stem auger. The tube, once retrieved, may be capped and the undisturbed soil sample extruded in the laboratory prior to analysis.

Split-Spoon/Split-Barrel Sampler - A cylindrical sampling device generally made of carbon steel that fits into a hollow-stem auger. The spoon is hinged lengthwise, which allows the sample to be retrieved by opening ("splitting") the spoon.

Slide Hammer - A device consisting of a drive weight (hammer) and a drive weight fall guide.

Subsurface Soil- The soil that exists deeper than approximately 30 cm (1 foot) from the surface but above bedrock or any other consolidated material.

Grab Sample - A discrete portion or aliquot taken from a specific location at a given point in time.

Liner - A cylindrical sampling device, generally made of brass, stainless steel, or Teflon® that is placed inside a split-spoon or hand auger bucket to collect undisturbed samples.

Composite Sample - Two or more sub-samples taken from a specific media and site at a specific point in time. The sub-samples are collected and mixed, and then a single average sample is taken from the mixture.

Auger Flight - A steel section length attached to an auger to extend the auger and remove unconsolidated material as coring depth increases.

2.2 Discussion

Shallow subsurface soil samples (to depths between 0.15 cm to 3 meters (m) [6 inches and 10 feet] may be collected using hand augers. However, soil samples collected with a hand auger are commonly of poorer quality than those collected by split-spoon/split-barrel or Shelby tube samplers since the soil sample is disturbed in the augering process. Split-spoon/split-barrel and Shelby tube liners are generally used during collection of soil samples using a hollow-stem auger, but may also be used to collect undisturbed soil samples from hand auger borings using a slide-hammer device. Liners are used to minimize the loss of volatile organic compounds (VOCs). The size and construction material of sampling devices should be selected based on project and analytical objectives and defined in site-specific plans.

2.3 Associated Procedures

- AES Packaging and Shipping Environmental Samples SOP
- AES Field Logbook Content and Control SOP
- AES Field Equipment Decontamination SOP

3.0 Responsibilities

Project Manager – The project manager is responsible for ensuring that field personnel are trained in the use of this procedure and the required equipment, and for ensuring that subsurface soil samples are collected in accordance with this procedure and any other SOPs pertaining to specific media sampling. The site manager must also ensure that the quantity and location of subsurface soil samples collected meet the requirements of the site-specific plans.

Field Team Leader (FTL) – The FTL is responsible for ensuring that field personnel collect subsurface soil samples in accordance with this SOP and other relevant procedures.

4.0 Required Equipment

4.1 General

- Site-specific plans
- Field logbook
- Indelible black ink pens and markers
- Labels and appropriate forms/documentation for sample shipment

- Clear, waterproof tape
- Appropriate sample containers
- Insulated cooler(s) and waterproof sealing tape
- Ice bags or Blue Ice
- Latex or appropriate gloves
- Plastic zip-top bags
- Personal protective clothing and equipment
- Stainless steel and/or Teflon-lined spatulas and pans, trays, bowls, trowels, or spoons Plastic sheeting
- Decontamination supplies

Additional equipment is discussed in Section 4.2.5, Field Sampling/Preservation Methods.

4.2 Manual (Hand) Augering

- T-handle
- Hand auger: flighted-, bucket-, or tube-type auger as required by the site-specific plans
- Extension rods
- Wrench(es), pliers
- Slide-hammer with extension rods

4.3 Split-Spoon/Split-Barrel and Shelby Tube Sampling

- Drill rig equipped with a 63-kilogram (kg) (140-lb) drop hammer and sufficient hollow-stem augers to drill to the depths required by the site-specific plans.
- Sufficient numbers of split-spoon/split-barrel or Shelby tube samplers so that at least one is always decontaminated and available for sampling. Three split-spoon/split-barrel or Shelby tube samplers are generally the minimum necessary. (Shelby tubes are usually used only once.)
- Split-spoon liners (as appropriate).
- Wrench(es), hammer.

5.0 Procedures

5.1 Preparation

1. Don the appropriate personal protective clothing as dictated by the site-specific health and safety plan.
2. Locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc.
3. Processes for verifying depth of sampling must be specified in the site-specific plans.
4. Clear away vegetation and debris from the ground surface at the boring location.

5. Prepare an area next to the sample collection location for laying out cuttings by placing plastic sheeting on the ground to cover the immediate area surrounding the borehole.
6. Set up a decontamination line, if decontamination is required, in accordance with the AES Field Equipment Decontamination SOP.

5.2 Collection

The following general steps must be followed when collecting all subsurface soil samples:

1. VOC samples or samples that may be degraded by aeration shall be collected first and with the least disturbance possible.
2. Sampling information shall be recorded in the field logbook and on any associated forms. Describe lithology in the field logbook.
3. Specific sampling devices to be used shall be identified in the site-specific plans and recorded in the field logbook.
4. Care must be taken to prevent cross-contamination and misidentification of samples.
5. Sample containers containing samples for VOC analysis should be filled completely to minimize headspace.

5.2.1 Manual (Hand) Augering

The following steps must be followed when collecting hand-augered samples:

1. Auger to the depth required for sampling. Place cuttings on plastic sheeting or as specified in the site-specific plans. If possible, layout the cuttings in stratigraphic order.
2. Throughout the augering, make detailed notes concerning the geologic features of the soil or sediments in the field logbook.
3. Cease augering when the top of the specified sampling depth has been reached. If required, remove the auger from the hole and decontaminate the auger or use a separate decontaminated auger, then obtain the sample.
4. Collect a grab sample for VOC analyses (or samples that may be degraded by aeration) immediately and place in sample container. Sample bottles should be filled completely to minimize headspace.
5. Remaining samples should be homogenized for other analyses prior to placing samples in the appropriate containers. Label containers as required.
6. Wipe containers with a clean Kimwipe or paper towel to remove residual soil from the exterior of the container(s).
7. Label the sample container with the appropriate information. Secure the label by covering it with a piece of clear tape.
8. Place the containers in zip-top plastic bags and seal the bags. Pack samples in a cooler with ice.
9. Proceed with further sampling, as required by the site-specific plans.
10. When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.

11. Complete the field logbook entry and other appropriate forms, being sure to record all relevant information before leaving the site.
12. Properly package all samples for shipment and complete all necessary sample shipment documentation. Remand custody of samples to the appropriate personnel.

5.2.2 Manual (Hand) Augering Using a Tube Sampler with Liner or Slide-Hammer

The following steps must be followed when collecting hand-augered samples using a tube sampler with a liner or slide-hammer:

1. Auger to the depth required for sampling. Place cuttings on the plastic sheeting as specified in the site-specific plans. If possible, layout the cuttings in stratigraphic order.
2. Throughout augering, make detailed notes in the field logbook concerning the geologic features of the soil or sediments.
3. Cease augering when the top of the specified sampling depth has been reached. Remove the auger from the hole and decontaminate.
4. Prepare a decontaminated tube sampler by installing a decontaminated liner in the auger tube.
5. Obtain the sample by driving the sample tube through the sample interval with the slide-hammer. Remove the liner from the tube and immediately cover the ends with Teflon tape and cap the ends of the tube. Seal the caps with waterproof tape.
6. Wipe sealed liners with a clean Kimwipe or paper towel.
7. Label the sealed liners as required in the site-specific plans. Mark the top and bottom of the sample on the outside of the liner.
8. Place sealed liners in zip-top plastic bags and seal the bags. Pack samples in a chilled cooler.
9. Proceed with further sampling, as required by the site-specific plans.
10. When sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
11. Decontaminate all equipment according to AES Field Equipment Decontamination SOP between each sample.
12. Complete the field logbook entry and other forms, being sure to record all relevant information before leaving the site.
13. Properly package all samples for shipment and complete all necessary sample shipment documentation. Remand custody of samples to the appropriate personnel.

5.2.3 Split-Spoon/Split Barrel Sampling

Note: Steps 1 through 12 describe activities to be performed by a licensed drilling contractor, not AES personnel.

The following steps must be followed when collecting split-spoon samples:

1. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
2. The drilling rig will be decontaminated at a separate location prior to drilling, per the AES Field Equipment Decontamination SOP or the site-specific decontamination procedures.
3. Attach the hollow-stem auger with the cutting head, plug, and center rod(s) to the drill rig.
4. Begin drilling and proceed to the first designated sample depth, adding auger(s) as necessary.
5. Upon reaching the designated sample depth, slightly raise the auger(s) to disengage the cutting head, and rotate the auger without advancement to clean cuttings from the bottom of the hole.
6. Remove the plug and center rods.
7. If required by the site-specific sampling plan, install decontaminated liners in the split-spoon/split barrel sampler.
8. Install a decontaminated split-spoon on the center rod(s) and insert it into the hollow-stem auger. Connect the hammer assembly and lightly tap the rods to seat the drive shoe at the top of undisturbed soil or sediment.
9. Mark the center rod in 15-cm (6-inch) increments from the top of the auger(s).
10. Drive the split-spoon using the hammer. Use a full 76-cm (30-inch) drop as specified by the American Society for Testing and Materials (ASTM) Method D-1586. Record the number of blows required to drive the spoon or tube through each 15-cm (6-inch) increment.
11. Cease driving when the full length of the spoon has been driven or upon refusal. Refusal occurs when little or no progress is made for 50 blows of the hammer. ASTM D1586-99 § 7.2.1 and 7.2.2 defines "refusal" as >50 blows per 6-inch advance or a total of 100 blows.
12. Pull the split-spoon free by using upswings of the hammer to loosen the sampler. Pull out the center rod and split-spoon.
13. Unscrew the split-spoon assembly from the center rod and place it on the plastic sheeting.
14. Remove the drive shoe and head assembly. If necessary, tap the split-spoon assembly with a hammer to loosen threaded couplings.
15. With the drive shoe and head assembly off, open (split) the split-spoon, being careful not to disturb the sample.
16. Label sample containers with appropriate information. Secure the label, covering it with a piece of clear tape. If liners were used, immediately install Teflon tape over the ends of the liners, cap the liners, and seal the caps over the ends of the liner with waterproof tape. Label the samples as required by the site-specific plans. Mark the top and bottom of each sample on the outside of each liner. Indicate boring/well number and depth on the outside of the liner, as required.
17. If VOC analyses are to be conducted on the soil sample and liners were not used, place that sample in its sample container immediately after opening the split-spoon, filling the sample bottle completely. Seal the container immediately, then describe it in the field logbook and/or associated forms. Record the sample

identification number, depth from which the sample was taken, and the analyses to be performed on the samples in the field logbook and on the appropriate forms.

18. Remaining samples should be homogenized prior to placing samples in appropriate containers.
19. Wipe containers with a clean Kimwipe or paper towel. Label containers as required when liners are not used.
20. Place containers and/or sealed liners in zip-top plastic bags and seal the bags. Pack samples in a chilled cooler.
21. In the field logbook and on the boring log, describe sample lithology by observing cuttings and/or the bottom end of the liner.
22. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
23. When sampling is complete, remove the drilling rig to the heavy equipment decontamination area.
24. Dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans. Backfill bore hole as specified in project-specific plans.
25. Decontaminate split-spoons and other small sampling equipment according to the AES Field Equipment Decontamination SOP before proceeding to other sampling locations.
26. Complete the field logbook entry and other forms, being sure to record all relevant information before leaving the site.
27. Properly package all samples for shipment to laboratories and complete all necessary sample shipment documentation. Remand custody of the samples to the appropriate personnel.

5.2.4 Shelby Tube Sampling

Note: Steps 1 through 11 describe activities to be performed by a licensed drilling contractor, not AES personnel.

The following steps must be followed when collecting samples using the Shelby tube:

1. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
2. The drilling rig will be decontaminated at a separate location prior to drilling.
3. Attach the hollow-stem auger with the cutting head, plug, and center rod(s).
4. Begin drilling and proceed to the first designated sample depth, adding auger(s) as necessary.
5. Upon reaching the designated sample depth, slightly raise the auger(s) to disengage the cutting head, and rotate the auger without advancement to clean cuttings from the bottom of the hole.
6. Remove the plug and center rods.
7. Attach a head assembly to a decontaminated Shelby tube. Attach the Shelby tube assembly to the center rods.

8. Lower the Shelby tube and center rods into the hollow-stem auger and seat it at the bottom. Be sure to leave 30 inches or more of center rod above the lowest point to the hydraulic piston's extension.
9. Use the rig's hydraulic drive to push the Shelby tube into undisturbed soil. The tube should be pushed with a steady force. Note the pressure used to push the Shelby tube in the field logbook.
10. When the Shelby tube has been advanced its full length or to refusal, back off the hydraulic pistons. Attach a hoisting plug to the upper end of the center rod, twist to break off the sample, and pull the apparatus out of the hole with the rig winch.
11. Retrieve the Shelby tube to the surface, detach it from the center rod, and remove the head assembly.
12. Since the typical intent of Shelby tube sampling is for engineering purposes and an undisturbed sample is required, the tube ends should be sealed immediately. Sealing is accomplished by filling any void space in the tube with beeswax, then placing caps on the ends of the tube and taping caps into place. The top and bottom ends of the tube should be marked and the tube transported to the laboratory in an upright position. Indicate boring/well number and depth on outside of liner.
13. Wipe sealed tubes with a clean Kimwipe or paper towel.
14. Place sealed tubes in zip-top plastic bags and seal bags. Pack samples in a chilled cooler.
15. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
16. When sampling is complete, remove the drilling rig to the heavy equipment decontamination area.
17. Dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
18. Complete the field logbook entry, being sure to record all relevant information before leaving the site. These methods may be used if directed by the EPA region, client, or governing sample plan.

5.2.5 Field Sampling/Preservation Methods

The following three sections contain SW 846 Methods for sampling and field preservation. These methods include EN CORE™ Sampler Method for low-level detection limits, EN CORE Sampler Method for high-level limits/screening, and methanol preservation. These methods may be used if required by the EPA Region, client, or governing sample plan. These methods are very detailed and contain equipment requirements at the beginning of each section.

When collecting soil samples using the EN CORE Sampler Method, collection of soil for moisture content analysis is required. Results of this analysis are used to adjust "wet" concentration results to "dry" concentrations to meet analytical method requirements. Note: Some variations from these methods, (e.g., sample volume) may be required depending on the contracted analytical laboratory.

5.2.5.1 EN CORE Sampler Collection for Low Level Analyses (≥1 *μg/kg)*

EN CORE Sampling Equipment Requirements

The following equipment is required for low-level analysis:

- Three 5 grams (g) samplers
- Note: The sample volume requirements specified are general requirements. Actual sample volume and/ or container sizes may vary depending on client or laboratory requirements.
- One 110-milliliter (mL) (4-ounce [oz.]) widemouth glass jar or applicable container for moisture analysis
- One T-handle
- Paper towels

EN CORE Sampling Steps for Low Level Analysis

1. Remove sampler and cap from package and attach T-handle to sampler body.
2. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full. The O-ring will be visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.
3. Extract sampler and wipe the sampler head with a paper towel so that the cap can be tightly attached.
4. Push cap on with a twisting motion to secure to the sampler body.
5. Rotate the sampler stem counterclockwise until stem locks in place to retain sample within the sampler body.
6. Fill out sample label and attach to sampler.
7. Repeat procedure for the remaining two samplers.
8. Collect moisture sample in 110-mL (4-oz.) widemouth jar using a clean stainless steel spoon or trowel.
9. Store samplers at 4 degrees (°) Celsius (C), ±2°C. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

Note: Verify requirements for extraction/holding times.

5.2.5.2 EN CORE Sampler Collection for High Level Analyses (≥200 *μg/kg)*

EN CORE Sampling Equipment Requirements

The following equipment is required for high-level analysis:

- One 5-g sampler or one 25-g sampler (the sampler size used will be dependent on client and laboratory requirements.)
- One 110-mL (4-oz.) widemouth glass jar or applicable container specified for moisture analysis.
- One T-handle.
- Paper towels.

EN CORE Sampling Steps for High Level Analysis

1. Remove sample and cap from package and attach T-handle to sampler body.

2. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full. The O-ring will be visible within the hole on the side of the T -handle. If the O-ring is not visible within this window, then the sampler is not full.
3. Use clean paper toweling to quickly wipe the sampler head so that the cap can be tightly attached.
4. Push cap on with a twisting motion to attach cap.
5. Fill out a sample label and attach to sampler.
6. Rotate sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.
7. Collect moisture sample in 110-mL (4-oz.) widemouth jar or designated container using a clean stainless steel spoon or trowel.
8. Store samplers at 4°C, ±2°C. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

Note: Verify requirements for extraction/holding times.

5.2.5.3 Methanol Preservation Sampling for High Level Analyses (≥200 *µglkg)*

Methanol Preservation Sampling Equipment Requirements

- One pre-weighed jar that contains methanol or a pre-weighed empty jar accompanied with a pre-weighed vial that contains methanol (laboratory grade)
- One dry weight cup Weighing balance that accurately weighs to 0.01 g (with accuracy of ±0.1 g)
- Set of balance weights used in daily balance calibration
- Latex gloves
- Paper towels
- Cutoff plastic syringe or other coring device to deliver 5 g or 25 g of soil

Sampling Preservation Steps

1. Wear gloves during all handling of pre-weighed vials.
2. Weigh the vial containing methanol preservative to the nearest 0.01 g. If the weight of the vial with methanol varies by more than 0.01 g from the original weight recorded on the vial, discard the vial. If the weight is within tolerance, it can be used for soil preservation/collection below.
3. Take the empty jar or the jar that contains the methanol preservative.
4. Quickly collect a 5-g or 25-g sample using a cutoff plastic syringe or other coring device designed to deliver 5 g or 25 g of soil from a freshly exposed surface of soil. The 5-g or 25-g size used is dependent on client and laboratory requirements.
5. Carefully wipe the exterior of the collection device with a clean paper towel.
6. Quickly transfer the soil to an empty jar or a jar that contains methanol. If extruding into a jar that contains methanol, be careful not to splash the methanol outside of the vial. Again, the type of jar used is dependent on the client or laboratory requirements.
7. If the jar used to collect the soil plug was empty before the soil was added, immediately preserve with the methanol provided, using only one vial of methanol preservative per sample jar.

8. Using the paper toweling, remove any soil off of the vial threads and cap the jar.
9. Weigh the jar with the soil in it to the nearest 0.01 g and record the weight on the sample label.
10. Collect dry weight sample using a clean stainless steel spoon or trowel.
11. Store samples at 4°, ±2°C.
12. Ship sample containers with plenty of ice in accordance with DOT regulations (CORROSIVE. FLAMMABLE LIQUID. POISON) to the laboratory.

6.0 Restrictions/Limitations

Basket or spring retainers may be needed for split-spoon sampling in loose, sandy soils. Shelby tubes may not retain the sample in loose, sandy soils.

7.0 References

American Society for Testing and Materials, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils,* Standard Method D1586-99, 1999.

U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846),* Third Edition, November 1986, (as amended by Updates I, II, IIA, IIB, III, and IIIA, June 1997). Method 5035 (**Note:** §6.2.1.8 of this method says samples stored in En Core™ samplers should be analyzed within 48 hours or transferred to soil sample vials in the laboratory within 48 hours): December 1996, Revision O, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples.

FIELD MEASUREMENT OF ORGANIC VAPORS
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to define the techniques and the requirements for the measurement of organic vapors in the field.

2.0 Background

2.1 Definitions

Photoionization Detector - A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the photoionization of organic vapors.

Flame Ionization Detector - A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the flame ionization of organic vapors.

2.2 Discussion

The measurement of organic vapors is a required step during numerous field activities. The primary purpose of such measurements is health and safety monitoring to determine if the breathing zone in a work area is acceptable or if personal protective equipment such as a respirator or a supplied air device is necessary for field personnel. In addition to health and safety monitoring, organic vapor measurement is also used in conjunction with sampling activities, including subsurface soil sampling and groundwater sampling, where measurements are useful for establishing approximate contaminant levels or ranges.

The two types of instruments most commonly used to measure organic vapors are photoionization detectors (PIDs) and flame ionization detectors (FIDs). Both instruments first ionize the gaseous compound and then measure the response, which is proportional to the concentration. The PID ionizes the gas using an ultraviolet lamp. The photons emitted by the ultraviolet lamp are absorbed by the gas molecules, producing a positively charged ion and an electron. The ionization potential (in electron volts) of the organic compounds to be measured must be less than the energy carried by the photons; therefore, the ionization potential of the known or suspected compounds should be checked against the energy of the ultraviolet lamp to verify that the energy provided by the lamp is greater. Additionally, manufacturer's manuals should be consulted to obtain the appropriate correction factors for known or suspected contaminants. The FID ionizes the gas by burning in a hydrogen/air flame. The FID allows measurement of a wide variety of compounds but in general its sensitivity is not as high as the PID.

2.3 Associated Procedures

- AES Subsurface Soil Sampling SOP

- AES Groundwater Sampling Using Bailers SOP
- AES Water Level Measurement SOP
- AES Well Development and Purging SOP

3.0 Responsibilities

Project Manager -- The project manager is responsible for ensuring that field activities are conducted in accordance with the procedure and any other SOPs pertaining to the specific activity.

4.0 Required Equipment

- Site-specific plans
- Field logbook
- Indelible black ink pen
- Personal protective clothing and equipment
- Photoionization detector or flame ionization detector
- 0.5 liter (16-ounce) or "Mason" type glass jar
- Hydrogen Canister (if using FID for a period of more than 1 day)

5.0 Procedures

5.1 Direct Reading Measurement

1. Connect the measurement probe to the instrument and make necessary operational checks (e.g., battery check, etc.) as outlined in the manufacturer's manual.
2. Calibrate the instrument following the applicable manufacturer's manual.
3. Make sure the instrument is reading zero and all function and range switches are set appropriately.
4. Insert the end of the probe directly into the atmosphere to be measured (e.g., breathing zone, monitoring well casing, split spoon, etc.) and read the organic vapor concentration in parts per million (ppm) from the instrument display. Apply the appropriate correction factor, if necessary. Record the highest instrument response.
5. Immediately document the reading in the field logbook or on the appropriate field form.

5.2 Headspace Measurement

1. Connect the measurement probe to the instrument and make necessary operational checks (e.g., battery check, etc.) as outlined in the manufacturer's manual.
2. Calibrate the instrument following the appropriate manufacturer's manual.
3. Make sure the instrument is reading zero and all function and range switches are set appropriately.

4. Fill a clean glass jar approximately half-full of the sample to be measured. Quickly cover the top of the jar with one or two sheets of clean aluminum foil and apply cap to seal the jar.
5. Allow headspace to develop for approximately 10 minutes. It is generally preferable to shake the sealed jar for 10 to 15 seconds at the beginning and end of headspace development.

   Note: When the ambient temperature is below 0°C (32°F), the headspace development and subsequent measurement should occur within a heated vehicle or building.
6. Remove the jar cap and quickly puncture the foil and insert the instrument probe to a point approximately one-half of the headspace depth.
7. Read the organic vapor concentration in ppm from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.
8. Immediately record the reading in the field logbook or on the appropriate field form.

6.0 Restrictions/Limitations

The two methods outlined above are the most commonly used for field measurement of organic vapors but do not apply to all circumstances. Consult project- or program-specific procedures and guidelines for deviations. Both the PID and FID provide quantitative measurement of organic vapors, but generally neither instrument is compound-specific. The typical reading range of the PID is 0 to 2,000 ppm, and the typical reading range of the FID is 0 to 1,000 ppm. The FID will measure methane while the PID will not. Note: The presence of methane will cause erratic PID measurements. In methane rich environments, toxic organic vapors should be monitored with an FID. If desired, a charcoal filter can be placed temporarily on the FID inlet probe, which will trap all organic vapors except methane. The filtered (methane only) reading can be subtracted from unfiltered (total organic vapors) to provide an estimate of non-methane organic vapors. The reading accuracy of both instruments can be affected by ambient temperature, barometric pressure, humidity, lithology, etc.

Standard Operating Procedure
Soil Sample Collection for
Petroleum Storage Tank Sites

These Soil Sample Collection Procedures describe soil sample collection, handling, and transport protocol for petroleum storage tank sites. Procedures have been developed to facilitate planning and implementation of soil sample collection in accordance with the New Mexico Petroleum Storage Tank Regulations, *Guidelines for Corrective Action,* TNRCC Technical Guidance No. RG-14/PST, and ADEQ LUST Site Characterization Manual (1/15/99) Appendix 2, as applicable.

UST Removal Soil Sample Locations
The location and number of laboratory samples required should be based on the following:

For tanks 2,000 gallons or less in capacity:
1. One sample under each end of the tank
2. If there are two or more tanks in a single pit, samples should be taken at the bottom of the pit in each corner.

For tanks greater than 2,OOO-galion capacity:
1. One sample under each end of the tank.
2. If there are three or more tanks in a single pit, samples should be taken at the bottom of the pit in each corner (or each wall midpoint) and in the pit center.

Soil samples should also be collected in the following locations:
1. Where holes or releases have occurred in tanks, piping runs, and ancillary equipment.
2. Where overfill/spill has occurred.
3. At piping joints and elbows.
4. Beneath each dispenser.
5. Any areas of discrete staining.

Sample Handling
1. The soil sample should be disturbed as little as possible.
2. Samples should be taken as soon as possible after the removal of the tank and before any backfilling or other disturbance of the pit bottom.
3. Sample a minimum of one (1) foot below the bottom of the tank or pit, whichever is deeper.
4. If soil samples are collected from a backhoe bucket, ensure that the samples are representative of the area being sampled. Scrape off the top six inches of soil in the bucket and fill the container.
5. Use only new, clean glassware, supplied by the laboratory.

Heated Headspace Method (as required)
1. Fill a 16-ounce or larger clean glass jar half full of soil sample. Plastic bags or other non-glass containers are not acceptable.

2. Seal top of jar with clean aluminum foil and lid ring or equivalent.
3. Ensure sample is at approximately 60°F to 80°F. Heated air from the interior of a vehicle should be used if necessary to raise sample temperature to the acceptable range. Protect samples from direct sunlight.
4. Aromatic hydrocarbon vapor concentrations should be allowed to develop in the headspace of the sample jar for 5 to 10 minutes. During the initial stages of headspace development, the sample is to be shaken vigorously for one minute (if gravel is present, take care not to break jar).
5. Pierce the foil seal with the probe of either a FID, a PID, or chlorimetric tubes, and record the highest (peak) measurement.

Methanol Extraction Procedure (as required)

1. Soil samples should be collected using a syringe.
2. Two bottles should be collected and extracted for volatile analysis.
3. Collect a dry-weight sample in a bottle supplied by the laboratory.
4. Unscrew the cap in the sample bottle and quickly push the sample into the bottle with the syringe plunger, being careful not to get soil particles on the rim of the bottle. Quickly replace the cap and tighten securely.
5. If the methanol is provided in a separate vial from the sample bottle, unscrew the cap on the sample bottle and quickly push the sample into the bottle with the syringe plunger, being careful not to get soil particles on the rim of the bottle. Open the vial containing the methanol and pour it into the sample bottle. Be careful not to spill any methanol. Quickly replace sample bottle cap and tighten securely.
6. Gently agitate the sample so the soil is immersed in the methanol. Excessive agitation may cause undue volatilization.

Transportation

1. Complete sample container labels.
2. Place samples in hard-shell insulated cooler immediately after collection.
3. Cooler should be cooled at <4°C.
4. Complete chain of custody documents.
5. Deliver to laboratory

PACKAGING AND SHIPPING ENVIRONMENTAL SAMPLES STANDARD OPERATING PROCEDURES

1.0 Packaging and Shipping of All Samples

This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved, the following sections may also be applicable.

Section 2.0 - Packaging and Shipping Samples Preserved with Methanol
Section 3.0 - Packaging and Shipping Samples Preserved with Sodium Hydroxide
Section 4.0 - Packaging and Shipping Samples Preserved with Hydrochloric Acid
Section 5.0 - Packaging and Shipping Samples Preserved with Nitric Acid
Section 6.0 - Packaging and Shipping Samples Preserved with Sulfuric Acid

1.1 Purpose

The purpose of this SOP is to outline the requirements for the packaging and shipment of environmental samples. Additionally, Sections 2.0 through 6.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and applies only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data loggers and self-contained breathing apparatus [SCBAs] or bulk chemicals that are regulated under the DOT, IATA, and ICAO.

1.2 Background

1.2.1 Definitions

Environmental Sample - An aliquot of air, water, plant material, sediment, or soil that represents the contaminant levels on a site. Samples of potential contaminant sources, like tanks, lagoons, or non-aqueous phase liquids are normally not "environmental" for this purpose. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/ or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

Outside Container - The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment - The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity - Excepted quantities are limits to the mass or volume of a hazardous material in the inside and outside containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity - Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance Testing - Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper - A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both AES and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. The samples should be packed in time to be shipped for overnight delivery. Make arrangements with the laboratory before sending samples for weekend delivery.

1.3 Required Equipment

Coolers with return address of the appropriate AES office
Heavy-duty plastic garbage bags
Plastic zip-type bags, small and large
Clear tape
Nylon reinforced strapping tape
Duct tape
Vermiculite (or an equivalent nonflammable material that is inert and absorbent)* Bubble wrap (optional)
Ice
Custody seals
Completed chain-of-custody record or contract laboratory program (CLP) custody records, if applicable
Completed bill of lading
"This End Up" and directional arrow labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.4 Packaging Environmental Samples

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager should be observed.
2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.
3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly.
4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. Note: Trip blanks must be included in coolers containing VOA samples.
5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally.
6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler should reflect only those samples within the cooler.
7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/ or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.
8. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.
9. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the opening of the cooler on opposite sides. The custody seals should be affixed to the cooler with half of the seal on the strapping

tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.

10. The shipping container lid must be marked "THIS END UP" and arrow labels that indicate the proper upward position of the container should be affixed to the cooler. A label containing the name and address of the shipper (AES) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

2.0 Packaging and Shipping Samples Preserved with Methanol

2.1 Containers

- The maximum volume of methanol in a sample container is limited to 30 ml.
- The sample container must not be full of methanol.

2.2 Responsibility

It is the responsibility of the qualified shipper to:

- Ensure that the samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

2.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packing may consist of glass or plastic jars
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

2.4 Packaging Samples Preserved with Methanol

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with

waterproof tape prior to sampling.

  - At a minimum the label must contain:
    - Project name
    - Project number
    - Date and time of sample collection
    - Sample location
    - Sample identification number
    - Collector's initials
    - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)

- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of methanol per shipping container must not exceed 500 ml.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Methanol Mixture
  UN1230
  LTD.QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.

- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

3.0 Packaging and Shipping Samples Preserved with Sodium Hydroxide

3.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	**Conc.**	**40ml**	**125ml**	**250ml**	**500ml**	**1 L**
NaOH	30%	>12	0.08%		.25	0.5	1	2

5 drops = 1ml

3.2 Responsibility

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

3.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Inner packings may consist of glass or plastic jars no larger than 1 pint
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

3.4 Packaging Samples Preserved with Sodium Hydroxide

Samples containing NaOH as a preservative that exceed the excepted concentration of 0.08 percent (2 ml of a 30 percent NaOH solution per liter) may be shipped as a limited quantity per packing instruction Y819 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.

    - At a minimum the label must contain:
        - Project name
        - Project number
        - Date and time of sample collection
        - Sample location
        - Sample identification number
        - Collector's initials
        - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- The total volume of sample in each cooler must not exceed 1-liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Sodium Hydroxide Solution
  UN1824
  LTD.QTY.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.

- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/ marking locations is shown in Figure 1.

  Note: Samples meeting the exception concentration of 0.08 percent NaOH by weight may be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 Packaging and Shipping Samples Preserved with Hydrochloric Acid

4.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Hydrochloric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*		
		pH	**Conc.**	**40ml**	**125ml**	**250ml**
HCl	2N	<1.96	0.04%	.2	.5	1

5 drops = 1ml

4.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

4.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packing may consist of glass or plastic jars no larger than 1 pint.

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

4.4 Packaging Samples Preserved with Hydrochloric Acid

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
  - At a minimum the label must contain:
    - Project name
    - Project number
    - Date and time of sample collection
    - Sample location
    - Sample identification number
    - Collector's initials
    - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (No more than 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of sample inside each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of

the cooler lid.

- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Hydrochloric Acid Solution
  UN1789
  LTD.QTY.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

  Note: Samples containing less than the exception concentration of 0.04 percent HCl by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 Packaging and Shipping Samples Preserved with Nitric Acid

5.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Nitric Acid Preservatives

Preservative	*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
	pH	**Conc.**	**40ml**	**125ml**	**250ml**	**500ml**	**1 L**

HNO_3	6N	<1.62	0.15%		2	4	5	8

5 drops = 1 ml

5.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

5.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

5.4 Packaging Samples Preserved with Nitric Acid

Samples containing $HN0_3$ as a preservative that exceed the excepted concentration of 0.15 percent $HN0_3$ will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
    - At a minimum the label must contain:
        - Project name
        - Project number
        - Date and time of sample collection
        - Sample location
        - Sample identification number
        - Collector's initials
        - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.

- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Nitric Acid Solution (with less than 20 percent)
  UN2031
  Ltd. Qty.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

  Note: Samples meeting the exception concentration of 0.15 percent $HN0_3$ by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified

radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.

- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 Packaging and Shipping Samples Preserved with Sulfuric Acid

6.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sulfuric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	**Conc.**	**40ml**	**125ml**	**250ml**	**500ml**	**1 L**
H_2SO_4	37N	<1.15	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

6.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

6.4 Packaging of Samples Preserved with Sulfuric Acid

Samples containing H_2S0_4 as a preservative that exceed the excepted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
  - At a minimum the label must contain:
    - Project name
    - Project number
    - Date and time of sample collection
    - Sample location
    - Sample identification number
    - Collector's initials
    - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/ sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sulfuric Acid Solution

UN2796
LTD.QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

  Note: Samples containing less than the exception concentration of 0.35 percent H_2S04 by weight will be shipped as non-regulated or non-hazardous in accordance with the procedure described in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 References

U.S. Environmental Protection Agency, *Sampler's Guide to the Contract Laboratory Program,* EPA/540/P-90/006, December 1990.

U.S. Environmental Protection Agency, Region IV, *Standard Operating Procedures and Quality Assurance Manual,* February 1991.

U.S. Environmental Protection Agency Rule, 40 CFR 136.

DESIGN AND INSTALLATION OF MONITORING WELLS IN AQUIFERS STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to provide guidelines for the installation of groundwater monitoring wells. These guidelines will help to produce consistency of approach in the design and installation of monitoring wells. Individual installations will probably vary in some respects as they may encounter differing hydrogeologic conditions.

2.0 Background

2.1 Definitions

Monitoring Well Installation - The act of installing well casing, screen, filter pack, bentonite seal, grout, and other specified materials in a borehole to construct a complete monitoring well.

2.2 Discussion

This SOP is intended to cover the installation of monitoring wells for use in conducting a variety of environmental investigations. It is intended to be a general guideline listing the types of materials and methods to be considered when a well is installed. Materials are not specified in detail since it is likely there will be wide variability required to meet the needs of individual site conditions or specific clients. Ideally, the well should not alter the medium that is being sampled.

2.3 Associated Procedures

- AES Lithologic Logging SOP
- AES Field Logbook Content and Control SOP
- AES Photographic Documentation of Field Activities SOP
- AES Well Development and Purging SOP
- AES Field Equipment Decontamination at Nonradioactive Sites SOP

3.0 Responsibilities

Project Manager – Translates client's requirements into technical direction of project. Sets technical criteria, reviews and approves technical progress, and ensures that all participating personnel have proper training.

Field Team Leader (FTL) – Supervises field operations. Assures that all necessary equipment including safety equipment is available and functioning properly before project operations begin. Assures that all necessary personnel are mobilized on time. Maintains daily log of activities each work day.

Field Geologist – Collects and maintains data and completes Monitoring Well Construction Forms. Coordinates and consults with project manager on decisions relative to unexpected encounters during well installation and deviation from this SOP. Directs activities of drill and support subcontractors.

Drilling Subcontractor – Provides necessary personnel, equipment, and services to meet terms of the contract.

4.0 Required Equipment and Materials

4.1 Required Equipment

- Field logbook
- Monitoring Well Construction Forms
- Measuring tape

4.2 Required Construction Materials

General - The materials that are used in the construction of a monitoring well and that come in contact with the groundwater should not measurably alter the chemical quality of a groundwater sample. The well casing and well screen should be steam cleaned (if appropriate for the selected material) prior to well installation or certified clean from the manufacturer and delivered to the site in protective wrapping. Samples of the cleaning water, drilling fluids, filter pack, annular seal, and mixed grout should be retained for analysis if groundwater contamination as the result of well installation is suspected. These samples will serve as quality control checks until the completion of at least one round of groundwater quality sampling and analysis.

Water - Water, which may be used in the well completion process, should be obtained from a source that does not contain constituents that could compromise the integrity of the well installation. A certificate of analysis should be provided with the water, or a sample of the water should be analyzed and documented as contaminant-free.

Primary Filter Pack - The primary filter pack (sand or gravel pack) consists of a clean, well-sorted, rounded granular material of selected grain size and gradation that is installed in the annulus between the screened interval and the borehole wall. The filter pack may be installed along the screened interval using a tremie pipe from the total depth of the well to the designated distance above the top of the screened interval. A filter pack material mostly consisting of siliceous, rather than calcareous, particles are preferred. Select the grading of the filter pack on the basis of the layer of finest material to be screened. A minimum filter pack thickness should be between 2 to 3 inches and generally never greater than 8 inches. The filter pack should extend at least 2 to 3 feet above the screened interval or more depending on the screen length to provide for filter pack settlement.

Well Screen - The well screen should be new and composed of materials most suited for the environment being monitored. The screened interval should be plugged at the bottom.

The plug should be of the same material as the bottom section of screen and should be securely attached, making a positive seal. This assembly must have the capability to withstand well installation and development stresses without becoming dislodged or damaged. The length of the well screen slotted area should be appropriate for the interval to be monitored including some allowance for changes in elevation of the water table. Prior to installation, the casing string and associated equipment should be cleaned with steam or high-pressure water, if not certified cleaned. Well screens to be used should be composed of stainless steel or polyvinyl chloride (PVC), as appropriate. Fluoropolymer materials may be substituted if necessary due to the potential for incompatible chemical reactions between contaminants and the stainless steel screen, or if stainless steel constituents are possible site contaminants. The minimum internal diameter of the well screen should be chosen based on the particular application. Well screens should be flush threaded per American Society for Testing and Materials (ASTM) standards. Glued or solvent-welded joints may not be used since glues and solvents may alter the chemistry of the water samples.

Slot Size - The slot size of the well screen should be determined relative to the grain-size analysis of the stratum to be monitored and the gradation of the filter pack material. In granular non-cohesive strata that falls in easily around the screen, filter packs may not be necessary. In these cases of natural development, the slot size of the well screen is to be determined using the grain size of the materials in the surrounding strata. The slot size and arrangement should retain at least 90 percent of the filter pack.

Casing - The well casing will be composed of PVC, stainless steel, or some other appropriate material and will extend from the screen to the surface. The type of casing and wall thickness should be adequate to withstand the forces of installation. Several different casing sizes may be required depending on the subsurface geologic conditions. The diameter of the casing for filter packed wells should be selected so that a minimum annular space of 2 inches is maintained between the casing and the borehole wall. The diameter of the casings in multi-cased wells should be selected so that a minimum annular space of 2 inches is maintained between casing strings and between the outer casing and the borehole (e.g., a 2-inch-diameter well screen will require first setting a 6-inch-diameter casing in a 10-inch-diameter boring). Under difficult drilling conditions (collapsing soils, rock, or cobbles), it may be necessary to advance temporary casing. Under these conditions, a smaller space may be maintained. The ends of each casing section should be flush-threaded.

Protective Casing - Protective casings may be made of galvanized steel (or rarely stainless steel). The protective casing should have a lid capable of being secured by a locking device. The inside dimensions of the protective casing should be at a minimum 4 inches larger than the diameter of the casing to facilitate the installation and operation of sampling equipment. Protective casing should extend approximately 2 to 3 feet into the ground to anchor it securely.

Annular Sealants - The materials used to seal the annulus may be prepared as a slurry or used unmixed in a dry pellet form. Sealants should be selected for compatibility with local geologic, hydrogeologic, climatic, and human-induced conditions anticipated to occur during the life of the well.

Bentonite - Bentonite should be powdered or pelletized sodium montmorillonite furnished in sacks or buckets from a commercial source and free of impurities that adversely impact water quality in the well. The diameter of pellets selected for monitoring well construction should be less than one-fifth the width of the annular space into which they are placed to reduce the potential for bridging. Pellets are typically used for placing annular seals, and powdered bentonite is used for mixing in grout slurry.

Cement - Each type of cement has slightly different characteristics that may be appropriate under various physical and chemical conditions. Cement should generally be Portland Type I, Type II, or Type I/II as specified in ASTM C 150. Quick-setting cements containing additives are not allowable for use in monitoring well installation. Additives may leach from the cement and influence the chemistry of the groundwater.

Grout - The grout backfill that is placed above the bentonite annular seal should be a liquid slurry consisting of water, bentonite grout of Volclay or equivalent quality, and Portland cement. Bentonite-based grouts are typically used when a more flexible grout is desired (i.e., freeze-thaw). Cement-based grout provides a more rigid installation. A typical bentonite grout mixture is 1 to 1.25 pounds bentonite to 2 pounds of Type I Portland Cement per gallon of water. Cement-based grout is typically 6 to 7 gallons of water per 94 pound bag of Type I Portland Cement and 2.7 percent bentonite powder.

Transition Sand - A layer of fine to very fine sand may be placed on top of the primary filter pack before emplacement of the bentonite seal. It should be of sufficient thickness to prevent bentonite from penetrating to the vicinity of the well screen during placement of the bentonite seal.

Annular Seal Equipment (Tremie Pipe) - A tremie pipe is used to inject the annular seals and filter pack. Tremie pipes are typically constructed of PVC or galvanized steel. Associated equipment may include a trough or mixing box and "mud pump" to place the material.

Primary Filter Pack - Screened and washed sand that is placed between the well screen and the borehole wall the full length of the screen.

5.0 Procedures

5.1 Drilling Methods

The actual methods of drilling at a site will vary depending on site conditions. The method to be used at a site shall be stated in the site-specific plans. Deviations from the methods prescribed in these plans shall be approved by the AES Project Manager. Typical drilling methods include air rotary, mud/fluid rotary, and hollow-stem auger. Drilling with mud, foam, or water is not desirable, but the driller shall have the capability to use this method if hole conditions warrant it. Installation of wells drilled by mud, foam, water, or air rotary shall be reamed to the appropriate borehole diameter. Installation of wells with protective casing shall be done by either penetrating the outer casing into the ground by hammer blows or by drilling a borehole. The outer casing should be set and secured by grouting or other means specified in the site-specific plans. The inner well borehole can then be drilled through the center of the outside casing. The monitoring wells shall be drilled vertical or at an angle if specified in the site-specific plans. The wells shall be drilled to a depth specified in the site-specific plans and may vary based on actual lithologic conditions. The depth to completion should be approved by the AES Project Manager prior to monitoring well construction. Drillers must prevent grease, oil, and other fluids from the drill rig from coming in contact with the ground around the area of well installation.

5.2 Monitoring Well Installation

5.2.1 Stable Borehole

A stable borehole must be constructed prior to attempting to install the monitoring well casing and assembly. Steps must be taken to stabilize the borehole before attempting installation if the borehole tends to cave or blow-in, or both. Boreholes that are not straight or are partially obstructed should be corrected prior to attempting the installations described herein.

Although all monitoring wells will not be completed exactly alike, there are common elements among them. The Soil Boring Log Form must be completed by the end of the activity with data obtained through the installation process. The soil boring log field form should be reviewed prior to initiation of drilling activities to assure that the required data are collected at appropriate times during drilling and installation.

Some monitoring wells may require collection of continuous core, which will be maintained from surface to total depth. Samples may be collected by the wire line coring method (or split-spoon sampler). A description of soil/lithologic materials and drilling observations needs to be recorded in a field logbook in accordance with the AES Field Logbook Content and Control SOP.

The retrieved samples will be visually screened for indications of water saturation to identify any perched zone and associated impervious layer. If there is sufficient groundwater in a perched zone, a monitoring well may be completed in that zone. Operations will resume if the suspected saturated interval is determined not to be perched water or to be of insufficient thickness to warrant well construction.

For wells not completed in perched zones, the drilling method should ensure isolation of the perched water from the advancing hole, which can be accomplished by an outer protective casing. This method, however, may require short core sections to maintain a close interval between the drive casing and the core depth (that is, until the perched water zone has been completely penetrated). During completion of the well through the perched water zones, the cement grout should stay well above the retracting drive casing shoe.

5.2.2 Well Casing Assembly

The well screen, casing, and bottom plug should be either certified clean from the manufacturer or decontaminated according to the AES Field Equipment Decontamination at Nonradioactive Sites SOP.

Personnel should take precautions to assure that grease, oil, or other contaminants that may alter water samples do not contact any portion of the well casing assembly. As a precaution, personnel should wear a pair of clean gloves while handling the assembly.

Normally, couplings are tightened by hand; however, steam- or high-pressure-cleaned strap wrenches may also be used. Use pipe wrenches with care as they may scar and weaken the pipe. Precautions should be taken to prevent damage to the threaded joints during installation.

5.2.3 Setting the Well Screen and Casing Assembly in Fluid Filled Holes

When the well screen and casing assembly is lowered to the predetermined level and held in position, the assembly may require a ballast to counteract the tendency to float in the borehole. Ballasting may be accomplished by continuously filling the casing assembly with contaminant-free water. If fluid ballasts are used, the quantity introduced must be recorded in the field logbook. Alternatively, the casing assembly may be slowly pushed into the fluid in the borehole with the aid of hydraulic rams on the drill rig and held in place as additional sections of casing are added to the column. Care must be taken to secure the casing assembly so that personnel safety is assured during the installation. For wells greater than 100 feet, the assembly should be installed straight using centralizers at selected intervals.

Difficulty in maintaining a straight installation may be encountered when the weight of the well screen and casing assembly is significantly less than the buoyant force of the fluid in the borehole. The casing should extend to grade or approximately 2 feet above grade, depending on the intended surface completion, and be capped or covered temporarily to deter entrance of foreign materials during completion operations.

Monitoring wells will be completed with material as approved by the AES Project Manager. The casing should be flush-threaded, using Schedule 40 PVC or other suitable monitoring well casing. No adhesives, cements, or lubricants shall be used during casing make-up or during other drilling and well completion operations.

5.2.4 Installation of the Primary Filter Pack

Placement of the casing assembly is followed by placing the primary filter pack sand/filter pack (consisting of silica sand sized according to the average grain size of the screened formation) into the bottom of the borehole by using a tremie pipe. The remaining primary filter pack is then placed in increments as the tremie is gradually raised. The sand pack will be emplaced by the "washdown" gravity method and the depth to the top of the sand pack shall be determined and recorded frequently during the operation to ensure proper placement. The tremie pipe or a weighted line inserted through the tremie pipe can be used to measure the top of the primary filter pack as work progresses. As primary filter pack material is poured into the tremie pipe, water from a source of known chemistry may be added to help move the filter pack. The quantity of water introduced must be recorded. If bridging of the primary filter pack occurs, the bridged material should be broken mechanically prior to proceeding with the addition of more filter pack material. The depth, volume, and gradation of the primary filter pack will be recorded on the well construction diagram.

If used, temporary casing or auger sections will be withdrawn in increments. Care should be taken to minimize lifting the casing with the withdrawal of the temporary casing/augers. To limit borehole collapse, the temporary casing or hollow-stem auger is usually withdrawn until the lowermost point on the temporary casing or hollow-stem auger is at least 2 feet, but no more than 5 feet, above the filter pack for unconsolidated materials; or at least 5 feet, but no more than 10 feet, for consolidated materials. Ascertain the depth of the sand with an acceptable measuring device or with tremie pipe and verify the thickness of the sand pack. The primary filter pack is typically placed a minimum of 2 feet above the top of the well screen to account for settlement of the filter pack.

5.2.5 Installation of the Bentonite Seal

A minimum 2-foot-thick bentonite seal should be emplaced on top of the filter pack or transition sand (if used) by using a tremie pipe, if required. If the tremie pipe becomes plugged, requiring an increase in pressure to clear it, not less than 20 feet of tremie pipe shall be pulled up to avoid jetting into the sand pack. If the seal is installed above the water level, water shall be added to allow proper hydration of the annular seal (approximately 1 gallon for each linear foot of annular seal). The volume and depth of the bentonite seal material shall be measured and recorded on the well construction diagram.

5.2.6 Grouting the Annular Space

The following procedures apply to both single- and multi-cased monitoring wells. However, it should be noted that grouting procedures will vary with the type of well design.

A sufficient volume of grout should be premixed onsite, according to procedure stipulated by the manufacturer, to compensate for unexpected losses and checked against the known volume of annular space to ensure that bridging does not occur during emplacement. The use of alternate grout materials, including grout containing Portland cement, may be necessary to control zones of high grout loss. The mixing (and placing) of grout should be performed with recorded weights and volumes of materials, according to procedures stipulated by the manufacturer. Lumpy grout should not be used in an effort to prevent bridging within the tremie and the well; however, lost circulation materials may be added to the grout if excessive grout loss occurs. Bentonite-based grout of Volclay or equivalent type should be mixed to the manufacturer's specifications then pumped into place using minimum pump pressure. All additives to grouts should be evaluated for their effects on subsequent water samples.

Depending upon the well design, grouting may be accomplished using a pressure grouting technique or by gravity feed through a tremie pipe. With either method, grout is introduced in one continuous operation until grout flows out at the ground surface without evidence of drill cuttings or fluid. The grout backfill should be injected under pressure using a tremie pipe to reduce the possibility of leaving voids in the annular seal and to displace any liquids and drill cuttings that may remain in the annulus.

Grouting should begin directly above the bentonite seal, after the bentonite has been adequately hydrated. Grout should be injected using a tremie pipe. The tremie pipe should be kept full of grout from start to finish with the discharge end of the pipe completely submerged as it is slowly and continuously lifted. Pump pressure shall be kept to a minimum. Approximately 5 to 10 feet of tremie pipe should remain submerged during grout emplacement. If possible, steel tape soundings should be made to ensure the level of the tremie material is in agreement with the calculated volume and that the desired placement of annular materials is achieved. A staged grouting procedure may be considered if the couplings of the selected casing cannot withstand the shear or if there is collapse stress exerted by the full column of grout as it sets. If used, the temporary casing or hollow-stem auger should be removed in increments (immediately following each lift of grout installation) well in advance of the time when the grout begins to set. The initial grout mixture must be allowed to cure for approximately 12 hours, then refilled to the surface.

The well casing should not be developed until the grout sets and cures for the amount of time necessary to prevent a break in the seal between the grout and casing. The amount of time required (generally 24 to 48 hours) will vary with grout content and climate conditions and should be documented on the well completion diagram along with the volume and depth of grout used to backfill the annular space.

5.3 Well Protection

Well protection refers specifically to installations made at or above the ground surface to deter unauthorized entry to the monitoring well and to prevent surface water from entering the annulus.

The protective casing should extend from below the frost line (at least 2 feet below grade) to slightly above the well casing top. The protective casing should be sealed and immobilized in concrete that has been placed around the outside of the protective casing above the set grout backfill. The casing should be positioned and stabilized in a position concentric with the casing. Clearance (usually 6 inches) should be maintained between the lid of the protective casing and the top of the casing to accommodate sampling equipment. A 1/4-inch-diameter weep hole should be drilled in the protective casing at the ground surface to permit water to drain out of the annular space. This hole will also prevent water freezing between the well protector and the well casing.

All materials used should be documented on the well construction diagram. The monitoring well identification number should be clearly visible on the inside and outside of the lid of the protective casing and the outside of the protective casing.

A 3-foot x 3-foot x 6-inch thick concrete pad, sloped to provide water drainage away from the well, may be placed around the installation. Pad size may vary according to site conditions or client specifications. Three 2-1/2-inch diameter concrete-filled steel posts set at least 24-inches below the surface in concrete should be equally spaced around the well to protect against damage by vehicular traffic for aboveground well completions. The protective casing and steel posts may be primed and painted with rust-resistant yellow paint.

A flush-mounted, traffic-rated casing or vault is typically used for the surface completion of monitoring wells installed in high-use paved areas. The well box cover should be finished slightly above pavement surface to prevent water entry. A layer of sand or gravel material should be placed under the casing/vault to allow infiltrating surface water to drain out.

5.4 Post Operation

5.4.1 Field

At the conclusion of the monitoring well installation activities, all equipment must be decontaminated (according to the AES Field Equipment Decontamination at Nonradioactive Sites SOP) prior to moving the equipment to a different work location. All water used in the decontamination of drilling equipment will be contained in an appropriate container, if required in the site-specific plans.

5.4.2 Documentation

The Soil Boring Log should be completed by the AES Project Manager or designee at the conclusion of the field activity.

Copies of all field notes, the daily logs, and any completed Groundwater Monitoring Well Construction Forms shall be given to the project manager. These records shall be maintained in the project and document control files. At a minimum, all materials used for construction should be documented by entering identifying numbers (lot numbers, manufacturer's identification, etc.) in the field logbook. Samples of well materials (including grout, sand, etc.) may be archived if specified in the project plans.

6.0 References

American Society for Testing and Materials, designation: D 5092-90, *Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers,* ASTM

Committee D-18-.21.05. October 1990.

U.S. Department of Energy, DOE/HWP-100/R1, Standard Operating Procedures for Site Characteristics. Standard Operating Procedure 2, *Monitoring Well Installation,* September 1996.

WELL DEVELOPMENT AND PURGING
STANDARD OPERATING PROCEDURES

1.0 Objective

The purpose of this standard operating procedure (SOP) is to define the procedural requirements for well development and purging.

2.0 Background

Monitoring wells are developed to repair damage to the formation caused by drilling activities and to settle and remove fines from the filter pack. Wells should not be developed for at least 24 to 48 hours after completion when a cement bentonite grout is used to seal the annular space; however, wells may be developed before grouting if conditions warrant. Wells are purged immediately before groundwater sampling to remove stagnant water and to sample representative groundwater conditions. Wells should be sampled within 3 hours of purging (optimum) to 24 hours after purging (maximum, for low recharge conditions).

2.1 Associated Procedures

- AES Water Level Measurement SOP
- AES Field Equipment Decontamination at Non-Radioactive Sites SOP

3.0 Responsibilities

Site Manager - The site manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that development and purging are carried out in accordance with this procedure.

Field Personnel – Field personnel are responsible for complying with this procedure.

4.0 Required Equipment

- Pump, pump tubing, or bailer and rope or wire line
- Power source (e.g., generator), if required
- Water-level meter or weighted surveyor's tape
- Temperature, conductivity, pH, and turbidity meters
- Personal protective equipment as specified in the site-specific health and safety plan
- Decontamination supplies, as required, according to the AES Field Equipment Decontamination at Nonradioactive Sites SOP
- Disposal drums, if required
- Photoionization detector (PID) or equivalent as specified in site-specific health and safety plan

5.0 Procedures

5.1 Well Development

The following steps must be followed when developing wells:

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
4. Determine the depth to static water level and depth to bottom of the casing.
5. Prepare the necessary equipment for developing the well. There are a number of techniques that can be used to develop a well. Some of the more common methods are bailing, overpumping, backwashing, mechanical surging, surge and pump, wire brush, swabbing, and high-velocity jetting. All of these procedures are acceptable; however, final approval of the development method rests with the appropriateness of a specific method to the site and the client.
6. For screened intervals longer than 3 meters (m) (10 feet), develop the well in 0.75- or 1-m (2- or 3-foot) intervals from bottom to top. This will ensure proper packing of the filter pack.
7. Continue well development until produced water is clear and free of suspended solids, as determined by a turbidity meter or when pH, conductivity, and temperature have stabilized. Record pertinent data in the field logbook and on appropriate well development forms. Remove the pump assembly or bailers from the well, decontaminate (if required), and clean up the area. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plans.

5.2 Volumetric Method of Well Purging

The following steps should be followed when purging a well by the volumetric method:

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements. Determine the depth to static water level and depth to bottom of well casing according to the AES Water Level Measurement SOP. Calculate the volume of water within the well bore using the following formula (or equivalent):

$$7.4805\ [D^2\pi\ /\ (4)]\ dH = \text{volume (in gallons)},$$

where

D = casing diameter in feet. (Note: This equation is used for grouted wells with short screens. For wells with long screens and/ or ungrouted wells, the D = borehole diameter in feet).

dH = the distance from well bottom to static water level in feet

π = 3.1416

Note: Record all data and calculations in the field logbook.

5. Prepare the pump and tubing, or bailer, and lower it into the casing.
6. Remove the number of well volumes specified in the site-specific plans. Generally, three to five well volumes will be required. Conductivity, pH, and temperature should be measured and recorded, if required by site-specific plans. In low recharge aquifers, the well commonly will be pumped or bailed to dryness before three well volumes of water are removed. If this is the case, there is no need to continue with purging operations. Record pertinent data in the field logbook.
7. Remove the pump assembly or bailer from the well, decontaminate it (if required), and clean up the site. Lock the well cover before leaving. Containerize and/ or dispose of development water as required by the site-specific plan.

5.3 Indicator Parameter Method of Well Purging

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
4. Determine the depth to static water level and depth to bottom. Set up surface probe(s), (e.g., pH, conductivity) at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber. Allow probe(s) to equilibrate according to manufacturer's specifications. Record the equilibrated readings in the field logbook.
5. Assemble the pump and tubing, or bailer, and lower into the casing.
6. Begin pumping or bailing the well. Record indicator parameter readings for every purge volume. Maintain a record of the approximate volumes of water produced. Continue pumping or bailing until indicator parameter readings remain stable within +10 percent for three consecutive recording intervals, or in accordance with site-specific plans. Purging should continue until the discharge stream is clear or turbidity becomes asymptotic-low or meets project requirements. In a low recharge aquifer, the well may pump or bail to dryness before indicator parameters stabilize. In this case, there is no need to continue purging. Record pertinent data in the field logbook.
7. Remove the pump assembly or bailer from the well, decontaminate (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plans.

6.0 Restrictions/Limitations

Where flammable, free, or emulsified product is expected, or known to exist on or in groundwater, use intrinsically safe electrical devices only and place portable power sources (e.g., generators) 15 m (50 feet) or further from the wellhead and disposal drums.

Standard Operating Procedure
Groundwater Monitoring Well Measurement

Purpose

The purposes of this Standard Operating Procedure are: 1). to prevent or lessen the possibility of cross-contamination between monitoring wells during measurement and sampling; 2) to obtain depth to **static** water level measurements from an equilibrated monitoring well; and 3) to prevent misrecorded water level measurements.

Method

1. Utilizing historic sampling data for this site, determine the order in which the monitoring wells will be measured and sampled. Generally, wells that have historically had the lowest contaminant concentrations will be sampled first, followed by the wells with higher contaminant concentrations. Basically, the measurement and sampling order should be from lowest to highest contamination. Most often, the measurement and sampling order is determined in the office prior to going to the site.

2. Following the determined measurement and sampling order, remove the well vault cover and locking well plug from each well. In areas with high vehicular or foot traffic, the well vault cover is to be placed over the well to protect the well casing, vehicles, and pedestrians.

3. Utilizing a **properly decontaminated** Water Level Indicator, starting at the first monitoring well opened (the least contaminated) obtain a depth to water measurement from the survey point on the top of the well casing to the static water level within the well and record the measurement result on the Sampling and Measurement Form under "Initial D.T.W." Measure depth to water in the remaining wells in the proper order, decontaminating the Water Level Indicator between each well measurement, and record the measurement results on the respective Sampling and Measurement Form.

4. Returning to the first well measured (least contaminated) and utilizing a **properly decontaminated** Water Level Indicator, re-measure the depth to water in the well and record the measurement result on the Sampling and Measurement Form under "Confirmed D.T.W."

5. Determine appropriate purging volume, purge the monitoring well, collect groundwater sample (utilizing appropriate SOPs), and finally, following sample collection, obtain a depth to water measurement in the well and record the measurement result on the Sampling and Measurement Form under "Final D.T.W."

6. Complete measurement and sampling in appropriate order on remaining wells, decontaminating all measurement and sampling equipment following each use.

GROUNDWATER SAMPLING USING BAILERS
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to define requirements for the collection of groundwater samples with bailers.

2.0 Background

Collection of groundwater samples from monitoring wells on or near a site may be required to characterize the nature and extent of groundwater contamination.

Methods used for the collection of groundwater samples include bailing and a variety of pumping techniques. Bailers are hollow cylinders with unidirectional (open up) check valves at the bottom end. Some bailers may also be closed or valved at the upper end. Bailers used in environmental applications are typically constructed of polyvinyl chloride (PVC), stainless steel, or Teflon. The bailer cable typically consists of disposable nylon cord, disposable polypropylene cord, or Teflon-coated stainless steel wire. The bailer is lowered into the well on an acceptable line until submerged. The bailer is then retrieved to the surface for sample collection. For the best results, the sequence of sampling is from least to most contaminated wells. It is preferable to have bailers dedicated to each monitoring well.

2.1 Associated SOPs

AES Water Level Measurement SOP
AES Packaging and Shipping Environmental Samples SOP
AES Field Logbook Content and Control SOP
AES Well Development and Purging SOP
AES Field Equipment Decontamination SOP
AES Concise Well Measurement SOP

3.0 Responsibilities

Project Manager – The project manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that groundwater samples are collected in accordance with this procedure.

Field Team Leader (FTL) – The FTL is responsible for ensuring that sampling efforts are conducted in accordance with this procedure and any associated SOPs.

4.0 Required Equipment

- Site-specific plans

- Historic sampling data, if available
- Field logbook
- Indelible black ink pens and markers
- Chain of Custody forms
- Labels and appropriate forms/documentation for sample shipment
- Insulated cooler and waterproof sealing tape (strapping tape)
- Plastic zip-top bags
- Blue Ice or ice double-bagged in plastic zip-top bags
- Bailer of the appropriate design and construction for the sampling application
- New cord or wire of sufficient length for conditions
- Water level meter and/or other water level measuring device
- Clean beaker(s) or other container(s) for measurement of water Quality parameters
- Plastic sheeting (4-mil thickness)
- Latex or appropriate gloves
- Filtering apparatus, if required
- Appropriate sample containers with labels and preservatives, as required
- Temperature, conductivity, pH, dissolved oxygen, and turbidity meters as required by the site-specific plans
- Photoionization detector (PID) or equivalent and other instruments as required by the site-specific health and safety plan
- Decontamination supplies, as required by the AES Field Equipment Decontamination SOP
- Personal protective clothing and equipment, if required by the site-specific health and safety plan

5.0 Procedures

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan. All field equipment will be calibrated, tested, or checked for proper functioning before use as per the manufacturer's instructions.

2. Prepare the site for sample acquisition. If required, cover the ground surface around the wellhead with plastic sheeting. Arrange the required decontaminated sampling and monitoring equipment for convenient use. If onsite decontamination is required, arrange the necessary supplies in a nearby but separate location, away from the wellhead (e.g., exclusion zone).

3. Open the well and note the condition of the casing and cap. Immediately check for organic vapors using a PID or flame ionization detector as appropriate. Refer to the site health and safety plan for the required monitoring and frequencies.

4. Determine the static water level and depth to well bottom according to the AES Water Level Measurement SOP. Record this information in the field logbook or on the appropriate form.

5. Purge the well according to the AES Well Development and Purging SOP. Allow the water level to recover to a depth at least sufficient for the complete submergence of the bailer without contacting the well bottom. (The water level in the well should be allowed to recharge to 75 percent of its static level so that a representative sample of the screened portion of the aquifer can be obtained.) Samples shall be collected within 3 hours of purging if recharge is sufficient. Wells with a low recharge rate must be collected within 24 hours of purging.

6. Securely attach the bailer to the line. The opposite end of the line should be secured to prevent loss of the bailer into the well.

7. Arrange the sample containers in the order of use. Samples to be analyzed for volatile organic compounds (VOCs), if required, shall be obtained first, followed in order by other organic samples, then inorganic samples and other parameters. For example:
   a) VOCs
   b) Purgeable organic carbon (POC)
   c) Purgeable organic halogens (POX)
   d) Total organic halogens (TOX)
   e) Total organic carbon (TOC)
   f) Extractable organics*
   g) Total metals
   h) Dissolved metals
   i) Cyanide
   j) Sulfate and chloride
   k) Nitrate and ammonia

   *Extractable organics include semivolatile organic compounds, pesticides, and PCBs.

8. Don clean sampling gloves; lower the decontaminated or disposable bailer into the well. The bailer should enter the water slowly to prevent aeration, particularly when VOC samples are being collected. Care should be taken to avoid having the bailer come in contact with the well bottom.

9. Retrieve the filled bailer to the surface. To prevent contamination of the bailer line, do not allow the line to contact the ground, instead keep the line on the plastic sheeting. Hang the bailer from a bailer stand or other support, if available, or have an assistant hold it off the ground. Immediately obtain any required volatile samples (VOC, POC, POX, TOX, or TOC) by gently transferring water from the bailer to the sample bottle through a VOC sampling device. The containers for

organic analytes should be tilted when filling to prevent aeration. Check the filled VOC vials for bubbles. If bubbles are present in a vial, discard it and fill another vial from the bailer. After collecting volatile samples, lower the bailer to collect additional water for the remaining parameters. If sample filtration is required for metals, it should be performed immediately following sample retrieval and prior to sample preservation. Organic samples generally do not require filtration; VOC samples should never be filtered. Preservation of samples should be performed according to the applicable field plan. Check the pH on samples (other than VOCs) that require preservation. Collect additional quality assurance/quality control samples as required by the applicable field plan.

10. Wipe the outer surfaces of the sample containers clean with a Kim-wipe or clean paper towel. Additional sample bottle decontamination may be appropriate in some cases.

11. Properly label all containers according to the AES Packaging and Shipping Environmental Samples SOP.

12. Place sample containers in individual zip-top plastic bags, and seal the bags (if required by site-specific plans).

13. Immediately pack all sample containers that require a 4°C preservation on ice in coolers (refer to the sampling plans).

14. Record analytes and volumes collected, and time and date of collection in the field logbook. Prepare chain-of-custody forms according to site-specific plans.

15. Decontaminate sampling equipment according to the AES Field Equipment Decontamination SOP.

16. Close and lock the well cover. Clean up the area and place disposable materials (plastic sheeting, gloves, Tyvek) in the designated receptacle.

6.0 Restrictions/Limitations

Obtain required field measurements such as temperature, conductivity, pH, oxidation potential (Eh), turbidity, salinity, or dissolved oxygen measurements immediately after samples have been collected. This may require additional time for well recovery. *Note:* Some of these parameters will have already been determined during purging; they should be repeated after sample collection if required by site-specific plans.

Proper sampling for VOC analysis or for analysis of any other compound(s) that may be degraded by aeration is necessary to minimize sample disturbance and analyte loss. The representativeness of this sample, however, is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

7.0 References

Office of Solid Waste and Emergency Response. 1986. *RCRA Groundwater Monitoring Technical Guidance Enforcement Document,* OSWER-9950.1. September.

U.S. Department of Energy. 1996. Hazardous Waste Remedial Actions Program, *Quality Control Requirements for Field Methods,* DOE/HWP-69R2. September.

U.S. Department of Energy. 1996. Hazardous Waste Remedial Actions Program, *Standard Operating Procedures for Site Characterization,* DOE/HWP-100/R1. September.

GUIDE TO HANDLING INVESTIGATION-DERIVED WASTE STANDARD OPERATING PROCEDURES

1.0 Purpose

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed prior to field activities
- Remove wastes that pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require offsite disposal or extended above-ground containerization
- Complying with federal, state, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 Background

2.1 Definitions

Hazardous Waste - Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes (IDWs) - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or non-hazardous.

Mixed-Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes - Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/ or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

> **Note:** The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with applicable regulatory requirements.

3.0 Responsibilities

Site Manager – The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager – The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members – Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required should consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT) approved steel containers
- Bulk storage tanks comprised of polyethylene or steel

Containment of IDW should be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device should be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking should be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are:

- Labels and markings that contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents. Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.
- Labeling or marking requirements for IDW expected to be transported offsite must be in accordance with the requirements of 49 CPR 172.

4.3 IDW Container Movement

Staging areas for IDW containers should be predetermined and in accordance with site-specific and/or client requirements. Arrangements should be made prior to field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation offsite onto a public roadway is prohibited unless 49 CPR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW should be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided as appropriate.

5.0 Procedures

The three general options for managing IDW are (1) collection and onsite disposal, (2) collection for offsite disposal, and (3) collection and interim management. Attachment 1 summarizes media-specific information on generation processes and management options. The option selected should take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite

- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client should approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a workplan or separate document.

5.1 Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).
2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).
3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).
4. Send to onsite TSDF - may require analytical analysis prior to treatment/disposal.

Note: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids

The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.
2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background upgradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.
3. Discharge to sanitary sewer.
4. Send to onsite TSDF - may require analysis prior to treatment/disposal.

Note: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE

The options for handling disposable PPE are as follows:

1. Double-bag contents in non-transparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.
2. Containerize, label, and send to onsite TSDF - may require analysis prior to treatment/disposal.

5.2 Offsite Disposal

Before sending to an offsite TSDF, analysis may be required. Also, manifests are required. Arrangements must be made with the client responsible for the site. The TSDF and transporter must be permitted for the respective wastes.

5.2.1 Soil/Sludge/Sediment

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums) until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE

When the final site remedy requires offsite treatment disposal the IDW may be containerized and stored. The management option selected should take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Interim Measures

All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW onsite until the final action may be practical in the following situations:
    - A. Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal in the final remediation alternative.
    - B. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.
    - C. Offsite disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.
    - D. Interim storage may be necessary to provide time for sampling and analysis.
2. Segregate and containerize all waste for future treatment and/or disposal.
    - A. Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.
    - B. Containment options for aqueous liquids may include mobile tanks or drums.
    - C. Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations

Site Managers should determine the most appropriate disposal option for aqueous liquids on a site-specific basis. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. Under no circumstances should these types of materials be brought back to the office or warehouse.

7.0 References

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001.1.

U.S. Environmental Protection Agency. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees,* EPA/530-SW-90-057.

U.S. Environmental Protection Agency. May 1991. *Management of Investigation-Derived Wastes During Site Inspections,* EPA/540/G-91/009.

U.S. Environmental Protection Agency. January 1992. *Guide to Management of Investigation-Derived Wastes,* 9345.3-03FS.

U.S. Environmental Protection Agency, Region IV. May 1996 and 1997. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual,* revisions.

AES Animas Environmental Services, LLC

Animas Environmental Services, LLC

624 E. Comanche • Farmington, NM 87401
Tel 505-564-2281 • Fax 505-324-2022
www.animasenvironmental.com

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Thursday, May 01, 2008 3:43 PM
To: 'Ross Kennemer'; Price, Wayne, EMNRD
Cc: Powell, Brandon, EMNRD; Mike Dimond
Subject: RE: Second Revised SAP - BMG Evaporation Pond

Ross,

I will try to meet you at the site Monday morning around 10:00 am, as we discussed. OCD appreciates your effort in revising the plan. The plan is adequate for the proposed purpose. The criteria for the final disposition of purged ground water back into the repaired evaporation pond is not required, but there is no need to revised the plan again. Once again, thank you for working with us. I'll see you Monday (May 5, 2008).

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us
Office: (505) 476-3487
Fax: (505) 476-3462

From: Ross Kennemer [mailto:rkennemer@animasenvironmental.com]
Sent: Tuesday, April 29, 2008 9:10 AM
To: Price, Wayne, EMNRD
Cc: Jones, Brad A., EMNRD; Powell, Brandon, EMNRD; Mike Dimond
Subject: Second Revised SAP - BMG Evaporation Pond

Attached is a revised version of the SAP sent out yesterday. It includes additional clarification requested by NMOCD and all of the SOPs to be utilized during the investigation.

Please call me with any questions. I will be in the field until Friday, but can be reached on my cell at (505) 486-1776.

Ross Kennemer
Project Manager

Animas Environmental Services, LLC
624 E. Comanche St.
Farmington, NM 87401
(505) 564-2281
rkennemer@animasenvironmental.com

Jones, Brad A., EMNRD

From: Mike Dimond [mikedimond@bmgdrilling.com]
Sent: Tuesday, April 29, 2008 2:55 PM
To: 'Ross Kennemer'; Price, Wayne, EMNRD
Cc: Jones, Brad A., EMNRD; Powell, Brandon, EMNRD; 'Ben Gonzales'
Subject: RE: Second Revised SAP - BMG Evaporation Pond

Ross,
Let's plan on replacing the liner. It has been there a while and we are thinking its leaking comes from sun damage on upper portions. I want this to leave as little worry as possible when complete.
Mike

From: Ross Kennemer [mailto:rkennemer@animasenvironmental.com]
Sent: Tuesday, April 29, 2008 9:10 AM
To: 'Price, Wayne, EMNRD'
Cc: brad.a.jones@state.nm.us; Brandon.powell@state.nm.us; Mike Dimond
Subject: Second Revised SAP - BMG Evaporation Pond

Attached is a revised version of the SAP sent out yesterday. It includes additional clarification requested by NMOCD and all of the SOPs to be utilized during the investigation.

Please call me with any questions. I will be in the field until Friday, but can be reached on my cell at (505) 486-1776.

Ross Kennemer
Project Manager

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Farmington, NM 87401
(505) 564-2281
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Jones, Brad A., EMNRD

From: Ross Kennemer [rkennemer@animasenvironmental.com]
Sent: Tuesday, April 29, 2008 9:10 AM
To: Price, Wayne, EMNRD
Cc: Jones, Brad A., EMNRD; Powell, Brandon, EMNRD; Mike Dimond
Subject: Second Revised SAP - BMG Evaporation Pond
Attachments: Revised SAP 042808.pdf

Attached is a revised version of the SAP sent out yesterday. It includes additional clarification requested by NMOCD and all of the SOPs to be utilized during the investigation.

Please call me with any questions. I will be in the field until Friday, but can be reached on my cell at (505) 486-1776.

Ross Kennemer
Project Manager

Animas Environmental Services, LLC
624 E. Comanche St.
Farmington, NM 87401
(505) 564-2281
rkennemer@animasenvironmental.com

Prepared for:
Brandon Powell
New Mexico Oil Conservation Division
1000 Rio Brazos Road
Aztec, New Mexico 87410

Prepared on behalf of:
Benson-Montin-Greer Drilling Corporation
4900 College Blvd.
Farmington, New Mexico 87402

REVISED SAMPLING AND ANALYSIS PLAN

Centralized Surface Waste Management Facility Evaporation Pond

Benson Montin Greer

NW¼ NW¼ of Section 20, T25N, R1E
Rio Arriba County, New Mexico

Date of Plan: April 28, 2008

Prepared by:
Animas Environmental Services, LLC
624 E. Comanche
Farmington, New Mexico 87401

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Appendix A. Standard Operating Procedures – Drilling
Standard Operating Procedures – Equipment Decontamination
Standard Operating Procedures – Subsurface Soil Sampling
Standard Operating Procedures – Field Measurement of Organic Vapors
Standard Operating Procedures – Soil Sampling Procedures at Petroleum Storage Tank Sites
Standard Operating Procedures – Packing and Shipping Samples
Standard Operating Procedures – Design and Installation of Monitoring Wells
Standard Operating Procedures – Well Development and Purging
Standard Operating Procedures – Groundwater Monitoring Well Measurement
Standard Operating Procedures – Groundwater Sampling Using Bailers
Standard Operating Procedures – Investigation Derived Waste Handling

1.0 Introduction

Animas Environmental Services, LLC (AES), on behalf of Benson Montin Greer Drilling Corporation (BMG), submits this Sampling and Analysis Plan (SAP) for the BMG Centralized Surface Waste Facility's Evaporation Pond subsequent to electronic correspondence between BMG and Wayne Price of the New Mexico Oil Conservation Division (NMOCD) on April 21, 2008. A leak from the evaporation pond was confirmed when AES observed water within the interstitial monitoring well between the primary and secondary pond liner on April 14, 2008.

2.0 Site Information

2.1 Site Location

The evaporation pond is located in the northeast corner of the BMG Centralized Surface Waste Facility located in the NW¼ NW¼ of Section 20, Township 25N, Range 1E, Rio Arriba County, New Mexico. A topographic site location map and a general site map are included as Figure 1 and Figure 2, respectively. The location of the interstitial monitoring well is shown on Figure 3.

3.0 Proposed Scope of Work

Site investigation activities will be initiated in order to determine whether the integrity of the secondary pond liner has been compromised, resulting in pond contents leaking into the subsurface. The investigation procedures are designed to be protective of both soil and groundwater and are based upon protocols outlined in the USEPA documents, *Expedited Site Assessment Tools for Underground Storage Tank Sites*, March 1997, and *Site Characterization for Subsurface Remediation*, November 1991.

3.1 Utilities Notification

AES will utilize the New Mexico One-Call system to identify and mark all underground utilities at the site before the start of any field activities which could impact buried utilities. Any local utilities not participating in the New Mexico One-Call system will be contacted separately by AES for utility locations.

3.2 Health and Safety Plan

AES has a Health and Safety Program in place to ensure the health and safety of all AES employees. The Health and Safety Program defines safety practices and procedures to be instituted in all AES work places, as applicable. The program meets the requirements promulgated by the Occupational Safety and Health Act (OSHA). All AES personnel are appropriately trained in accordance with OSHA 40 CFR 1910.120.

A comprehensive site-specific Health and Safety Plan (HASP) addressing the site investigation and associated sampling will be prepared prior to the start of the field work. All employees and subcontractors will be required to read and sign the HASP to acknowledge their understanding of the information contained within it. The HASP will be implemented and enforced on site by the assigned Site Safety and Health Officer. Daily tailgate meetings will be held and documented during field activities and will address specific health and safety concerns or issues.

3.3 Installation of Soil Borings

AES proposes to install four soil borings, each of which will be completed as a groundwater monitoring well, along the perimeter of the evaporation pond in order to determine whether or not groundwater has been impacted by a potential release from the pond's secondary liner. The locations of the soil borings/monitor wells will be determined in the field based on the observations and best judgment of the AES project manager in consultation with BMG and NMOCD representatives that may be on-site. It is anticipated that groundwater will be encountered between 30 and 50 feet below ground surface. Possible locations of the soil borings/monitor wells are shown on Figure 3.

Soil borings will be advanced with a CME 75 hollow stem auger drill rig, utilizing 7.25 inch outside diameter augers. Drilling will be provided by Envirodrill, Albuquerque, New Mexico. All drilling will be completed in strict accordance with the Standard Operating Procedure (SOP) for hollow stem auger drilling included in Appendix A. Strict decontamination procedures for drilling and sampling equipment will be maintained in accordance with the SOP included in Appendix A.

3.4 Soil Sampling and Analyses

3.4.1 Soil Sample Collection

Soil samples will be collected from continuously driven core-barrel samplers during advancement of the soil borings, and for each soil boring, a Soil Boring Log will be completed. These logs will record observations of soil moisture, color, density, grain size, plasticity, contaminant presence, and overall stratigraphy. Soil sample collection will be completed in strict accordance with the SOP included in Appendix A.

3.4.2 Field Screening

Soil samples will be collected from each boring at intervals of five feet and field screened for volatile organic vapors utilizing a photo-ionization detector (PID) organic vapor meter (OVM) calibrated with isobutylene gas to obtain preliminary data regarding potential petroleum hydrocarbon-impacted soil.

Once collected, the soil sample to be field screened will be immediately placed in a clean 16 ounce glass jar, filled approximately half full, and sealed with a threaded ring lid and a sheet of aluminum foil. The sample jar will then be placed in a warm water bath where it will be warmed to approximately 80°F. Approximately ten minutes will be allowed for the soil to be heated and for any VOCs in the soil to accumulate in the head space of the jar. During the initial stages of headspace development, the sample will be gently shaken for one minute to promote vapor development and disaggregate the sample. Volatile gases will then be measured by piercing the aluminum foil with the sample probe of the PID-OVM. The highest (peak) measurement will be recorded.

The action level for PID-OVM readings will be considered to be any reading that is above a concentration of 10 parts per million (ppm). The extent of soil contamination will continue to be defined in either a vertical and/or horizontal direction until non-detectable field screening concentrations are reached. PID-OVM readings will be recorded onto the Soil Boring Logs. All field screening will be completed in strict accordance with the SOP included in Appendix A.

3.4.3 Laboratory Analyses - Soil

AES will collect at least two soil samples from each soil boring for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), total petroleum hydrocarbons (TPH), and chlorides. At least one sample will be collected from the depth at which the highest soil vapor reading is observed and one sample will be collected from the final boring depth, or if groundwater is encountered, from just above the capillary fringe. Soil sample collection will be completed in strict accordance with the SOP included in Appendix A.

Analytical samples collected from soil borings will be submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 1. Soil Analytical Parameters

Parameter	***Analytical Method***	***Analyzing Laboratory***
BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Total Petroleum Hydrocarbons (TPH) (C_6-C_{36})	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

Once collected, sample containers will be packed with ice in insulated coolers and shipped via UPS or Greyhound Bus to the analyzing laboratory. Typical laboratory regular turn around time is 12 to 15 business days. Sample handling and shipping will be completed in strict accordance with the SOP included in Appendix A.

For all laboratory samples, quality assurance and quality control (QA/QC) procedures, sample preservation, apparatus required, and analyses performed will be in accordance with USEPA Document EPA-600, "Methods for Chemical Analysis for Water and Wastes" dated July 1982; and USEPA document SW-846, 3rd Edition, "Test Methods for Evaluating Solid Waste: Physical Chemical Methods", dated November, 1986.

3.5 Groundwater Monitor Well Installation

3.5.1 Groundwater Monitor Well Installation and Construction

Two-inch diameter groundwater monitoring wells will be installed within each of the four soil borings. The screened interval will extend 15 feet across the water table, with 5 feet above and 10 feet below the water table. The wells will be constructed of 2-inch PVC well screen (0.010-inch slot) and 2-inch PVC blank casing. A filter pack of 10/20 Colorado silica sand well placed from the bottom of the well to one foot above the upper most screen slot. A bentonite seal will be placed above the sand pack, and concrete grout with approximately five percent bentonite will be poured from the top of the bentonite plug up to within a foot of ground surface. An above grade locking steel protective casing, enclosed with a shroud of concrete, will be installed on the well to prevent unauthorized access and damage. A proposed monitoring well construction schematic is included on Figure 4. Monitoring wells will be designed and installed in strict accordance with the SOP included in Appendix A.

3.5.2 Groundwater Monitor Well Development

Following monitor well installation and completion, each well will be developed by a combination of surging and bailing techniques. Monitoring wells will be developed in strict accordance with the SOP included in Appendix A.

Groundwater purged from the wells will be contained in labeled and sealed 55-gallon drums. Development water will be drummed and labeled and will remain on-site in a secure location until proper disposal as described below in Section 3.6.2.

3.5.3 Groundwater Monitor Well Monitoring and Sampling

Upon completion and development, the monitor wells will be allowed to sit undisturbed for a minimum of one week. The groundwater monitor wells will then be gauged to determine water table elevation and direction of groundwater flow. The wells will then be purged of a minimum of three well volumes, and a groundwater sample will be collected from each well.

Groundwater samples will be collected from each well with a dedicated aqua-bailer. Purging data, including pH, temperature, conductivity, oxidation-reduction potential, and dissolved oxygen, will be measured with a YSI water quality meter and documented on a Water Sample Collection Form along with purged water volume. All sampling equipment will be thoroughly decontaminated between uses.

Duplicate groundwater samples will be collected from each monitoring well and held in the event that further laboratory analyses are required. All sample collection data, including sample collection depth, will be documented on a Water Sample Collection Form. A Chain of Custody Record will be completed in the field as samples are being collected. Samples will be stored in a chilled, insulated cooler at 4°C until delivered to the analyzing laboratory.

Groundwater gauging, sampling, and shipping will be completed in strict accordance with the SOPs included in Appendix A.

3.5.4 Professional Survey

The location and elevation of the top of each well casing will be surveyed to the nearest 0.01 foot with reference to mean sea level by a licensed surveyor in order to accurately determine the local groundwater depth and flow direction beneath the site. Each well will be tied to an existing USGS benchmark. AES will arrange with a New Mexico Licensed Professional Surveyor to complete the survey upon completion of the monitoring well installation.

3.5.5 Laboratory Analyses - Groundwater

All groundwater analytical samples collected from the monitoring wells will be submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 2. Groundwater Analytical Parameters

Water Sample Location	***Parameter***	***Analytical Method***	***Analyzing Laboratory***
All Monitoring Wells	BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Total Dissolved Soilds	SM 2540C	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

A travel blank and field blank will be analyzed for BTEX per EPA Method 8021B. Once collected, sample containers will be packed with ice in insulated coolers and shipped via UPS or Greyhound Bus to the laboratory. Typical laboratory regular turn around time is 12 to 15 days.

For all laboratory samples, QA/QC procedures, sample preservation, apparatus required, and analyses performed will be per USEPA Document EPA-600, "Methods for Chemical Analysis for Water and Wastes" dated July 1982; and USEPA document SW-846, 3rd Edition, "Test Methods for Evaluating Solid Waste: Physical Chemical Methods", dated November 1986, as amended by Update One, July 1992.

3.6 Investigation Derived Waste - Waste Acceptance Criteria

All investigation derived waste will be managed in accordance with applicable State and Federal regulations and in strict accordance with the SOP included in Appendix A.

3.6.1 Investigation Derived Waste - Soil

All drill cuttings will be placed within 55-gallon DOT approved drums, which will then be marked with identification and sealed. Samples of the drummed drill cuttings will be collected and submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 3. Investigation Derived Waste – Soil Analytical Parameters

Water Sample Location	*Parameter*	*Analytical Method*	*Analyzing Laboratory*
Each Drum	BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Paint Filter	SW 9095A	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

The final disposition of the drill cuttings will be based on the results of the above analyses and the following criteria:

1. Hydrocarbon contaminants are of a type that can be remediated, as determined by NMOCD
2. "Passing" result of Paint Filter Test
3. Chloride concentration of less than 500 ppm

If all of the three criteria above are met, drill cuttings will then be disposed of at the BMG Landfarm, an NMOCD approved facility. In the event that any of the three criteria is not met, an alternative disposal facility will be selected based on consultation with the NMOCD. Disposal manifests will be included within the assessment report.

3.6.2 Investigation Derived Waste - Groundwater

Groundwater obtained from monitoring well development and pre-sample purging will be stored on-site within 55-gallon DOT approved drums, which will then be marked with identification and sealed. Samples of the drummed groundwater will be collected and submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 4. Investigation Derived Waste – Groundwater Analytical Parameters

Water Sample Location	***Parameter***	***Analytical Method***	***Analyzing Laboratory***
Each Drum	BTEX	EPA Method 8021B	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015B Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Each Drum	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

The final disposition of the purged groundwater will be based on the results of the above analyses and the following criteria:

1. Hydrocarbon contaminants are of a type that can be remediated, as determined by NMOCD
2. Chloride concentration of less than 500 ppm

If each of the two criteria above is met, purged groundwater will then be disposed of at the BMG evaporation pond, an NMOCD approved facility, following either repair or replacement of the ponds primary liner. In the event that either of the two criteria is not met, an alternative disposal facility will be selected based on consultation with the NMOCD. Disposal manifests will be included within the assessment report.

3.6.3 Investigation Derived Waste – Equipment Decontamination Water

All investigation derived decontamination and rinse water will be managed, sampled, analyzed, and disposed in accordance with those methods described Section 3.6.2.

3.6.4 Pond Liner Disposal

In the event the pond liner is to be replaced rather than repaired, the damaged liner will be disposed of at the San Juan County Landfill, Crouch Mesa, New Mexico. Determination of repair or replacement will be made in consultation with the NMOCD.

3.7 *Quality Assurance/Quality Control and Chain of Custody Procedures*

3.7.1 Quality Control Samples

Field quality control samples will be collected in order to assess variability of the media being sampled and to detect contamination and sampling error in the field. Field QC samples will include field duplicates and trip blanks.

- One field duplicate sample will be collected for every ten field samples collected for laboratory analysis in order to check for reproducibility of laboratory and field procedures.

- One trip blank sample will be utilized per sampling event to check for contamination of volatile organic samples during handling and shipment from the field to the analyzing laboratory.

Laboratory QC samples will be analyzed by the laboratory and will consist of matrix spike and matrix spike duplicates for organic samples in order to identify, measure, and control the sources of error that may be introduced from the time of sample bottle preparation through analysis.

3.7.2 Sample Quality Assurance Elements

Sample quality assurance elements will include the following:

1. Sample documentation (location, date and time collected, batch, etc.)
2. Complete chain of custody records
3. Initial and periodic calibration of field equipment
4. Determination and documentation of applicable detection limits
5. Analyte(s) identification
6. Analyte(s) quantification

3.7.3 Chain of Custody Record

A Chain of Custody Record will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for, and a copy of the record will be kept by each individual who has signed it. The Chain of Custody Record will include the following information:

1. Sample identification
2. Sample location
3. Sample collection date
4. Sample information, i.e., matrix, number of bottles collected, etc.
5. Names and signatures of samplers
6. Signatures of all individuals who have had custody of the samples

When samples are not under direct control of the individual currently responsible for them, they will be stored in a locked container which has been sealed with a Custody Seal.

3.7.4 Custody Seal

Custody seals demonstrate that a sample container has not been opened or tampered with. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

4.0 Deliverables

Within 60 days of the completing the SAP, a Site Assessment Report (SAR) summarizing the SAP activities will be submitted to the NMOCD. The SAR will include the following:

1. A summary of all work conducted in the implementation of the SAP;
2. Maps of all soil boring/monitoring well locations, sampling results, geologic cross sections, and soil and groundwater contamination plumes;
3. All laboratory data and quality assurance and quality control information; and
4. Recommendations of further sampling which needs to be conducted as a result of the sampling pursuant to the SAP.
5. Recommendations for further remediation measures

5.0 Implementation Schedule

AES proposes to install and develop the monitoring wells during the week of May 5, 2008. AES personnel will return to the site the following week to collect groundwater samples. AES will prepare the SAR, which will be submitted to the NMOCD within 30 days of receipt of the analytical results.

6.0 Certification

AES has prepared this Sampling and Analysis Plan on behalf of Benson Montin Greer Drilling Corporation to determine whether the integrity of the secondary liner of the evaporation pond has been compromised resulting in a release to the environment.

Respectfully submitted,

Lany Cupps
Project Manager

Ross Kennemer
Senior Environmental Scientist

7.0 References

U.S. Environmental Protection Agency (USEPA). 1982. *Methods for Chemical Analysis for Water and Wastes.* Document EPA-600, July, 1982.

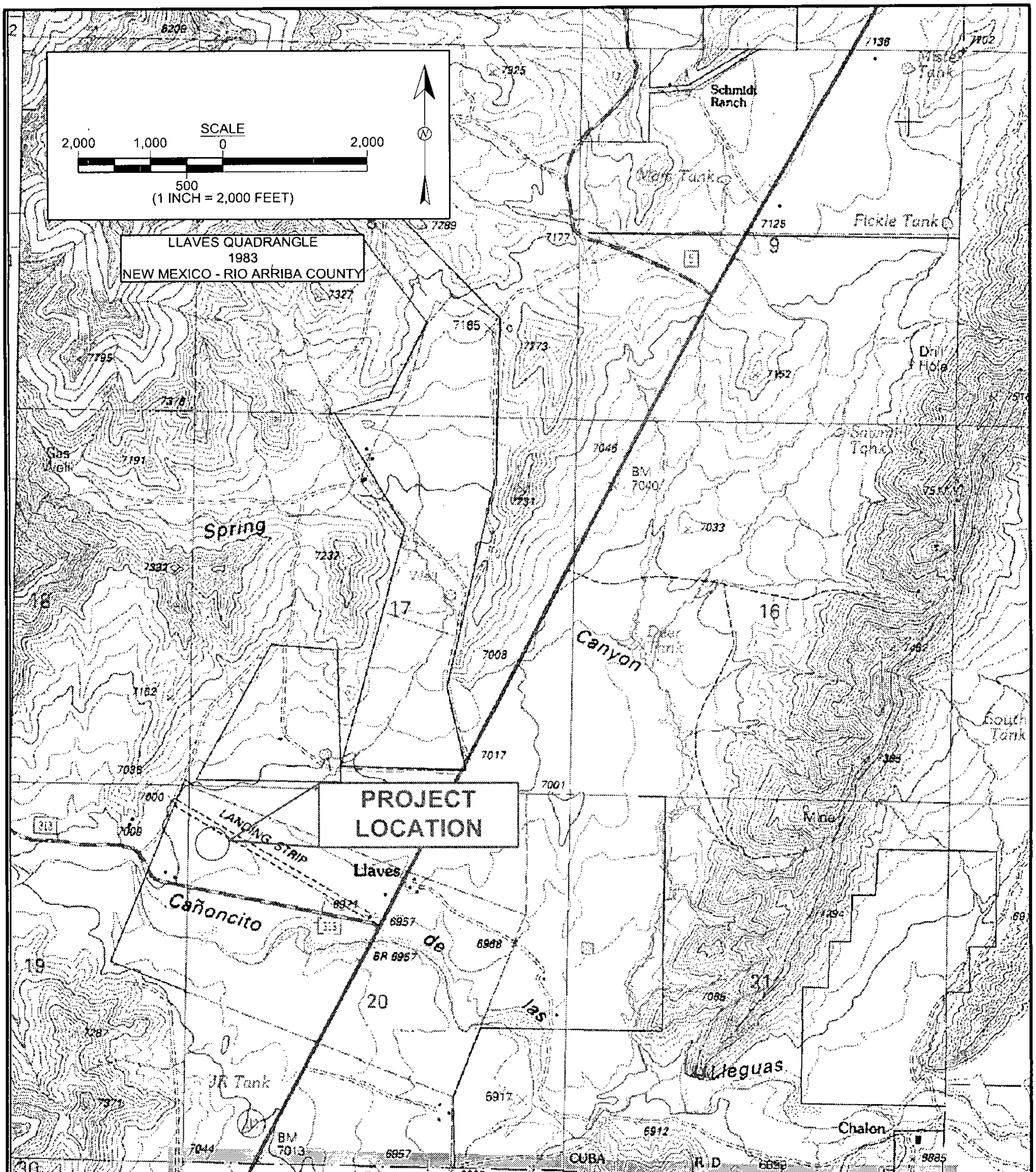
USEPA. 1992. SW-846, 3rd Edition, *Test Methods for Evaluating Solid Waste: Physical Chemical Methods*, dated November, 1986, and as amended by Update One, July, 1992.

USEPA. 1991. *Site Characterization for Subsurface Remediation*, EPA 625/4-91-026, November, 1991.

USEPA. 1997. *Expedited Site Assessment Tools for Underground Storage Tank Sites.* OSWER 5403G and EPA 510B-97-001, March, 1997.

USEPA. 2001. Contract Laboratory Program (CLP) Guidance for Field Samplers. OSWER 9240.0-35, EPA 540-R-00-003. June, 2001.

FIGURES



AES

Animas Environmental Services, LLC

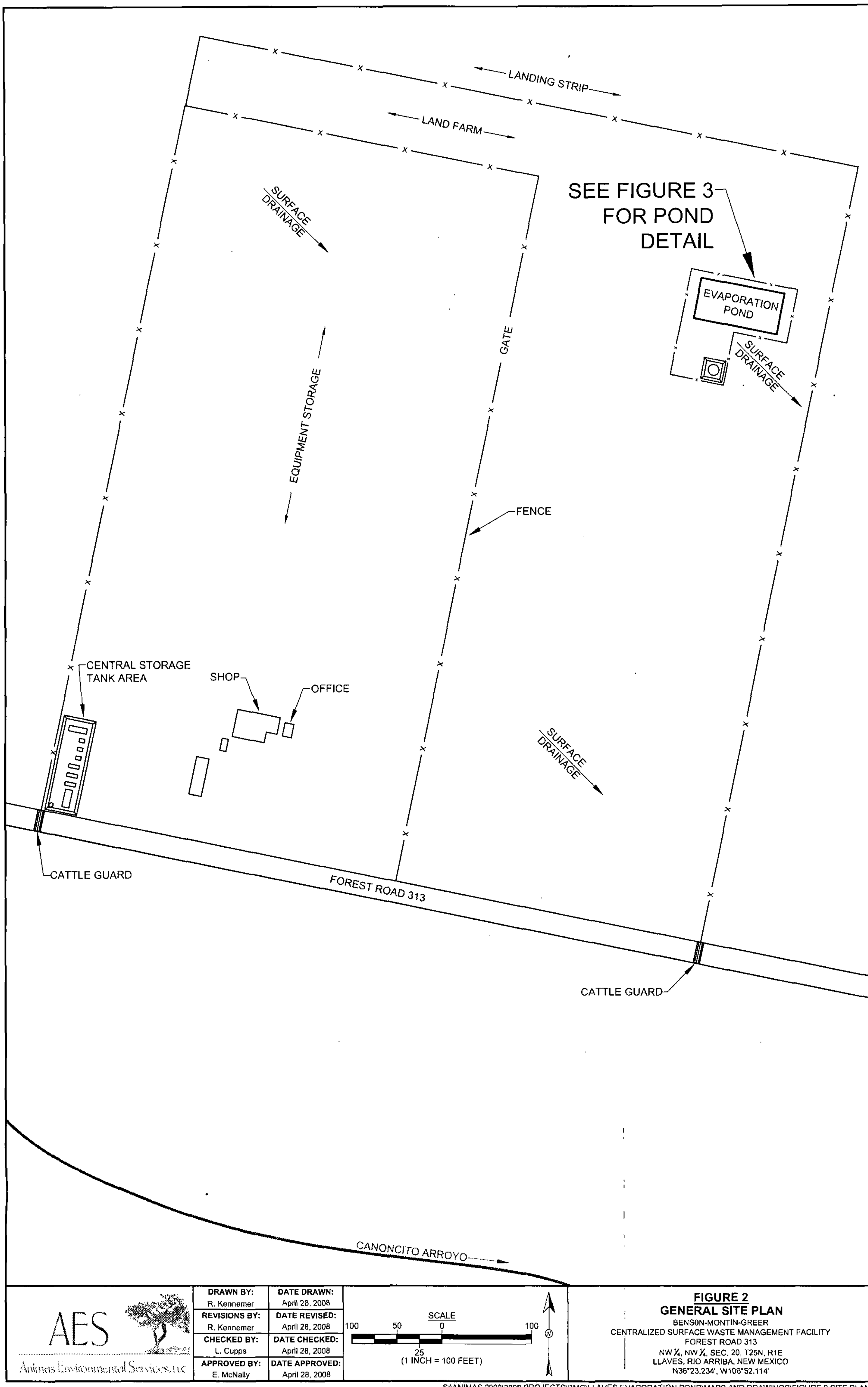
DRAWN BY:	DATE DRAWN:
R. Kennemer	April 28, 2008
REVISIONS BY:	DATE REVISED:
R. Kennemer	April 28, 2008
CHECKED BY:	DATE CHECKED:
L. Cupps	April 28, 2008
APPROVED BY:	DATE APPROVED:
E. McNally	April 28, 2008

FIGURE 1

TOPOGRAPHIC SITE LOCATION MAP

BENSON-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW ¼, NW ¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 1 TOPO LOCATION MAP

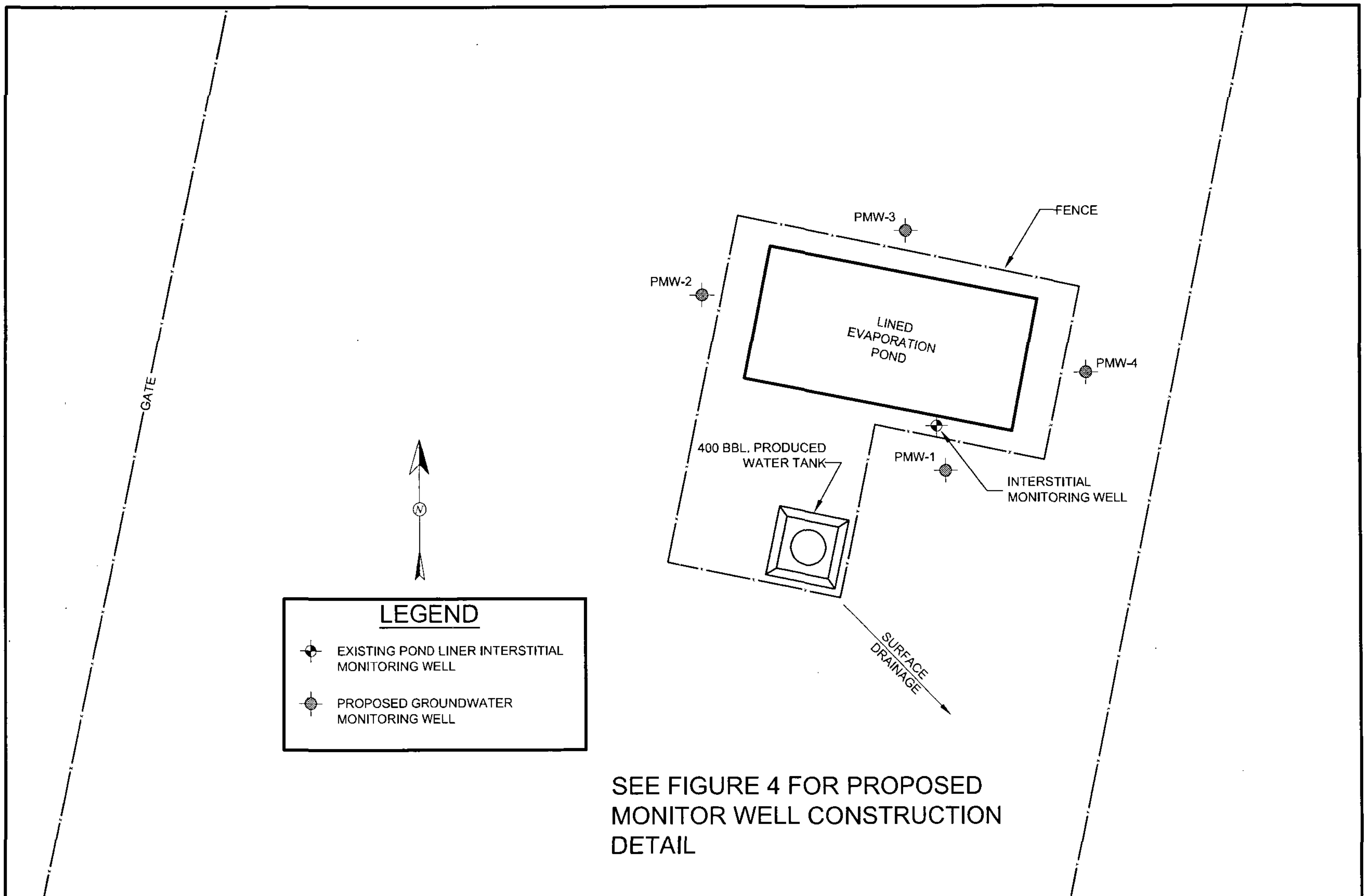


AES
Animas Environmental Services, LLC

DRAWN BY:	DATE DRAWN:
R. Kennemer	April 28, 2008
REVISIONS BY:	DATE REVISED:
R. Kennemer	April 28, 2008
CHECKED BY:	DATE CHECKED:
L. Cupps	April 28, 2008
APPROVED BY:	DATE APPROVED:
E. McNally	April 28, 2008

FIGURE 2
GENERAL SITE PLAN
BENSON-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW ¼, NW ¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 2 SITE PLAN



SEE FIGURE 4 FOR PROPOSED MONITOR WELL CONSTRUCTION DETAIL

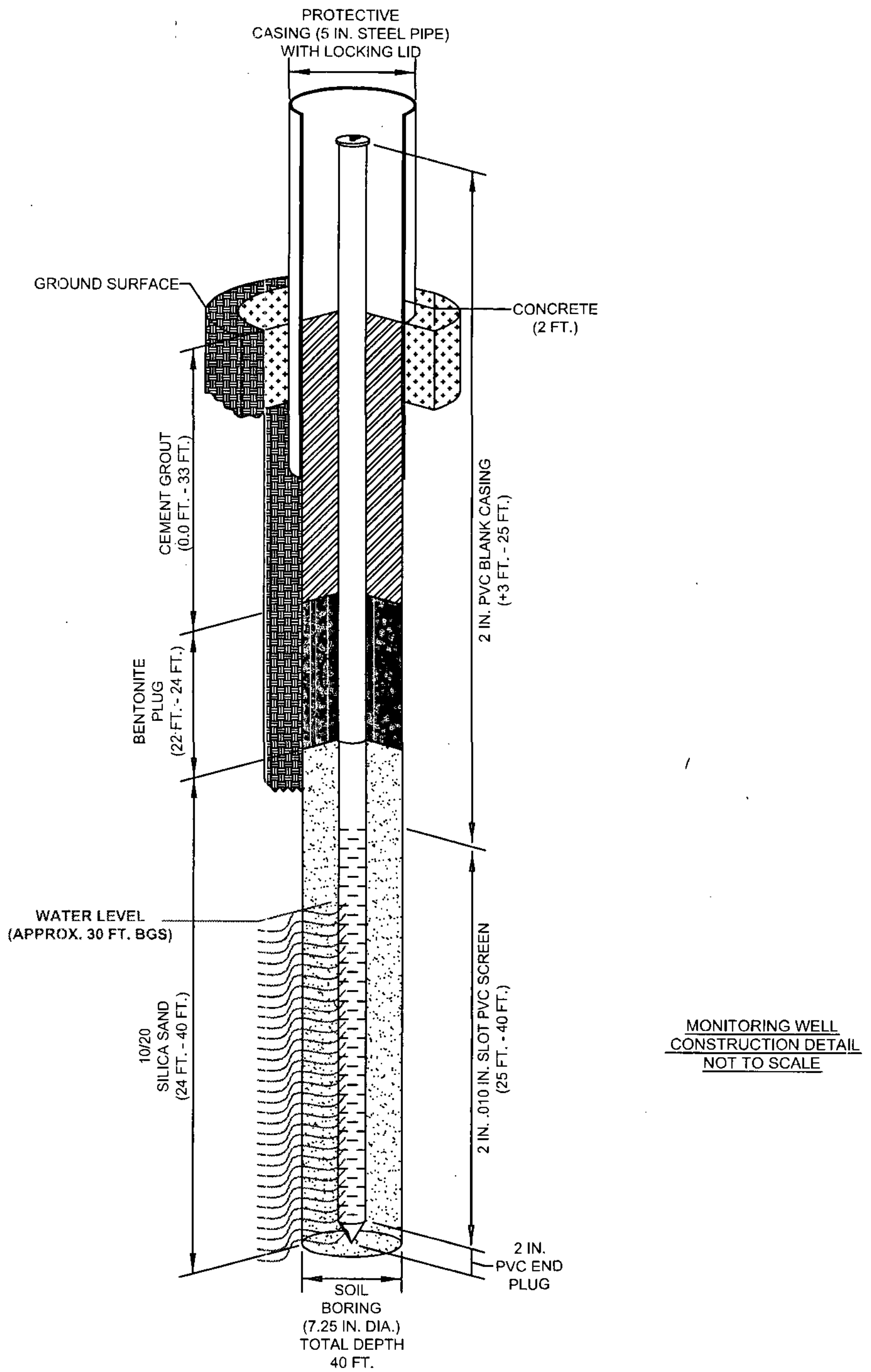
AES
Animas Environmental Services, LLC

DRAWN BY: R. Kennemer	**DATE DRAWN:** April 28, 2008
REVISIONS BY: R. Kennemer	**DATE REVISED:** April 28, 2008
CHECKED BY: L. Cupps	**DATE CHECKED:** April 28, 2008
APPROVED BY: E. McNally	**DATE APPROVED:** April 28, 2008

SCALE
50 30 0 50
10
(1 INCH = 50 FEET)

FIGURE 3
EVAPORATION POND AND PROPOSED MONITOR WELL LOCATIONS
BENSON-MONTIN-GREER
CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
FOREST ROAD 313
NW ¼, NW ¼, SEC. 20, T25N, R1E
LLAVES, RIO ARRIBA, NEW MEXICO
N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 3 EVAPORATION POND AND PROPOSED MONITOR WELLS



AES Animas Environmental Services, LLC	DRAWN BY:	DATE DRAWN:	**FIGURE 4**
	N. Willis	November 15, 2007	**PROPOSED MONITOR WELL CONSTRUCTION SCHEMATIC**
	REVISIONS BY:	DATE REVISED:	BENSON-MONTIN-GREER
	R. Kennemer	April 28, 2008	CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
	CHECKED BY:	DATE CHECKED:	FOREST ROAD 313
	L. Cupps	April 28, 2008	NW ¼, NW ¼, SEC. 20, T25N, R1E
	APPROVED BY:	DATE APPROVED:	LLAVES, RIO ARRIBA, NEW MEXICO
	E. McNally	April 28, 2008	N36°23.234', W106°52.114'

S:\ANIMAS 2000\2008 PROJECTS\BMG\LLAVES EVAPORATION POND\MAPS AND DRAWINGS\FIGURE 4 PROPOSED MONITORING WELL CONSTRUCTION SCHEMATIC

APPENDIX A.

DRILLING STANDARD OPERATING PROCEDURES
HEALTH AND SAFETY PLAN

Drill Rig:

- Evaluate the drill rig's safety as a vehicle. Make sure that the brakes work and that the tires have tread.
- The rig's gauge board should be clean. All gauges and controls should be operational.
- Have the driller show you how the kill switch works. If the switch does not stop the rig, do not allow the rig on-site.
- Check all cables and ropes for frays, wear, and especially, spots that look "squashed". Damaged lines should be replaced.
- Each wire rope loop should be secured with two wire clamps. Damaged hoses should be replaced.
- Check for whip-checks on the high-pressure hose connection. Each fitting should have one.
- Require a guard or housing on the impact of any automatic split spoon hammer.
- Check for a fire extinguisher and first aid kit in the rig.
- Examine the doughnut type rod clamps. Wear on the inside edges can cause the clamp to release under load.

Site Preparation:

- Have all buried utilities checked by the appropriate utility companies before drilling.
- Mast must be at least ten feet (plus 1/30 foot for every KV over 50KV) from overhead power lines.
- Remove sticks, brush, and trash from working area.
- Define an exclusion zone that includes all points less than radius of 1.5 times the mast height distant from the borehole.

- Locate your sample processing table at least one mast height from the borehole.

<u>Mechanical Safety During Drilling:</u>

- Whenever possible, stay at least one mast height away from the borehole, especially when the hammer, augers, or rods are being hoisted.

- If you must stand near the borehole to observe or perform air monitoring:

    a. When drilling - stand as far around passenger side corner of rig as possible;

    b. When pounding - stand as far around driver's side corner of rig as possible.

- Never stand on or near the cat head rope. If the cat head shares hydraulic power with other operating parts, the cat head can start turning without notice.

<u>Bad Weather:</u>

- If an electrical storm occurs, stop work. The mast of the drilling rig is a good ground for lightening kills.

- Under rainy conditions, the rope can stick to the cat head and rapidly thread through the pulley at the top of the mast. The object at the end of the rope will then free fall from the top of the mast. Therefore, during rainy weather, the driller, crew, and AES personnel shall take caution.

FIELD EQUIPMENT DECONTAMINATION
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to describe the general procedures required for decontamination of field equipment. This SOP serves as a guide and is applicable at most sites; however, it should be noted that site-specific conditions (i.e. type of contamination, type of media sampled) and the governing agency (i.e. EPA, DOE, USACE) may require modifications to the decontamination procedures provided in this SOP.

2.0 Background

2.1 Definitions

Acid Rinse - A solution of 10 percent nitric or hydrochloric acid made from reagent grade acid and analyte-free water.

Analyte-Free Water - Tap water that has been treated so that the water contains no detectable heavy metals or other inorganic compounds. Analyte-free water should be stored only in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Clean - Free of visible contamination and when decontamination has been completed in accordance with this SOP.

Cross Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or noncontaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

Organic-Free/Analyte-Free Water - Tap water that has been treated so that the water meets the analyte-free water criteria and contains no detectable organic compounds. Organic-free/analyte-free water should be stored only in clean glass, Teflon, or stainless steel containers that can be closed when not in use.

Potable Water - Tap water may be obtained from any municipal system. Chemical analysis of the water source may be required before it is used.

Soap - Low-sudsing, nonphosphate detergent such as Liquinox 1M.

Solvent Rinse - Pesticide grade, or better, isopropanol, acetone, or methanol.

2.2 Discussion

Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants offsite.

3.0 Responsibilities

Field Team Leader (FTL) – The FTL ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this procedure. The FTL may also be required to collect and document rinsate samples to proved quantitative verification that these procedures have been correctly implemented.

4.0 Required Equipment

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Soap
- Nalgene or Teflon sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes, rags, or paper towels
- Potable water*
- Analyte-free water
- Organic-free/analyte-free water
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g., 10 percent and/or 1 percent nitric acid [$HN0_3$], acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks (as required)
- Pallets for drums or tanks holding decontamination water (as required)

* Potable water may be required to be tested for contaminants before use. Check field plan for requirements.

5.0 Procedures

All reusable equipment (non-dedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at a central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally located decontamination station will include an appropriately sized bermed and lined area on which equipment decontamination will occur and shall be equipped with a collection system and storage vessels. In certain circumstances, berming is not required when small quantities of water are being generated and for some short duration field activities (i.e., pre-remedial sampling), Equipment should be transported to the decontamination station in a manner to prevent cross contamination of equipment and/or area. Precautions taken may include enclosing augers in plastic wrap while being transported on a flatbed truck.

The decontamination area will be constructed so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) or within the berms of the decontamination area that then drains into a collection system. Water from the collection system will be transferred into 55-gallon drums or portable tanks for storage. Typically, decontamination water will be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined. The exact procedure for decontamination waste disposal should be discussed in the field plan. Also, solvent and acid rinse fluids may need to be segregated from other investigation-derived wastes.

All items that will come into contact with potentially contaminated media will be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they will be covered either with clean plastic or aluminum foil depending on the size of the item. All decontamination procedures for the equipment being used are as follows:

General Guidelines

- Potable, analyte-free, and organic-free/analyte-free water should be free of all contaminants of concern. Following the field plan, analytical data from the water source may be required. Sampling equipment that has come into contact with oil and grease will be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or client requirements regarding solvent use will be stated in the field plan.
- All solvents and acids will be pesticide grade or better and traceable to a source. The corresponding lot numbers will be recorded in the appropriate logbook. Solvents and acids are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents should never be used in a closed building. See the site-specific health and safety plan and/or the chemical's Material

Safety Data Sheet (MSDS) for specific information regarding the safe use of the chemical.

- Decontaminated equipment will be allowed to air dry before being used.
- Documentation for all cleaning will be recorded in the appropriate logbook.
- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment will be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs and backhoes. Follow these steps when decontaminating this equipment:

- Establish a bermed decontamination area that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be used; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads should be upwind of the area under investigation.
- With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated soils using a hot water high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.
- Use brushes, soap, and potable water to remove dirt whenever necessary.
- Remove equipment from the decontamination pad and allow it to air dry before returning it to the work site.
- Record the equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the field plan. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment includes hollow-stem augers, drill pipes, rods, stems, etc. Follow these steps when decontaminating this equipment:

- Set up a centralized decontamination area, if possible. This area should be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.
- Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads should be upwind of any areas under investigation.
- Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports. The objects to be cleaned should be at least 2 feet above the around to avoid splashback when decontaminating.
- Using soap and potable water in the hot water high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside

the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt

- If using soapy water, rinse the equipment using clean, potable water. If using hot water, the rinse step is not necessary if the hot water does not contain a detergent. If the hot water contains a detergent, this final clean water rinse is required.
- Using a suitable sprayer, rinse the equipment thoroughly with analyte-free water.
- Remove the equipment from the decontamination area and place in a clean area upwind to air dry.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Sampling equipment is defined as equipment that comes into direct contact with the sample media. Such equipment includes split spoon samplers, well casing and screens, and spatulas or bowls used to homogenize samples. Follow these steps when decontaminating this equipment:

- Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment. At minimum, clean plastic sheeting must be used to cover the ground, table, or other surfaces that the decontaminated equipment is placed for drying.
- Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.
- Wash the items with potable water and soap using a stiff brush as necessary to remove particulate matter and surface films. The items may be steam cleaned using soap and hot water as an alternative to brushing. Note that polyvinyl chloride or plastic items should not be steam cleaned. Items that have come into contact with concentrated and/or oily contaminants may need to be rinsed with a solvent such as hexane and allowed to air dry prior to this washing step.
- Thoroughly rinse the items with potable water.
- If sampling for metals, thoroughly rinse the items with an acid solution (e.g., 10 percent nitric acid) followed by a rinse using analyte-free water. If sampling for organic compounds, thoroughly rinse the items with solvent (e.g., isopropanol) followed by a rinse using analyte-free water. The specific chemicals used for the acid rinse and solvent rinse phases should be specified in the work plan. The acid rinsate and solvent rinsate must each be containerized separately. Acids and solvents are potentially hazardous materials and care must be exercised when using these chemicals to prevent adverse health affects (e.g., skin bums, irritation to the eyes and respiratory system, etc.). Appropriate personal protective equipment must be worn when using these chemicals. These chemicals (including

spent rinsate) must be managed and stored appropriately. Special measures such as proper labels, paperwork, notification, etc. may be required when transporting or shipping these chemicals.

- Rinse the items thoroughly using organic-free/analyte-free water.
- Allow the items to air dry completely.
- After drying, reassemble the parts as necessary and wrap the items in clean plastic wrap or in aluminum foil.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable personal protective equipment. Place the contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. Refer to site-specific plans for labeling and waste management requirements.

5.4 Pump Decontamination

Follow the manufacturer's recommendation for specified pump decontamination procedures. At minimum, follow these steps when decontaminating pumps:

- Set up the decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up four containers: the first container shall contain dilute (nonfoaming) soapy water, the second container shall contain potable water, the third container shall be empty to receive wastewater, and the fourth container shall contain analyte-free water.
- The pump should be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first container. Place the discharge outlet in the wastewater container above the level of the wastewater. Pump soapy water through the pump assembly until it discharges to the waste container. Scrub the outside of the pump and other wetted parts with a metal brush.
- Move the pump assembly to the potable water container while leaving discharge outlet in the waste container. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
- Move the pump intake to the analyte-free water container. Pump the water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes will be required.
- Decontaminate the discharge outlet by hand, following the steps outlined in Section 4.3.
- Remove the decontaminated pump assembly to the clean area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.

- Record the equipment type, serial number, date, time, and method of decontamination in the appropriate logbook.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements such as pH meters, conductivity meters, etc. will be decontaminated between samples and after use with analyte-free, or better, water.

5.6 Waste Disposal

Refer to site-specific plans for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as investigation-derived waste. Small quantities of decontamination solutions may be allowed to evaporate to dryness.
- If large quantities of used decontamination solutions will be generated, each type of waste should be contained in separate containers.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste.
- Waste liquids should be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 Restrictions/Limitations

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics respectively. These steps should not be used, unless required, because of the potential for acid burns and ignitability hazards.

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with your EPA region, state, and client for approved decontamination solvents.

7.0 References

American Society for Testing and Materials. 2002. *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites,* ASTM D5088-02. January 10.

Department of Energy. Hazardous Waste Remedial Actions Program. 1996. *Standard Operating Procedures for Site Characterization,* DOE/HWP-100/R1. September.

__________. Hazardous Waste Remedial Actions Program. 1996. *Quality Control Requirements for Field Methods,* DOE/HWP-69/R2. September.

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001.1.

__________. Region 2. 1989. *CERCLA Quality Assurance Manual,* Revision 1.

__________. Region 4. 2001. *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual.* November.

SUBSURFACE SOIL SAMPLING
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to define the techniques and requirements for collecting soil samples from the unconsolidated zone. Techniques include use of hand augers, Shelby tubes, continuous core samplers, and split-spoon samplers.

2.0 Background

2.1 Definitions

Unconsolidated Zone - The layer of soil above bedrock that exists in a relatively loose state.

Hand Auger - A stainless steel cylinder (bucket) approximately 7 to 10 centimeters (cm) (3 to 4 inches) in diameter and 30 cm (1 foot) in length, open at both ends with the bottom edge designed to twist into the soil and cut out a soil core. The bucket collects the soil sample. The auger has a T-shaped handle (for hand operation) attached to the top of the bucket by extendable stainless steel rod(s).

Shelby Tube - A cylindrical sampling device, generally made of steel, that is driven into the subsurface soil through the hollow-stem auger. The tube, once retrieved, may be capped and the undisturbed soil sample extruded in the laboratory prior to analysis.

Split-Spoon/Split-Barrel Sampler - A cylindrical sampling device generally made of carbon steel that fits into a hollow-stem auger. The spoon is hinged lengthwise, which allows the sample to be retrieved by opening ("splitting") the spoon.

Slide Hammer - A device consisting of a drive weight (hammer) and a drive weight fall guide.

Subsurface Soil- The soil that exists deeper than approximately 30 cm (1 foot) from the surface but above bedrock or any other consolidated material.

Grab Sample - A discrete portion or aliquot taken from a specific location at a given point in time.

Liner - A cylindrical sampling device, generally made of brass, stainless steel, or Teflon® that is placed inside a split-spoon or hand auger bucket to collect undisturbed samples.

Composite Sample - Two or more sub-samples taken from a specific media and site at a specific point in time. The sub-samples are collected and mixed, and then a single average sample is taken from the mixture.

Auger Flight - A steel section length attached to an auger to extend the auger and remove unconsolidated material as coring depth increases.

2.2 Discussion

Shallow subsurface soil samples (to depths between 0.15 cm to 3 meters (m) [6 inches and 10 feet] may be collected using hand augers. However, soil samples collected with a hand auger are commonly of poorer quality than those collected by split-spoon/split-barrel or Shelby tube samplers since the soil sample is disturbed in the augering process. Split-spoon/split-barrel and Shelby tube liners are generally used during collection of soil samples using a hollow-stem auger, but may also be used to collect undisturbed soil samples from hand auger borings using a slide-hammer device. Liners are used to minimize the loss of volatile organic compounds (VOCs). The size and construction material of sampling devices should be selected based on project and analytical objectives and defined in site-specific plans.

2.3 Associated Procedures

- AES Packaging and Shipping Environmental Samples SOP
- AES Field Logbook Content and Control SOP
- AES Field Equipment Decontamination SOP

3.0 Responsibilities

Project Manager – The project manager is responsible for ensuring that field personnel are trained in the use of this procedure and the required equipment, and for ensuring that subsurface soil samples are collected in accordance with this procedure and any other SOPs pertaining to specific media sampling. The site manager must also ensure that the quantity and location of subsurface soil samples collected meet the requirements of the site-specific plans.

Field Team Leader (FTL) – The FTL is responsible for ensuring that field personnel collect subsurface soil samples in accordance with this SOP and other relevant procedures.

4.0 Required Equipment

4.1 General

- Site-specific plans
- Field logbook
- Indelible black ink pens and markers
- Labels and appropriate forms/documentation for sample shipment

- Clear, waterproof tape
- Appropriate sample containers
- Insulated cooler(s) and waterproof sealing tape
- Ice bags or Blue Ice
- Latex or appropriate gloves
- Plastic zip-top bags
- Personal protective clothing and equipment
- Stainless steel and/or Teflon-lined spatulas and pans, trays, bowls, trowels, or spoons Plastic sheeting
- Decontamination supplies

Additional equipment is discussed in Section 4.2.5, Field Sampling/Preservation Methods.

4.2 Manual (Hand) Augering

- T-handle
- Hand auger: flighted-, bucket-, or tube-type auger as required by the site-specific plans
- Extension rods
- Wrench(es), pliers
- Slide-hammer with extension rods

4.3 Split-Spoon/Split-Barrel and Shelby Tube Sampling

- Drill rig equipped with a 63-kilogram (kg) (140-lb) drop hammer and sufficient hollow-stem augers to drill to the depths required by the site-specific plans.
- Sufficient numbers of split-spoon/split-barrel or Shelby tube samplers so that at least one is always decontaminated and available for sampling. Three split-spoon/split-barrel or Shelby tube samplers are generally the minimum necessary. (Shelby tubes are usually used only once.)
- Split-spoon liners (as appropriate).
- Wrench(es), hammer.

5.0 Procedures

5.1 Preparation

1. Don the appropriate personal protective clothing as dictated by the site-specific health and safety plan.
2. Locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc.
3. Processes for verifying depth of sampling must be specified in the site-specific plans.
4. Clear away vegetation and debris from the ground surface at the boring location.

5. Prepare an area next to the sample collection location for laying out cuttings by placing plastic sheeting on the ground to cover the immediate area surrounding the borehole.
6. Set up a decontamination line, if decontamination is required, in accordance with the AES Field Equipment Decontamination SOP.

5.2 Collection

The following general steps must be followed when collecting all subsurface soil samples:

1. VOC samples or samples that may be degraded by aeration shall be collected first and with the least disturbance possible.
2. Sampling information shall be recorded in the field logbook and on any associated forms. Describe lithology in the field logbook.
3. Specific sampling devices to be used shall be identified in the site-specific plans and recorded in the field logbook.
4. Care must be taken to prevent cross-contamination and misidentification of samples.
5. Sample containers containing samples for VOC analysis should be filled completely to minimize headspace.

5.2.1 Manual (Hand) Augering

The following steps must be followed when collecting hand-augered samples:

1. Auger to the depth required for sampling. Place cuttings on plastic sheeting or as specified in the site-specific plans. If possible, layout the cuttings in stratigraphic order.
2. Throughout the augering, make detailed notes concerning the geologic features of the soil or sediments in the field logbook.
3. Cease augering when the top of the specified sampling depth has been reached. If required, remove the auger from the hole and decontaminate the auger or use a separate decontaminated auger, then obtain the sample.
4. Collect a grab sample for VOC analyses (or samples that may be degraded by aeration) immediately and place in sample container. Sample bottles should be filled completely to minimize headspace.
5. Remaining samples should be homogenized for other analyses prior to placing samples in the appropriate containers. Label containers as required.
6. Wipe containers with a clean Kimwipe or paper towel to remove residual soil from the exterior of the container(s).
7. Label the sample container with the appropriate information. Secure the label by covering it with a piece of clear tape.
8. Place the containers in zip-top plastic bags and seal the bags. Pack samples in a cooler with ice.
9. Proceed with further sampling, as required by the site-specific plans.
10. When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.

11. Complete the field logbook entry and other appropriate forms, being sure to record all relevant information before leaving the site.
12. Properly package all samples for shipment and complete all necessary sample shipment documentation. Remand custody of samples to the appropriate personnel.

5.2.2 Manual (Hand) Augering Using a Tube Sampler with Liner or Slide-Hammer

The following steps must be followed when collecting hand-augered samples using a tube sampler with a liner or slide-hammer:

1. Auger to the depth required for sampling. Place cuttings on the plastic sheeting as specified in the site-specific plans. If possible, layout the cuttings in stratigraphic order.
2. Throughout augering, make detailed notes in the field logbook concerning the geologic features of the soil or sediments.
3. Cease augering when the top of the specified sampling depth has been reached. Remove the auger from the hole and decontaminate.
4. Prepare a decontaminated tube sampler by installing a decontaminated liner in the auger tube.
5. Obtain the sample by driving the sample tube through the sample interval with the slide-hammer. Remove the liner from the tube and immediately cover the ends with Teflon tape and cap the ends of the tube. Seal the caps with waterproof tape.
6. Wipe sealed liners with a clean Kimwipe or paper towel.
7. Label the sealed liners as required in the site-specific plans. Mark the top and bottom of the sample on the outside of the liner.
8. Place sealed liners in zip-top plastic bags and seal the bags. Pack samples in a chilled cooler.
9. Proceed with further sampling, as required by the site-specific plans.
10. When sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
11. Decontaminate all equipment according to AES Field Equipment Decontamination SOP between each sample.
12. Complete the field logbook entry and other forms, being sure to record all relevant information before leaving the site.
13. Properly package all samples for shipment and complete all necessary sample shipment documentation. Remand custody of samples to the appropriate personnel.

5.2.3 Split-Spoon/Split Barrel Sampling

Note: Steps 1 through 12 describe activities to be performed by a licensed drilling contractor, not AES personnel.

The following steps must be followed when collecting split-spoon samples:

1. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
2. The drilling rig will be decontaminated at a separate location prior to drilling, per the AES Field Equipment Decontamination SOP or the site-specific decontamination procedures.
3. Attach the hollow-stem auger with the cutting head, plug, and center rod(s) to the drill rig.
4. Begin drilling and proceed to the first designated sample depth, adding auger(s) as necessary.
5. Upon reaching the designated sample depth, slightly raise the auger(s) to disengage the cutting head, and rotate the auger without advancement to clean cuttings from the bottom of the hole.
6. Remove the plug and center rods.
7. If required by the site-specific sampling plan, install decontaminated liners in the split-spoon/split barrel sampler.
8. Install a decontaminated split-spoon on the center rod(s) and insert it into the hollow-stem auger. Connect the hammer assembly and lightly tap the rods to seat the drive shoe at the top of undisturbed soil or sediment.
9. Mark the center rod in 15-cm (6-inch) increments from the top of the auger(s).
10. Drive the split-spoon using the hammer. Use a full 76-cm (30-inch) drop as specified by the American Society for Testing and Materials (ASTM) Method D-1586. Record the number of blows required to drive the spoon or tube through each 15-cm (6-inch) increment.
11. Cease driving when the full length of the spoon has been driven or upon refusal. Refusal occurs when little or no progress is made for 50 blows of the hammer. ASTM D1586-99 § 7.2.1 and 7.2.2 defines "refusal" as >50 blows per 6-inch advance or a total of 100 blows.
12. Pull the split-spoon free by using upswings of the hammer to loosen the sampler. Pull out the center rod and split-spoon.
13. Unscrew the split-spoon assembly from the center rod and place it on the plastic sheeting.
14. Remove the drive shoe and head assembly. If necessary, tap the split-spoon assembly with a hammer to loosen threaded couplings.
15. With the drive shoe and head assembly off, open (split) the split-spoon, being careful not to disturb the sample.
16. Label sample containers with appropriate information. Secure the label, covering it with a piece of clear tape. If liners were used, immediately install Teflon tape over the ends of the liners, cap the liners, and seal the caps over the ends of the liner with waterproof tape. Label the samples as required by the site-specific plans. Mark the top and bottom of each sample on the outside of each liner. Indicate boring/well number and depth on the outside of the liner, as required.
17. If VOC analyses are to be conducted on the soil sample and liners were not used, place that sample in its sample container immediately after opening the split-spoon, filling the sample bottle completely. Seal the container immediately, then describe it in the field logbook and/or associated forms. Record the sample

identification number, depth from which the sample was taken, and the analyses to be performed on the samples in the field logbook and on the appropriate forms.

18. Remaining samples should be homogenized prior to placing samples in appropriate containers.
19. Wipe containers with a clean Kimwipe or paper towel. Label containers as required when liners are not used.
20. Place containers and/or sealed liners in zip-top plastic bags and seal the bags. Pack samples in a chilled cooler.
21. In the field logbook and on the boring log, describe sample lithology by observing cuttings and/or the bottom end of the liner.
22. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
23. When sampling is complete, remove the drilling rig to the heavy equipment decontamination area.
24. Dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans. Backfill bore hole as specified in project-specific plans.
25. Decontaminate split-spoons and other small sampling equipment according to the AES Field Equipment Decontamination SOP before proceeding to other sampling locations.
26. Complete the field logbook entry and other forms, being sure to record all relevant information before leaving the site.
27. Properly package all samples for shipment to laboratories and complete all necessary sample shipment documentation. Remand custody of the samples to the appropriate personnel.

5.2.4 Shelby Tube Sampling

Note: Steps 1 through 11 describe activities to be performed by a licensed drilling contractor, not AES personnel.

The following steps must be followed when collecting samples using the Shelby tube:

1. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
2. The drilling rig will be decontaminated at a separate location prior to drilling.
3. Attach the hollow-stem auger with the cutting head, plug, and center rod(s).
4. Begin drilling and proceed to the first designated sample depth, adding auger(s) as necessary.
5. Upon reaching the designated sample depth, slightly raise the auger(s) to disengage the cutting head, and rotate the auger without advancement to clean cuttings from the bottom of the hole.
6. Remove the plug and center rods.
7. Attach a head assembly to a decontaminated Shelby tube. Attach the Shelby tube assembly to the center rods.

8. Lower the Shelby tube and center rods into the hollow-stem auger and seat it at the bottom. Be sure to leave 30 inches or more of center rod above the lowest point to the hydraulic piston's extension.
9. Use the rig's hydraulic drive to push the Shelby tube into undisturbed soil. The tube should be pushed with a steady force. Note the pressure used to push the Shelby tube in the field logbook.
10. When the Shelby tube has been advanced its full length or to refusal, back off the hydraulic pistons. Attach a hoisting plug to the upper end of the center rod, twist to break off the sample, and pull the apparatus out of the hole with the rig winch.
11. Retrieve the Shelby tube to the surface, detach it from the center rod, and remove the head assembly.
12. Since the typical intent of Shelby tube sampling is for engineering purposes and an undisturbed sample is required, the tube ends should be sealed immediately. Sealing is accomplished by filling any void space in the tube with beeswax, then placing caps on the ends of the tube and taping caps into place. The top and bottom ends of the tube should be marked and the tube transported to the laboratory in an upright position. Indicate boring/well number and depth on outside of liner.
13. Wipe sealed tubes with a clean Kimwipe or paper towel.
14. Place sealed tubes in zip-top plastic bags and seal bags. Pack samples in a chilled cooler.
15. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
16. When sampling is complete, remove the drilling rig to the heavy equipment decontamination area.
17. Dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
18. Complete the field logbook entry, being sure to record all relevant information before leaving the site. These methods may be used if directed by the EPA region, client, or governing sample plan.

5.2.5 Field Sampling/Preservation Methods

The following three sections contain SW 846 Methods for sampling and field preservation. These methods include EN CORE™ Sampler Method for low-level detection limits, EN CORE Sampler Method for high-level limits/screening, and methanol preservation. These methods may be used if required by the EPA Region, client, or governing sample plan. These methods are very detailed and contain equipment requirements at the beginning of each section.

When collecting soil samples using the EN CORE Sampler Method, collection of soil for moisture content analysis is required. Results of this analysis are used to adjust "wet" concentration results to "dry" concentrations to meet analytical method requirements. Note: Some variations from these methods, (e.g., sample volume) may be required depending on the contracted analytical laboratory.

5.2.5.1 EN CORE Sampler Collection for Low Level Analyses (≥1 µg/kg)

EN CORE Sampling Equipment Requirements

The following equipment is required for low-level analysis:

- Three 5 grams (g) samplers
- Note: The sample volume requirements specified are general requirements. Actual sample volume and/ or container sizes may vary depending on client or laboratory requirements.
- One 110-milliliter (mL) (4-ounce [oz.]) widemouth glass jar or applicable container for moisture analysis
- One T-handle
- Paper towels

EN CORE Sampling Steps for Low Level Analysis

1. Remove sampler and cap from package and attach T-handle to sampler body.
2. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full. The O-ring will be visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.
3. Extract sampler and wipe the sampler head with a paper towel so that the cap can be tightly attached.
4. Push cap on with a twisting motion to secure to the sampler body.
5. Rotate the sampler stem counterclockwise until stem locks in place to retain sample within the sampler body.
6. Fill out sample label and attach to sampler.
7. Repeat procedure for the remaining two samplers.
8. Collect moisture sample in 110-mL (4-oz.) widemouth jar using a clean stainless steel spoon or trowel.
9. Store samplers at 4 degrees (°) Celsius (C), ±2°C. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

Note: Verify requirements for extraction/holding times.

5.2.5.2 EN CORE Sampler Collection for High Level Analyses (≥200 µg/kg)

EN CORE Sampling Equipment Requirements

The following equipment is required for high-level analysis:

- One 5-g sampler or one 25-g sampler (the sampler size used will be dependent on client and laboratory requirements.)
- One 110-mL (4-oz.) widemouth glass jar or applicable container specified for moisture analysis.
- One T-handle.
- Paper towels.

EN CORE Sampling Steps for High Level Analysis

1. Remove sample and cap from package and attach T-handle to sampler body.

2. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full. The O-ring will be visible within the hole on the side of the T -handle. If the O-ring is not visible within this window, then the sampler is not full.
3. Use clean paper toweling to quickly wipe the sampler head so that the cap can be tightly attached.
4. Push cap on with a twisting motion to attach cap.
5. Fill out a sample label and attach to sampler.
6. Rotate sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.
7. Collect moisture sample in 110-mL (4-oz.) widemouth jar or designated container using a clean stainless steel spoon or towel.
8. Store samplers at 4°C, ±2°C. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

Note: Verify requirements for extraction/holding times.

5.2.5.3 Methanol Preservation Sampling for High Level Analyses* (≥200 *µglkg)

Methanol Preservation Sampling Equipment Requirements

- One pre-weighed jar that contains methanol or a pre-weighed empty jar accompanied with a pre-weighed vial that contains methanol (laboratory grade)
- One dry weight cup Weighing balance that accurately weighs to 0.01 g (with accuracy of ±0.1 g)
- Set of balance weights used in daily balance calibration
- Latex gloves
- Paper towels
- Cutoff plastic syringe or other coring device to deliver 5 g or 25 g of soil

Sampling Preservation Steps

1. Wear gloves during all handling of pre-weighed vials.
2. Weigh the vial containing methanol preservative to the nearest 0.01 g. If the weight of the vial with methanol varies by more than 0.01 g from the original weight recorded on the vial, discard the vial. If the weight is within tolerance, it can be used for soil preservation/collection below.
3. Take the empty jar or the jar that contains the methanol preservative.
4. Quickly collect a 5-g or 25-g sample using a cutoff plastic syringe or other coring device designed to deliver 5 g or 25 g of soil from a freshly exposed surface of soil. The 5-g or 25-g size used is dependent on client and laboratory requirements.
5. Carefully wipe the exterior of the collection device with a clean paper towel.
6. Quickly transfer the soil to an empty jar or a jar that contains methanol. If extruding into a jar that contains methanol, be careful not to splash the methanol outside of the vial. Again, the type of jar used is dependent on the client or laboratory requirements.
7. If the jar used to collect the soil plug was empty before the soil was added, immediately preserve with the methanol provided, using only one vial of methanol preservative per sample jar.

8. Using the paper toweling, remove any soil off of the vial threads and cap the jar.
9. Weigh the jar with the soil in it to the nearest 0.01 g and record the weight on the sample label.
10. Collect dry weight sample using a clean stainless steel spoon or trowel.
11. Store samples at 4°, ±2°C.
12. Ship sample containers with plenty of ice in accordance with DOT regulations (CORROSIVE. FLAMMABLE LIQUID. POISON) to the laboratory.

6.0 Restrictions/Limitations

Basket or spring retainers may be needed for split-spoon sampling in loose, sandy soils. Shelby tubes may not retain the sample in loose, sandy soils.

7.0 References

American Society for Testing and Materials, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils,* Standard Method D1586-99, 1999.

U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846),* Third Edition, November 1986, (as amended by Updates I, II, IIA, IIB, III, and IIIA, June 1997). Method 5035 (**Note:** §6.2.1.8 of this method says samples stored in En Core™ samplers should be analyzed within 48 hours or transferred to soil sample vials in the laboratory within 48 hours): December 1996, Revision O, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples.

Standard Operating Procedure
Soil Sample Collection for
Petroleum Storage Tank Sites

These Soil Sample Collection Procedures describe soil sample collection, handling, and transport protocol for petroleum storage tank sites. Procedures have been developed to facilitate planning and implementation of soil sample collection in accordance with the New Mexico Petroleum Storage Tank Regulations, *Guidelines for Corrective Action,* TNRCC Technical Guidance No. RG-14/PST, and ADEQ LUST Site Characterization Manual (1/15/99) Appendix 2, as applicable.

<u>UST Removal Soil Sample Locations</u>
The location and number of laboratory samples required should be based on the following:

For tanks 2,000 gallons or less in capacity:
1. One sample under each end of the tank
2. If there are two or more tanks in a single pit, samples should be taken at the bottom of the pit in each corner.

For tanks greater than 2,OOO-galion capacity:
1. One sample under each end of the tank.
2. If there are three or more tanks in a single pit, samples should be taken at the bottom of the pit in each corner (or each wall midpoint) and in the pit center.

Soil samples should also be collected in the following locations:
1. Where holes or releases have occurred in tanks, piping runs, and ancillary equipment.
2. Where overfill/spill has occurred.
3. At piping joints and elbows.
4. Beneath each dispenser.
5. Any areas of discrete staining.

Sample Handling
1. The soil sample should be disturbed as little as possible.
2. Samples should be taken as soon as possible after the removal of the tank and before any backfilling or other disturbance of the pit bottom.
3. Sample a minimum of one (1) foot below the bottom of the tank or pit, whichever is deeper.
4. If soil samples are collected from a backhoe bucket, ensure that the samples are representative of the area being sampled. Scrape off the top six inches of soil in the bucket and fill the container.
5. Use only new, clean glassware, supplied by the laboratory.

Heated Headspace Method (as required)
1. Fill a 16-ounce or larger clean glass jar half full of soil sample. Plastic bags or other non-glass containers are not acceptable.

2. Seal top of jar with clean aluminum foil and lid ring or equivalent.
3. Ensure sample is at approximately 60°F to 80°F. Heated air from the interior of a vehicle should be used if necessary to raise sample temperature to the acceptable range. Protect samples from direct sunlight.
4. Aromatic hydrocarbon vapor concentrations should be allowed to develop in the headspace of the sample jar for 5 to 10 minutes. During the initial stages of headspace development, the sample is to be shaken vigorously for one minute (if gravel is present, take care not to break jar).
5. Pierce the foil seal with the probe of either a FID, a PID, or chlorimetric tubes, and record the highest (peak) measurement.

Methanol Extraction Procedure (as required)

1. Soil samples should be collected using a syringe.
2. Two bottles should be collected and extracted for volatile analysis.
3. Collect a dry-weight sample in a bottle supplied by the laboratory.
4. Unscrew the cap in the sample bottle and quickly push the sample into the bottle with the syringe plunger, being careful not to get soil particles on the rim of the bottle. Quickly replace the cap and tighten securely.
5. If the methanol is provided in a separate vial from the sample bottle, unscrew the cap on the sample bottle and quickly push the sample into the bottle with the syringe plunger, being careful not to get soil particles on the rim of the bottle. Open the vial containing the methanol and pour it into the sample bottle. Be careful not to spill any methanol. Quickly replace sample bottle cap and tighten securely.
6. Gently agitate the sample so the soil is immersed in the methanol. Excessive agitation may cause undue volatilization.

Transportation

1. Complete sample container labels.
2. Place samples in hard-shell insulated cooler immediately after collection.
3. Cooler should be cooled at <4°C.
4. Complete chain of custody documents.
5. Deliver to laboratory

PACKAGING AND SHIPPING ENVIRONMENTAL SAMPLES
STANDARD OPERATING PROCEDURES

1.0 Packaging and Shipping of All Samples

This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved, the following sections may also be applicable.

Section 2.0 - Packaging and Shipping Samples Preserved with Methanol
Section 3.0 - Packaging and Shipping Samples Preserved with Sodium Hydroxide
Section 4.0 - Packaging and Shipping Samples Preserved with Hydrochloric Acid
Section 5.0 - Packaging and Shipping Samples Preserved with Nitric Acid
Section 6.0 - Packaging and Shipping Samples Preserved with Sulfuric Acid

1.1 Purpose

The purpose of this SOP is to outline the requirements for the packaging and shipment of environmental samples. Additionally, Sections 2.0 through 6.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and applies only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data loggers and self-contained breathing apparatus [SCBAs] or bulk chemicals that are regulated under the DOT, IATA, and ICAO.

1.2 Background

1.2.1 Definitions

Environmental Sample - An aliquot of air, water, plant material, sediment, or soil that represents the contaminant levels on a site. Samples of potential contaminant sources, like tanks, lagoons, or non-aqueous phase liquids are normally not "environmental" for this purpose. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/ or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

Outside Container - The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment - The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity - Excepted quantities are limits to the mass or volume of a hazardous material in the inside and outside containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity - Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance Testing - Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper - A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both AES and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. The samples should be packed in time to be shipped for overnight delivery. Make arrangements with the laboratory before sending samples for weekend delivery.

1.3 Required Equipment

Coolers with return address of the appropriate AES office
Heavy-duty plastic garbage bags
Plastic zip-type bags, small and large
Clear tape
Nylon reinforced strapping tape
Duct tape
Vermiculite (or an equivalent nonflammable material that is inert and absorbent)* Bubble wrap (optional)
Ice
Custody seals
Completed chain-of-custody record or contract laboratory program (CLP) custody records, if applicable
Completed bill of lading
"This End Up" and directional arrow labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.4 Packaging Environmental Samples

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager should be observed.
2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.
3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly.
4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. Note: Trip blanks must be included in coolers containing VOA samples.
5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally.
6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler should reflect only those samples within the cooler.
7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/ or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.
8. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.
9. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the opening of the cooler on opposite sides. The custody seals should be affixed to the cooler with half of the seal on the strapping

tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.

10. The shipping container lid must be marked "THIS END UP" and arrow labels that indicate the proper upward position of the container should be affixed to the cooler. A label containing the name and address of the shipper (AES) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

2.0 Packaging and Shipping Samples Preserved with Methanol

2.1 Containers

- The maximum volume of methanol in a sample container is limited to 30 ml.
- The sample container must not be full of methanol.

2.2 Responsibility

It is the responsibility of the qualified shipper to:

- Ensure that the samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

2.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packing may consist of glass or plastic jars
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

2.4 Packaging Samples Preserved with Methanol

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with

waterproof tape prior to sampling.
  - At a minimum the label must contain:
    - Project name
    - Project number
    - Date and time of sample collection
    - Sample location
    - Sample identification number
    - Collector's initials
    - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of methanol per shipping container must not exceed 500 ml.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Methanol Mixture
  UN1230
  LTD.QTY.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and

recipient.

- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

3.0 Packaging and Shipping Samples Preserved with Sodium Hydroxide

3.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	**Conc.**	**40ml**	**125ml**	**250ml**	**500ml**	**1 L**
NaOH	30%	>12	0.08%		.25	0.5	1	2

5 drops = 1ml

3.2 Responsibility

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

3.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Inner packings may consist of glass or plastic jars no larger than 1 pint
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

3.4 Packaging Samples Preserved with Sodium Hydroxide

Samples containing NaOH as a preservative that exceed the excepted concentration of 0.08 percent (2 ml of a 30 percent NaOH solution per liter) may be shipped as a limited quantity per packing instruction Y819 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.

- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- The total volume of sample in each cooler must not exceed 1-liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Sodium Hydroxide Solution
  UN1824
  LTD.QTY.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.

- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/ marking locations is shown in Figure 1.

  Note: Samples meeting the exception concentration of 0.08 percent NaOH by weight may be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 Packaging and Shipping Samples Preserved with Hydrochloric Acid

4.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Hydrochloric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*		
		pH	**Conc.**	**40ml**	**125ml**	**250ml**
HCl	2N	<1.96	0.04%	.2	.5	1

5 drops = 1ml

4.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

4.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packing may consist of glass or plastic jars no larger than 1 pint.

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 *corrosive* labels
- Orientation labels
- Consignor/consignee labels

4.4 Packaging Samples Preserved with Hydrochloric Acid

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
    - At a minimum the label must contain:
        - Project name
        - Project number
        - Date and time of sample collection
        - Sample location
        - Sample identification number
        - Collector's initials
        - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (No more than 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of sample inside each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to *prevent movement during shipment.*
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of

the cooler lid.

- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Hydrochloric Acid Solution
  UN1789
  LTD.QTY.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

  Note: Samples containing less than the exception concentration of 0.04 percent HCl by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 Packaging and Shipping Samples Preserved with Nitric Acid

5.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Nitric Acid Preservatives

Preservative	*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
	pH	**Conc.**	**40ml**	**125ml**	**250ml**	**500ml**	**1 L**

HNO_3	6N	<1.62	0.15%		2	4	5	8

5 drops = 1 ml

5.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

5.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

5.4 Packaging Samples Preserved with Nitric Acid

Samples containing $HN0_3$ as a preservative that exceed the excepted concentration of 0.15 percent $HN0_3$ will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
    - At a minimum the label must contain:
        - Project name
        - Project number
        - Date and time of sample collection
        - Sample location
        - Sample identification number
        - Collector's initials
        - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.

- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

    Nitric Acid Solution (with less than 20 percent)
    UN2031
    Ltd. Qty.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

    Note: Samples meeting the exception concentration of 0.15 percent HNO_3 by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

    Note: No marking or labeling can be obscured by strapping or duct tape.

    Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.

- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 Packaging and Shipping Samples Preserved with Sulfuric Acid

6.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sulfuric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	**Conc.**	**40ml**	**125ml**	**250ml**	**500ml**	**1 L**
H_2SO_4	37N	<1.15	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

6.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

6.4 Packaging of Samples Preserved with Sulfuric Acid

Samples containing H_2S0_4 as a preservative that exceed the excepted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
  - At a minimum the label must contain:
    - Project name
    - Project number
    - Date and time of sample collection
    - Sample location
    - Sample identification number
    - Collector's initials
    - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/ sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sulfuric Acid Solution

UN2796
LTD.QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.

  Note: Samples containing less than the exception concentration of 0.35 percent H_2S04 by weight will be shipped as non-regulated or non-hazardous in accordance with the procedure described in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.
- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 References

U.S. Environmental Protection Agency, *Sampler's Guide to the Contract Laboratory Program,* EPA/540/P-90/006, December 1990.

U.S. Environmental Protection Agency, Region IV, *Standard Operating Procedures and Quality Assurance Manual,* February 1991.

U.S. Environmental Protection Agency Rule, 40 CFR 136.

FIELD MEASUREMENT OF ORGANIC VAPORS
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to define the techniques and the requirements for the measurement of organic vapors in the field.

2.0 Background

2.1 Definitions

Photoionization Detector - A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the photoionization of organic vapors.

Flame Ionization Detector - A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the flame ionization of organic vapors.

2.2 Discussion

The measurement of organic vapors is a required step during numerous field activities. The primary purpose of such measurements is health and safety monitoring to determine if the breathing zone in a work area is acceptable or if personal protective equipment such as a respirator or a supplied air device is necessary for field personnel. In addition to health and safety monitoring, organic vapor measurement is also used in conjunction with sampling activities, including subsurface soil sampling and groundwater sampling, where measurements are useful for establishing approximate contaminant levels or ranges.

The two types of instruments most commonly used to measure organic vapors are photoionization detectors (PIDs) and flame ionization detectors (FIDs). Both instruments first ionize the gaseous compound and then measure the response, which is proportional to the concentration. The PID ionizes the gas using an ultraviolet lamp. The photons emitted by the ultraviolet lamp are absorbed by the gas molecules, producing a positively charged ion and an electron. The ionization potential (in electron volts) of the organic compounds to be measured must be less than the energy carried by the photons; therefore, the ionization potential of the known or suspected compounds should be checked against the energy of the ultraviolet lamp to verify that the energy provided by the lamp is greater. Additionally, manufacturer's manuals should be consulted to obtain the appropriate correction factors for known or suspected contaminants. The FID ionizes the gas by burning in a hydrogen/air flame. The FID allows measurement of a wide variety of compounds but in general its sensitivity is not as high as the PID.

2.3 Associated Procedures

- AES Subsurface Soil Sampling SOP

- AES Groundwater Sampling Using Bailers SOP
- AES Water Level Measurement SOP
- AES Well Development and Purging SOP

3.0 Responsibilities

Project Manager – The project manager is responsible for ensuring that field activities are conducted in accordance with the procedure and any other SOPs pertaining to the specific activity.

4.0 Required Equipment

- Site-specific plans
- Field logbook
- Indelible black ink pen
- Personal protective clothing and equipment
- Photoionization detector or flame ionization detector
- 0.5 liter (16-ounce) or "Mason" type glass jar
- Hydrogen Canister (if using FID for a period of more than 1 day)

5.0 Procedures

5.1 Direct Reading Measurement

1. Connect the measurement probe to the instrument and make necessary operational checks (e.g., battery check, etc.) as outlined in the manufacturer's manual.
2. Calibrate the instrument following the applicable manufacturer's manual.
3. Make sure the instrument is reading zero and all function and range switches are set appropriately.
4. Insert the end of the probe directly into the atmosphere to be measured (e.g., breathing zone, monitoring well casing, split spoon, etc.) and read the organic vapor concentration in parts per million (ppm) from the instrument display. Apply the appropriate correction factor, if necessary. Record the highest instrument response.
5. Immediately document the reading in the field logbook or on the appropriate field form.

5.2 Headspace Measurement

1. Connect the measurement probe to the instrument and make necessary operational checks (e.g., battery check, etc.) as outlined in the manufacturer's manual.
2. Calibrate the instrument following the appropriate manufacturer's manual.
3. Make sure the instrument is reading zero and all function and range switches are set appropriately.

4. Fill a clean glass jar approximately half-full of the sample to be measured. Quickly cover the top of the jar with one or two sheets of clean aluminum foil and apply cap to seal the jar.
5. Allow headspace to develop for approximately 10 minutes. It is generally preferable to shake the sealed jar for 10 to 15 seconds at the beginning and end of headspace development.

   Note: When the ambient temperature is below 0°C (32°F), the headspace development and subsequent measurement should occur within a heated vehicle or building.
6. Remove the jar cap and quickly puncture the foil and insert the instrument probe to a point approximately one-half of the headspace depth.
7. Read the organic vapor concentration in ppm from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.
8. Immediately record the reading in the field logbook or on the appropriate field form.

6.0 Restrictions/Limitations

The two methods outlined above are the most commonly used for field measurement of organic vapors but do not apply to all circumstances. Consult project- or program-specific procedures and guidelines for deviations. Both the PID and FID provide quantitative measurement of organic vapors, but generally neither instrument is compound-specific. The typical reading range of the PID is 0 to 2,000 ppm, and the typical reading range of the FID is 0 to 1,000 ppm. The FID will measure methane while the PID will not. Note: The presence of methane will cause erratic PID measurements. In methane rich environments, toxic organic vapors should be monitored with an FID. If desired, a charcoal filter can be placed temporarily on the FID inlet probe, which will trap all organic vapors except methane. The filtered (methane only) reading can be subtracted from unfiltered (total organic vapors) to provide an estimate of non-methane organic vapors. The reading accuracy of both instruments can be affected by ambient temperature, barometric pressure, humidity, lithology, etc.

WELL DEVELOPMENT AND PURGING
STANDARD OPERATING PROCEDURES

1.0 Objective

The purpose of this standard operating procedure (SOP) is to define the procedural requirements for well development and purging.

2.0 Background

Monitoring wells are developed to repair damage to the formation caused by drilling activities and to settle and remove fines from the filter pack. Wells should not be developed for at least 24 to 48 hours after completion when a cement bentonite grout is used to seal the annular space; however, wells may be developed before grouting if conditions warrant. Wells are purged immediately before groundwater sampling to remove stagnant water and to sample representative groundwater conditions. Wells should be sampled within 3 hours of purging (optimum) to 24 hours after purging (maximum, for low recharge conditions).

2.1 Associated Procedures

- AES Water Level Measurement SOP
- AES Field Equipment Decontamination at Non-Radioactive Sites SOP

3.0 Responsibilities

Site Manager - The site manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that development and purging are carried out in accordance with this procedure.

Field Personnel – Field personnel are responsible for complying with this procedure.

4.0 Required Equipment

- Pump, pump tubing, or bailer and rope or wire line
- Power source (e.g., generator), if required
- Water-level meter or weighted surveyor's tape
- Temperature, conductivity, pH, and turbidity meters
- Personal protective equipment as specified in the site-specific health and safety plan
- Decontamination supplies, as required, according to the AES Field Equipment Decontamination at Nonradioactive Sites SOP
- Disposal drums, if required
- Photoionization detector (PID) or equivalent as specified in site-specific health and safety plan

5.0 Procedures

5.1 Well Development

The following steps must be followed when developing wells:

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
4. Determine the depth to static water level and depth to bottom of the casing.
5. Prepare the necessary equipment for developing the well. There are a number of techniques that can be used to develop a well. Some of the more common methods are bailing, overpumping, backwashing, mechanical surging, surge and pump, wire brush, swabbing, and high-velocity jetting. All of these procedures are acceptable; however, final approval of the development method rests with the appropriateness of a specific method to the site and the client.
6. For screened intervals longer than 3 meters (m) (10 feet), develop the well in 0.75- or 1-m (2- or 3-foot) intervals from bottom to top. This will ensure proper packing of the filter pack.
7. Continue well development until produced water is clear and free of suspended solids, as determined by a turbidity meter or when pH, conductivity, and temperature have stabilized. Record pertinent data in the field logbook and on appropriate well development forms. Remove the pump assembly or bailers from the well, decontaminate (if required), and clean up the area. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plans.

5.2 Volumetric Method of Well Purging

The following steps should be followed when purging a well by the volumetric method:

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements. Determine the depth to static water level and depth to bottom of well casing according to the AES Water Level Measurement SOP. Calculate the volume of water within the well bore using the following formula (or equivalent):

$$7.4805\ [D^2\pi / (4)]\ dH = \text{volume (in gallons)},$$

where

D = casing diameter in feet. (Note: This equation is used for grouted wells with short screens. For wells with long screens and/ or ungrouted wells, the D = borehole diameter in feet).

dH = the distance from well bottom to static water level in feet

π = 3.1416

Note: Record all data and calculations in the field logbook.

5. Prepare the pump and tubing, or bailer, and lower it into the casing.
6. Remove the number of well volumes specified in the site-specific plans. Generally, three to five well volumes will be required. Conductivity, pH, and temperature should be measured and recorded, if required by site-specific plans. In low recharge aquifers, the well commonly will be pumped or bailed to dryness before three well volumes of water are removed. If this is the case, there is no need to continue with purging operations. Record pertinent data in the field logbook.
7. Remove the pump assembly or bailer from the well, decontaminate it (if required), and clean up the site. Lock the well cover before leaving. Containerize and/ or dispose of development water as required by the site-specific plan.

5.3 Indicator Parameter Method of Well Purging

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
4. Determine the depth to static water level and depth to bottom. Set up surface probe(s), (e.g., pH, conductivity) at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber. Allow probe(s) to equilibrate according to manufacturer's specifications. Record the equilibrated readings in the field logbook.
5. Assemble the pump and tubing, or bailer, and lower into the casing.
6. Begin pumping or bailing the well. Record indicator parameter readings for every purge volume. Maintain a record of the approximate volumes of water produced. Continue pumping or bailing until indicator parameter readings remain stable within +10 percent for three consecutive recording intervals, or in accordance with site-specific plans. Purging should continue until the discharge stream is clear or turbidity becomes asymptotic-low or meets project requirements. In a low recharge aquifer, the well may pump or bail to dryness before indicator parameters stabilize. In this case, there is no need to continue purging. Record pertinent data in the field logbook.
7. Remove the pump assembly or bailer from the well, decontaminate (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plans.

6.0 Restrictions/Limitations

Where flammable, free, or emulsified product is expected, or known to exist on or in groundwater, use intrinsically safe electrical devices only and place portable power sources (e.g., generators) 15 m (50 feet) or further from the wellhead and disposal drums.

Standard Operating Procedure
Groundwater Monitoring Well Measurement

Purpose
The purposes of this Standard Operating Procedure are: 1). to prevent or lessen the possibility of cross-contamination between monitoring wells during measurement and sampling; 2) to obtain depth to **static** water level measurements from an equilibrated monitoring well; and 3) to prevent misrecorded water level measurements.

Method
1. Utilizing historic sampling data for this site, determine the order in which the monitoring wells will be measured and sampled. Generally, wells that have historically had the lowest contaminant concentrations will be sampled first, followed by the wells with higher contaminant concentrations. Basically, the measurement and sampling order should be from lowest to highest contamination. Most often, the measurement and sampling order is determined in the office prior to going to the site.

2. Following the determined measurement and sampling order, remove the well vault cover and locking well plug from each well. In areas with high vehicular or foot traffic, the well vault cover is to be placed over the well to protect the well casing, vehicles, and pedestrians.

3. Utilizing a **properly decontaminated** Water Level Indicator, starting at the first monitoring well opened (the least contaminated) obtain a depth to water measurement from the survey point on the top of the well casing to the static water level within the well and record the measurement result on the Sampling and Measurement Form under "Initial D.T.W." Measure depth to water in the remaining wells in the proper order, decontaminating the Water Level Indicator between each well measurement, and record the measurement results on the respective Sampling and Measurement Form.

4. Returning to the first well measured (least contaminated) and utilizing a **properly decontaminated** Water Level Indicator, re-measure the depth to water in the well and record the measurement result on the Sampling and Measurement Form under "Confirmed D.T.W."

5. Determine appropriate purging volume, purge the monitoring well, collect groundwater sample (utilizing appropriate SOPs), and finally, following sample collection, obtain a depth to water measurement in the well and record the measurement result on the Sampling and Measurement Form under "Final D.T.W."

6. Complete measurement and sampling in appropriate order on remaining wells, decontaminating all measurement and sampling equipment following each use.

GROUNDWATER SAMPLING USING BAILERS
STANDARD OPERATING PROCEDURES

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to define requirements for the collection of groundwater samples with bailers.

2.0 Background

Collection of groundwater samples from monitoring wells on or near a site may be required to characterize the nature and extent of groundwater contamination.

Methods used for the collection of groundwater samples include bailing and a variety of pumping techniques. Bailers are hollow cylinders with unidirectional (open up) check valves at the bottom end. Some bailers may also be closed or valved at the upper end. Bailers used in environmental applications are typically constructed of polyvinyl chloride (PVC), stainless steel, or Teflon. The bailer cable typically consists of disposable nylon cord, disposable polypropylene cord, or Teflon-coated stainless steel wire. The bailer is lowered into the well on an acceptable line until submerged. The bailer is then retrieved to the surface for sample collection. For the best results, the sequence of sampling is from least to most contaminated wells. It is preferable to have bailers dedicated to each monitoring well.

2.1 Associated SOPs

AES Water Level Measurement SOP
AES Packaging and Shipping Environmental Samples SOP
AES Field Logbook Content and Control SOP
AES Well Development and Purging SOP
AES Field Equipment Decontamination SOP
AES Concise Well Measurement SOP

3.0 Responsibilities

Project Manager – The project manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that groundwater samples are collected in accordance with this procedure.

Field Team Leader (FTL) – The FTL is responsible for ensuring that sampling efforts are conducted in accordance with this procedure and any associated SOPs.

4.0 Required Equipment

- Site-specific plans

- Historic sampling data, if available
- Field logbook
- Indelible black ink pens and markers
- Chain of Custody forms
- Labels and appropriate forms/documentation for sample shipment
- Insulated cooler and waterproof sealing tape (strapping tape)
- Plastic zip-top bags
- Blue Ice or ice double-bagged in plastic zip-top bags
- Bailer of the appropriate design and construction for the sampling application
- New cord or wire of sufficient length for conditions
- Water level meter and/or other water level measuring device
- Clean beaker(s) or other container(s) for measurement of water Quality parameters
- Plastic sheeting (4-mil thickness)
- Latex or appropriate gloves
- Filtering apparatus, if required
- Appropriate sample containers with labels and preservatives, as required
- Temperature, conductivity, pH, dissolved oxygen, and turbidity meters as required by the site-specific plans
- Photoionization detector (PID) or equivalent and other instruments as required by the site-specific health and safety plan
- Decontamination supplies, as required by the AES Field Equipment Decontamination SOP
- Personal protective clothing and equipment, if required by the site-specific health and safety plan

5.0 Procedures

1. Don personal protective clothing and equipment as specified in the site-specific health and safety plan. All field equipment will be calibrated, tested, or checked for proper functioning before use as per the manufacturer's instructions.

2. Prepare the site for sample acquisition. If required, cover the ground surface around the wellhead with plastic sheeting. Arrange the required decontaminated sampling and monitoring equipment for convenient use. If onsite decontamination is required, arrange the necessary supplies in a nearby but separate location, away from the wellhead (e.g., exclusion zone).

3. Open the well and note the condition of the casing and cap. Immediately check for organic vapors using a PID or flame ionization detector as appropriate. Refer to the site health and safety plan for the required monitoring and frequencies.

4. Determine the static water level and depth to well bottom according to the AES Water Level Measurement SOP. Record this information in the field logbook or on the appropriate form.

5. Purge the well according to the AES Well Development and Purging SOP. Allow the water level to recover to a depth at least sufficient for the complete submergence of the bailer without contacting the well bottom. (The water level in the well should be allowed to recharge to 75 percent of its static level so that a representative sample of the screened portion of the aquifer can be obtained.) Samples shall be collected within 3 hours of purging if recharge is sufficient. Wells with a low recharge rate must be collected within 24 hours of purging.

6. Securely attach the bailer to the line. The opposite end of the line should be secured to prevent loss of the bailer into the well.

7. Arrange the sample containers in the order of use. Samples to be analyzed for volatile organic compounds (VOCs), if required, shall be obtained first, followed in order by other organic samples, then inorganic samples and other parameters. For example:
   a) VOCs
   b) Purgeable organic carbon (POC)
   c) Purgeable organic halogens (POX)
   d) Total organic halogens (TOX)
   e) Total organic carbon (TOC)
   f) Extractable organics*
   g) Total metals
   h) Dissolved metals
   i) Cyanide
   j) Sulfate and chloride
   k) Nitrate and ammonia

   *Extractable organics include semivolatile organic compounds, pesticides, and PCBs.

8. Don clean sampling gloves; lower the decontaminated or disposable bailer into the well. The bailer should enter the water slowly to prevent aeration, particularly when VOC samples are being collected. Care should be taken to avoid having the bailer come in contact with the well bottom.

9. Retrieve the filled bailer to the surface. To prevent contamination of the bailer line, do not allow the line to contact the ground, instead keep the line on the plastic sheeting. Hang the bailer from a bailer stand or other support, if available, or have an assistant hold it off the ground. Immediately obtain any required volatile samples (VOC, POC, POX, TOX, or TOC) by gently transferring water from the bailer to the sample bottle through a VOC sampling device. The containers for

organic analytes should be tilted when filling to prevent aeration. Check the filled VOC vials for bubbles. If bubbles are present in a vial, discard it and fill another vial from the bailer. After collecting volatile samples, lower the bailer to collect additional water for the remaining parameters. If sample filtration is required for metals, it should be performed immediately following sample retrieval and prior to sample preservation. Organic samples generally do not require filtration; VOC samples should never be filtered. Preservation of samples should be performed according to the applicable field plan. Check the pH on samples (other than VOCs) that require preservation. Collect additional quality assurance/quality control samples as required by the applicable field plan.

10. Wipe the outer surfaces of the sample containers clean with a Kim-wipe or clean paper towel. Additional sample bottle decontamination may be appropriate in some cases.

11. Properly label all containers according to the AES Packaging and Shipping Environmental Samples SOP.

12. Place sample containers in individual zip-top plastic bags, and seal the bags (if required by site-specific plans).

13. Immediately pack all sample containers that require a 4°C preservation on ice in coolers (refer to the sampling plans).

14. Record analytes and volumes collected, and time and date of collection in the field logbook. Prepare chain-of-custody forms according to site-specific plans.

15. Decontaminate sampling equipment according to the AES Field Equipment Decontamination SOP.

16. Close and lock the well cover. Clean up the area and place disposable materials (plastic sheeting, gloves, Tyvek) in the designated receptacle.

6.0 Restrictions/Limitations

Obtain required field measurements such as temperature, conductivity, pH, oxidation potential (Eh), turbidity, salinity, or dissolved oxygen measurements immediately after samples have been collected. This may require additional time for well recovery. *Note:* Some of these parameters will have already been determined during purging; they should be repeated after sample collection if required by site-specific plans.

Proper sampling for VOC analysis or for analysis of any other compound(s) that may be degraded by aeration is necessary to minimize sample disturbance and analyte loss. The representativeness of this sample, however, is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

7.0 References

Office of Solid Waste and Emergency Response. 1986. *RCRA Groundwater Monitoring Technical Guidance Enforcement Document,* OSWER-9950.1. September.

U.S. Department of Energy. 1996. Hazardous Waste Remedial Actions Program, *Quality Control Requirements for Field Methods,* DOE/HWP-69R2. September.

U.S. Department of Energy. 1996. Hazardous Waste Remedial Actions Program, *Standard Operating Procedures for Site Characterization,* DOE/HWP-100/R1. September.

GUIDE TO HANDLING INVESTIGATION-DERIVED WASTE STANDARD OPERATING PROCEDURES

1.0 Purpose

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed prior to field activities
- Remove wastes that pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require offsite disposal or extended above-ground containerization
- Complying with federal, state, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 Background

2.1 Definitions

Hazardous Waste - Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes (IDWs) - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or non-hazardous.

Mixed-Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes - Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/ or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

> **Note:** The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with applicable regulatory requirements.

3.0 Responsibilities

Site Manager – The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager – The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members – Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required should consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT) approved steel containers
- Bulk storage tanks comprised of polyethylene or steel

Containment of IDW should be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device should be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking should be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are:

- Labels and markings that contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents. Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.
- Labeling or marking requirements for IDW expected to be transported offsite must be in accordance with the requirements of 49 CPR 172.

4.3 IDW Container Movement

Staging areas for IDW containers should be predetermined and in accordance with site-specific and/or client requirements. Arrangements should be made prior to field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation offsite onto a public roadway is prohibited unless 49 CPR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW should be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided as appropriate.

5.0 Procedures

The three general options for managing IDW are (1) collection and onsite disposal, (2) collection for offsite disposal, and (3) collection and interim management. Attachment 1 summarizes media-specific information on generation processes and management options. The option selected should take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite

- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client should approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a workplan or separate document.

5.1 Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).
2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).
3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).
4. Send to onsite TSDF - may require analytical analysis prior to treatment/disposal.

Note: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids

The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.
2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background upgradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.
3. Discharge to sanitary sewer.
4. Send to onsite TSDF - may require analysis prior to treatment/disposal.

Note: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE

The options for handling disposable PPE are as follows:

1. Double-bag contents in non-transparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.
2. Containerize, label, and send to onsite TSDF - may require analysis prior to treatment/disposal.

5.2 Offsite Disposal

Before sending to an offsite TSDF, analysis may be required. Also, manifests are required. Arrangements must be made with the client responsible for the site. The TSDF and transporter must be permitted for the respective wastes.

5.2.1 Soil/Sludge/Sediment

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums) until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE

When the final site remedy requires offsite treatment disposal the IDW may be containerized and stored. The management option selected should take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Interim Measures

All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW onsite until the final action may be practical in the following situations:
    A. Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal in the final remediation alternative.
    B. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.
    C. Offsite disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.
    D. Interim storage may be necessary to provide time for sampling and analysis.
2. Segregate and containerize all waste for future treatment and/or disposal.
    A. Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.
    B. Containment options for aqueous liquids may include mobile tanks or drums.
    C. Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations

Site Managers should determine the most appropriate disposal option for aqueous liquids on a site-specific basis. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. Under no circumstances should these types of materials be brought back to the office or warehouse.

7.0 References

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001.1.

U.S. Environmental Protection Agency. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees,* EPA/530-SW-90-057.

U.S. Environmental Protection Agency. May 1991. *Management of Investigation-Derived Wastes During Site Inspections,* EPA/540/G-91/009.

U.S. Environmental Protection Agency. January 1992. *Guide to Management of Investigation-Derived Wastes,* 9345.3-03FS.

U.S. Environmental Protection Agency, Region IV. May 1996 and 1997. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual,* revisions.

Jones, Brad A., EMNRD

From: Mike Dimond [mikedimond@bmgdrilling.com]
Sent: Wednesday, April 23, 2008 3:29 PM
To: Price, Wayne, EMNRD; 'Lany Cupps'; Powell, Brandon, EMNRD; Jones, Brad A., EMNRD
Cc: 'Ross Kennemer'; 'Beth McNally'
Subject: RE: Revised schedule for BMG Evaporation Pond

Lany,
Please proceed with installation of the 2" wells. Please, get me a cost estimate in advance, not because we have any financial troubles, but because we like to know what to expect so we might budget prudently.

Mike Dimond

From: Price, Wayne, EMNRD [mailto:wayne.price@state.nm.us]
Sent: Wednesday, April 23, 2008 2:59 PM
To: Mike Dimond; Lany Cupps; Powell, Brandon, EMNRD; Jones, Brad A., EMNRD
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Dear Mike, ¾ "wells are inadequate when it comes to purging, bailing, etc. We have had very bad experience with small diameter wells and have for at least 10 years quit approving them. We also consider cost and that is the main reason we don't allow them anymore. We have spent many of the peoples tax money and man hours trying to properly develop and sample these small wells, we have stuck bailers in them, and it goes on and on. The state is not willing to spend additional $cost for such issues.

Monitor wells are our fail safe mechanism to protect all down gradient groundwater sources. Yes the MW's will tell you and us if a GW impact has occurred and we can quickly mediate the situation. In addition to MW's, we have leak detection also. If you don't have enough money to spend on the pond versus installing monitor wells then that raises a red flag with the agency. That tells us you may be in financial trouble and if that is the case we want the extra protection so the people of NM do not have to clean-up after you.

Please install the wells!

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Sent: Wednesday, April 23, 2008 10:14 AM
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Please contact me with any questions.

Thanks,

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Jones, Brad A., EMNRD

From: Price, Wayne, EMNRD
Sent: Wednesday, April 23, 2008 1:50 PM
To: Mike Dimond; 'Lany Cupps'; Powell, Brandon, EMNRD; Jones, Brad A., EMNRD
Cc: 'Ross Kennemer'; 'Beth McNally'
Subject: RE: Revised schedule for BMG Evaporation Pond

Dear Mike,

For years operators have ask the OCD to not require monitor wells during the initial installation, and OCD has accommodated them. However, once you have had a release at a permitted SWMF then OCD is routinely requesting that MW's be installed to fulfill monitoring requirements. We should have already asked for MW's to be installed as a means of monitoring. So now is the time.

From: Mike Dimond [mailto:mikedimond@bmgdrilling.com]
Sent: Wednesday, April 23, 2008 1:41 PM
To: 'Lany Cupps'; Powell, Brandon, EMNRD; Jones, Brad A., EMNRD; Price, Wayne, EMNRD
Cc: 'Ross Kennemer'; 'Beth McNally'
Subject: RE: Revised schedule for BMG Evaporation Pond

Sorry, I was out in the field today at Llaves and apparently was not able to be reached by anyone. I need to know a lot more info about this "demand" before we decide to proceed. I do not understand why 2" monitoring wells are required after 8-10 years of operation. Is there something in the Regs I am missing? I am not arguing, just looking for information.

Mike Dimond

From: Lany Cupps [mailto:lcupps@animasenvironmental.com]
Sent: Wednesday, April 23, 2008 10:14 AM
To: 'Powell, Brandon, EMNRD'; brad.a.jones@state.nm.us; 'Mike Dimond'; wayne.price@state.nm.us
Cc: Ross Kennemer; Beth McNally
Subject: Revised schedule for BMG Evaporation Pond

Good morning,

Per the conversation between Ross Kennemer and Brad Jones this morning the work scheduled at the BMG Evaporation Pond has been postponed so that the proposed ¾" monitoring wells can instead be completed as standard environmental 2" diameter permanent monitoring wells. This work has tentatively been rescheduled to occur during the beginning of the week of May 5th. A revised Sampling and Analysis Plan will be submitted on Monday, April 28th. I will keep everyone informed as to the finalized drilling schedule.

Please contact me with any questions.

Thanks,

Lany Cupps
Project Manager

Animas Environmental Services, LLC
624 E. Comanche St.
Farmington, NM 87401
Ph (505) 564-2281
Fax (505) 324-2022
www.animasenvironmental.com

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Please contact me with any questions.

Thanks,

Lany Cupps
Project Manager

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Jones, Brad A., EMNRD

From: Lany Cupps [lcupps@animasenvironmental.com]
Sent: Tuesday, April 22, 2008 3:54 PM
To: Price, Wayne, EMNRD; Powell, Brandon, EMNRD; Jones, Brad A., EMNRD; 'Mike Dimond'
Cc: Ross Kennemer; Beth McNally
Subject: BMG Evaporation Pond Sampling and Analysis Plan
Attachments: BMG Evap Pond SAP0001.pdf

Good afternoon,

Attached please find the Sampling and Analysis Plan for the BMG Centralized Surface Waste Management Evaporation Pond, Permit: NM-02-0004. Geoprobing has been scheduled for this site on Friday, April 25, 2008.

Please contact me or Ross Kennemer if you have any questions.

Thanks,

Lany Cupps
Project Manager

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AES Animas Environmental Services, LLC

624 E. Comanche . Farmington, NM 87401 . Tel 505-564-2281 . Fax 505-324-2022 . www.animasenvironmental.com

Prepared for:
Brandon Powell
New Mexico Oil Conservation Division
1000 Rio Brazos Road
Aztec, New Mexico 87410

Prepared on behalf of:
Benson-Montin-Greer Drilling Corporation
4900 College Blvd.
Farmington, New Mexico 87402

SAMPLING AND ANALYSIS PLAN
Centralized Surface Waste Management Facility Evaporation Pond

Benson Montin Greer
SW¼ NW¼ of Section 20, T25N, R2E
Rio Arriba County, New Mexico

Date of Plan: April 22, 2008

Prepared by:
Animas Environmental Services, LLC
624 E. Comanche
Farmington, New Mexico 87401

Contents

1.0 Introduction

Animas Environmental Services, LLC (AES), on behalf of Benson Montin Greer Drilling Corporation (BMG), submits this Sampling and Analysis Plan (SAP) for the BMG Centralized Surface Waste Facility's Evaporation Pond per electronic correspondence between BMG and Wayne Price of the New Mexico Oil Conservation Division (NMOCD) on April 21, 2008.

2.0 Site Information

2.1 Site Location

The evaporation pond is located in the northeast corner of the BMG Centralized Surface Waste Facility located in the SW¼ NW¼ of Section 20, Township 25N, Range 2E, Rio Arriba County, New Mexico. A leak from the evaporation pond was confirmed when AES observed water within the interstitial monitoring tube between the primary and secondary pond liner on April 14, 2008.

3.0 Proposed Scope of Work

Site investigation activities will be initiated in order to determine whether the integrity of the secondary pond liner has been compromised resulting in pond contents leaking into the environment. The investigation procedures are designed to be protective of both soil and groundwater and are based upon protocols outlined in the USEPA documents, *Expedited Site Assessment Tools for Underground Storage Tank Sites*, March 1997, and *Site Characterization for Subsurface Remediation*, November 1991.

3.1 Utilities Notification

AES will utilize the New Mexico One-Call system to identify and mark all underground utilities at the site before the start of any proposed field activities which could impact buried utilities. Any local utilities not participating in the New Mexico One-Call system will be contacted separately by AES for utility locations.

3.2 Health and Safety Plan

AES has a Health and Safety Program in place to ensure the health and safety of all AES employees. The Health and Safety Program defines safety practices and procedures to be instituted in all AES work places, as applicable. The program meets the requirements promulgated by the Occupational Safety and Health Act (OSHA). All AES personnel are appropriately trained in accordance with OSHA 40 CFR 1910.120.

A comprehensive site-specific Health and Safety Plan (HASP) addressing the site investigation and associated sampling will be prepared prior to the start of the field work. All employees and subcontractors will be required to read and sign the HASP to acknowledge their understanding of the information contained within it. The HASP will be implemented and enforced on site by the assigned Site Safety and Health Officer. Daily tailgate meetings will be held and documented during field activities and will address specific health and safety concerns or issues.

3.3 Installation of Soil Borings

AES proposes to install four soil borings, each of which may be completed as groundwater monitoring wells, along the perimeter of the evaporation pond in order to determine whether or not groundwater has been impacted by a release from the pond's secondary liner. The locations of the soil borings and monitoring wells will be determined in the field based on the observations and best judgment of the AES project manager in consultation with BMG and NMOCD representatives that may be on-site. It is anticipated that groundwater will be encountered in the soil borings between 30 and 50 feet below ground surface.

Soil borings will be advanced with a DT 6620 track-mounted direct push rig, manufactured by Geoprobe®, and equipped with a 2-inch outer diameter (OD) core barrel. Direct push drilling will be provided by Earth Worx, Los Lunas, New Mexico.

3.4 Soil Sampling and Analyses

3.4.1 Soil Sample Collection

AES will be prepared to perform field screening of volatile organic compounds (VOCs) with a photo-ionization detector (PID) organic vapor meter (OVM) should conditions warrant. Based on the results of OVM readings, AES will collect soil samples for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), total petroleum hydrocarbons (TPH), and chlorides.

For each soil boring, a Soil Boring Log will be completed. These logs will record observations of soil moisture, color, density, grain size, plasticity, contaminant presence, and overall stratigraphy.

If necessary, soil samples will be collected from continuously driven core-barrel samplers during advancement of the soil borings. Discrete samples will be collected based on PID-OVM screening measurements from the core barrel sampler and transferred to appropriately labeled sample containers. Soil sample collection will be completed in strict accordance with the USEPA Environmental Response Team's Standard Operating Procedures (SOPs).

3.4.2 Field Screening

If determined to be necessary, samples will be collected from soil sampling locations and field screened for volatile organic vapors utilizing a PID-OVM calibrated with isobutylene gas to obtain preliminary data regarding potential petroleum hydrocarbon-impacted soil.

Once collected, the soil sample to be field screened will be immediately placed in a clean 16 ounce glass jar, filled approximately half full, and sealed with a threaded ring lid and a sheet of aluminum foil. The sample jar will then be placed in a warm water bath where it will be warmed to approximately 80°F. Approximately ten minutes will be allowed for the soil to be heated and for any VOCs in the soil to accumulate in the head space of the jar. During the initial stages of headspace development, the sample will be gently shaken for one minute to promote vapor development and disaggregate the sample. Volatile gases will then be measured by piercing the aluminum foil with the sample probe of the PID-OVM. The highest (peak) measurement will be recorded. PID-OVM readings will be recorded onto the Soil Boring Logs. All field screening will be completed in strict accordance with the USEPA Environmental Response Team's SOP.

3.4.3 Laboratory Analyses - Soil

If necessary, analytical samples collected from soil borings will be submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 1. Soil Analytical Parameters

Parameter	*Analytical Method*	*Analyzing Laboratory*
BTEX	EPA Method 8021	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Total Petroleum Hydrocarbons (TPH) (C_6-C_{36})	EPA Method 8015 Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

Once collected, sample containers will be packed with ice in insulated coolers and shipped via UPS or Greyhound Bus to the analyzing laboratory. Typical laboratory regular turn around time is 12 to 15 business days.

For all laboratory samples, quality assurance and quality control (QA/QC) procedures, sample preservation, apparatus required, and analyses performed will be in accordance with USEPA Document EPA-600, "Methods for Chemical Analysis for Water and Wastes" dated July 1982; and USEPA document SW-846, 3rd Edition, "Test Methods for Evaluating Solid Waste: Physical Chemical Methods", dated November, 1986.

3.5 Groundwater Monitor Well Installation

3.5.1 Groundwater Monitor Well Installation and Construction

Groundwater monitoring wells may be installed within each of the 4 soil borings. Monitoring well construction will consist of 1.4-inch outside diameter (OD) [0.75-inch inside diameter (ID)] Schedule 40 PVC screen and 1.0-inch blank riser casing. The screened interval will extend 15 feet across the water table. The wells will be constructed of a 1.4-inch OD (0.75-inch ID) pre-packed screen (0.010-inch slot). The screen is factory packed with 20/40 Colorado silica sand. A bentonite seal will be placed above the sand pack, and concrete grout with approximately five percent bentonite will be poured from the top of the bentonite plug up to within a foot of ground surface. An above grade locking steel protective casing, enclosed with a shroud of concrete, will be installed on the well to prevent unauthorized access and damage from runoff and debris within the wash. A proposed monitoring well construction schematic is included on Figure 1. Monitoring wells will be installed in strict accordance with the USEPA Environmental Response Team's SOP.

3.5.2 Groundwater Monitor Well Development

Following monitor well installation and completion, each well will be developed by a combination of surging and bailing techniques. Groundwater purged from the wells will be contained in labeled and sealed 55-gallon drums. Development water will remain on-site in a secure location until proper disposal. Monitoring wells will be developed in strict accordance with the USEPA Environmental Response Team's SOP.

3.5.3 Groundwater Monitor Well Monitoring and Sampling

Upon completion and development, the monitor wells will be allowed to sit undisturbed for a minimum of one week. The groundwater monitor wells will then be gauged to determine water table elevation and direction of groundwater flow. The wells will then be purged of a minimum of three well volumes, and a groundwater sample will be collected from each well.

Groundwater samples will be collected from each well with a dedicated aqua-bailer. Purging data, including pH, temperature, conductivity, oxidation-reduction potential, and dissolved oxygen, will be measured with a YSI water quality meter and documented on a Water Sample Collection Form along with purged water volume. All sampling equipment will be thoroughly decontaminated between uses.

Duplicate groundwater samples will be collected from each monitoring well and held in the event that further laboratory analyses are required. All sample collection data, including sample collection depth, will be documented on a Water Sample Collection Form. A Chain of Custody Record will be completed in the field as samples are being collected. Samples will be stored in a chilled, insulated cooler at 6°C until delivered to the analyzing laboratory.

Groundwater monitoring, well installation, well development, and sampling will be completed in strict accordance with the USEPA Environmental Response Team's SOPs.

3.5.4 Professional Survey

The location and elevation of the top of each well casing will be surveyed to the nearest 0.01 foot with reference to mean sea level by a licensed surveyor in order to accurately determine the local groundwater depth and flow direction beneath the site. Each well will be tied to an existing USGS benchmark. AES will arrange with a New Mexico Licensed Professional Surveyor to complete the survey upon completion of the monitoring well installation.

3.5.5 Laboratory Analyses - Groundwater

All groundwater analytical samples collected from the monitoring wells will be submitted to an EPA-approved laboratory, Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, or one of its subcontractors for analysis of the following parameters:

Table 2. Groundwater Analytical Parameters

Water Sample Location	*Parameter*	*Analytical Method*	*Analyzing Laboratory*
All Monitoring Wells	BTEX	EPA Method 8021	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Total Petroleum Hydrocarbons (TPH) (C6-C36)	EPA Method 8015 Modified	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Chlorides	EPA Method 300.1	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975
All Monitoring Wells	Total Dissolved Soilds	SM 2540C	Hall Environmental Analysis Laboratory 4901 Hawkins NE, Suite D Albuquerque, NM (505) 345-3975

A travel blank and field blank will be analyzed for BTEX per EPA Method 8021. Once collected, sample containers will be packed with ice in insulated coolers and shipped via UPS or Greyhound Bus to the laboratory. Typical laboratory regular turn around time is 12 to 15 days.

For all laboratory samples, QA/QC procedures, sample preservation, apparatus required, and analyses performed will be per USEPA Document EPA-600, "Methods for Chemical Analysis for Water and Wastes" dated July 1982; and USEPA document SW-846, 3rd Edition, "Test Methods for Evaluating Solid Waste: Physical Chemical Methods", dated November 1986, as amended by Update One, July 1992.

3.6 Investigation Derived Waste

3.6.1 Investigation Derived Waste - Soil

Contaminated soils will be managed in accordance with applicable State and Federal regulations. All contaminated drill cuttings will be placed within 55-gallon DOT approved drums, which will then be marked with identification and sealed. These soils will then be disposed of at the BMG Landfarm, an NMOCD approved facility. Disposal manifests will be included within the assessment report.

3.6.2 Investigation Derived Waste - Groundwater

Contaminated water will be managed in accordance with applicable State and Federal regulations. Groundwater obtained from monitoring well development and pre-sample purging will be stored on-site within 55-gallon DOT approved drums, which will then be marked with identification and sealed. This water will then be disposed of at the evaporation pond at the BMG Landfarm, once primary liner replacement has been completed. Disposal manifests will be included within the assessment report.

3.6.3 Investigation Derived Waste – Equipment Decontamination Water

All decontamination and rinse water will be managed in accordance with applicable State and Federal regulations. This water will be stored on-site within 55-gallon DOT approved drums, which will then be marked with identification and sealed. Equipment decontamination water will then be disposed of at the evaporation pond at the BMG Landfarm, once primary liner replacement has been completed. Disposal manifests will be included within the assessment report.

3.7 Quality Assurance/Quality Control and Chain of Custody Procedures

3.7.1 Quality Control Samples

Field quality control samples will be collected in order to assess variability of the media being sampled and to detect contamination and sampling error in the field. Field QC samples will include field duplicates and trip blanks.

- One field duplicate sample will be collected for every ten field samples collected for laboratory analysis in order to check for reproducibility of laboratory and field procedures.
- One trip blank sample will be utilized per sampling event to check for contamination of volatile organic samples during handling and shipment from the field to the analyzing laboratory.

Laboratory QC samples will be analyzed by the laboratory and will consist of matrix spike and matrix spike duplicates for organic samples in order to identify, measure, and control the sources of error that may be introduced from the time of sample bottle preparation through analysis.

3.7.2 Sample Quality Assurance Elements

Sample quality assurance elements will include the following:

1. Sample documentation (location, date and time collected, batch, etc.)
2. Complete chain of custody records
3. Initial and periodic calibration of field equipment
4. Determination and documentation of applicable detection limits
5. Analyte(s) identification
6. Analyte(s) quantification

3.7.3 Chain of Custody Record

A Chain of Custody Record will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for, and a copy of the record will be kept by each individual who has signed it. The Chain of Custody Record will include the following information:

1. Sample identification
2. Sample location
3. Sample collection date
4. Sample information, i.e., matrix, number of bottles collected, etc.

5. Names and signatures of samplers
6. Signatures of all individuals who have had custody of the samples

When samples are not under direct control of the individual currently responsible for them, they will be stored in a locked container which has been sealed with a Custody Seal.

3.7.4 Custody Seal

Custody seals demonstrate that a sample container has not been opened or tampered with. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

4.0 Deliverables

Within 60 days of the completing the SAP, a Site Assessment Report (SAR) summarizing the SAP activities will be submitted to the NMOCD. The SAR will include the following:

1. A summary of all work conducted in the implementation of the SAP;
2. Maps of all sampling locations, including soil and groundwater contamination plumes;
3. All laboratory data and quality assurance and quality control information; and
4. Recommendations of further sampling which needs to be conducted as a result of the sampling pursuant to the SAP.
5. Recommendations for further remediation measures

5.0 Implementation Schedule

AES proposes to install and develop the monitoring wells on April 25, 2008. AES personnel will return to the site the following week to collect groundwater samples. AES will prepare the SAR, which will be submitted to the NMOCD within 30 days of receipt of the analytical results.

6.0 Certification

AES has prepared this Sampling and Analysis Plan on behalf of Benson Montin Greer Drilling Corporation to determine whether the integrity of the secondary liner of the evaporation pond has been compromised resulting in a release to the environment.

Respectfully submitted,

Sandrea R. Cupps
Lany Cupps
Project Manager

Elizabeth McNally
Elizabeth McNally, NM PE #15799
Environmental Engineer

7.0 References

U.S. Environmental Protection Agency (USEPA). 1982. *Methods for Chemical Analysis for Water and Wastes.* Document EPA-600, July, 1982.

USEPA. 1992. SW-846, 3rd Edition, *Test Methods for Evaluating Solid Waste: Physical Chemical Methods*, dated November, 1986, and as amended by Update One, July, 1992.

USEPA. 1991. *Site Characterization for Subsurface Remediation*, EPA 625/4-91-026, November, 1991.

USEPA. 1997. *Expedited Site Assessment Tools for Underground Storage Tank Sites.* OSWER 5403G and EPA 510B-97-001, March, 1997.

USEPA. 2001. Contract Laboratory Program (CLP) Guidance for Field Samplers. OSWER 9240.0-35, EPA 540-R-00-003. June, 2001.

Animas Environmental Services, LLC

DRAWN BY	LRC	CHECKED BY	LRC	04-22-08	REVISIONS
	04-22-08	APPROVED BY	LRC	04-22-08	BY: Larry DATE: 04-22-08

S:\ANIMAS 2000\2008 PROJECTS\BMG\LANDFARM\DRAWINGS\FIGURE 1.DWG

PROPOSED WELL CONSTRUCTION DETAIL

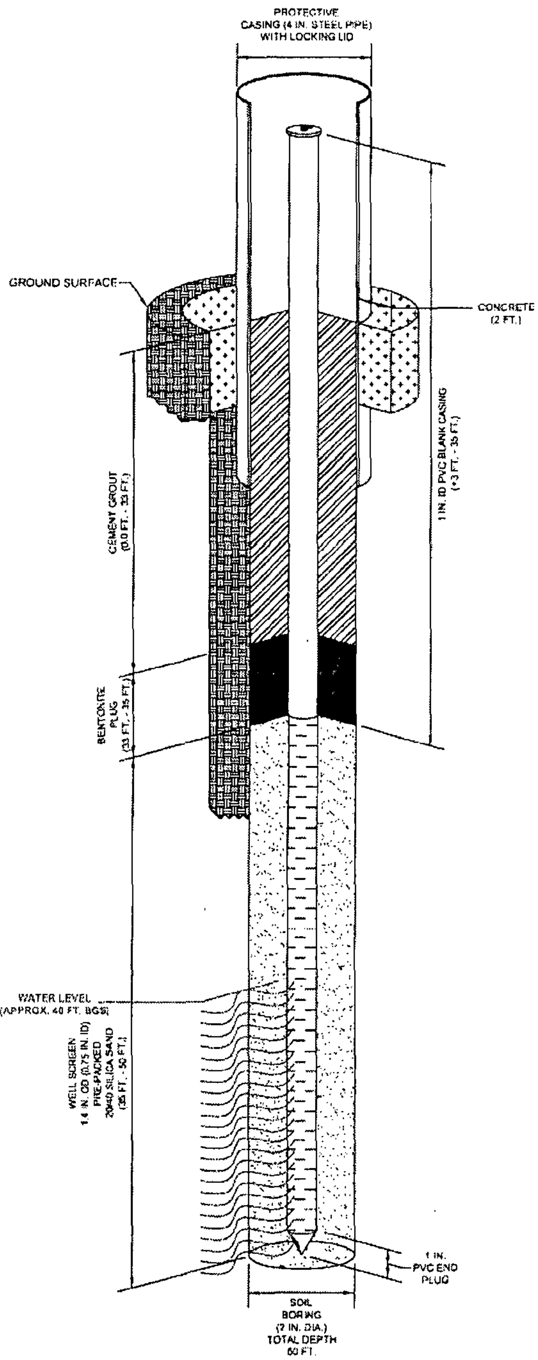

FIGURE 1

BMG EVAPORATION POND PROPOSED GROUNDWATER MONITORING WELL SCHEMATIC

CENTRALIZED SURFACE WASTE MANAGEMENT FACILITY
SW ¼, NW ¼, SECTION 20, T25N, R2E
RIO ARRIBA COUNTY, NEW MEXICO

NOT TO SCALE

Jones, Brad A., EMNRD

From: Price, Wayne, EMNRD
Sent: Monday, April 21, 2008 3:50 PM
To: Mike Dimond
Cc: Powell, Brandon, EMNRD; 'Lany Cupps'; Jones, Brad A., EMNRD
Subject: RE: Evap Pond; Permit: NM - 02-0004

OCD hereby approves of the path forward. Please copy Brad Jones on all future correspondence as he is the permit writer for your site.

Please be advised that OCD approval of this plan does not relieve the owner/operator of responsibility should their operations fail to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, OCD approval does not relieve the owner/operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

From: Mike Dimond [mailto:mikedimond@bmgdrilling.com]
Sent: Monday, April 21, 2008 2:31 PM
To: Price, Wayne, EMNRD
Cc: Powell, Brandon, EMNRD; 'Lany Cupps'
Subject: Evap Pond; Permit: NM - 02-0004

Wayne Price:
Benson-Montin-Greer Drilling Corp. has discovered a leak in its Centralized Surface Waste Management Facility's Evap pond and provides the following details and proposal;

The pond has a primary and secondary liner with a monitoring tube installed between the two.

The most recent water sample results should be back from the lab the end of this week but other samples indicate typical TDS around 85,000 mg/L.

The ground water at this location is estimated at approximately 60 feet.

There is no indication of leaking through the secondary liner but we propose to drill samples with a geoprobe unit around the perimeter of the pond to verify.

Animas Environmental will provide a detailed plan for the sample holes to you on April 22. Should there be any indication of leakage outside the secondary liner a detailed clean-up procedure will be submitted to you.

We are presently removing the remaining water within the pond and will remove the primary liner and replace it.

We ask your approval of our remediation plan and rehabilitation of our evaporation pond.
Thank You.

Mike Dimond
Benson-Montin-Greer Drilling Corp.