

## **ATTACHMENT 17 INVESTIGATION AND SAMPLING METHODS AND PROCEDURES**

The Permittee shall submit to NMED, for review and written approval, site-specific work plans for each site prior to the commencement of field activities where environmental investigation, corrective action, sampling or monitoring is being conducted or proposed. The site-specific work plans shall include the methods to be used to conduct all activities at each site or unit and shall be prepared in accordance with the format described in the Permit attachment 20 (*Reporting Requirements*). The Permittee shall provide notification to NMED of corrective action field activities a minimum of 15 days prior to commencing the activity.

The methods used to conduct investigation, remediation, and monitoring activities shall be sufficient to fulfill the requirements of this Permit and provide accurate data for the evaluation of site conditions, the nature and extent of contamination and contaminant migration, and for remedy selection and implementation, where necessary. The methods presented in Section 17.2 of this Permit Attachment are minimum requirements for environmental investigation and sampling, and are not intended to include all methods that may be necessary to fulfill the requirements of this Permit. The methods for conducting investigations, corrective actions, and monitoring at the Facility must be determined based on the conditions and contaminants that exist at each site or unit.

### **17.1 STANDARD OPERATING PROCEDURES**

The Permittee shall provide a brief description of investigation, sampling or analytical methods and procedures in documents submitted to NMED that includes sufficient detail to evaluate the quality of the acquired data. The Permittee cannot substitute standard operating procedure documents for such descriptions.

### **17.2 INVESTIGATION, SAMPLING, AND ANALYSIS METHODS**

#### **17.2.1 Introduction and Purpose**

This section provides minimum requirements for field investigations, sample collection, handling and screening procedures, field and laboratory sample analysis, and quality assurance procedures for samples of the medium being investigated or tested at the Facility.

The purpose of this section is to: 1) provide minimum requirements for drilling and sample collection in exploratory borings and other excavations; 2) provide minimum requirements for sampling of the target media; 3) provide minimum requirements for monitoring of groundwater and vadose zone conditions; and 4) identify minimum required screening, analytical, and quality assurance procedures that shall be implemented during field sampling activities and laboratory analyses.

The quality assurance procedures referenced in the previous paragraph include: 1) the Facility investigation data quality objectives; 2) the requirements for QA/QC to be followed during field investigations and by the analytical laboratories; and 3) the methodology for the review and evaluation of the field and laboratory QA/QC results and documentation.

## **17.2.2 Field Exploration Activities**

Exploratory borings shall be advanced at locations specified in NMED approved site-specific work plans. NMED may require additional exploratory borings to fulfill the requirements of this Permit. Any additional boring locations, if required, will be determined or approved by NMED. The depths and locations of all exploratory and monitoring well borings shall be specified in the site-specific work plans submitted to NMED for approval prior to the start of the respective field activities. NMED must approve proposed unit aggregates grouped for the purpose of site investigation, remediation, and/or monitoring activities.

### **17.2.2.a Subsurface Features/Utility Geophysical Surveys**

The Permittee shall conduct surveys to locate underground utilities, pipelines structures, drums, debris, and other buried features, including buried waste, in the shallow subsurface prior to the start of field exploration activities. The methods used to conduct the surveys, such as magnetometer, ground penetrating radar, resistivity, or other methods, shall be selected based on the characteristics of the site and the possible or suspected underground structures. The results of the surveys shall be included in the investigation reports submitted to NMED.

### **17.2.2.b Drilling and Soil, Rock, and Sediment Sampling**

#### **17.2.2.b.i Drilling**

Exploratory and monitoring well borings shall be drilled using the most effective, proven, and practicable method for recovery of undisturbed samples and potential contaminants. NMED shall approve the drilling methods selected for advancement of each boring prior to the start of field activities. Based on the drilling conditions, the borings shall be advanced using one of the following methods:

- Hollow-stem auger
- Air rotary
- Mud rotary
- Percussion hammer
- Sonic
- Dual wall air rotary
- Direct Push Technology (DPT)
- Cryogenic
- Cable tool

Hollow-stem auger or DPT drilling methods are preferred if vapor-phase or VOC contamination is known or suspected to be present. Air rotary drilling is preferred for borings intersecting the regional aquifer. The type of drilling fluid used, if necessary, shall be approved by NMED prior to the start of drilling activities or prior to use at any site.

All drilling equipment shall be in good working condition and capable of performing the assigned task. Drilling rigs and equipment shall be operated by properly trained, experienced, and responsible crews. The Permittee are responsible for ensuring that contaminants from another site or facility are not introduced into the site under investigation due to malfunctioning equipment or poor site maintenance. The drilling equipment shall be properly decontaminated before drilling each boring.

Exploratory borings shall be advanced to unit- and location-specific depths specified or approved by NMED. The Permittee shall propose drilling depths in the site-specific work plans submitted for each subject area. Unless otherwise specified by NMED, the borings shall be advanced to the following minimum depths:

1. In all borings, 25 feet (ft) below the deepest detected contamination based on field screening, laboratory analyses, and/or previous investigations at the site;
2. Twenty ft below the base of disposal units if contamination is not detected;
3. Five ft below the base of shallow structures such as piping or building sumps, or other building structures;
4. One hundred ft below the deepest known intermediate perched groundwater zone;
5. One hundred ft below the top of the regional aquifer; and
6. Depths specified by NMED based on regional or unit specific data needs.

The Permittee shall notify NMED as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the depths specified by NMED or proposed in an approved work plan so that alternative actions may be discussed. Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities. Contaminant zones shall be isolated from other zones encountered in the borings.

The drilling and sampling shall be accomplished under the direction of a qualified engineer or geologist who shall maintain a detailed log of the materials and conditions encountered in each boring. Both sample information and visual observations of the cuttings and core samples shall be recorded on the boring log. Known site features and/or site survey grid markers shall be used as references to locate each boring prior to surveying the location as described in Section 17.2.2.f of this Permit Attachment. The boring locations shall be measured to the nearest foot, and locations shall be recorded on a scaled site map upon completion of each boring.

Trenching and other exploratory excavation methods shall follow the applicable general procedures outlined in this Permit Attachment. The particular methods proposed for use by the Permittee for exploratory excavation and sampling at any specific unit shall be included in the site-specific investigation work plan submitted to NMED. NMED will include any changes or additional requirements for conducting exploratory excavation and sampling activities at the subject unit in its response to the Permittee after review of the investigation work plan.

### **17.2.2.b.ii Soil and Rock Sampling**

Relatively undisturbed discrete soil and rock samples shall be obtained, where possible, during the advancement of each boring for the purpose of logging, field screening, and analytical testing. Generally, the samples shall be collected at the following intervals and depths:

1. At five-ft intervals, ten-ft intervals, continuously, or as approved by NMED;
2. At the depth immediately below the base of the disposal unit or facility structure;
3. At the maximum depth of each boring;
4. At the depths of contacts or first encounter, observed during drilling, with geologic units of different lithology, structural or textural characteristics, or of relatively higher or lower permeability;
5. Of soil or rock types relatively more likely to sorb or retain contaminants than surrounding lithology;
6. At the depth of the first encounter, during drilling, with shallow or intermediate saturated zones;
7. At intervals suspected of being source or contaminated zones;
8. At the top of the aquifer; and
9. At other intervals approved or required by NMED.

The sampling interval for the borings may be modified, or samples may be obtained from a specific depth, based on field observations. A decontaminated split-barrel sampler lined with brass sleeves, a coring device, or other method approved by NMED shall be used to obtain samples during the drilling of each boring.

A split barrel sampler lined with brass sleeves or a coring device is the preferred sampling method for borehole soil, rock, and sediment sampling. The following procedures should be followed if a split barrel sampler is used. Upon recovery of the sample, one or more brass sleeves shall be removed from the split barrel sampler and the open ends of the sleeves covered with Teflon tape or foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory. If brass sleeves are not used, a portion of the sample shall be placed in pre-cleaned, laboratory-prepared sample containers for laboratory chemical analysis. The remaining portions of the sample shall be used for logging and field screening, as described in Sections 17.2.2.c and 17.2.2.d of this Permit, respectively.

Discrete samples shall be collected for field screening and laboratory analyses. Homogenization of discrete samples collected for analyses other than for VOC and SVOC analyses shall be performed by the analytical laboratory, if necessary. The Permittee may submit site-specific, alternative methods for homogenization of samples in the field to NMED for review and written approval.

Samples to be submitted for laboratory analyses shall be selected based on: 1) the results of the field screening or mobile laboratory analyses; 2) the position of the sample relative to groundwater, suspected releases, or site structures; 3) the sample location relative to former or altered site features or structures; 4) the stratigraphy encountered in the boring; and 5) the specific objectives and requirements of this Permit and the approved site-specific work plan. The proposed number of

samples and analytical parameters shall be included as part of the site-specific work plan submitted to NMED for approval prior to the start of field investigation activities at each unit. The work plans shall allow for flexibility in modifying the project-specific tasks based on information obtained during the course of the investigation. Modifications to site-specific work plan tasks must be pre-approved in writing by NMED.

#### **17.2.2.b.iii Sediment Sampling**

Sediment samples shall be collected in the same manner as described in Section 17.2.2.b.ii for soil and rock sampling where borings are drilled to explore alluvial subsurface conditions. The sampling device shall be a decontaminated, hand-held stainless steel coring device, shelby tube, thin-wall sampler, or other device approved by NMED where sediment sampling is conducted without the use of the drilling methods described in Section 17.2.2.b.i of this Permit Attachment. The samples shall be transferred to pre-cleaned laboratory prepared containers for submittal to the laboratory. Samples obtained for volatiles analysis shall be collected using shelby tubes, thin-wall samplers, or other device approved by NMED. The ends of the samplers shall be lined with Teflon tape or aluminum foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory.

The physical characteristics of the sediment (such as mineralogy, ASTM soil classification, AGI [American Geological Institute] rock classification, moisture content, texture, color, presence of stains or odors, and/or field screening results), depth where each sample was obtained, method of sample collection, and other observations shall be recorded in the field log.

#### **17.2.2.b.iv Drill Cuttings (Investigation Derived Waste)**

Drill cuttings, excess sample material and decontamination fluids, and all other investigation derived waste (IDW) shall be contained and characterized using methods based on the boring location, boring depth, drilling method, and type of contaminants suspected or encountered. Proposed IDW management shall be included with the unit-specific investigation work plan submitted to NMED for approval prior to the start of field investigations. NMED shall approve the method of containment for drill cuttings prior to the start of drilling activities. Borings not completed as groundwater or vapor monitoring wells shall be properly abandoned in accordance with the methods listed in Section 19.4 of this Permit Attachment 19 (*Monitoring Well Construction Requirements*). Borings completed as groundwater monitoring wells shall be constructed in accordance with the requirements described in Section 19.3 of this Permit Attachment 19 (*Monitoring Well Construction Requirements*).

#### **17.2.2.c Logging of Soil/Rock and Sediment Samples**

Samples obtained from all exploratory borings and excavations shall be visually inspected and the soil or rock type classified in general accordance with ASTM D2487 (Unified Soil Classification System) and D2488, or AGI Methods for soil and rock classification. Detailed logs of each boring shall be completed in the field by a qualified engineer or geologist. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling shall be recorded on the logs. Field boring logs, test pit logs, and field well construction diagrams shall be converted to the format acceptable for use in final reports submitted to NMED. If requested, draft boring logs, test pit logs, and well construction diagrams shall be submitted to NMED for review within 30 days after the completion of each boring or monitoring well.

#### **17.2.2.d Soil, Rock, and Sediment Sample Field Screening**

Samples obtained from borings shall be screened in the field for evidence of the potential presence of contaminants. Field screening results shall be recorded on the exploratory boring and excavation logs. Field screening results are used as a general guideline to determine the nature and extent of possible contamination. In addition, screening results shall be used to aid in the selection of soil, rock, sediment, and vapor-phase samples for laboratory analysis. NMED recognizes that field screening alone will not detect the possible presence or full nature and extent of all contaminants that may be encountered at the site.

The primary screening methods to be used shall include: 1) visual examination; 2) headspace vapor screening for VOCs; and 3) metals screening using X-ray fluorescence (XRF). Additional screening for site- or release-specific characteristics such as pH, High Explosives (HE), Total Petroleum Hydrocarbons (TPH) or for other specific compounds using field test kits shall be conducted where appropriate.

Headspace vapor screening shall target VOCs and shall be conducted by placing a soil or rock sample in a plastic sample bag or a foil-sealed container allowing space for ambient air. The container shall be sealed and then shaken gently to expose the soil or rock to the air trapped in the container. The sealed container shall be allowed to rest for a minimum of five minutes while vapors equilibrate. Vapors present within the sample bag headspace will then be measured by inserting the probe of the instrument in a small opening in the bag or through the foil. The maximum value and the ambient air temperature shall be recorded on the field boring or test pit log for each sample. The monitoring instruments shall be calibrated each day to the manufacturers standard for instrument operation. A photo-ionization detector (PID) equipped with a 10.6 or higher electron volt (eV) lamp, combustible gas indicator, or other instrument approved by NMED shall be used for VOC field screening. The limitations, precision, and calibration procedures of the instrument to be used for VOC field screening shall be included in the site-specific investigation work plan prepared for each unit.

XRF may be used to screen soil, rock, or sediment samples for the presence of metals. XRF screening requires proper sample preparation and proper instrument calibration. Sample preparation and instrument calibration procedures shall be documented in the field logs. The methods and procedures for sample preparation and instrument calibration shall be approved by NMED prior to the start of field activities. Field XRF screening results for selected metals may be used in lieu of laboratory analyses upon written approval by NMED. However, the results shall, at a minimum, be confirmed by laboratory analyses at a frequency of 20 percent (one sample per every five analyzed by XRF analysis).

Field screening results are site- and boring-specific and the results vary with instrument type, media screened, weather conditions, moisture content, soil or rock type, and type of contaminant. The Permittee shall record on the field logs all conditions capable of influencing the results of field screening. The Permittee shall submit to NMED conditions potentially influencing field screening results as part of the site-specific investigation, remediation, or monitoring reports.

At a minimum, the Permittee shall submit the samples with the greatest apparent degree of contamination, based on field observations and field screening, for laboratory analysis. The Permittee shall also use the location of the sample relative to groundwater, stratigraphic units or contacts, and the

proximity to significant site or subsurface features or structures as a guideline for sample selection. In addition, the Permittee shall submit the samples with no or little apparent contamination, based on field screening, for laboratory analysis if the intention is to confirm that the base (or other depth interval) of a boring or other sample location is not contaminated.

#### **17.2.2.e Soil, Rock, and Sediment Sample Types**

The Permittee shall collect soil, rock, and sediment samples at the frequencies outlined in the site-specific investigation, corrective action, or monitoring work plans for each SWMU, AOC, or other site submitted by the Permittee for review and written approval by NMED. The samples collected shall be representative of the media and site conditions being investigated or monitored. The Permittee shall collect QA/QC samples to monitor the validity of the soil, rock, and sediment sample collection procedures. Field duplicates will be collected at a rate of ten percent. The Permittee shall collect equipment blanks from all sampling apparatus at a frequency of ten percent for chemical analysis. Equipment blanks shall be collected at a frequency of one per day if disposable sampling equipment is used. The Permittee shall collect field blanks at a frequency of one per day for each medium (with the exception of air samples) at each SWMU, AOC, or other site. Reagent blanks shall be used if chemical analytical procedures requiring reagents are employed in the field as part of the investigation or monitoring program. The resulting data will provide information on the variability associated with sample collection, handling, and laboratory analysis operations. The blanks and duplicates shall be submitted for laboratory analyses associated with the project-specific contaminants, data quality concerns, and media being sampled.

#### **17.2.2.f Sample Point and Structure Location Surveying**

The horizontal and vertical coordinates of the top of each monitoring well casing and the ground surface at each monitoring well location shall be determined by a registered New Mexico professional land surveyor in accordance with the State Plane Coordinate System (NMSA 1978 47-1-49-56 (Repl. Pamp. 1993)). The surveys shall be conducted in accordance with Sections 500.1 through 500.12 of the Regulations and Rules of the Board of Registration for Professional Engineers and Surveyors Minimum Standards for Surveying in New Mexico. Horizontal positions shall be measured to the nearest 0.1-ft, and vertical elevations shall be measured to the nearest 0.01-ft. The Permittee shall prepare site map(s), certified by a registered New Mexico professional land surveyor, presenting all surveyed locations and elevations including relevant site features and structures for submittal with all associated reports to NMED.

Site attributes (e.g., soil sample locations, sediment sample locations, springs, outfalls, pertinent structures, monitoring stations, as well as staked out sampling grids), shall be located by using the global positioning system (GPS), another NMED-approved surveying system, or by using a registered New Mexico Registered Land Surveyor using the methods described in the paragraph above. If using GPS, horizontal locations shall be measured to the nearest 0.5 ft. Permittee shall provide NMED a statement of accuracy for survey data upon request.

### **17.2.2.g Subsurface Vapor-Phase Monitoring and Sampling**

Samples of subsurface vapors shall be collected from vapor monitoring points from both discrete zones, selected based on investigation and field screening results, and as total well subsurface vapor samples where required by NMED.

During subsurface drilling explorations at sites where there is a potential for vapor-phase contamination to be present, soil gas samples shall be obtained at NMED-approved intervals for field screening and/or laboratory analyses. An inflatable packer shall be dropped to isolate the bottom 2-3 feet of the borehole. The isolated portion of the borehole shall be purged by slowly removing approximately five times the volume of the annular space beneath the packer, followed by a VOC measurement using a PID equipped with a 11.7 eV lamp, a combustible gas indicator or other instrument approved by NMED. The data shall be logged and used for determining the samples to be sent to an analytical laboratory.

The Permittee shall, at a minimum, collect vapor samples for field measurement of the following during subsurface vapor monitoring activities:

- Percent oxygen;
- Organic vapors (using a photo-ionization detector with an 11.7 eV lamp, a combustible vapor indicator or other method approved by NMED);
- Percent carbon dioxide;
- Static subsurface pressure; and
- Other parameters (such as carbon monoxide and hydrogen sulfide) as required by NMED.

The Permittee also shall collect vapor samples for laboratory analysis of the following as required:

- Percent moisture;
- VOCs; and
- Other analytes required by NMED.

Vapor samples analyzed by the laboratory for percent moisture and VOCs shall be collected using SUMMA canisters or other sample collection method approved by NMED. The samples shall be analyzed for VOC concentrations by EPA Method TO-15, as it may be updated, or equivalent VOC analytical method.

Field vapor measurements, the date and time of each measurement, and the instrument used shall be recorded on a vapor monitoring data sheet. The instruments used for field measurements shall be calibrated daily in accordance with the manufacturers specifications and as described in Section 17.2.4. The methods used to obtain vapor-phase field measurements and samples shall be approved by NMED in writing prior to the start of air monitoring at each Facility site where vapor-phase monitoring is conducted.

**17.2.2.h Groundwater Monitoring**

**17.2.2.h.i Groundwater Levels**

Groundwater level measurements shall be obtained at intervals required by NMED. Groundwater levels also shall be obtained prior to purging in preparation for a sampling event. Measurement data and the date and time of each measurement shall be recorded on a site monitoring data sheet. The depth to groundwater shall be measured to the nearest 0.01 ft. The depth to groundwater shall be recorded relative to the surveyed well casing rim or other surveyed datum.

Groundwater levels shall be measured in all wells at the facility (or the number of wells otherwise specified in a NMED approved groundwater monitoring work plan) within a 14 days period time. Plume-front area groundwater level measurements shall be obtained at all well locations (or the number of wells otherwise specified in a NMED approved groundwater monitoring work plan) within 14 days of the commencement of the specified measuring event. The Permittee shall conduct periodic measuring events, the schedule for which shall be provided in the groundwater monitoring work plans.

**17.2.2.i Groundwater Sampling**

Groundwater samples shall initially be obtained from newly installed monitoring wells between ten and 30 days after completion of well development. Groundwater monitoring and sampling shall be conducted at an interval approved by NMED after the initial sampling event. The Permittee shall sample all saturated zones screened to allow entry of groundwater into each monitoring well during each sampling event (or as otherwise specified in a NMED approved groundwater monitoring work plan). All requests for variances from the groundwater sampling schedule shall be submitted to NMED, in writing, no less than 30 days prior to the start of scheduled monitoring and sampling events. Groundwater samples shall be collected from all saturated zones, where possible, within exploratory borings not intended to be completed as monitoring wells prior to abandonment of the borings.

Water samples shall be analyzed in accordance with the NMED-approved groundwater monitoring work plan for one or more of the following general chemistry parameters as required by NMED:

nitrate/nitrite	sulfate	chloride	sodium
dissolved CO <sub>2</sub>	alkalinity	carbonate/bicarbonate	boron
fluoride	manganese	calcium	silicon
ferric/ferrous iron	ammonia	potassium	phosphorus/phosphate
sulfide	bromide	magnesium	methane
TKN	total organic carbon	total dissolved solids	

### **17.2.2.i.i Well Purging**

All zones in each monitoring well shall be purged by removing groundwater prior to sampling and in order to ensure that formation water is being sampled. Purge volumes shall be determined by monitoring, at a minimum, groundwater pH, specific conductance, dissolved oxygen concentrations, turbidity, redox potential, and temperature during purging of volumes and at measurement intervals approved by NMED in writing. The groundwater quality parameters shall be measured using a flow-through cell and instruments approved by NMED in writing. The volume of groundwater purged, the instruments used, and the readings obtained at each interval shall be recorded on the field monitoring log. In general, water samples may be obtained from the well after the measured parameters of the purge water have stabilized to within ten percent for three consecutive measurements. Well purging may also be conducted in accordance with NMED's Position Paper "Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring" (October 30, 2001, or as updated). The Permittee may submit to NMED for approval, a written request for a variance from the described methods of well purging for individual wells no later than 90 days prior to scheduled sampling activities. NMED will respond to the request, in writing, within 60 days of receipt of the variance request.

### **17.2.2.i.ii Groundwater Sample Collection**

Groundwater samples shall be obtained from each well after a sufficient amount of water has been removed from the well casing to ensure that the sample is representative of formation water. Groundwater samples shall be obtained using methods approved by NMED within eight hours of the completion of well purging. Sample collection methods shall be documented in the field monitoring reports. The samples shall be transferred to the appropriate clean and laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures are described in Section 17.2.2.j of this Permit Attachment. Decontamination procedures shall be established for reusable water sampling equipment as described in Section 17.2.3 of this Permit Attachment.

All purged groundwater and decontamination water transported to ETU shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums, less-than-90-day storage areas or other containers approved by NMED until proper characterization and disposal can be arranged. The methods for disposal of purge/decontamination water shall be approved by NMED prior to removal from the temporary storage area. Disposable materials shall be handled as described in Section 17.2.5 of this Permit Attachment.

Groundwater samples intended for metals analysis shall be submitted to the laboratory as total metals samples. If required by NMED, the Permittee shall obtain groundwater samples for dissolved metals analysis to be filtered using disposable in-line filters with a 0.45 micron or other mesh size approved by NMED.

### **17.2.2.i.iii Surface Water Sample Collection**

Surface water samples shall be collected using methods approved by NMED. Samples shall be collected in clean laboratory-prepared sampling containers. The methods and instruments used to measure field parameters shall be approved by NMED prior to conducting surface water sampling.

The sampling and monitoring techniques used and the measurements obtained shall be recorded in the field monitoring reports.

#### **17.2.2.i.iv Groundwater and Surface Water Sample Types**

Groundwater samples shall be collected from each monitoring well and surface water samples shall be collected at predetermined locations. Field duplicates, field blanks, equipment rinseate blanks, reagent blanks, if necessary, and trip blanks shall be obtained for quality assurance during groundwater and surface water sampling activities. The samples shall be handled as described in Section 17.2.2.j of this Permit Attachment.

Field duplicate surface water and groundwater samples shall be obtained at a frequency of ten percent. At a minimum, one duplicate sample per sampling event shall always be obtained.

Field blanks shall be obtained at a frequency of no less than one per day per site or unit. Field blanks shall be generated by filling sample containers in the field with deionized water and submitting the samples, along with the groundwater or surface water samples, to the analytical laboratory for the appropriate analyses.

Equipment rinseate blanks shall be obtained for chemical analysis at the rate of five percent but no fewer than one rinseate blank per sampling day. Equipment rinseate blanks shall be collected at a rate of one per sampling day if disposable sampling apparatus is used. Rinseate samples shall be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinseate sample then shall be placed in the appropriate sample container and submitted with the groundwater or surface water samples to the analytical laboratory for the appropriate analyses.

Reagent blanks shall be obtained at a frequency of ten percent but no fewer than one per day per unit if chemical analyses requiring the use of chemical reagents are conducted in the field during water sampling activities.

Trip blanks shall accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks shall consist of a sample of analyte-free deionized water prepared by the laboratory and placed in an appropriate sample container. The trip blank shall be prepared by the analytical laboratory prior to the sampling event and shall be kept with the shipping containers and placed with other water samples obtained from the site each day. Trip blanks shall be analyzed at a frequency of one for each shipping container of samples.

#### **17.2.2.j Sample Handling**

At a minimum, the following procedures shall be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves shall be worn when collecting samples. New disposable gloves shall be used to collect each sample;
2. All samples collected of each medium for chemical analysis shall be transferred into clean sample containers supplied by the project analytical laboratory with the exception of soil, rock, and sediment samples obtained in brass sleeves or in Encore™ samplers. Upon

recovery of the sample collected using split barrel samplers with brass sleeves, the brass sleeves shall be removed from the split barrel sampler and the open ends of the sleeves shall be lined with Teflon tape or foil and sealed with plastic caps. The caps shall be fastened to the sleeve with tape for storage and shipment to the analytical laboratory. The sample depth and the top of the sample shall be clearly marked. Sample container volumes and preservation methods shall be in accordance with EPA SW-846 and established industry practices for use by accredited analytical laboratories. Sufficient sample volume shall be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis; and

3. Sample labels and documentation shall be completed for each sample following procedures included in the site-specific work plans approved by NMED. Immediately after the samples are collected, they shall be stored in a cooler with ice or using another appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described in Section 17.2.6.b of this Permit Attachment, shall be followed for all samples collected. All samples shall be submitted to the laboratory soon enough to allow the laboratory to conduct the analyses within the method holding times. At a minimum, all samples shall be submitted to the laboratory within 48 hours after their collection.

Shipment procedures shall include the following:

1. Individual sample containers shall be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler shall be sealed and secured in case of sample container leakage. Temperature blanks shall be included with each shipping container;
2. Each cooler or other container shall be delivered directly to the analytical laboratory;
3. Glass bottles shall be separated in the shipping container by cushioning material to prevent breakage;
4. Plastic containers shall be protected from possible puncture during shipping using cushioning material;
5. The chain-of-custody form and sample request form shall be shipped inside the sealed storage container to be delivered to the laboratory;
6. Chain-of-custody seals shall be used to seal the sample-shipping container in conformance with EPA protocol; and
7. Signed and dated chain-of-custody seals shall be applied to each cooler prior to transport of samples from the site.

#### **17.2.2.k In-situ Testing**

In-situ permeability tests, remediation system pilot tests, stream flow tests, and other tests conducted to evaluate site and subsurface conditions shall be designed to accommodate specific site conditions and to achieve the test objectives. The testing methods shall be approved, in writing, by NMED prior to implementation. The tests shall be conducted in order to appropriately represent site conditions and in

accordance with USGS, ASTM or other industry-wide generally accepted methods. Detailed logs of all relevant site conditions and measurements shall be maintained during the testing events. If requested, a summary of the general test results, including unexpected or unusual test results and equipment failures or testing limitations shall be reported to NMED within 30 days of completion of the test. The summary shall be presented in a format acceptable to NMED and in general accordance with the report formats outlined in Permit Attachment 20 (*Reporting Requirements*). A report summarizing the results of each test shall be submitted to NMED within one hundred and twenty (120) days of completion of each test.

### **17.2.3 Decontamination Procedures**

The objective of the decontamination procedures is to minimize the potential for cross-contamination. A designated decontamination area shall be established for decontamination of drilling equipment, reusable sampling equipment and well materials. The drilling rig shall be decontaminated prior to entering the site or unit. Drilling equipment or other exploration equipment that may come in contact with the borehole shall be decontaminated by steam cleaning, by hot-water pressure washing, or by other method approved by NMED prior to drilling each new boring.

Sampling or measurement equipment, including but not limited to stainless steel sampling tools, split-barrel or core samplers, well developing or purging equipment, groundwater quality measurement instruments, and water level measurement instruments, shall be decontaminated in accordance with the following procedures or other methods approved by NMED before each sampling attempt or measurement:

1. Brush equipment with a wire or other suitable brush, if necessary or practicable, to remove large particulate matter;
2. Rinse with potable tap water;
3. Wash with nonphosphate detergent or other detergent approved by NMED (examples include Fantastik™, Liqui-Nox®) followed by a tap water rinse;
4. Rinse with 0.1 molar nitric acid (to remove trace metals, if necessary) followed by a tap water rinse;
5. Rinse with methanol (to remove organic compounds, if necessary) followed by a tap water rinse;
6. Rinse with potable tap water; and
7. Double rinse with deionized water.

All decontamination solutions shall be collected and stored temporarily as described in Section 17.2.5 of this Permit Attachment. Decontamination procedures and the cleaning agents used shall be documented in the daily field log.

### **17.2.4 Field Equipment Calibration Procedures**

Field equipment requiring calibration shall be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. At a minimum, calibration checks shall be conducted daily, or at other intervals approved by NMED, and the instruments shall be recalibrated, if

necessary. Calibration measurements shall be recorded in the daily field logs. If field equipment becomes inoperable, its use shall be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument shall be used.

### **17.2.5 Collection and Management of Investigation Derived Waste**

Investigation derived waste (IDW) includes general refuse, drill cuttings, excess sample material, water (decontamination, development and purge), and disposable equipment generated during the course of investigation, corrective action, or monitoring activities. All IDW shall be properly characterized and disposed of in accordance with all Federal, State, and local rules and regulations for storage, labeling, handling, transport, and disposal of waste. The Permittee shall include a description of anticipated management of IDW as part of the applicable work plan submitted to NMED for approval prior to disposal of any IDW produced during investigation, corrective action, or monitoring activities. The Permittee may submit a request to NMED to dispose of IDW on a case-by-case basis prior to submittal of the applicable work plan.

All water generated during sampling and decontamination activities shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums or other containers approved by NMED until proper characterization and disposal can be arranged. The IDW may be characterized for disposal based on the known or suspected contaminants potentially present in the waste. The methods for waste characterization and disposal of IDW shall be approved by NMED prior to removal from the temporary storage area.

### **17.2.6 Documentation of Field Activities**

#### **17.2.6.a General**

Daily field activities, including observations and field procedures, shall be recorded on appropriate forms. The original field forms shall be maintained at the Facility. Copies of the completed forms shall be maintained in a bound and sequentially numbered field file for reference during field activities. Indelible ink shall be used to record all field activities. Photographic documentation of field activities shall be performed, as appropriate. The daily record of field activities shall include the following:

- Site or unit designation;
- Date;
- Time of arrival and departure;
- Field investigation team members including subcontractors and visitors;
- Weather conditions;
- Daily activities and times conducted;
- Observations;
- Record of samples collected with sample designations and locations specified;
- Photographic log;

- Field monitoring data, including health and safety monitoring if conditions arise that require modification of required work;
- Equipment used and calibration records, if appropriate;
- List of additional data sheets and maps completed;
- An inventory of the waste generated and the method of storage or disposal; and
- Signature of personnel completing the field record.

#### **17.2.6.b Sample Custody**

All samples collected for analysis shall be recorded in the field report or data sheets. Chain-of-custody forms shall be completed at the end of each sampling day, prior to the transfer of samples off site, and shall accompany the samples during shipment to the laboratory. A signed and dated custody seal shall be affixed to the lid of the shipping container. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form shall be signed as received by the laboratory, and the conditions of the samples shall be recorded on the form. The original chain-of-custody form shall remain with the laboratory and copies shall be returned to the relinquishing party. The Permittee shall maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of the chain-of-custody records (either paper copies or electronically scanned in PDF format) shall be included with all draft and final laboratory reports submitted to NMED.

### **17.3 CHEMICAL ANALYSES**

The Permittee shall submit all samples for laboratory analysis to accredited contract laboratories. The laboratories shall use the most recent EPA and industry-accepted extraction and analytical methods for chemical analyses for target analytes as the testing methods for each medium sampled. The Permittee shall use the most sensitive laboratory methods (with the lowest detection limits) available unless specific conditions preclude their use.

The Permittee shall submit a list of analytes and analytical methods to NMED, for review and written approval as part of each site-specific investigation, corrective action, or monitoring work plan. The detection limits for each method shall be less than applicable background, screening, and regulatory cleanup levels. The preferred method detection limits are a maximum of 20 percent of the cleanup, screening, or background levels. Analyses conducted with detection limits that are greater than applicable background, screening, and regulatory cleanup levels shall be considered data quality exceptions and the reasons for the elevated detection limits shall be reported to NMED. These data cannot be used for statistical analyses. All analytical data (non-detects, estimated blanks, and detects) shall be included in the electronic copy of the investigation report in Microsoft™ Excel format with qualifiers as attached from the analytical laboratory. The summary tables shall include only detects of the data based on the corresponding qualifiers. The Permittee shall not censor the data based on detection limits, quantitation limits, or measurement uncertainty.

#### **17.3.1 Laboratory QA/QC Requirements**

The following requirements for laboratory QA/QC procedures shall be considered the minimum QA/QC standards for the laboratories employed by the Permittee that provide analytical services for

environmental investigation, corrective action, and monitoring activities conducted at the Facility. The Permittee shall provide the names of the contract analytical laboratories and copies of the laboratory quality assurance manuals to NMED within 90 days of awarding a contract for analytical services to any contract laboratory.

#### **17.3.1.a Quality Assurance Procedures**

Contract analytical laboratories shall maintain internal quality assurance programs in accordance with EPA and industry-wide accepted practices and procedures. At a minimum, the laboratories shall use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), blank spike/blank spike duplicates (BS/BSD), and laboratory control samples to demonstrate analytical QA/QC. The laboratories shall establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories shall establish internal QA/QC that meets EPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

#### **17.3.1.b Equipment Calibration Procedures and Frequency**

The laboratories' equipment calibration procedures, calibration frequency, and calibration standards shall be in accordance with the EPA test methodology requirements and documented in the laboratories' quality assurance and SOP manuals. All instruments and equipment used by the laboratory shall be operated, calibrated, and maintained according to manufacturers' guidelines and recommendations. Operation, calibration, and maintenance shall be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance shall be kept on file at the laboratory.

#### **17.3.1.c Laboratory QA/QC Samples**

Analytical procedures shall be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs, and laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed shall be documented in the cited EPA or DOE test methodologies. At a minimum, the laboratory shall analyze laboratory blanks, MS/MSDs, BS/BSDs, and laboratory duplicates at a frequency of one in twenty for all batch runs requiring EPA test methods and at a frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples shall be specific to the project.

#### **17.3.1.d Laboratory Deliverables**

The laboratory analytical data package shall be prepared in accordance with EPA-established Level III or IV analytical support protocol. The following shall be provided in the analytical laboratory reports submitted to the Permittee either electronically or in hard (paper) copy for this project:

1. Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any data quality exceptions, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report.

2. Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; soil, rock, or sediment sample results in consistent units (mg/kg) or micrograms per kilogram in dry-weight basis; water sample results in consistent units (milligrams per liter or micrograms per liter ( $\mu\text{g/L}$ )); vapor sample results in consistent units (ppm or  $\mu\text{g/m}^3$ ); and detection limits for undetected analytes. Results shall be reported for all field samples, including field duplicates and blanks, submitted for analysis.
3. Method blank results, including detection limits for undetected analytes.
4. Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only).
5. MS/MSD and/or BS/BSD spike concentrations, percent recoveries, relative percent differences (RPDs), and corresponding control limits.
6. Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits.
7. Sample chain-of-custody documentation.
8. Holding times and conditions.
9. Conformance with required analytical protocol(s).
10. Instrument calibration.
11. Blanks.
12. Detection/quantitation limits.
13. Recoveries of surrogates.
14. Variability for duplicate analyses.
15. Completeness.
16. Data report formats.
17. The following data deliverables for organic compounds shall be required from the laboratory:
  - A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;
  - Report of sample collection, extraction, and analysis dates, including sample holding conditions;
  - Tabulated results for samples in units as specified, including data qualification in conformance with EPA protocol, and definition of data descriptor codes;
  - Reconstructed ion chromatograms for gas chromatograph/mass spectrometry (GC/MS) analyses for each sample and standard calibration;
  - Selected ion chromatograms and mass spectra of detected target analytes (GC/MS) for each sample and calibration with associated library/reference spectra;

- Gas chromatograph/electron capture device (GC/ECD) and/or gas chromatograph/flame ionization detector (GC/FID) chromatograms for each sample and standard calibration;
  - Raw data quantification reports for each sample and calibrations, including areas and retention times for analytes, surrogates, and internal standards;
  - A calibration data summary reporting calibration range used and a measure of linearity [include decafluorotriphenylphosphine (DFTPP) and p-bromofluorobenzene (BFB) spectra and compliance with tuning criteria for GC/MS];
  - Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitation limit for each analyte;
  - Analyte concentrations with reporting units identified, including data qualification in conformance with the CLP Statement of Work (SOW) (include definition of data descriptor codes);
  - Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample;
  - Recovery assessments and a replicate sample summary, including all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts); and
  - Report of tentatively identified compounds with comparison of mass spectra to library/reference spectra.
18. The following data deliverables for inorganic compounds shall be required from the laboratory:
- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications; including signature from authority representative certifying to the quality and authenticity of data as reported;
  - Report of sample collection, digestion, and analysis dates, with sample holding conditions;
  - Tabulated results for samples in units as specified, including data qualification in conformance with the CLP SOW (including definition of data descriptor codes);
  - Results of all method QA/QC checks, including inductively coupled plasma (ICP) Interference Check Sample and ICP serial dilution results;
  - Tabulation of instrument and method practical detection/quantitation limits;
  - Raw data quantification report for each sample;
  - A calibration data summary reporting calibration range used and a measure of linearity, where appropriate;
  - Final digestate volumes (and dilutions required), sample size, and wet-to-dry weight ratios;

- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample; and
- Recovery assessments and a replicate sample summary, including post-digestate spike analysis; all MS data (including spike concentrations) for each sample, if accomplished; all MS results (recoveries and spike amounts); and laboratory control sample analytical results).

The Permittee shall present summary tables of these data and Level II QA/QC results to NMED in the formats described in Permit Attachment 20 (*Reporting Requirements*) of this Permit. The raw analytical data, including calibration curves, instrument calibration data, data calculation work sheets, and other laboratory support data for samples from this project, shall be compiled and kept on file at the Facility for reference. The Permittee shall make the data available to NMED upon request.

All data quality exceptions (flagged analytical results) must be discussed in the laboratory report case narrative. An explanation shall be provided for each data quality exception including a discussion of the significance and acceptability of each flagged result.

### **17.3.2 Review of Field and Laboratory QA/QC Data**

The Permittee shall evaluate the sample data, field, and laboratory QA/QC results for acceptability with respect to the data quality objectives (DQOs). Each group of samples shall be compared with the DQOs and evaluated using data validation guidelines contained in EPA guidance documents, the latest version of SW-846, and industry-accepted QA/QC methods and procedures.

The Permittee shall require the laboratory to notify the Facility project manager of data quality exceptions within one business day of discovery in order to allow for sample re-analysis, if possible. The Facility project manager shall contact NMED within one business day of receipt of laboratory notification of data quality exceptions that may affect the ability to meet the objectives of the investigation or compliance activity in order to discuss the implications and determine whether the data will still be considered acceptable or if sample re-analysis or resampling is necessary. The Facility project manager shall summarize the results of the discussion with NMED project leader regarding the data quality exceptions in a memorandum. The Permittee shall submit the memorandum to NMED by fax or electronic mail within three business days of the conclusion of the data quality discussion.

### **17.3.3 Blanks, Field Duplicates, Reporting Limits and Holding Times**

#### **17.3.3.a Blanks**

The analytical results of field blanks and field rinseate blanks shall be reviewed to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by decontamination of sampling equipment. The analytical results of trip blanks shall be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. The analytical results of laboratory blanks shall be reviewed to evaluate the possibility of contamination caused by the analytical procedures. If contaminants are detected in field or laboratory blanks, the sample data shall be qualified, as appropriate.

### **17.3.3.b Field Duplicates**

Field duplicates shall consist of two samples either split from the same sample device or collected sequentially. Field duplicate samples shall be collected at a minimum frequency of ten percent of the total number of samples submitted for analysis. RPDs for field duplicates shall be calculated. A precision of no more than 20 percent for duplicates shall be considered acceptable for soil, rock, and sediment sampling conducted at the Facility. The analytical DQO for precision shall be used for water duplicates.

### **17.3.3.c Method Reporting Limits**

Method reporting limits for sample analyses for each medium shall be established at the lowest level practicable for the method and analyte concentrations and shall not exceed soil, groundwater, surface water, or vapor emissions background levels, cleanup standards, and screening levels. The preferred method detection limits are a maximum of 20 percent of the background, screening, or cleanup levels. Detection limits that exceed established soil, groundwater, surface water, or air emissions cleanup standards, screening levels, or background levels and are reported as “not detected” shall be considered data quality exceptions and an explanation for the exceedance and its acceptability for use shall be provided.

### **17.3.3.d Holding Times**

The Permittee shall review the sampling, extraction, and analysis dates to confirm that extraction and analyses were completed within the recommended holding times, as specified by EPA protocol. Appropriate data qualifiers shall be noted if holding times were exceeded.

## **17.3.4 Representativeness and Comparability**

### **17.3.4.a Representativeness**

Representativeness is a qualitative parameter related to the degree to which the sample data represent the relevant specific characteristics of the media sampled. The Permittee shall implement procedures to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. The Permittee shall note any procedures or variations that may affect the collection or analysis of representative samples and shall qualify the data.

### **17.3.4.b Comparability**

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, the Permittee shall report analytical results in appropriate units for comparison with other data (past studies, comparable sites, screening levels, and cleanup standards), and shall implement standard collection and analytical procedures. Any procedure or variation that may affect comparability shall be noted and the data shall be qualified.

### **17.3.5 Laboratory Reporting, Documentation, Data Reduction, and Corrective Action**

Upon receipt of each laboratory data package, data shall be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria shall be noted and the data will be qualified. A full review and discussion of analytical data QA/QC and all data qualifiers shall be submitted as appendices or attachments to investigation and monitoring reports prepared in accordance with Permit Attachment 20 (*Reporting Requirements*) of this Permit. Data validation procedures for all samples shall include checking the following, when appropriate:

1. Holding times;
2. Detection limits;
3. Field equipment rinseate blanks;
4. Field blanks;
5. Field duplicates;
6. Trip blanks;
7. Reagent blanks;
8. Laboratory duplicates;
9. Laboratory blanks;
10. Laboratory matrix spikes;
11. Laboratory matrix spike duplicates;
12. Laboratory blank spikes;
13. Laboratory blank spike duplicates; and
14. Surrogate recoveries.

If significant quality assurance problems are encountered, appropriate corrective action shall be implemented. All corrective action shall be defensible and the corrected data shall be qualified.

## **17.4 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS**

The Permittee shall prepare human health and ecological risk assessment report for determination of clean closure, risk-based closure, and/or in support of corrective action. Risk assessments shall be conducted in accordance with current and acceptable United States Environmental Protection Agency (EPA), Regional EPA, and NMED guidance and methodology.

### **17.4.1 Human Health Risk Assessment Methods**

A risk assessment may be required for human receptors that are potentially exposed to site-related chemicals in environmental media. The risk assessment shall contain a conceptual site model (CSM), which shall aid in understanding and describing each site. The CSM shall address the following components:

1. Identification of suspected sources,
2. Identification of contaminants,
3. Identification of contaminant releases,
4. Identification of transport mechanisms,
5. Identification of affected media,
6. Identification of land use scenarios,
7. Identification of potential receptors under current land use scenario,
8. Identification of potential receptors under future land use scenario, and
9. Identification of potential routes of exposure.

Potential human receptors under current and/or future land use scenarios may include residential, industrial, construction, and recreational. Other special receptors may be required on a site-specific basis.

#### **17.4.1.a Exposure Pathways**

The identification of exposure pathways shall include of discussion of all potential pathways and justify whether the pathways are complete. Pathways that shall be considered include soil, groundwater, air, surface water, sediment, and biota. An evaluation of the potential for contaminants to migrate from soil to groundwater shall also be provided. The risk assessment shall also address exposure mechanisms for each exposure pathway, including ingestion, inhalation, dermal, and inhalation of organic compounds volatilized from soil and/or groundwater.

#### **17.4.1.b Data quality Assurance**

The risk assessment shall include an evaluation of analytical data and the usability of the data in the assessment. Data validation shall be conducted in accordance with current EPA guidelines. The evaluation of data shall also include a comparison of detection limits with appropriate and current risk-based screening levels. Current EPA methodology for handling non-detects and replicates in the risk assessment shall be applied.

#### **17.4.1.c Constituents of Potential Concern**

Appropriate EPA and/or NMED guidance shall be used to identify constituents of potential concern (COPCs). With the exception of chemicals attributed to field or laboratory contamination, all analytes detected in sampled media (i.e., soil, air, surface water, groundwater, biota, and/or sediment) shall be retained or eliminated as COPCs using one or more of the following processes:

1. Site attribution analysis,
2. Essential nutrients, and/or

### 3. Risk-based toxicity screen.

Unless sufficient evidence and special circumstances can be provided by the Permittee, all detected organics not attributable to field or laboratory contamination shall be retained and treated as site-related chemicals.

Inorganics detected in site media shall be compared to an appropriate background data set to determine if concentrations are present at levels significantly above background. The site attribution analysis may consist of a tiered approach as follows:

1. Comparison of maximum detected site concentrations to a background reference value (e.g., upper tolerance limit, UTL);
2. If the site maximum exceeds the background reference value, and sample size is sufficient, statistically compare the site data set to the background data set using appropriate statistical analyses (e.g., Wilcoxon Rank Sum Test);
3. Conduct a graphical analysis of site data and background data (e.g., histograms and/or box and whisker plots);
4. Conduct a geochemical analysis of site data to a background reference chemical; and/or
5. Evaluate essential nutrients and compare to recommended daily allowances and/or upper intake limits.

All inorganics for which the site attribution analyses indicate are present above natural background shall be retained as COPCs for the risk assessments.

#### **17.4.1.d Risk-based Toxicity Screen**

The Permittee may conduct a risk-based screening assessment to identify the COPCs that are likely to contribute significantly to risks calculated for each exposure scenario and exposure medium in order to focus the risk assessment on those chemicals that contribute the greatest significance to overall risk. The risk-based screening assessment shall consist of the comparison of the maximum detected site concentration to an appropriate risk-based screening level (e.g., New Mexico Soil Screening Levels or EPA Region 6 Soil Screening Levels). Chemicals for which the maximum detected site concentrations exceed the respective risk-based screening levels shall be retained for further risk analysis.

#### **17.4.1.e Exposure Point Concentrations**

The Permittee shall determine exposure point concentrations (EPCs) that are representative of the concentrations of chemicals in each given medium to which a receptor may be exposed. EPA recommends a 95% estimate of the upper confidence limit (95% UCL) on the arithmetic mean be used as an EPC for chronic exposures. For acute exposures, the maximum detected site concentration shall be used as the EPC.

The EPCs shall be determined using statistical analyses that are data distribution and size dependent. EPA and/or NMED accepted guidance and methodologies shall be used, such as the ProUCL software.

EPCs shall be calculated for soil, groundwater, surface water, sediment, and biota.

EPA does not recommend estimating intakes for the air inhalation pathway, but rather compares estimated volatile/particulate air concentrations adjusted for exposure frequencies, duration, and time. For inhalation of volatiles/particulates from soil, EPCs shall be determined based upon the current EPA and/or State methodology, based upon the volatilization factor or particulate emission factor. Indoor air concentrations shall be determined using EPA and State accepted approaches, such as the EPA-recommended Johnson and Ettinger model.

#### **17.4.1.f Exposure Assumptions**

The Permittee shall use EPA and/or State approved exposure assumptions. Exposure assumptions may be based upon site-specific data.

#### **17.4.1.g Toxicity Assessment**

The Permittee shall use the most recently available toxicity factors to calculate carcinogenic and noncarcinogenic risks/hazards based upon the currently acceptable hierarchy of sources for toxicity data. Generally, the approved hierarchy is as follows:

1. EPA's Integrated Risk Information System (IRIS),
2. Provisional EPA National Center for Environmental Assessment (NCEA),
3. Agency for Toxic Substances and Disease Registry (ASTDR), and
4. Other EPA publications (such as the Health Effects Assessment Summary Tables (HEAST), Water Quality Criteria, and Health Advisories).

#### **17.4.1.h Toxicity Assessment**

The Permittee shall quantitatively estimate the potential for carcinogenic (risk) and noncarcinogenic (hazard) effects for all chemicals with toxicity data and provide a discussion of uncertainties associated with the risk assessment. Cumulative effects for risk and hazard shall be determined.

For those chemical without toxicity data, appropriate surrogate data may be applied. If surrogate toxicity data are not available, risks/hazards shall be qualitatively addressed in the uncertainties section of the report.

#### **17.4.1.i Uncertainties**

The Permittee shall provide an uncertainties section that discusses all assumptions, professional judgments, and data which may result in uncertainties in the final estimates of risk and hazard. The

uncertainties shall also discuss whether risks/hazards may have been under or overestimated due to the assumptions made in the assessment.

#### **17.4.2 Ecological Risk Assessment Methods**

An ecological risk assessment may be required for receptors that are potentially exposed to site-related chemicals in environmental media. The ecological risk assessment process shall consist of a scoping assessment, a screening-level assessment, and if warranted, a site-specific assessment. Based upon the results of the scoping assessment, the Permittee shall demonstrate whether additional analyses are warranted. If the scoping assessment indicates that there is potential for ecological hazard, a screening-level ecological risk assessment shall be conducted. Based upon the results of the screening assessment, a site-specific ecological risk assessment may or may not be necessary.

##### **17.4.2.a Scoping Assessment**

In order to assess whether ecological hazards are a concern at the site, the Permittee shall conduct a scoping assessment. The New Mexico Environment Department's "Site Assessment Checklist" and/or other current EPA and/or NMED guidance shall be used for conducting the scoping assessment. The site assessment checklist and/or scoping report shall contain the following information:

1. Scope and intent,
2. Specific site information (including site location and site characterization),
3. Findings of a site investigation (including habitat and exposure pathway evaluation),
4. Identification of ecological receptors of potential concern, and
5. Preliminary conceptual site exposure model (including complete exposure pathways).

If the scoping assessment indicates that there are any rare, threatened, or endangered species or otherwise protected species use the property, and/or there are any species which are considered a recreational or a commercial resource, and/or plants or animal species use the affected property for habitat or foraging and could come into contact with site contaminants, then the Permittee shall conduct a screening level ecological risk assessment.

##### **17.4.2.b Screening Level Ecological Risk Assessment**

The screening level ecological risk assessment shall be conducted in accordance with current EPA and/or NMED approved methodologies. The Permittee shall establish ecologically based screening levels (EBSL) calculated using dietary exposure models and toxicity reference values (TRVs). The screening level hazard quotient shall be calculated for each constituent of potential ecological concern (COPEC) in each media using the maximum detected site concentration and the calculated EBSL. The assessment of overall risk shall include cumulative risk if more than one COPEC is present at a site.

#### **17.4.2.c Site-specific Ecological Risk Assessment**

If the screening level ecological risk assessment indicates unacceptable risk, then the Permittee shall conduct a site-specific ecological risk assessment. The assessment shall be conducted using EPA and/or NMED approved guidance and methodologies. The ecological risk assessment shall follow the same methodologies outlined above in the human health risk assessment for determining COPEC and data quality assurance.

#### **17.5 DETERMINATION OF BACKGROUND**

The Permittee shall determine an appropriate background data set for inorganic constituents at the site. The Permittee shall determine whether one or more background data sets are appropriate depending on soil type and geology at the site. Background concentrations for groundwater shall be collected from upgradient wells. The background data set shall be representative of natural conditions unaffected by site activities and shall be statistically defensible. Sufficient number of background samples shall be collected for use in the risk assessment, including conducting site attribution analyses and comparison of data sets.

The Permittee shall provide summary statistics for background metals concentrations in each medium of concern and include the following information:

1. Number of detects,
2. Total number of samples,
3. Frequency of detection,
4. Minimum detected concentration,
5. Maximum detected concentration,
6. Minimum sample quantitation limit (SQL),
7. Maximum SQL,
8. Arithmetic mean,
9. Median,
10. Standard deviation, and
11. Coefficient of variation.

The Permittee shall determine the 95% upper tolerance limit (UTL) for each metal using statistical methods that are distribution based.

### **17.5.1 Comparing Site Data to Background**

The 95% UTL for each metal shall be used as the background reference value for use in screening assessments and determining whether metals are present in soil/groundwater/surface water/sediment due to site activities. The site maximum detected concentration shall be compared to the 95% UTL for each metal. If the site maximum detected concentration is greater than the background reference value, then additional site attribution analyses shall be conducted.

Site attribution analyses shall be conducted in accordance with current EPA and/or NMED accepted guidance. The site attribution analyses shall consist of a statistical comparison of the background dataset to the site data set, using distribution based tests such as the Wilcoxon Rank Sum Test.

If the results of the site attribution analyses indicate that the metal is present at the site above naturally occurring levels, then the Permittee shall include that metal as a site contaminant.