Sampling and Analysis Plan Phase II
Environmental Site Assessment
St. John’s Mine

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September 2019
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<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>ABCA</td>
<td>Analysis of Brownfield Cleanup Alternatives</td>
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<tr>
<td>APN</td>
<td>Assessor’s Parcel Number</td>
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<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
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<td>Burleson</td>
<td>Burleson Consulting Inc.</td>
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<td>CAM</td>
<td>California Assessment Manual</td>
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<td>CHHSL</td>
<td>California Human Health Screening Levels</td>
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<td>CSM</td>
<td>conceptual site model</td>
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<td>DI</td>
<td>de-ionized</td>
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<td>DQO</td>
<td>data quality objective</td>
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<td>EPA</td>
<td>Environmental Protection Agency</td>
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<td>ESA</td>
<td>Environmental Site Assessment</td>
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<td>ESL</td>
<td>environmental screening level</td>
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<td>GIS</td>
<td>geographic information system</td>
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<td>GPS</td>
<td>global positioning system</td>
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<td>mm</td>
<td>millimeter</td>
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<td>MRDS</td>
<td>mineral resources database system</td>
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<td>MS/MSD</td>
<td>matrix spike/matrix spike duplicate</td>
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<td>ORP</td>
<td>oxidation reduction potential</td>
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<td>PPE</td>
<td>personal protective equipment</td>
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<td>QAPP</td>
<td>quality assurance project plan</td>
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<td>QA/QC</td>
<td>quality assurance/quality control</td>
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<tr>
<td>RMC</td>
<td>risk management criteria</td>
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<td>RSL</td>
<td>Regional Screening Levels</td>
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<td>RWQCB</td>
<td>California Regional Water Quality Control Board—San Francisco Bay Region</td>
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<td>SAP</td>
<td>Sampling and Analysis Plan</td>
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<tr>
<td>Site</td>
<td>St. John’s Mine</td>
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<td>STLC</td>
<td>soluble threshold limit concentration</td>
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<td>TCLP</td>
<td>toxicity characteristic leaching potential</td>
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<td>TOC</td>
<td>total organic carbon</td>
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<td>WET</td>
<td>waste extraction test</td>
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<td>XRF</td>
<td>x-ray fluorescence</td>
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1.0 Introduction and Purpose

This document serves as the Sampling and Analysis Plan (SAP) for the St. John’s Mine (Site) Phase II Environmental Site Assessment (ESA). This SAP defines:

- The purpose of this study;
- The use of the data generated;
- The quality of data needed to accomplish the goals of the study; and
- The data collection methods.

The purpose of the Phase II ESA is to document whether a release has occurred at the historic St. John’s Mercury Mine, evaluate the magnitude of a release with respect to risk-based screening benchmarks, and support an Analysis of Brownfield Cleanup Alternatives (ABCA) if necessary.

This SAP incorporates the relevant provisions of the Quality Assurance Project Plan (QAPP) for Cooperative Agreement No. 99T3031 as they apply to collection and analysis of environmental samples, provided in Appendix A. This SAP also anticipates compliance with the safety procedures outlined in the Site-Specific HSP Checklist for Site Surveys and Sampling Activities included in Appendix B.

2.0 Site Description and Environmental Setting

2.1 Site Description and Location

The Site is located on four adjoining parcels. APN 0182060030 is owned by the City of Vallejo, while APNs 0182060200, 0182010040 and 0182010060 are private property. The Site is on rural land totaling about 566 acres, located roughly 6 miles northeast of Vallejo, in Solano County, California. A regional map is provided as Figure 1 and a Site map is provided as Figure 2.

For the purposes of this Phase II ESA, the Site is limited to parcels owned by the City of Vallejo, and immediately adjacent privately-owned parcels to which access may be granted by the private property owner. The Site will also be referred to as the target property. The specific parcels on which the activities described herein will be completed will be determined prior to field sampling based on responses to requests for access.

2.2 Geology and Soil

The target property is located in the Coast Range geomorphic province. The area is underlain by the Franciscan Complex, which has been severely folded and faulted in the region. The specific components of the Franciscan Complex occurring at the Site are Jurassic and Cretaceous.
sandstone and mudstone; and Jurassic serpentinite and volcanic rocks (USGS, 2006). Soils likely to occur on-site include loam and clay loams (SSURGO, 2018).

The mine features are spatially related to the locations of rock identified on the geologic map as Franciscan Jurassic volcanic rocks and serpentinite. California Regional Water Quality Control Board—San Francisco Bay Region (RWQCB) geologists observed the predominant geology in mining areas as volcanic, possibly also andesite from the Franciscan complex, and soils observed were consistent with sand, loam, and clay loams (RWQCB, 2017).

Cinnabar reportedly occurred at St. John’s Mine as fissure fillings in altered andesite dikes intruded along the contact between silica carbonate rock and shale, and as irregular bodies in silica carbonate rock (USBM, 1965).

### 2.3 Hydrology and Hydrogeology

The Site is located on a drainage divide between American Canyon Creek to the northwest, Sulphur Springs Creek to the east, and Rindler Creek to the south. The creeks are reported to be intermittent at the target property (USGS National Hydrography Dataset, 2019). No seeps, springs, or evidence thereof were described during previous inspections, so it is likely that the creeks are ephemeral in those reaches, with flow only during and immediately following rain events (RWQCB, 2009).

Site-specific groundwater flow data were not available for the target property; however, groundwater flow often parallels the topography, such that it flows from areas of higher elevation to lower elevations. Deviations from this principle could occur if nearby active residential or agricultural supply wells are pumping, or if geologic features such as faults affect groundwater flow.

Based on the topography of the area (Figure 3), groundwater is expected to flow from Mount Luffman to the north and Mount Saint John to the northwest toward American Canyon Creek, east from Mount Saint John toward Sulphur Spring Creek, and south from Mount Luffman toward Rindler Creek. American Canyon Creek and Rindler Creek are in the watershed for the Napa-Sonoma Valley Napa-Sonoma lowlands groundwater subbasin (Groundwater Basin 2-002.03); and Sulphur Springs Creek is within the watershed for the Suisun-Fairfield Valley groundwater subbasin (Groundwater Basin 2-003) (California DWR 2018).

Three domestic wells and one dry borehole are located within about 1,200 feet of Site features (DWR 2018). Information regarding each well is summarized in Table 1. One of the well logs describes a dry borehole located along Sulphur Springs Creek north of St. John’s Mine. This borehole was dry to a depth of 600 feet. The remaining three wells are associated with private structures to the south and southwest of the Site and are identified as domestic wells on the well logs. These wells all appear to have encountered confined groundwater at depths of 55 to 300 feet below ground surface.
2.4 Climate

The target property is in a region with a Mediterranean climate and experiences hot and dry summers, and cool wet winters. Average summer monthly temperature is approximately 87°F and average winter temperature is around 56°F. Average annual rainfall is 22 inches.

3.0 Background and History

St. John’s Mine is an inactive mercury mine located 6 miles east/northeast of the City of Vallejo that was mined intermittently at the surface and underground from 1873 to 1923. Mine workings are inaccessible, but numerous adits and shallow shafts were constructed covering a vertical range of 650 feet (USBM, 1965). The mine operated intermittently from 1873-1880, 1889-1909, and 1914-1918 (USBM, 1965). Work was sporadic after 1918 until 1925 when a fire destroyed the furnace. From 1873 to 1880, St. John’s Mine produced 11,530 flasks of mercury (Bradley, 1918). The mine produced another 4,923 flasks of mercury by 1917 (Bradley, 1918). A fire in 1925 or 1926 destroyed the furnace (Ransome and Kellogg, 1939). Around 1939 sluice boxes were constructed to concentrate cinnabar from the old mine dumps and the concentrates were retorted to produce mercury (Ransome and Kellogg, 1939). In 1956 extensive sampling occurred during trenching with bulldozers (USBM, 1965).

The USGS Mineral Resources Database System (MRDS) lists the Site’s productivity as medium and indicates ore was processed onsite. At least two furnace locations were identified, one on City of Vallejo open space property which was likely removed in the 1990s, and one on private property with remnants still present (bricks and concrete foundations) (RWQCB, 2017). USGS California Prospects and Mine Related Features and MRDS databases indicate several adits are present at the Site. At least one adit on City property is believed to have been closed in the 1990s to protect Site visitors.

3.1 Previous Studies

St. John’s Mine was identified by the RWQCB (2009) as a high priority site with a high risk to water quality based on erosion of tailings piles into Rindler Creek. This prioritization was based on (but not limited to) results of site inspections conducted in 2007 and 2008 to assess the potential for mine wastes to erode into surface waters.

During 2016, RWQCB staff conducted a desktop analysis to rank mines in the region, including the St John’s Mine, for additional investigation. In November 2017, RWQCB staff inspected the site, collecting hydrologic and chemical data to determine whether contamination is discharging offsite. They performed a screening investigation, measuring metal(loid) concentrations in soils, mine structures, and wastes with an X-Ray Fluorescence Spectrometer (XRF). Evidence of erosion of waste rock with high concentrations of mercury, arsenic, and other metal(loid)s into Rindler Creek, drainage was observed by staff, who concluded a release
had occurred and further site investigation was necessary to quantify the threat and determine whether cleanup would be necessary to prevent further migration of wastes.

Ten areas of concern were identified that RWQCB staff considered to have significant mercury, arsenic, nickel, and cobalt contamination (RWQCB, 2017). These areas drain into two unnamed tributaries to American Canyon Creek and Rindler Creek.

Analytical results excerpted from both RWQCB inspections of St. John’s Mine are provided in Tables 2 and 3.

4.0 Conceptual Site Model and Data Quality Objectives

A conceptual site model (CSM) for the target property was prepared to address the potential migration pathways for metals from sources to receptors (Figure 4). The CSM was used to develop data quality objectives (DQO) which focus on documenting the release of contaminants at the target property. DQOs were not developed to address all aspects of contamination potentially associated with the Site. For example, the CSM supports an inference that mine waste from the target property migrated along drainages to Lake Chabot and marshes at American Canyon through sediment and could provide a source for mercury to be methylated and accumulate in the food web; however, this field sampling effort is not intended to address all such issues. The DQOs developed herein are intended to obtain information needed to document releases associated with past operation of St. John’s Mine, and identify potential threats to likely human and ecological receptors, and water quality at the target property. Documenting the extent and impacts of any mine waste in sediment off the target property is beyond the scope of this project.

The DQOs guided preparation of this SAP and are provided in Table 4. The CSM and DQOs are described below.

4.1 Conceptual Site Model

The CSM addresses mine waste (overburden, waste rock, ore, tailings) and naturally occurring mercury-enriched rock as the primary metal sources; and groundwater, surface water, soil, sediment, and air as secondary sources and pathways. Potential receptors include both human and ecological receptors. Human exposure scenarios at the target property include nearby residents, recreational users, and Site workers. Ecological receptors include aquatic life and other wildlife including, but not limited to, birds and mammals.

The CSM describes the primary source, fate and transport, pathways to secondary sources, exposure pathways, and receptors.

4.1.1 Primary Source and Release Mechanism
Mine waste, such as overburden, waste rock, and calcine tailings, may contain concentrations of metals such as aluminum, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, thallium, vanadium, zinc, and sulfur and sulfide minerals that may pose a threat to water quality, or to human and ecological receptors due to ingestion or adsorption through direct contact. In addition, the mine waste may be capable of creating metal-laden drainage when exposed to water and oxygen.

Primary mechanisms that could release metals from the waste rock include infiltration/percolation of water, runoff of water, erosion by wind and water, and aerial suspension of mercury on particles and/or volatilization of elemental mercury. Mining-related disturbances including road building, and excavating and placing waste rock at the surface may have increased transport of mercury and/or other metals to the watershed.

4.1.2 Secondary Sources and Release Mechanisms

Mine Drainage. Drainage formed through oxidation of sulfide minerals in mine waste during interaction with infiltrating/percolating water can cause metals to become mobilized from in-situ rock, mine waste, and/or soil. Mine drainage has not been reported during inspections by RWQCB staff, nor was the need to dewater the underground workings noted in the mining literature. Thus, drainage impacts are anticipated to be limited to short durations associated with rainfall. For this reason, the current investigation does not include collection of water or drainage samples.

Surface Water. Erosion of mine waste and transport to sediments may degrade surface water in American Canyon Creek and Rindler Creek. American Canyon Creek is west of the target property and flows west. Rindler Creek flows southwest past several Site features. Because the creeks are understood to flow only during and immediately following rain events, surface water sampling is not believed to be possible during this investigation.

Groundwater. Due to the target property location at the headwaters of intermittent or ephemeral drainages, groundwater from the target property is considered herein to be of limited quantity and extent, and to discharge to American Canyon Creek, Sulphur Springs Creek, and/or Rindler Creek through fractures, and permeable horizons of the bedrock. Thus, any metals in groundwater related to the mines would be present in drainage (if present) from underground workings, or in discharge to American Canyon Creek, Sulphur Springs Creek, and/or Rindler Creek. It is expected that drainage will not be present. Because of the inferred lack of or small quantities of groundwater, the current investigation does not include collection of water or drainage samples. However, should results of this investigation identify significant mobility of metals from the mine waste in de-ionized water extracts, sampling of the three residential wells described above may be necessary to ensure that a complete groundwater pathway from the mine features to the wells is not present.
**Soil.** Target property soil may be affected by metals through mixing with eroded mine waste, settling of contaminated dust or mercury vapor from the air, and/or deposition from drainage and runoff. Affected soil could then become a secondary source for contaminants in the sediment and air. Soil will be addressed herein via consideration of mine waste and sediment, and integrating the results of this field sampling effort with results on ongoing investigations by Regional Board staff. In particular, existing and future results of field XRF measurements will be evaluated for evidence of contamination related to atmospheric ‘fall out’ of mercury associated with historical ore processing equipment (furnaces and/or retorts) at the target property, and contaminated soil near mine waste piles.

**Sediment.** Sediment in American Canyon Creek and Rindler Creek below St. John’s Mine could contain mine waste eroded from the target property. Affected sediment could be present along and within the channels of American Canyon Creek and Rindler Creek.

Plants growing in sediment containing mine-related chemical precipitates or mine waste could transfer metals to foraging biota or humans. Erosive flow events could suspend mine waste and/or chemical sediments in the water column making metals more available to degrade water quality or affect the food web. In particular, mercury in sediment can be methylated and accumulate in the food web.

Because episodic flow is capable of eroding mine waste and transporting eroded material through the watershed, local depositional areas on parcels at the Site will be sought for sediment sampling to evaluate this pathway.

**Air.** Wind may entrain metal-laden particles from mine waste and deposit those particles on plant surfaces, soil, and in surface water. Respirable particles could be inhaled by humans or animals. Mercury vapors could be inhaled by humans or animals. A mercury vapor survey will be completed to assess mercury in air near mine waste piles and mine openings. Particulate meter readings will be collected during field sampling to evaluate potential contaminant mobilization on dust.

### 4.1.3 Receptors

The CSM shows potential migration pathways and potential receptors for conditions at the target property.

Under current land use conditions, hikers and Site workers have access to mine wastes and mine features, and private lands are used for livestock grazing. The area contains suitable habitat for terrestrial and some aquatic receptors, including migratory birds. Under future land use conditions, residents or hikers may be exposed to mine waste in the area. Also, wildlife exposure may continue to occur. Potential exposure pathways include direct contact with and incidental ingestion of surface soil, inhalation of fugitive dust and/or mercury vapors emitted from the waste rock and tailings, and direct contact and incidental ingestion of surface water/sediment. There are currently no known complete groundwater exposure pathways for
residents, recreators/trespassers, or workers. However, should results of this investigation identify significant mobility of metals from the mine waste in de-ionized water extracts, sampling of the three residential wells may be necessary to ensure that a complete groundwater pathway from the mine features to the wells is not present.

**Summary.** The CSM identified two primary sources of metals and associated release mechanisms:

1. **Mine Waste – Overburden, waste rock, and calcine tailings remaining from historical mining activities could provide a source for mercury and other metals.**
2. **Mercury Enriched Rock – Silica carbonate rock and/or mineralized andesite exposed by historical mining activities could provide a source for mercury and other metals.**

Storm water could erode and transport metal-containing particles to sediment and through the watershed. Human, livestock, and wildlife receptors could come into direct contact with metal-laden mine waste, mining exposed rock, or sediment, and could incidentally ingest metal-laden material. Humans and wildlife could be exposed to mercury vapor and/or mercury-laden dust particles in air.

The CSM identifies three secondary sources of and release mechanisms for metals at St. John’s Mine:

1. **Soil - Metals in soil could be transported to sediment through erosion in runoff, or suspended in air on dust.**
2. **Sediment - Metals could accumulate as particulates, become suspended in the water column and redeposited, or dissolve from accumulations.**
3. **Air - Metals could be suspended on respirable particulates, and/or mercury may be released as vapor.**

The CSM identified three complete pathways for exposure to metals from St. John’s Mine:

1. **Soil/Mine Waste – Exposure routes for humans, terrestrial biota, and aquatic biota might include ingestion and direct contact.**
2. **Sediment - Exposure routes for humans, terrestrial biota, and aquatic biota might include ingestion and direct contact. In addition, mercury derived from the Site may become methylated and bioaccumulate in fish or other wildlife, and humans could be exposed through consuming fish.**
3. **Air-Exposure routes for humans and terrestrial biota might include inhalation, and accumulation on plant tissues with subsequent uptake via ingestion by foraging humans and biota.**

The potential for metals to be mobilized at the Site through leaching by infiltrating water is uncertain at this time. This potential pathway will be assessed through analysis of leachate obtained from mine waste in accordance with the California waste extraction test (WET) using de-ionized water as the extractant, for metals.
Reference Area

Reference areas are those areas that have geologic and soil characteristics similar to the mine disturbed area, but where metal concentrations have not been affected by mining activities. Metal concentrations in soil and sediment will be compared between reference areas and mine-affected areas. This comparison will support evaluation of cumulative and residual risks and determination of whether increased risks to human health or the environment are caused by historical mining at St. John’s Mine. Knowledge of reference or background metal concentrations also informs the scope of potential future response actions, in part by ensuring that statutory limitations on response are not exceeded.

Reference areas are described for evaluating St. John’s Mine and for comparison with soil and sediment affected by St. John’s Mine. A suitable reference area for comparison with St. John’s Mine would be in similar geologic units and soils that are not affected by release from the mine. Based on the geologic map provided in Figure 5, the slopes above the mine south of Mount St. John, and the slopes to the east and south of Mount Luffman appear to have similar geology and soils compared with those in mine-affected areas, and are not believed to be affected by historical mining activities. Thus, soil and sediment from these areas would likely provide suitable reference information.

4.2 Data Quality Objectives

DQOs were developed in accordance with the seven-step systematic planning process (EPA, 2006) to guide additional investigations at the target property and evaluate potential threats to human health and the environment, and preparation of an ABCA if necessary, and are presented on Table 4. The CSM described above was developed as part of Step 1, and provides a basis for identifying those pathways from mine waste and mineralized rock exposed by mining along which metals at St. John’s Mine may migrate to surface water, sediment, soil, groundwater, and air; which metals may degrade water quality; and which metals may be available for human and ecological receptor uptake. The release of metals, and associated impacts remain uncertain at this time. Reference concentrations for soil and sediment, are necessary to document a release, assess possible impacts to human and ecological receptors, and quantify impacts to water quality in American Canyon Creek and Rindler Creek. Step 2 identifies study goals based on the CSM. Step 3 identifies information inputs including a summary of existing information from St. John’s Mine. Step 4 define study boundaries. Step 5 develops the analytical approach. Step 6 specifies acceptance criteria. And Step 7 develops the plan to obtain data.

Data requirements identified during development of DQOs include:

- Location and physical properties of mine waste
- Volume of mine waste
- Metal content of mine waste
4.3 Data Quality

Throughout the data acquisition and site characterization activities, the contractor will implement quality assurance/quality control (QA/QC) procedures including review of project deliverables by senior staff, review of laboratory documentation by a project chemist, review of completed field documentation, and adherence to the field sampling protocols described in this SAP.

Necessary QA/QC measures are based on the anticipated uses of the data to support DQOs identified in Section 4.2 of this SAP. QA/QC samples for the project laboratory will consist of duplicate and matrix spike/matrix spike duplicate (MS/MSD) for 10% of the samples collected in the field. Duplicate samples will be submitted blind to the laboratory. Sampling and analysis will be conducted in accordance with the QAPP provided in Appendix A. Table 6 identifies screening benchmarks, analytical detection limits and the associated analytical method for each of the metals. All analytical detection limits are below screening benchmarks except for arsenic. The arsenic screening benchmark is about two orders of magnitude below the analytical detection limit. This is not a significant issue because background arsenic concentrations in un-mineralized agricultural soils across California range from 0.6 mg/kg to 11.0 mg/kg (average 3.5 mg/kg) (Bradford and others, 1996). Thus, the background concentrations can be detected by the analytical method.

5.0 Field Sampling and Site Characterization

Activities to support the Phase II ESA were identified by developing a CSM, developing DQOs through systematic planning, and identifying data needed to support DQOs. Based on the DQOs and data requirements, site activities, described below, were identified. Decision statements and data requirements for each media and proposed sampling activities are summarized in Table 5.

5.1 Site Mapping and Field XRF

Site mapping will involve accurately determining the location of Site features and compiling location information into a geographic information system (GIS). Mapping of mine waste will accurately determine the extent of mine waste piles, and support identification of sampling locations. Mapping of Site drainage pathways is necessary to determine surface water flow paths and assist in identifying sediment accumulation areas for sampling along American Canyon Creek and Rindler Creek tributaries.
Site mapping will be completed using a geographic positioning system (GPS) receiver to record locations within 1-meter accuracy. Point locations will be recorded in a field notebook and plotted on an aerial photograph base map in the field. Lines and areas will be similarly plotted on the base map in the field. Field notes and the aerial photograph base map will be used to rectify the GIS shape file created from the GPS data.

Field XRF will allow preliminary evaluation of metal contents of mine waste, evaluation of the presence of fall-out from historical retort or furnace operations at the Site, and evaluation of the potential for presence of metals contamination from mine waste in nearby soils. Field XRF is expected to provide screening level results for mercury and other metals including arsenic. Comparisons between analytical laboratory data and field XRF analyses of the same samples could support XRF data use for future decision making as discussed in Section 5.2.3.

Approximate XRF sample transect locations to assess fall-out are shown on Figure 6. XRF sample locations are also anticipated in soil near mine waste pile boundaries. XRF soil sample locations will be determined after mine waste pile limits are mapped.

### 5.2 Mine Waste Sampling and Analysis

Mine waste sample collection and field preparation procedures for field XRF and laboratory analysis are described in this section. Discrete sub-samples will be collected for field XRF analysis from random locations identified at each mine waste pile identified during mapping, and composite samples will be collected for laboratory analysis. Sampling locations will be selected to represent the materials present based on field observation of textural variations, rock type, and material (for example waste rock versus tailings) as determined during site mapping. Composite sampling will be conducted in an attempt to represent the average metal concentration present in each type of material. Actual sample locations will be documented in the report.

#### 5.2.1 Hand Sampling Procedure for Mine Waste

Sampling will be conducted using decontaminated or disposable hand sampling equipment. Equipment will be decontaminated prior to each use, or new disposable equipment will be used to collect each sample.

Mine waste sample processing includes a visual description and classification of the soil and sieving using a Number 10 (2 millimeter [mm]) sieve. Visual description of the soil and soil classification will be in accordance with ASTM D2488. Visual descriptions will be documented in the field on soil sampling forms (Appendix C).

Loose material such as leaves, twigs, and rock will be cleared from the surface. An appropriate decontaminated or disposable tool will be used to remove the sample volume from the desired depth. The material sampled will be described based on visual characteristics. Large rock fragments (greater than 0.25 inches in diameter) will be removed from the sample. The sample will be processed by completing visual description, classification of the soil, and logging soil
descriptions on the sampling form; and sieving using a Number 10 (2 mm) sieve. The samples will then be placed into appropriate sample containers, labeled, recorded on a chain of custody form, and placed on and under ice in an ice chest pending transport to the analytical laboratory. Compositing will be performed in the field by mixing equal size splits from each sieved sample in a plastic bag. Mixing will be performed by agitating the sample until no visible segregated sample volumes are observed.

5.2.2 Laboratory Analytes

Mine waste will be analyzed for:

- Total metals (California Assessment Manual [CAM] 17 list plus aluminum, iron, and manganese),
- Toxicity Characteristic Leaching Potential (TCLP) metals,
- Soluble Threshold Limit Concentration (STLC) (STLC metals),
- De-ionized (DI) Waste Extraction Test (WET), (CAM-17 Metals list plus aluminum, iron, and manganese),
- Acid base accounting,
- Total organic carbon (TOC),
- Selective sequential extraction (SSE) for mercury (two samples) and
- Grain size.

CAM 17 metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. The physical and chemical parameters other than metals (TOC, grain size, etc.) are only needed on a representative subset of each sample type to evaluate those characteristics sufficiently for determining metals mobility, attenuation, and erosion potential. Samples will be collected to represent the main types of geologic materials observed on the mine waste piles during mapping as described above.

5.2.3 Field X-Ray Fluorescence

The contractor will collect samples from Site soils, waste rock, and tailings for analysis of metals using XRF and will send sample splits to an analytical laboratory. The XRF data collected in the field will be compared to the laboratory analytical results for the same sample for a variety of metals (for example, arsenic, copper, lead) to evaluate the relationship between XRF and laboratory analytical results. A regression analysis will be completed and appropriate graphs will be prepared. The regression equation will be used to estimate lab results from XRF results, and the estimates will be compared with actual lab measurements. If a significant relationship between XRF and laboratory analytical results is confirmed, XRF data may be useful for supporting future decision-making.

Field XRF Procedures. Field XRF analysis will be performed in general accordance with SW-846, Method 6200 (EPA 2007) using a field portable XRF device that generates x-rays in an x-ray
tube. Therefore, radioisotopes will not be transported to the Site as part of this work. Field XRF will be performed on in-situ and ex-situ samples to provide screening level data for arsenic, copper, lead, and other metals. Sampling of mine waste, tailings, and soil will be performed as described in Section 5.2.

In-situ measurements will be made in approximate 4-inch by 4-inch areas of exposed soil prepared by clearing vegetation, debris, and rocks larger than approximately ½-inch in diameter and then smoothing the resultant surface with a plastic or steel trowel. The measurement is made by placing the x-ray window of the handheld device close to the surface, activating the XRF device, and taking a reading.

Ex-situ measurements will be made by placing approximately 8-ounces of soil in a sealable plastic bag (after first sieving to obtain the <2mm fraction), mixing by agitation for approximately 5 minutes, and then analyzing the soil through the bag in a manner similar to that described above for the in-situ measurement.

The XRF unit internal calibration, replicate analyses of National Institute of Standards and Technology (NIST) standards provided with the XRF unit, and comparison of replicate analysis of selected samples will be used to verify performance.

5.3 Sediment Sampling

Figure 6 presents locations identified for collection of sediment samples. Actual locations will be determined in the field with samples collected from areas of sediment accumulation. Hand tools will be used to collect sediment samples for laboratory analysis to evaluate the presence and extent of Site-related metals.

5.3.1 Sediment Sampling Procedure

Sediment samples will be collected in the field using decontaminated hand tools. A pre-cleaned disposable trowel will be used to collect each sample. Any debris, plant material, or rocks will be cleared from the sediment surface prior to sample collection. The sample will be collected from the entire thickness of the sediment column up to 12 inches depth. If sediment deposits greater than 12 inches in depth are encountered, a core or exposed section of the sediment will be visually examined for presence of differing horizons or sediment layers. A sample will be collected from differing layers in proportion to their thickness. If an extensive sediment deposit (for example a sand bar) is present, a composite sample comprising a mixture of subsamples from across the deposit will be collected. Samples will be visually inspected, and sealed into the sample container with no/minimal head space to minimize the chance for oxidation. The sample will then be labeled, recorded on a chain of custody form, and placed on and under ice in an ice chest pending transport to the analytical laboratory. Sediment adjacent to the sample locations will be visually described.

5.3.2 Analytes
Bulk sediment samples will be analyzed for:

- Total metals (CAM 17 list plus aluminum, iron, and manganese)
- Total organic carbon
- Grain size
- SSE for mercury (up to four samples).

### 5.4 Reference Soil Sampling

Reference soil samples will be collected and analyzed to identify ambient concentrations of metals in soil to allow documentation of a release, evaluation of water quality threats, and risks above ambient levels. Figure 6 presents locations identified for collection of reference soil samples. These locations are on sandstone and serpentinite on the slopes of Mount Luffman, and on volcanic rock up-hill from AOC 7.

Reference soil locations on Mount Luffman are upwind from the historical furnace/retort locations, and upslope from other known mine features. Wind directions are based on a compilation of wind directions for Davis Point in San Pablo Bay available from the Iowa State University Environmental Mesonet at:

[https://mesonet.agron.iastate.edu/sites/windrose.phtml?station=DPXC1&network=CA_D](https://mesonet.agron.iastate.edu/sites/windrose.phtml?station=DPXC1&network=CA_D)

According to this information the prevailing wind direction is from the west-southwest at Vallejo. Prevailing wind directions at nearby stations (westerly at Rush Ranch near Fairfield and west-southwestly at Novato) are similar.

The reference soil location up-hill from AOC 7 is believed to be located between potential soot fall-out locations from historical furnaces/retorts based on the prevailing west-southwest wind direction. Field XRF measurements will be used to evaluate whether soot fallout from historical furnace/retort operations has affected soil metal concentrations prior to sampling.

The reference sampling locations will be reevaluated after completion of mapping and field XRF analysis and prior to sampling to ensure the locations were not affected by mining-related soot fallout or other mining activities.

#### 5.4.1 Soil Sampling Procedure

Soil sampling procedures for reference locations will be similar to those described for mine waste.

#### 5.4.2 Analytes

Reference soil will be analyzed for:

- Total metals (CAM 17 list plus aluminum, iron, and manganese),
• Leachable metals using DI WET for CAM 17 list (plus aluminum, iron, and manganese),
• Cation exchange capacity,
• SSE for mercury (two samples), and
• Grain size.

Reference soils are not considered for waste classification; therefore, analyses for waste
classification (WET and TCLP) are not conducted on reference soil samples. CEC from
reference soils may be useful to model attenuation.

5.6 Air Particulate Measurements

The contractor will measure the particulate mass in the air using a handheld air particulate
measuring device such as a Thermo® personal particulate monitor or similar device. Visual
observations will also be performed to evaluate sources of dust at the Site. These measurements
and observations will be collected during mapping of mine features. These observations will be
used with soil and mine waste physical and chemical properties to support estimating metal
concentrations in air at the Site.

5.7 Mercury Vapor Measurements

The contractor will conduct a mercury vapor survey to evaluate whether mercury vapors from
waste rock are below levels of concern, and to assess personal protective equipment (PPE)
requirements during mine waste sampling.

The mercury vapor survey will be completed using a Lumex RA-915 mercury vapor detector or
device with similar performance. Vapor measurements on mine waste piles will be made at
ground level and about four feet above the ground, vapor measurements at adits will be made
at safely accessible openings. The air temperature will be recorded at each measurement
location. The mercury vapor locations measured will be recorded using GPS and included in
the GIS for the Site.

5.8 Mercury Selective Sequential Extraction Measurements

The contractor will collect sediment and mine waste samples for selective sequential extraction
for mercury. Representative composite samples of mine waste in each sub-watershed, and
associated upstream and downstream sediment (if present) will be collected for SSE
measurement. This effort will provide up to eight field samples for SSE mercury measurement
(one waste rock, one tailings, one each upstream and downstream sediment in each of two sub-
watersheds, and two reference samples). SSE is believed to provide information about the
relative abundance of various forms of mercury present in the materials being analyzed. This
information will be used to assess potential cleanup levels.
6.0  Data Evaluation

Field mapping and sampling results will be documented in a Phase II Site Assessment Report. The report will document whether a release has occurred and identify affected media. The report will include evaluation of threats to human and ecological receptors and water quality to allow informed decisions concerning the management and mitigation of potential mine-related chemical hazards at St. John’s Mine. Risk evaluations to human and ecological receptors will also be conducted to support appropriate classification of mine wastes and contribute to decision making at areas that may require management and mitigation of potential chemical hazards due to historic mining operations. Water quality assessment and risk evaluation are described in the sections below.

6.1  Background Conditions

Many of the metals found in mine waste are also present in native soils around St. John’s Mine. Separating background conditions from the former mining residues is required to document a release (EPA 1995), and is a critical issue for risk management decisions; therefore, local background concentrations for metals in soil will be established by sampling materials not affected by mining as described in Section 5.4. The range of concentrations detected in reference and site-affected media will be compared to assess the presence of a release for the purposes of this Phase II ESA. If necessary, regional data published by USGS that are relevant to this work will also be compared to assess the likelihood for a release.

The metals of concern will be selected based on risk assessment guidelines including consideration of background concentrations.

6.2  Water Quality Assessment

A water quality assessment will be conducted to assess potential threats to water quality in American Canyon Creek and Rindler Creek from mine waste and sediment for those metals detected at concentrations indicating a significant release (greater than three times the background concentrations) (EPA 1992). The water quality assessment for mine waste will include consideration of the acid generating potential, evaluation of attenuation mechanisms, and estimating metal concentrations reaching water. Mobility of metals from mine waste will be assessed via comparison of DI WET concentrations with numerical water quality objectives protective of receiving water beneficial use in accordance with procedures described in the ESL Users Guide (RWQCB 2016). For any metals exceeding objectives, attenuation will be evaluated, and estimated concentrations will also be compared with numerical and narrative water quality criteria from the Basin Plan (RWQCB, 2017).

Sediment in American Canyon Creek and Rindler Creek near St. John’s Mine will be evaluated for metal concentrations that suggest the presence of mine waste eroded from the Site during storm events and chemical precipitates resulting from mixing of drainage with surface water.
Water samples are not anticipated due to the intermittent nature of creeks at the target property and expected lack of flow.

6.3 Risk Assessment

Potential risks to human health and wildlife will be evaluated by comparing metal concentrations in sediment and mine waste at St. John’s Mine to reference concentrations and screening benchmarks. A limited risk assessment to evaluate human and ecological receptors based on results of this investigation will be completed and risk-based cleanup levels will be calculated.

The limited risk assessment will consist of comparison of raw data with screening benchmarks and calculation of risks based on site-related metals identified through screening. Screening benchmarks used for this comparison would include ESLs (RWQCB 2016), wildlife-based Risk Management Criteria (RMC) for Metals at Bureau of Land Management (BLM) Mining Sites (BLM, 2004), EPA Regional Screening Levels (RSL) for Contaminants at Superfund Sites (EPA 2014), and California Human Health Screening Levels (CHHSL) (OEHHA, 2010). Tier 1 and Tier 2 ESLs will be evaluated. The EPA RSLs and CHHSLs are calculated based on an industrial use scenario (for humans working at a site), which is routinely thought to reflect exposures greater than recreational exposures. The industrial exposure calculation assumes exposure of five 8-hour days per week for 50 weeks per year for 25 years. This assumption is likely a greater exposure time than would be selected for recreational exposures. Therefore, use of the industrial RSL and CHHSL likely overstates the potential risk for recreational visitors.

Significance of the relationship of Site concentrations and screening benchmarks will be made in accordance with the discussion provided in BLM (2004):

- Concentration less than benchmark: low risk
- Concentration 1 to 10 times benchmark: moderate risk
- Concentration 10 to 100 times benchmark: high risk
- Concentration >100 times benchmark: extremely high risk

BLM (2004) also suggests that moderate risk may be addressed by management and/or institutional controls, and that high risk might require a response action.

The limited risk assessment will identify cleanup levels for metals of concern based on site-specific consideration of human and ecological exposure routes. Recommendations will be provided for either no further action, implementation of institutional controls, or a response action based on results of limited risk assessment.
7.0 References


EPA. 2014. Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. November.


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† XRF measurement is total mercury and ESLs are for Hg⁰ and MeHg.
* XRF measurement is total chromium and ESLs are for Cr⁴⁺ and Cr⁶⁺.
Table 3: RWQCB 2009 Inspection Report Mercury Sample Results

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<tr>
<th>Sample type</th>
<th>Sample ID</th>
<th>Lab Sample ID</th>
<th>Date Sampled</th>
<th>Mercury 7471A mg/kg dry wt.</th>
<th>DL</th>
<th>RL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>051107-S-BB-04</td>
<td>MQE0768-04</td>
<td>5/11/07</td>
<td>ND</td>
<td>ND</td>
<td>0.2</td>
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<tr>
<td>Background</td>
<td>040108-S-CA-05</td>
<td>MRD0118-05</td>
<td>4/2/08</td>
<td>6.2</td>
<td>0.0037</td>
<td>2.1</td>
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<tr>
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<td>041408-S-CA-01</td>
<td>MRD0611-01</td>
<td>4/14/08</td>
<td>9.0</td>
<td>0.0036</td>
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<tr>
<td>Background</td>
<td>041408-S-CA-02</td>
<td>MRD0611-02</td>
<td>4/14/08</td>
<td>4.4</td>
<td>0.0037</td>
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</tr>
<tr>
<td>Mine Waste</td>
<td>051107-S-BB-01</td>
<td>MQE0768-01</td>
<td>5/11/07</td>
<td>15</td>
<td>NR</td>
<td>2</td>
</tr>
<tr>
<td>Mine Waste</td>
<td>051107-S-BB-02</td>
<td>MQE0768-02</td>
<td>5/11/07</td>
<td>14</td>
<td>NR</td>
<td>2</td>
</tr>
<tr>
<td>Mine Waste</td>
<td>041408-S-CA-03</td>
<td>MRD0611-03</td>
<td>4/14/08</td>
<td>7.6</td>
<td>0.0036</td>
<td>2</td>
</tr>
<tr>
<td>Mine Waste</td>
<td>041408-S-CA-04</td>
<td>MRD0611-04</td>
<td>4/14/08</td>
<td>770</td>
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</tr>
<tr>
<td>Mine Waste</td>
<td>041408-S-CA-05</td>
<td>MRD0611-05</td>
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<td>347</td>
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<td>20</td>
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<tr>
<td>Mine Waste</td>
<td>041408-S-CA-06</td>
<td>MRD0611-06</td>
<td>4/14/08</td>
<td>500</td>
<td>0.036</td>
<td>20</td>
</tr>
<tr>
<td>Down Stream</td>
<td>051107-S-BB-03</td>
<td>MQE0768-03</td>
<td>5/11/07</td>
<td>0.86</td>
<td>NR</td>
<td>0.2</td>
</tr>
<tr>
<td>Down Stream</td>
<td>040108-S-CA-06</td>
<td>MRD0118-06</td>
<td>4/2/08</td>
<td>22</td>
<td>0.0038</td>
<td>2.1</td>
</tr>
</tbody>
</table>

**Notes:**

ND = Not detected
NR = not reported
**Problem Statement**

- Define Study Boundaries
- Identify principal study question, consider alternative outcomes, develop decision statements, organize multiple decisions.
- Inputs to the Decision
- Identify types and sources of information needed to answer study questions, identify the basis of information, and select appropriate sampling and analysis methods for generating the information.
- Define Study Boundaries
- Specify the target population, determine spatial and temporal limits, identify practical constraints, and define the scale of inference.
- Decision Rule
- Specify appropriate population parameters for making estimates and specify the statistical function and the estimation procedure.
- Tolerable Limits on Decision Errors
- Specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors.
- Optimize the Sampling Design
- Select the resource-effective sampling and analysis plan that meets the performance or acceptance criteria.

**Identify the Decision**

- Give a concise description of the problem that necessitates the study and develop a conceptual model of the environmental hazard to be investigated.
- Determine whether releases from the St. Johns Mine degrade beneficial uses of surface water in American Canyon Creek and Rindler Creek and/or pose unacceptable threats to human or ecological receptors at levels requiring remediation, or recommend that no further investigation is necessary.
- If a release is determined to have occurred, further action such as additional characterization and/or response may be necessary. If a release is not identified then further action may not be necessary.
- Metals, including mercury, in mine waste at St. Johns Mine might migrate to surface water, sediment, soil, and air and may degrade water quality and be available for uptake by humans and ecological receptors. The downwaste of metals and associated impacts remain uncertain at this time. Reference concentrations for soil, surface water, and sediment, are necessary to assess possible impacts to human and ecological receptors, and to assess potential impacts to water quality in American Canyon Creek and Rindler Creek.

**Inputs to the Decision**

- Identification of any special status species at the site via database review.
- Location, extent, and chemical and physical data from mine waste from target property mapping and field sampling.
- Target property hydrology (American Canyon Creek, Rindler Creek) and hydrogeology.
- Sources, amount, and chemistry of drainage at the target property.
- Reference soil and sediment chemical and physical data.
- Location, extent, physical and chemical properties of sediment along American Canyon Creek and Rindler Creek in the vicinity of the target property.
- Risk based screening benchmark concentrations for surface water, sediment, and soil.
- Metal concentrations in mine waste, sediment, and soil.
- Vapor samples at mine waste and reference locations.
- Particulate in air measurements at mine waste and reference locations.
- Mine waste characterization.
- Mine waste classification.

**Define Study Boundaries**

- The study area will include St. Johns Mine and associated mine wastes, adjacent and up/upperupstream reference areas, and adjacent downstream sediment in drainages (if present).
- Field sampling will occur one time during Fall 2019 or Spring 2020.
- Samples will be collected at the mine waste locations and along associated drainage pathways and tributaries to surface water.
- Sampling activities may be limited by access along Rindler Creek, or unsafe conditions preventing access to steep slopes during rainfall. Sample locations and/or timing may be constrained by site conditions.
- Access to locations along American Canyon Creek and Rindler Creek may be limited by lack of permission from adjoining property owners.

**Decision Rule**

- Project resources do not permit development and implementation of a statistics-based sampling approach. For this reason, composite samples will be collected to approximate overall environmental exposures.
- For mine waste and sediment, the range of concentrations will be compared with the range of reference material concentrations and risk-based screening benchmarks. Significance of any exceedances will be expressed following BLM 2004.
- Air concentrations will be estimated based on solid matrix analytical results, particulate in air measurements, and meteorological information.
- Mercury vapor concentrations will be directly measured one time.
- Detected leachable metal concentrations will be compared with waste characterization criteria (TCLP and WET leachate) and water quality criteria protective of beneficial uses (DI WET leachate).

**Tolerable Limits on Decision Errors**

- Judgmental composite sampling of mine waste and soil will be performed to support comparisons of concentration data.
- Sediment samples will be collected at sampling locations identified as up- and down-stream from mining disturbances based on professional judgment. If upstream sediment is not present, sediment from a nearby drainage with similar geologic characteristics will be collected.
- Analytical data will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability criteria through use of laboratory control samples, calibration data, and results of MS/MSD samples. These evaluations will result in quantification of the reliability of the analytical data. The goal is to produce defined data suitable for use in risk evaluation.

**Optimize the Sampling Design**

- The site will be mapped prior to sampling to confirm the affected areas and allow identification of mine waste, reference, surface water and sediment sampling locations.
- Comparisons and evaluations will be based on the range of measured concentrations for each medium sampled, consideration of information published by USGS in the area, and professional judgement.

**Table 4: St. John’s Mine Data Quality Objective Summary.**

<table>
<thead>
<tr>
<th>Problem Statement</th>
<th>Identify the Decision</th>
<th>Inputs to the Decision</th>
<th>Define Study Boundaries</th>
<th>Decision Rule</th>
<th>Tolerable Limits on Decision Errors</th>
<th>Optimize the Sampling Design</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Give a concise description of the problem that necessitates the study and develop a conceptual model of the environmental hazard to be investigated.</strong></td>
<td><strong>Identify principal study question, consider alternative outcomes, develop decision statements, organize multiple decisions.</strong></td>
<td><strong>Identify types and sources of information needed to answer study questions, identify the basis of information, and select appropriate sampling and analysis methods for generating the information.</strong></td>
<td><strong>Specify the target population, determine spatial and temporal limits, identify practical constraints, and define the scale of inference.</strong></td>
<td><strong>Specify appropriate population parameters for making estimates and specify the statistical function and the estimation procedure.</strong></td>
<td><strong>Specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors.</strong></td>
<td><strong>Select the resource-effective sampling and analysis plan that meets the performance or acceptance criteria.</strong></td>
</tr>
</tbody>
</table>

- St. John’s Mine Data Quality Objective Summary.

- Field sampling will occur one time during Fall 2019 or Spring 2020.

- Target property hydrology (American Canyon Creek, Rindler Creek) and hydrogeology.

- Sources, amount, and chemistry of drainage at the target property.

- Reference soil and sediment chemical and physical data.

- Location, extent, physical and chemical properties of sediment along American Canyon Creek and Rindler Creek in the vicinity of the target property.

- Risk based screening benchmark concentrations for surface water, sediment, and soil.

- Metal concentrations in mine waste, sediment, and soil.

- Vapor samples at mine waste and reference locations.

- Particulate in air measurements at mine waste and reference locations.

- Mine waste characterization.

- Mine waste classification.

- The study area will include St. Johns Mine and associated mine wastes, adjacent and up/upperupstream reference areas, and adjacent downstream sediment in drainages (if present).

- Field sampling will occur one time during Fall 2019 or Spring 2020.

- Samples will be collected at the mine waste locations and along associated drainage pathways and tributaries to surface water.

- Sampling activities may be limited by access along Rindler Creek, or unsafe conditions preventing access to steep slopes during rainfall. Sample locations and/or timing may be constrained by site conditions.

- Access to locations along American Canyon Creek and Rindler Creek may be limited by lack of permission from adjoining property owners.

- Project resources do not permit development and implementation of a statistics-based sampling approach. For this reason, composite samples will be collected to approximate overall environmental exposures.

- For mine waste and sediment, the range of concentrations will be compared with the range of reference material concentrations and risk-based screening benchmarks. Significance of any exceedances will be expressed following BLM 2004.

- Air concentrations will be estimated based on solid matrix analytical results, particulate in air measurements, and meteorological information.

- Mercury vapor concentrations will be directly measured one time.

- Detected leachable metal concentrations will be compared with waste characterization criteria (TCLP and WET leachate) and water quality criteria protective of beneficial uses (DI WET leachate).

- Judgmental composite sampling of mine waste and soil will be performed to support comparisons of concentration data.

- Sediment samples will be collected at sampling locations identified as up- and down-stream from mining disturbances based on professional judgment. If upstream sediment is not present, sediment from a nearby drainage with similar geologic characteristics will be collected.

- Analytical data will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability criteria through use of laboratory control samples, calibration data, and results of MS/MSD samples. These evaluations will result in quantification of the reliability of the analytical data. The goal is to produce defined data suitable for use in risk evaluation.

- The site will be mapped prior to sampling to confirm the affected areas and allow identification of mine waste, reference, surface water and sediment sampling locations.

- Comparisons and evaluations will be based on the range of measured concentrations for each medium sampled, consideration of information published by USGS in the area, and professional judgement.
<table>
<thead>
<tr>
<th>Target Population</th>
<th>Decision Statement</th>
<th>Available Information</th>
<th>Volume and Extent</th>
<th>Metals Concentration</th>
<th>Chemical Properties</th>
<th>Physical Properties</th>
</tr>
</thead>
</table>
| Mine Waste: Overburden, Waste Rock, and Tailings | • If the mine waste contains metals above levels of concern, then the Analysis of Brownfield Cleanup Alternatives (ABCA) will identify appropriate actions to mitigate concerns.  
• If the mine waste does not contain metals above levels of concern, then an ABCA may not be necessary. | Mine Waste: RWQCB XRF results and analytical laboratory results for total metals. | Site mapping  
Shallow hand excavation | One composite sample per mine waste location | One composite sample per mine waste pile | One composite sample per waste type |
| Soil adjacent to Mine Waste | • If soil adjacent to mine waste contains metals above levels of concern, then the Analysis of Brownfield Cleanup Alternatives (ABCA) will identify appropriate actions to mitigate concerns.  
• If soil adjacent to mine waste does not contain metals above levels of concern, then an ABCA may not be necessary. | Limited number of RWQCB XRF analyses | Within several feet of each mine waste pile. | Field XRF analysis | From Reference Soil | From Reference Soil |
| American Canyon Creek and Rindler Creek Sediment at the Target Property | • If metals from St. Johns Mine are present in American Canyon Creek and Rindler Creek sediment at levels that exceed reference concentrations and pose an unacceptable risk, then the ABCA will identify appropriate actions to mitigate concerns.  
• If metals from St. Johns Mine are present in American Canyon Creek and Rindler Creek sediment comparable with reference concentrations or below levels posing an unacceptable risk, then an ABCA may not be necessary. | Sediment: No Samples | Site Mapping | Sediment: a minimum of 2 sediment samples (one each from American Canyon and Rindler creeks) | Minimum of one composite sediment sample per creek | Minimum of 1 composite sample |
| Reference Soil | • If suitable reference areas for comparison of metal concentrations in soil and sediment with St. Johns Mine affected media are available, then reference concentrations can be identified for use in evaluating a release and associated risk.  
• If suitable reference areas for comparison of metal concentrations in soil and sediment with St. Johns Mine affected media are not available, then reference concentrations cannot be identified, and alternative sources of reference concentrations (regional, local, etc.) need to be evaluated. | Reference Soil: RWQCB and USGS data. | Not Applicable, reference area will be identified on maps. | Reference Soil: Up to 2 reference soil samples | Reference Soil: Minimum of 2 composite samples | Not Applicable |
| Air | • If metals from St. Johns Mine are migrating through air at levels that pose an unacceptable risk to receptors, then the ABCA will identify appropriate actions to mitigate concerns.  
• If metals migrating through air from St. Johns Mine do not pose unacceptable risks to receptors, then an ABCA may not be necessary. | Air: No Samples | • Visual Observation  
• Mercury Vapor measurement  
• Particulate Monitoring  
• Total Hg: Vapor survey  
• Metals: calculation from particulate and soil data | • Minimum of one vapor survey per feature  
• Minimum of one set of dust particulate values from each feature | Not Applicable |
Table 6: Screening Benchmarks and Analytical Detection Limits for Metals

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Screening Criteria (mg/kg)</th>
<th>Analytical Detection Limit (mg/kg)</th>
<th>Analytical Method</th>
</tr>
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<tbody>
<tr>
<td>Silver</td>
<td>380(^1)</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Aluminum</td>
<td>77,000(^3)</td>
<td>50</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
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<tr>
<td>Arsenic</td>
<td>0.067(^4)</td>
<td>1.0(^3)</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Barium</td>
<td>3,000(^4)</td>
<td>5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Beryllium</td>
<td>42(^4)</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Boron</td>
<td>16,000(^4)</td>
<td>5.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.3(^1)</td>
<td>0.25</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
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<tr>
<td>Cobalt</td>
<td>23(^4)</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Chromium III</td>
<td>100,000(^2)</td>
<td>1.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
<tr>
<td>Copper</td>
<td>7(^1)</td>
<td>1.0</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Iron</td>
<td>55,000(^1)</td>
<td>20</td>
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</tr>
<tr>
<td>Manganese</td>
<td>1,800(^3)</td>
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<tr>
<td>Total Mercury</td>
<td>1(^1)</td>
<td>0.05</td>
<td>EPA 7470/7471</td>
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<tr>
<td>Molybdenum</td>
<td>390(^4)</td>
<td>0.5</td>
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</tr>
<tr>
<td>Nickel</td>
<td>86(^4)</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Lead</td>
<td>80(^4)</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
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<tr>
<td>Antimony</td>
<td>31(^4)</td>
<td>1.0</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Selenium</td>
<td>35(^1)</td>
<td>2.0</td>
<td>EPA 200.8/3050B-SW-846 6020A</td>
</tr>
<tr>
<td>Thallium</td>
<td>63(^2)</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Vanadium</td>
<td>390(^4)</td>
<td>1.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
<tr>
<td>Zinc</td>
<td>43(^3)</td>
<td>5.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
</tbody>
</table>

Notes:
1 Ecological Risk Management Criteria from BLM Technical Note 390 (October 2004).
2 California Human Health Screening Level for Soil—Commercial/Industrial Land Use
3 US Environmental Protection Agency Regional Screening Levels, Resident Soil Table, May, 2018
4 San Francisco Bay RWQCB Tier 1 Environmental Screening Levels (Soil) February 2016, Revision 3
5 The arsenic analytical detection limit is above the screening level; however, arsenic typically occurs naturally at concentrations above the analytical detection limit. For this reason, the identified analytical method is considered sensitive enough for the purposes of this investigation.
Figures
(6 Pages)
Figure 2 - Site Map

Legend
- City of Vallejo Property
- Private Property
- Areas of Concern

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, GeoEye, IGN, IGP, swisstopo, and the GIS User Community

Westside Brownfields Coalition Assessment Project - St. John's Mine

Burleson Consulting, Inc.
O = Exposure route not complete or not significant
X = Exposure route complete
XXX = Off property exposure route beyond scope of this project

FIGURE 4
St. John’s Mine Conceptual Site Model
Burleson Consulting Inc.
Fig. 5 - Geologic Map

Legend
- Jurassic Serpentinite
- Jurassic Volcanics
- Cretaceous Sandstone
- Quaternary Alluvium
- Fault
- City of Vallejo Property
- Private Property
- Areas of Concern

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo,
Figure 6
Proposed Sample Locations

Legend
- Proposed Waste Rock Sample Locations (Private)
- Proposed Waste Rock Sample Locations (Public)
- Proposed Sediment Sample Locations
- Proposed Reference Sample Locations
- XRF Sample Locations
- Inferred Soot Fallout Area Boundary
- Alfisols - Dibble-Los Osos Clay loams
- Inceptisols - Millsholm Loam
- City of Vallejo Property
- Private property
- Areas of Concern

Westside Brownfields Coalition Assessment Project - St. John's Mine
Burleson Consulting, Inc.
Appendix A
Draft Quality Assurance Project Plan
Draft Quality Assurance Project Plan (QAPP)

For

Cooperative Agreement #: 99T30301

For

Abandoned Mine Sites in the Cache and Putah Creek Watersheds in the Counties of Lake, Napa, Solano, and Yolo

February 2018

Prepared by:
Greg Reller, Burleson Consulting, Inc.
Beth Kelly, Burleson Consulting, Inc.
Christopher Scudder, Burleson Consulting, Inc.

For:
McCord Environmental, Inc.
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Table 6 Field Analytical Methods and Detection Limits
Table 7 Laboratory Measurement Quality Objectives for Analytical Parameters for Water
Table 8a Measurement Quality Objectives for Metals in Water and Soil
Table 8b Measurement Quality Objectives for Mercury and Inorganic/Organic Parameters in Water and Soil
Table 9 Field Sampling Locations and Analytical Methods
Table 10 Analytical Laboratory Sample Analysis, Volumes, Holding Times, and Preservation Requirements.
Table 11 Summary of Analytical Parameters and Methods
Table 12 Summary of Laboratory Quality Control Samples
Table 13 Summary of Laboratory and Field Calibration Requirements for Major Parameters
Table 14 Definitions of Data Flags and Qualifiers for Inorganic Data

Acronyms

°C degrees Centigrade
% percent
CCR California Code of Regulations
COC Chain-of-Custody
DQO Data Quality Objectives
EDD electronic data deliverable
EPA Environmental Protection Agency
GPRA Government Performance and Results Act
HSP Health and Safety Plan
ID identification
LCS laboratory control samples
MDL method detection limit
MS/MSD matrix spike/matrix spike duplicate
ORP oxidation reduction potential
QA quality assurance
QAPP Quality Assurance Project Plan
QC quality control
RPD relative percent difference
SOP standard operating procedure
TDS total dissolved solids
TSS total suspended solids
1.0 PROJECT/TASK ORGANIZATION

This project supports the Work Plan for Grant Number 99T30301 (Grant), an agreement with the U.S. Environmental Protection Agency (EPA), under their Brownfields Assessment Program. This project supports the EPA's Strategic Plan and Government Performance and Results Act (GPRA) Goal 3: Cleaning up Communities and Advancing Sustainable Development, Objective 3.1 Promote Sustainable and Livable Communities.

This project is distinct from typical brownfields in that the targeted sites are predominantly abandoned mine sites in rural areas. This project provides a unique opportunity to address our region’s mining legacy of contamination holistically, consistently, and collectively. Mercury is our state’s leading cause of water quality impairment, and abandoned mine sites in our two watersheds were—and continue to be—major sources of that contamination. Within the 1,500-square mile planning area, there are approximately 100 abandoned mine features. Mercury monitoring in sediments, water, and fish downstream of these features has led to the listing of five reservoirs and many miles of streams as mercury-impaired.

The mining legacy is often associated with the Gold Rush in the late 1800’s, but mining also occurred sporadically to supply munitions for the world wars, and industrial products (thermometers, hearing aids, fluorescent light bulbs) into the early 1970’s. The upper watersheds were exploited by miners during each era with no regard to environmental protection. Now, several of the rural communities are economically disadvantaged and separated from the economic development experienced in the valleys below. The target community has over 10% unemployment and nearly 40% of people live below poverty levels. This project will connect these communities to downstream water users and to significant regional development plans.

1.1 Involved Parties and Roles

Chris Lee, Solano County Water Agency, is the Grant Manager and Project Lead. Elisa Sabatini, Yolo County, Tom Smythe, Lake County, and Chris Silke, Napa County, roles are Project Support. Stephen McCord of McCord Environmental, Inc. is the project manager. Danielle Dolan, local Government Commission, is the Project Facilitator. Greg Reller, Burleson Consulting, is the Site Assessor and Cleanup Planner. Erik Ringelberg and Kurt Balasek, BSK Associates, are Land Use Planners.

1.2 Organizational Chart and Responsibilities

Please see Table 1 for QAPP responsibilities. The Grant project organizational chart and personnel responsibilities are shown below in Figure 1.
1.3 Quality Assurance Officer Role

Beth Kelly is the Quality Assurance (QA) Officer. She is a chemist with over 25 years of environmental and chemical analytical experience, including data validation. Her role is to oversee the quality assurance/quality control (QA/QC) procedures found in this Quality Assurance Project Plan (QAPP) as part of the sampling, field analysis, and in-house analytical procedures.

The QA Officer will also review and assess all procedures during the life of the contract against QAPP requirements. She may stop all actions if there are significant deviations from required practices or if there is evidence of a systematic failure and will report all findings to Stephen McCord, Project Manager, including all requests for corrective action. Personnel responsible for implementing the QAPP are listed in Table 1.

Table 1: QAPP Personnel Responsibilities

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATIONAL AFFILIATION</th>
<th>TITLE/ROLE</th>
<th>CONTACT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christopher Lee</td>
<td>Solano County Water Agency (SCWA)</td>
<td>Project Lead</td>
<td>707-455-1105</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><a href="mailto:clee@scwa2.com">clee@scwa2.com</a></td>
</tr>
</tbody>
</table>
1.4 Problem Statement

Chemicals of potential concern in mine waste at the sites might migrate to surface water, sediment, soil, groundwater, and air and may be available for uptake by humans and wildlife. The impacts from release of these chemicals remain uncertain at this time. Reference concentrations for soil, surface water, and sediment are used to evaluate possible impacts to water quality, human and ecological receptors, and to quantify impacts to local creeks. Site characterization is used to characterize the mine waste, surface water, mine drainage, and provide information to support design of mitigation measures.

1.5 Decisions or Outcomes

This project will obtain information to: characterize and classify mine waste, evaluate whether there is environmental contamination requiring a response to protect human health and the environment, and evaluate cleanup alternatives as needed.

If analytical data obtained under this QAPP exceed regulatory criteria, an analysis of Brownfields Cleanup Alternatives (ABCA) will be prepared to describe a remediation strategy based on the anticipated site use. The ABCA is prepared to identify a recommended cleanup alternative if necessary to protect human health and the environment under the anticipated site use.

1.6 Regulatory Criteria

Regulatory criteria for comparison with data are further discussed in the Phase II Sampling and Analysis Plan, Plymouth Mine (Burleson, 2017a). Levels of concern in mine waste, surface water, soil and sediment are determined in part by regulations and in part through comparison with screening benchmarks. Regulations, such as California Code of Regulations (CCR) Title 27, include prescriptive requirements for mine waste management such as capping to minimize infiltration of water, and isolation from waterways. Classification of the mine wastes in accordance with Title 27 is in part dependent on the degree of hazard they represent based on risk assessment and threats to water quality and in part on site characteristics.

Evaluation of potential water quality threats and/or potential threats to human health relies on physical site attributes including slope, vegetation, soil characteristics, distance to receiving water, anticipated
land use, and receiving water beneficial uses. Evaluating potential threats also requires information regarding chemistry of soil and water, both site-affected, and not affected by the site (background or reference). The appropriate scale for decision-making will depend upon the intended use of the property. For this reason, screening benchmarks believed to be protective of human health and the environment under intended site use will be used to evaluate the analytical data.
2.0 PROJECT/TASK DESCRIPTION

The project tasks supported under this QAPP focus on addressing environmental impacts associated with mine drainage, and mine waste impacted soil and surface water. The ultimate goal of the project is to achieve a significant improvement in water quality through reducing metal loading to nearby creeks.

2.1 Work Statement and Produced Products

Quantitative and qualitative data will be collected during a Phase II Environmental Site Assessment (ESA) as described in the Sampling and Analysis Plan Phase II Environmental Site Assessment Plymouth Mine (Burleson, 2017a).

The tasks included in this QAPP include: mine waste, background soil, sediment characterization and sampling, and surface water and mine drainage sampling.

2.2 Constituents Monitored and Measurement Techniques

Table 3 lists the data quality objectives for the Phase II ESA for all sites, and includes the types of sampling, the rationale (decision statement, available information), volume and extent, frequency of sample collection, as applicable.

2.3 Project Schedule

Table 2 includes the schedule for activities performed under this QAPP.

Table 2: Project Schedule and Deliverables

<table>
<thead>
<tr>
<th>GRANT PROJECT TASK</th>
<th>SUB-TASKS</th>
<th>GRANT PRODUCT</th>
<th>ESTIMATED INITIATION DATE OR TIMEFRAME</th>
<th>ESTIMATED COMPLETION DATE OR TIMEFRAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase II</td>
<td>Prepare SAP/QAPP</td>
<td></td>
<td>November 2017</td>
<td>December 2017</td>
</tr>
<tr>
<td></td>
<td>Site visit to collect samples and Map features</td>
<td>Phase II ESA – Plymouth Mine</td>
<td>January 2018</td>
<td>January 2018</td>
</tr>
<tr>
<td></td>
<td>Prepare final report</td>
<td></td>
<td>February 2018</td>
<td>March 2018</td>
</tr>
</tbody>
</table>
Table 3: Data Quality Objectives

<table>
<thead>
<tr>
<th>Target Population</th>
<th>Decision Statement</th>
<th>Available Information</th>
<th>Volume and Extent</th>
<th>Metals Concentration</th>
<th>Chemical Properties</th>
<th>Physical Properties</th>
</tr>
</thead>
</table>
| **Mine Waste**    | • If the mine waste contains metals above levels of concern, and exposure pathways are complete through erosion/sedimentation to surface water and/or sediment, then we will document a release.  
• If the mine waste does not contain metals above levels of concern, and/or there is no exposure pathway through erosion/sedimentation, a remediation work plan may not be necessary. | • Parcel ID  
• Literature | • Site mapping  
• Shallow hand excavation | Minimum of one composite sample per mine waste location | Minimum of 1 composite sample per mine waste pile | Minimum of 1 composite sample per waste type |
| **Mine Drainage** | • If mine drainage is encountered and contains metals above levels of concern, we will determine if that mine drainage is interacting with surface water, and if so, we will document a release.  
• If the mine drainage does not contain metals above levels of concern, or does not encounter surface water, then a remediation work plan may not be necessary. | • Parcel ID  
• Literature | • Site mapping  
• Public Domain Information  
• On-Site Measurement | Number of samples and locations to be determined | • Measure field parameters  
• Sample & analyze total metals and general chemical parameters | Not Applicable |
| **Surface Water** | • If metal concentrations or loads are at or above levels of concern in surface water, then we document a release.  
• If metal concentrations or loads are below levels of concern in surface water, then a remediation work plan may not be necessary. | • Parcel ID  
• Literature | • Site mapping  
• Public Domain Information  
• On-Site Measurement | Number of samples and locations to be determined | • Measure field parameters  
• Sample & analyze total metals and general chemical parameters | Not Applicable |
| **Sediment**      | • If metals are present in sediment at levels that pose an unacceptable risk to receptors, then we will document a release through erosion of mine waste or enriched rock.  
• If metals are present in sediment below levels posing an unacceptable risk, then a remediation work plan may not be necessary. | • Parcel ID  
• Literature | • Site Mapping | Number dependent on presence of sediment at each selected location | Minimum of 1 composite sediment sample per location (upstream and downstream) | Minimum of 1 composite sample |
| **Soil**          | • If suitable reference areas for comparison of metal concentrations in soil, sediment, and surface water with affected media are available, then reference concentrations can be identified for use in evaluating risk.  
• If suitable reference areas for comparison of metal concentrations in soil, sediment, and surface water with affected media are not available, then reference concentrations cannot be identified, and alternative sources of reference concentrations (regional, local, etc.) need to be evaluated. | • Parcel ID  
• Literature | • Reference Soil: TBD  
• Reference Sediment: TBD  
• Reference Surface Water: TBD | | | Not Applicable |
| **Air**           | • If metals are migrating through air at levels that pose an unacceptable risk to receptors, then we will document a release from either dust or volatilization of mine waste.  
• If metals migrating through air do not pose unacceptable risks to receptors, then a remediation work plan may not be necessary. | • Parcel ID  
• Literature | • Visual Observation  
• Mercury Vapor measurement  
• Particulate Monitoring | • Total Hg: Vapor survey  
• Metals: calculation from particulate and soil data | • Minimum of one vapor survey per feature  
• Minimum of one set of dust particulate values from each feature | Not Applicable |
2.4 Geographical Setting

The project area is located in the Mayacmas Mercury District, a historical mercury mining area located south of Clear Lake East of Middletown, California. Saint Helena Creek is a sub-watershed tributary to Pope Creek, a major tributary to Lake Berryessa. This area represents the third largest mercury producing region in the nation when production was most active between 1850 and 1961 (US Department of Interior, Bureau of Mines [USBM], 1965). Half of all toxic mercury pollution that enters the Sacramento River watershed comes from the Putah and Cache Creek watersheds.

This mining legacy contributes to the state’s listing as impaired of several creeks in the region. And has resulted in fish consumption advisories posted for lakes and streams in the region.

3.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

This section presents the QA objectives for the project data quality indicators: precision, accuracy, representativeness, completeness, detection limits, and comparability. Tables 4 through 8b summarize the analytical parameters and laboratory QA/QC objectives for each analysis.

3.1 Precision and Accuracy

Precision and accuracy goals depend on the types of samples, analyses, and ultimate use of the analytical data. Accuracy will be evaluated from matrix spike/matrix spike duplicate (MS/MSD) samples as percent recovery (%Recovery). In addition, laboratory control samples (LCS) prepared from a different stock solution than the calibration standards and traceable to established standards will be analyzed with each sample batch and the % Recovery calculated. Precision will be evaluated as the relative percent difference (RPD) between MS/MSD results. Precision also will be evaluated using laboratory duplicates. An RPD will be calculated for each analyte in the duplicate pair. The QA objectives for all analyses will be 25% RPD for precision and 75-125 % for accuracy.

3.2 Detection Limits

Expected detection limits listed in the tables below are based on historical method detection limit (MDL) studies by the laboratory and experience with the type of matrix being analyzed within the evaluation. Method blank results will be reported only at concentrations greater than the detection limit to decrease reporting of low-level blank contamination.

3.3 Completeness

Completeness is an assessment of the amount of valid data obtained from a measurement system compared to the amount of data expected. The percent completeness is calculated as follows: the number of samples yielding acceptable data is divided by the total number of samples collected multiplied by 100. The objective for the degree of completeness is 90 percent. If completeness is less than 90 percent, this will be documented during the data quality assessment why this objective was not met and the impact of any lower percentage on the project.
3.4 Representativeness

For this project, representativeness involves sample size, sample volume, and sampling locations. The QA goal is to obtain an adequate number of samples that represent the media and its properties at the time of collection. The volume of sample collected also depends on the analytical method chosen, allowing for QC sample analysis and re-analysis if needed. Method blanks are also an indicator of representativeness. If target compounds are not detected in method blank samples, then target compounds detected in analytical samples are representative of the sample rather than laboratory or cross-contamination.

3.5 Comparability

Data comparability will be maximized by using standard EPA analytical methods when possible. Procedures for all planned methods are specified, and any deviations from the methods will be documented. All results will be reported down to the detection limit in the standard units shown in the tables or in the units specified in the method. Comparability also will be maximized by use of consistent sample collection techniques and analytical methods.
### Table 4: Screening Benchmarks and Analytical Detection Limits for Metals in Soil/Sediment/Mine Waste.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Screening Criteria (mg/kg)</th>
<th>Analytical Detection Limit (mg/kg)</th>
<th>Analytical Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>35&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Aluminum</td>
<td>NA</td>
<td>50</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Arsenic</td>
<td>1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.0</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Barium</td>
<td>6,300&lt;sup&gt;2&lt;/sup&gt;</td>
<td>5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Beryllium</td>
<td>1,700&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Boron</td>
<td>NA</td>
<td>5.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.3&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.25</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Cobalt</td>
<td>3,200&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Chromium III</td>
<td>100,000&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
<tr>
<td>Copper</td>
<td>7&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.0</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Iron</td>
<td>NA</td>
<td>20</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Manganese</td>
<td>960&lt;sup&gt;1&lt;/sup&gt;</td>
<td>20</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Mercury</td>
<td>1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.05</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>4,800&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Nickel</td>
<td>135&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Lead</td>
<td>6&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Antimony</td>
<td>380&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.0</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Selenium</td>
<td>35&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2.0</td>
<td>EPA 200.8/3050B-SW-846 6020A</td>
</tr>
<tr>
<td>Thallium</td>
<td>63&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5</td>
<td>EPA 200.8/3050B SW-846 6020A</td>
</tr>
<tr>
<td>Vanadium</td>
<td>6,700&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
<tr>
<td>Zinc</td>
<td>43&lt;sup&gt;1&lt;/sup&gt;</td>
<td>5.0</td>
<td>EPA 200.7/3050B SW-846 6010B</td>
</tr>
</tbody>
</table>

**Notes:**
2. California Human Health Screening Level for Soil—Commercial/Industrial Land Use

NA – not applicable
Table 5: Metal Detection Limits and Screening Criteria for Water/Drainage.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Screening Criteria (µg/L)³</th>
<th>Analytical Detection Limit (µg/L)</th>
<th>Analytical Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>0.84⁴</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Aluminum</td>
<td>87³</td>
<td>50</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Arsenic</td>
<td>10</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Barium</td>
<td>1,000</td>
<td>5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Beryllium</td>
<td>4</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Boron</td>
<td>700</td>
<td>5.0</td>
<td>EPA 200.7/3010 A SW-846 6010B</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1.1⁴</td>
<td>0.25</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Cobalt</td>
<td>50</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Chromium III</td>
<td>50</td>
<td>1.0</td>
<td>EPA 200.7/3010 A SW-846 6010B</td>
</tr>
<tr>
<td>Copper</td>
<td>4.1⁴</td>
<td>1.0</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Iron</td>
<td>300</td>
<td>20</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Manganese</td>
<td>50</td>
<td>20</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.05</td>
<td>0.05</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>10</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Nickel</td>
<td>24⁴</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Lead</td>
<td>0.92⁴</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Antimony</td>
<td>6</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Selenium</td>
<td>5³</td>
<td>2.0</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Thallium</td>
<td>1.7</td>
<td>0.5</td>
<td>EPA 200.8/3010 A SW-846 6020A</td>
</tr>
<tr>
<td>Vanadium</td>
<td>50</td>
<td>0.5</td>
<td>EPA 200.7/3010 A SW-846 6010B</td>
</tr>
<tr>
<td>Zinc</td>
<td>54⁴</td>
<td>5.0</td>
<td>EPA 200.7/3010 A SW-846 6010B</td>
</tr>
</tbody>
</table>

Notes:
2. California Human Health Screening Level for Soil—Commercial/Industrial Land Use
3. A Compilation of Water Quality Goals, California Regional Water Quality Control Board—Central Valley Region (August 2003)
4. Varies with hardness for protection of fresh water aquatic life, value provided is for 40 mg/l hardness.
5. Method for most metals is ICP/MS, EPA Method 200.8; a few metals are analyzed using ICP, EPA Method 200.7.
NA – not applicable

Table 6: Field Analytical Methods and Detection Limits

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>PHASE</th>
<th>METHOD</th>
<th>DETECTION LIMIT</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Oxygen (DO)</td>
<td>Total</td>
<td>DO Polarographic Probe</td>
<td>0.0 to 19.9</td>
<td>mg/L or (% Saturation)</td>
</tr>
<tr>
<td>pH</td>
<td>Total</td>
<td>EPA 150.1</td>
<td>0.1 (0 to 14)</td>
<td>pH</td>
</tr>
<tr>
<td>Specific Conductance</td>
<td>Total</td>
<td>EPA 120.1</td>
<td>1</td>
<td>µmho</td>
</tr>
<tr>
<td>Oxidation Reduction Potential (ORP)</td>
<td>Total</td>
<td>SM 2580 AB</td>
<td>± 25mv</td>
<td>mv as Eh</td>
</tr>
</tbody>
</table>

mg/L = milligrams per liter, ng or mg/m³ = nanograms or milligrams per cubic meter, mv = millivolts, ORP = oxidation reduction potential
### Table 7: Laboratory Measurement Quality Objectives for Analytical Parameters for Water

<table>
<thead>
<tr>
<th>ANALYTE</th>
<th>ANALYTICAL METHOD OR EQUIVALENT</th>
<th>WATER DETECTION LIMIT A</th>
<th>PRECISION (RPD) B</th>
<th>ACCURACY (% R) C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total and Dissolved Metals</td>
<td>EPA 200.8</td>
<td>Various (see Table 8a)</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Total Organic Carbon</td>
<td>EPA 415.3/SM5310B</td>
<td>0.02 mg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Hardness (as CaCO₃)</td>
<td>SM2340/EPA 200.8/EPA 6010</td>
<td>1 mg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Chloride</td>
<td>EPA 300.1</td>
<td>20 µg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Nitrate-N</td>
<td>EPA 300.1</td>
<td>400 µg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Turbidity</td>
<td>EPA 180.1</td>
<td>0.1 NTU</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Sulfate, Chloride, Nitrate</td>
<td>EPA 300.0</td>
<td>200 µg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Alkalinity as CaCO₃</td>
<td>EPA 310.1/SM2320B</td>
<td>1.0 mg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>EPA 360.1</td>
<td>1 mg/L</td>
<td>10</td>
<td>5% bias</td>
</tr>
<tr>
<td>pH</td>
<td>EPA 150.1</td>
<td>0.1 pH units</td>
<td>10</td>
<td>0.1 % bias</td>
</tr>
<tr>
<td>TDS/TSS</td>
<td>EPA 160.1/160.2</td>
<td>10 mg/L / 4 mg/L</td>
<td>10</td>
<td>5% bias</td>
</tr>
<tr>
<td>ORP</td>
<td>SM 2580 AB</td>
<td>± 25 mv as Eh</td>
<td>10</td>
<td>5% bias</td>
</tr>
<tr>
<td>SC</td>
<td>EPA 120.1</td>
<td>1 µmho</td>
<td>10</td>
<td>5% bias</td>
</tr>
<tr>
<td>Ethanol</td>
<td>EPA 8015B</td>
<td>2.0 mg/L (MDL 0.15 mg/L)</td>
<td>10</td>
<td>75-125</td>
</tr>
</tbody>
</table>

**Notes:**
- a = Detection limits may be higher for samples with elevated contaminant concentrations.
- b = Precision as relative percent difference (RPD)
- c = Accuracy as % R of matrix spikes

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORP</td>
<td>Oxidation Reduction Potential</td>
</tr>
<tr>
<td>mv</td>
<td>millivolts</td>
</tr>
<tr>
<td>MDL</td>
<td>method detection limit</td>
</tr>
<tr>
<td>SC</td>
<td>Specific Conductance</td>
</tr>
<tr>
<td>%R</td>
<td>Percent recovery</td>
</tr>
<tr>
<td>RPD</td>
<td>Relative percent difference</td>
</tr>
<tr>
<td>SM</td>
<td>Standard Methods for Chemical Analysis of Water and Wastes (EPA 1983)</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligrams per liter</td>
</tr>
<tr>
<td>meq/L</td>
<td>Milliequivalents per liter</td>
</tr>
<tr>
<td>mg/kg</td>
<td>Milligrams per kilogram</td>
</tr>
<tr>
<td>µg/L</td>
<td>Micrograms per liter</td>
</tr>
<tr>
<td>ng/L</td>
<td>Nanograms per liter</td>
</tr>
<tr>
<td>ng/g</td>
<td>Nanograms per gram</td>
</tr>
<tr>
<td>NTU</td>
<td>Nephelometric Turbidity Units</td>
</tr>
<tr>
<td>Analyte</td>
<td>Analytical Method</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Aluminum</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Antimony</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Arsenic</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Barium</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Beryllium</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Boron</td>
<td>EPA 200.7/SW-846 6010B</td>
</tr>
<tr>
<td>Cadmium</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Calcium</td>
<td>EPA 200.7/SW-846 6010B</td>
</tr>
<tr>
<td>Chromium</td>
<td>EPA 200.7/SW-846-6010B</td>
</tr>
<tr>
<td>Cobalt</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Copper</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Iron</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Lead</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Magnesium</td>
<td>EPA 200.7/SW-846-6010B</td>
</tr>
<tr>
<td>Manganese</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Mercury</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Nickel</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
<tr>
<td>Potassium</td>
<td>EPA 200.7/SW-846-6010B</td>
</tr>
<tr>
<td>Selenium</td>
<td>EPA 200.8/SW-846 6020A</td>
</tr>
</tbody>
</table>
### Table 8b: Measurement Quality Objectives for Mercury and Inorganic/Organic Parameters in Water and Soil

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Analytical Method</th>
<th>Soil Detection Limit</th>
<th>Water Detection Limit</th>
<th>Precision (RPD)</th>
<th>Accuracy (% R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mercury</td>
<td>EPA 245.1/7471</td>
<td>0.05 mg/kg</td>
<td>0.2 μg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Cation Exchange Capacity</td>
<td>EPA 9080</td>
<td>1 mg/L or 1 meq/L</td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Acid Base Accounting</td>
<td>EPA 600/2-78-054</td>
<td>100 mg/kg (AGP and ANP)</td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC)</td>
<td>EPA 415.3/SM5310B/EPA 9060</td>
<td>200 mg/kg</td>
<td>0.3 mg/L</td>
<td>25</td>
<td>75-125</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>SM 2540D</td>
<td></td>
<td>4 mg/L</td>
<td>25</td>
<td>5% bias</td>
</tr>
<tr>
<td>Hardness (as CaCO₃)</td>
<td>SM2340/EPA 200.8</td>
<td>1 mg/L</td>
<td>25</td>
<td>75-125</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>EPA 300.1</td>
<td>500 μg/L</td>
<td>25</td>
<td>75-125</td>
<td></td>
</tr>
<tr>
<td>Nitrate-N</td>
<td>EPA 300.1</td>
<td>400 μg/L</td>
<td>25</td>
<td>75-125</td>
<td></td>
</tr>
<tr>
<td>Sulfate</td>
<td>EPA 300.1</td>
<td>500 μg/L</td>
<td>25</td>
<td>75-125</td>
<td></td>
</tr>
<tr>
<td>Alkalinity as CaCO₃</td>
<td>EPA 310.1/SM2320B</td>
<td>1.0 mg/L</td>
<td>25</td>
<td>75-125</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>SM 4500H-B</td>
<td>0.1 pH units</td>
<td>10</td>
<td>0.1 % bias</td>
<td></td>
</tr>
<tr>
<td>ORP (Eh)</td>
<td>SM 2580 AB</td>
<td>± 25mv</td>
<td>10</td>
<td>5% bias</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>EPA 120.1</td>
<td>1 μmho</td>
<td>10</td>
<td>5% bias</td>
<td></td>
</tr>
</tbody>
</table>
Notes:
a = Detection limits based on CLS laboratory and may be higher for samples with elevated contaminant concentrations. The above laboratory detection limits for the STLC leachate are lower than the CCR Title 22 STLC regulatory values for identification of hazardous substances.
b = Precision as relative percent difference (RPD)
c = Accuracy as % R of matrix spikes
d = subcontracted to FGL laboratory for lower detection limit.

CCR  California Code of Regulations
STLC Soluble Threshold Limit Concentration
ORP  Oxidation Reduction Potential
Mv   millivolt
SC   Specific Conductance
%R   Percent recovery
RPD  Relative percent difference
SM   Standard Methods for Chemical Analysis of Water and Wastes (EPA 1983)
mg/L Milligram per liter
meq/L Milliequivalents per liter
μmho micromhos
mg/kg Milligram per kilogram
NTU nephelometric turbidity units
μg/L Microgram per liter
4.0 SPECIAL TRAINING NEEDS/CERTIFICATION

4.1 Specialized Training or Certifications

Training requirements specified in the Health and Safety Plan (HSP) (Burleson, 2017b) will be completed as required for field sampling.

In addition, personnel responsible for operating mechanical equipment will receive the necessary operating instruction on that equipment. Sampling personnel will be trained to use industry-standard practices.

4.2 Training and Certification Documentation

All personnel involved in field activities will be familiar with the requirements of this project QAPP. Hard copies of the current approved version of the project-specific QAPP and its appendices will be maintained by QAPP Personnel for ready reference.

Each analytical laboratory maintains their training documentation and certification.

4.3 Training Personnel

Sampling oversight will be provided by Greg Reller and Chris Scudder.
5.0 DOCUMENTS AND RECORDS

5.1 Field Documentation

Sample collection activities will be documented in permanently bound, page-numbered, weather-resistant field logbooks assigned to each field sampling technician or coordinator. Each notebook will be identified by project monitoring activity and the individual assigned custody of the logbook. If logbook custody is transferred to another individual, such transfer will be noted in the logbook and signed and dated by both parties. All entries will be made in indelible ink; errors will be corrected by one single line through the text being revised, and all such corrections will be initialed and dated.

Bound field logbooks will be used to record the following information:

- Sample date, time, types, numbers, and quantities;
- Sample container preservation steps performed;
- Sample locations or station identification (ID) number or code;
- Sampling equipment used;
- Decontamination steps performed;
- Calibration and maintenance actions;
- Information identifying other field equipment by equipment identification number; model/manufacturer, serial number, or other unique identifier; and
- Confirmation that Chain-of-Custody (COC) forms or notebook pages were properly completed and sample custody transferred as required by this QAPP.

In addition, other ancillary information should be recorded on a field form, including:

- Summary of daily activities;
- Any deviations from the associated work plan, sampling plan, QAPP, or standard operating procedure (SOP);
- Time of arrivals/departures of field technician and/or other visitors to the sampling station;
- Weather conditions;
- Time and subject of any incoming or outgoing telephone/radio contacts; and
- Any unusual events.

5.2 Chain-of-Custody Records

During sampling activities, a “paper trail” of sample custody must be maintained from the time the samples are collected until laboratory data are issued. Initial information concerning sample collection will be recorded in the field logbook. Information on the custody, transfer, handling, and shipping of samples will be recorded by the field technician on a COC form provided by the destination laboratory.
A COC form or equivalent notebook page will be completed for each set of samples collected daily and will contain the following information:

- Field Technician’s signature;
- Project name;
- Date and time of collection;
- Sample identification number and matrix;
- Analyses requested;
- Number of containers;
- Signature of persons relinquishing custody, dates, and times;
- Signature of persons accepting custody, dates, and times;
- Method of shipment; and
- Shipping papers/waybill identification number (as appropriate).

A copy of each as-transmitted COC form or equivalent log-book or forms will be retained in the monitoring program records.

### 5.3 Analytical Laboratory Records

The laboratories will be responsible for preparing analytical laboratory reports and electronic data deliverables (EDD) that are reviewed and approved by the laboratory’s QA Officer.

Laboratory analytical reports will include the following: field sample identification, laboratory sample identification, QA batch number, analyte name, units, dilution factor, results, results qualification code, method detection limit (if requested) and reporting limit, and laboratory QA codes as needed with explanation.

A written report will be prepared by the analytical laboratory documenting all the activities associated with each sample analysis. At a minimum, the following will be included in this report:

- Results of the laboratory analysis and laboratory QA/QC results;
- All protocols used during analyses;
- COC procedures; and
- Discussion of any deviations from the approved methods.

### 5.4 Project Record Files

Project records are defined as completed, legible documents, which furnish objective evidence of the quality and completeness of the data acquired pursuant to the requirements of the project activities. These records will be organized, filed and maintained under the direction the QA Officer, and will include, at a minimum:

- Copies of all bound field logbooks;
- Field copies and original (laboratory) copies of all COC forms;
- Personnel training records;
- Incoming and outgoing correspondence related to the project activity (e.g., letters, telephone conversation records, faxes, and hard copies of e-mail messages);
- Copies of all laboratory agreements and amendments thereto;
- As-received laboratory reports and data packages;
- All approved field changes;
- Draft and final versions of all reports and any associated laboratory data packages;
- Corrective and preventive action documentation or forms;
- Assessment and/or technical review reports;
- Data validation reports; and
- Draft and final versions of this QAPP and its appendices.

5.5 Field Change Request Forms

Field sampling activities can experience unexpected situations that will require deviations or modifications to the requirements of the QAPP (and/or sampling plan). Other changes may be required by other external stakeholders during the course of the project and monitoring program. The QA Officer or Project Manager may authorize the field coordinator to undertake modifications to the QAPP or its appendices provided that the scope of such modifications is discussed with and approved by the QA Officer.
6.0 SAMPLING METHOD

6.1 Field Sampling and Field Measurements Process

Activities to support site characterization were identified in the SAP (Burleson, 2017a). Based on the DQOs and data requirements, the activities described below were identified (Table 9).

6.1.1 Air Particulate Measurements

Air Particulate mass will be measured using a handheld air particulate measuring device. Visual observations will also be performed to evaluate sources of dust at the site. These measurements and observations would be collected during mapping of mine features.

6.1.2 Mercury Vapor Measurements

A mercury vapor survey will be completed using a Lumex RA-915 mercury vapor detector. Vapor measurements on mine waste piles will be made at ground level and about four feet above the ground, vapor measurements at adits will be made at accessible openings. The air temperature will be recorded at each measurement location. Mercury vapor measurements will be recorded on a field form. The mercury vapor locations measured will be recorded using GPS and included in the GIS for the site.

6.1.3 Surface Water Field Measurements

Field parameter measurements will be made in-situ in the streams or drainage, whenever possible. If an in-situ measurement is not possible, then the measurement will be made streamside by collecting the water using a decontaminated plastic container. Field equipment and meters will be calibrated prior to each sampling event, and when an instrument sampling probe is changed, in accordance with manufacturer’s instructions. The sampling probe will be decontaminated after each measurement, and before each sample is measured to avoid cross contamination. Measurements will be recorded on field sampling forms and in field logbooks.

6.1.4 Mine Drainage and Surface Water Sampling

Mine drainage and surface water samples will be collected by immersion of sample containers. Pre-cleaned sample containers provided by the laboratory will be used to collect surface water samples. Surface water will be collected by immersing sample containers directly into the water to be sampled when and where sufficient water is present. The mouth of the sample container will face upstream, and the sample will be collected at the approximate middle of the water column at the sampling location. Care will be taken to avoid collecting water with disturbed sediment by collecting samples upstream of sampling personnel positions and progressing from downstream to upstream sample locations. Samples for dissolved constituents will be collected by pumping water directly from the surface water and through a 0.45 micron disposable filter prior to filling the sample container. Preserved sample containers will be filled without over-flowing to avoid diluting preservatives. Unpreserved containers will be rinsed two times with water from the sample location prior to collecting the sample when sufficient water is present. At locations where sufficient water is not present to immerse the sample container, each container will be filled at a location where the natural flow of water allows, such as flow over the lip of a pool. Sample container rinsing will not be performed at low-flow locations.
6.1.5 Mine Waste Sampling

Loose material such as leaves, twigs, and rock will be cleared from the surface. An appropriate decontaminated or disposable tool will be used to remove the sample volume from the desired depth. The material sampled will be described based on visual characteristics. Large rock fragments (> than 0.25 inches in diameter) will be removed from the sample. The sample will be processed by completing visual description, classification of the soil, and logging soil descriptions on the sampling form; and sieving using a Number 10 (2 mm) sieve. The samples will then be placed into appropriate sample containers, labeled, recorded on a chain of custody form, and placed on and under ice in an ice chest pending transport to the analytical laboratory. Compositing will be performed in the field by mixing splits from each sieved sample in a plastic bag. Mixing will be performed by agitating the sample until no visible segregated sample volumes are observed.

6.1.6 Sediment and Reference Sampling

Loose material such as leaves, twigs, and rock will be cleared from the sediment surface prior to sample collection. An appropriate decontaminated or disposable tool will be used to remove the sample volume from the desired depth. The sample will be collected from the entire thickness of the sediment column up to 12 inches thick. If thicker sediment deposits are encountered, a core or exposed section of the sediment will be visually examined for presence of differing horizons or sediment layers, and representative samples from each layer will be collected. If an extensive sediment deposit (for example a sand bar) is present, a composite sample comprising a mixture of subsamples from across the deposit will be collected. Samples will be removed from the water, visually inspected, and sealed into the sample container with no/minimal head space to minimize the chance for oxidation. The sample will then be labeled, recorded on a chain of custody form, and placed on and under ice in an ice chest pending transport to the analytical laboratory. Sediment adjacent to the sample location will be visually described.
Table 9: Field Sampling Locations and Analytical Methods

<table>
<thead>
<tr>
<th>Water</th>
<th>Sample Frequency Based on Available Flow and Grant Years</th>
<th>Approximate Number of Field Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Metals (Full List) 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulfate, Chloride, Nitrate (Aqueous Samples Only)</td>
</tr>
<tr>
<td>Surface Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upstream of adit</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Downstream of adit</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Mine Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dirt Road west of Adit across Hoffman Creek</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Open Cuts uphill of adit</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Sediment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upstream of adit in Hoffman Creek</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Downstream of adit in Hoffman Creek</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Saint Helena Creek upstream of Hoffman Creek</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Saint Helena Creek downstream of Hoffman Creek</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Reference Soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>East and uphill of adit and open cuts</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Southwest of adit across tributary of Hoffman Creek</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Mercury Vapor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adit entrance</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>Dirt road across Hoffman Creek from adit</td>
<td>1 X</td>
<td>X</td>
</tr>
<tr>
<td>East and uphill of adit in open cuts</td>
<td>1 X</td>
<td>X</td>
</tr>
</tbody>
</table>

Notes: NA = not applicable

1 The full metals list includes: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, cobalt, chromium, copper, iron, magnesium, manganese, mercury, molybdenum, nickel, lead, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
6.2 Decontamination

For routine field sampling, reusable equipment will be triple rinsed prior to taking each sample. All rinsate may be disposed of on-site. Field personnel will handle field equipment and containers carefully to minimize the potential for cross-contamination. Equipment rinsate blanks will be collected by directing rinsate water from the decontaminated tool into a sample container during the final rinse. If filtered aqueous samples are collected, a filter blank will be collected in the field by running distilled water through a filter and directing the filtered water into a sample container. One rinsate sample will be collected each day during field sampling.

In the event that EPA Method 1669, *Sampling Ambient Water for Determination of Trace Metals at EPA Water Quality Criteria Levels* (EPA, 1998) is necessary to preclude contamination during the sampling process, all sampling equipment and sample containers will be cleaned in a laboratory or cleaning facility using detergent, mineral acids, and reagent water, and filled with weak acid and double bagged for shipment. The laboratory is responsible for generating an acceptable equipment blank to demonstrate that the sampling equipment and containers are free from trace metals contamination before they are shipped to the field sampling team. Field blanks are also required to be collected. Upon arrival at the site, a two-person team (clean and dirty hands) collects the samples. Clean hands are used for contact with the sample bottles. Dirty hands for operating equipment. All personnel must wear gloves, and sampling equipment used must be non-metallic. Field duplicate samples are also required.

6.3 Sample Containerization, Preservation, and Holding Times

Table 10 presents containerization, preservation, and holding time requirements for each parameter to be analyzed by the laboratory. Container sizes have been selected to allow for adequate sample volume for the required analysis. All containers will be obtained from the laboratory, and the laboratory will place the appropriate amount of preservatives in each container before shipment. Holding times presented are identified from the analytical methods. The holding time is the duration a sample can be held—from the time it is collected to the time it is analyzed—and still produce acceptable results.

<table>
<thead>
<tr>
<th>ANALYSIS</th>
<th>METHOD</th>
<th>MATRIX</th>
<th>SAMPLE VOLUME REQUIRED</th>
<th>HOLDING TIME</th>
<th>PRESERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CAM 17 Metals a plus Al, Fe, and Mn</td>
<td>EPA 200.8/6020A (ICP/MS)</td>
<td>Soil</td>
<td>8-ounce glass jar</td>
<td>6 months (28 days for Hg)</td>
<td>Cool to 4 °C</td>
</tr>
<tr>
<td>CAM 17 WET STLC b</td>
<td>CA Title 22, Ch. 11 App II</td>
<td>Soil</td>
<td>8-ounce glass jar (100 g minimum)</td>
<td>6 months (28 days for Hg)</td>
<td>Cool to 4 °C</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>EPA 7470/7471</td>
<td>Soil</td>
<td>8-ounce glass jar</td>
<td>28 days</td>
<td>Cool to 4 °C</td>
</tr>
<tr>
<td>Test</td>
<td>Method/Code</td>
<td>Sample</td>
<td>Container</td>
<td>Duration/Condition</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
<td>--------</td>
<td>-----------</td>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>EPA9060</td>
<td>Soil</td>
<td>8-ounce glass jar</td>
<td>28 days Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Cation Exchange Capacity (CEC)</td>
<td>EPA9080</td>
<td>Soil</td>
<td>8-ounce glass jar</td>
<td>6 months Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Acid Base Accounting</td>
<td>EPA 600/2-78-054</td>
<td>Soil</td>
<td>8-ounce glass jar</td>
<td>NS Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Grain Size</td>
<td>ASTM D422</td>
<td>Soil</td>
<td>8-ounce glass jar</td>
<td>NA Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Total and Dissolved Metals</td>
<td>EPA 200.8/SW-846 6020A(ICP/MS)</td>
<td>Water</td>
<td>500 Milliliter poly bottle</td>
<td>180 days Nitric Acid pH&lt;2 Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Total Mercury</td>
<td>EPA 1631E/1669</td>
<td>Water</td>
<td>500 ml glass</td>
<td>If unpreserved, 48 hr Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Total Methyl Mercury</td>
<td>EPA 1630/1669</td>
<td>Water</td>
<td>500 ml glass (lab bottle blank &amp; field equipment blank)</td>
<td>If unpreserved, 48 hr Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td>180.1</td>
<td>Water</td>
<td>100 ml poly</td>
<td>48 hours Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>TDS, TSS</td>
<td>160.1, 160.2</td>
<td>Water</td>
<td>1 Liter poly</td>
<td>7 days Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Ethanol</td>
<td>EPA 8015B</td>
<td>Water</td>
<td>3-VOA</td>
<td>14 days pH &lt;2, HCl Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Cations (Ca, Mg, Na, K)</td>
<td>EPA 6010</td>
<td>Water</td>
<td>500 Milliliter poly bottle</td>
<td>180 days Nitric Acid pH&lt;2 Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Major Ions – Chloride, Nitrate-N, Sulfate</td>
<td>EPA 300.1</td>
<td>Water</td>
<td>500 Milliliter poly bottle</td>
<td>28 days/48 hours Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Total Organic Carbon</td>
<td>SM5310B</td>
<td>Water</td>
<td>2 VOA glass vials</td>
<td>28 days HCl pH&lt;2 Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>EPA 310.1/SM 2320B</td>
<td>Water</td>
<td>200 Milliliter poly bottle</td>
<td>14 days Cool to 4 °C</td>
<td></td>
</tr>
<tr>
<td>Hardness</td>
<td>SM2340B/EP A 200.8</td>
<td>Water</td>
<td>100 milliliter Poly/Glass</td>
<td>6 months pH &lt;2, HNO₃</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- Metals include aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc.
- WET will be performed using de-ionized water.
- < Less than
- °C Degrees Celsius
- ASTM American Society for Testing and Materials
- EPA U.S. Environmental Protection Agency
- NA Not applicable
- Poly Polyethylene
- SM Standard Methods for Examination of Water and Wastewater (1983)
7.0 SAMPLE HANDLING AND CUSTODY

General sample identification, labeling, handling and COC requirements are discussed in this section. COC procedures will be strictly adhered to during sample collection, transportation and laboratory handling to assure the identity of the samples. Improper sample and data handling and inadequate COC procedures affect the credibility and acceptability of analytical results, regardless of their accuracy or precision. COC documentation will document the processing of the sample from the time of collection to the time of analysis.

7.1 Sample Labeling and Handling

Sample containers with the necessary preservatives will be provided by the contract laboratories. After collection, samples will be labeled with all necessary information filled out using waterproof ink. At a minimum, each sample label will contain the following information:

- Project name;
- Site location;
- Sample identification code;
- Date and time of sample collection, with sampler’s initials;
- Analyses required;
- Method of preservation, if used; and
- Sample matrix.

Each sample will be assigned a unique ID according to sample location and date. This ID will consist of the location code, followed by the date (4-digit year, 2-digit month, and the number for the day). For example, a sample collected from an Adit on January 15, 2018 would be labeled A20180115.

Sample containers will be sealed in Ziploc® plastic bags and immediately placed on ice in an insulated cooler chilled to 4 degrees centigrade (°C). Insulated coolers will be provided by the contract laboratories. Samples will be placed right-side up in a cooler with ice for delivery to the laboratory.

7.2 Chain-of-Custody Procedures

The field team responsible for the collection of samples will sign and retain a copy of the COC form, document the method of shipment, and send the original with the samples. The original signed COC form will be sealed in a watertight plastic envelope and attached to the inside lid of the cooler. Coolers will be secured with strapping tape and a container custody seal applied that is over-strapped with clear strapping tape. All sample shipment coolers will be transferred from the field directly to the analytical laboratory. In cases where direct delivery to the analytical laboratory is not possible, samples will be stored in a refrigerator at no more than 4°C, but above freezing. Access to the refrigerator will be restricted to the field technician or coordinators and technicians.
A COC form will be shipped or accompany the cooler to confirm transfer; the carrier waybill number will be recorded on the original COC. Commercial carriers are not required to sign the COCs. Copies of the COCs, notebook pages, and waybills will be forwarded to the monitoring program records by the field technician or coordinator.

Sample shipment will be scheduled to prevent exceeding any required holding times. Failure to conduct analyses within the required holding times may potentially require the qualification of associated analytical results and will prompt appropriate corrective and preventive action measures.

7.3 Laboratory Operations

Laboratory analyses will be managed in accordance with the laboratories’ approved QA plans or manuals and the minimum requirements described in this section of the QAPP (Appendix A). In the event conflicts may exist between the QAPP and any of the laboratory QA plans, the more stringent requirement will apply.

7.3.1 Sample Receipt

When samples arrive at each laboratory, the designated laboratory custodian receiving the sample cooler will inspect the cooler custody seal. The custodian will sign the shipping COC (when utilized) and attach the carrier billing. The shipping COC and waybill will be archived in the laboratory’s project file and a copy of the shipping COC and waybill will be forwarded for filing in the project records. The laboratory custodian will then open the cooler to inspect the samples for integrity and compare the number of containers and label information with the COC form attached to the inside of the cooler lid. Cooler temperatures will be checked and documented on the COC form. Broken custody seals, damaged sample containers, sample labeling discrepancies between container labels and the COC form, and analytical request discrepancies will be noted on the COC form. The QA Officer or field technician or coordinator will be notified of any such problems for their appropriate action.

Once any discrepancies are resolved, the laboratory custodian will enter the samples into an analytical custody log and will assign each sample a unique identification number that is cross referenced to the sample number assigned in the field. The identification number will be used by the laboratory in its internal tracking system and the status of any given sample can be checked at any time by referring to the laboratory numbers on the COC form and in the laboratory logbooks. The laboratory custodian will then sign the COC form. The original COC will be routed to the laboratory’s data management group. Copies of the COC forms documenting custody changes and documentation will be received and kept in the laboratory’s project files. The original COC forms will remain with the samples until final disposition of the samples by the laboratory. Samples, extracts, or digestates will not be sent to another laboratory without the written authorization of the QA Officer. After sample disposal, a copy of the original COC will be sent to the QA Officer to be filed in the monitoring program records.

The following identifying information will be entered into the laboratory’s database or logged into the laboratory's bound sample receiving logbook:

- Date and time of receipt
- Laboratory project number or work order number
- Project name and number
- Sample numbers, matrices
• Analyses required

7.3.2 Sample Storage and Security

Samples will be stored in secure, designated refrigerated areas as required for the analysis to be performed. A logbook or form will be maintained for each refrigerated area, and the temperature will be recorded each working day. At a minimum, the following procedures will be applied:

• Samples and extracts will be stored in a secure area controlled by the laboratory’s designated sample custodian;

• Samples will be removed from the shipping container and stored in their original containers unless damaged; damaged samples will be disposed in an appropriate manner after notifying the lab manager and authorization to dispose is received and documented;

• Whenever samples are removed from storage, removal will be documented;

• Sample transfers will be documented on internal COC records;

• Samples and extracts will be stored after completion of analyses in accordance with contractual requirements, or until instructed otherwise by the lab manager; and

• Samples will not be stored with standards or sample extracts.

7.3.3 Sample Tracking

Laboratory personnel will use COC records, notebook pages, and databases to generate backlist reports of analyses for each sample. The reports will include the collection times along with the laboratory sample number, and will include a reference to the project title, field sample identifications, and sample matrix. Sample analyses will be scheduled on the basis of holding time considerations. Analytical assignments will be reviewed on a daily basis to ensure that holding times are not exceeded. If holding times are exceeded during laboratory custody, the QA Officer or field technician or coordinator will be immediately notified for their appropriate action.

7.3.4 Sample Custody Records

Minimum requirements for laboratory sample COC controls are as follows:

• Samples will be stored in a secured area;

• Access to the laboratory will be through a monitored area; other outside access doors to the laboratory will be kept locked in accordance with local fire requirements;

• A visitor’s log will be maintained, and visitors will be escorted while in the laboratory;

• Refrigerators, freezers, and other sample storage areas will be securely locked or maintained in a secured area;

• Only authorized personnel will have keys to locked sample storage area(s);

• Samples will remain in secure sample storage until removed for preparation or analysis;

• Sample transfers into and out of storage will be documented; and

• Custody records will be maintained by the laboratory’s sample management group.
Samples, extracts, and digestates will be retained at the laboratory for at least 60 days after the laboratory’s final analytical data report has been submitted, so that any potential analytical problems can be properly addressed. The samples, extracts, and digestates may then be discarded in an approved and environmentally safe manner unless otherwise directed by the lab manager.
8.0 ANALYTICAL METHODS

This project will focus on the metals aluminum, antimony, arsenic, barium, beryllium, cadmium, total chromium, cobalt, copper, iron, lead, manganese, total mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. In addition, field parameters (oxidation reduction potential (ORP), pH, temperature, specific conductance), total dissolved solids (TDS), major ions (such as sulfate, chloride, nitrate), and hardness will be monitored. Table 11 provides a list and description of the analytical methods used for this project for water, soil, and waste samples.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Matrix</th>
<th>Method Reference</th>
<th>Method Type</th>
<th>Method Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total and Dissolved Metals</td>
<td>Water</td>
<td>EPA 200.8 or 3010A / SW-846 6020A(ICP/MS)</td>
<td>Laboratory</td>
<td>Inductively coupled plasma mass spectrometry (ICP/MS)</td>
</tr>
<tr>
<td>Total and Dissolved Hg</td>
<td>Water</td>
<td>EPA Method 245.1</td>
<td>Laboratory/Fielld Sampling</td>
<td>Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)</td>
</tr>
<tr>
<td>Major Anions – Chloride, Sulfate, Nitrate-N</td>
<td>Water</td>
<td>EPA 300.1</td>
<td>Laboratory</td>
<td>Determination of Inorganic Anions in Drinking Water by Ion Chromatography</td>
</tr>
<tr>
<td>Hardness</td>
<td>Water</td>
<td>SM2340B/EPA 200.8</td>
<td>Laboratory</td>
<td>Hardness by calculation, and inductively coupled plasma mass spectrometry (ICP/MS)</td>
</tr>
<tr>
<td>pH</td>
<td>Water</td>
<td>SM 4500H-B</td>
<td>Lab/Field</td>
<td>pH</td>
</tr>
<tr>
<td>Eh (ORP)</td>
<td>Water</td>
<td>SM2580 AB</td>
<td>Field</td>
<td>Oxidation-Reduction Potential (ORP)</td>
</tr>
<tr>
<td>Specific Conductance (SC)</td>
<td>Water</td>
<td>EPA 120.1</td>
<td>Field</td>
<td>Specific Conductance (SC)</td>
</tr>
<tr>
<td>Total Metals (CAM 17 list plus Aluminum, Iron and Manganese)</td>
<td>Soil</td>
<td>200.8/EPA Method 3050B 6020A(ICP/MS)</td>
<td>Laboratory</td>
<td>Inductively coupled plasma mass spectrometry (ICP/MS)</td>
</tr>
<tr>
<td>CAM 17 b Metals plus Aluminum, Iron and Manganese/STLC</td>
<td>Soil/Waste/DI-STLC</td>
<td>CA Title 22, Ch 11, App II/EPA 3010A or 200.8/6020A(ICP/MS)</td>
<td>Laboratory</td>
<td>CA Hazardous Waste Soluble Threshold Limit Concentration waste extraction test method using deionized water/ Inductively coupled plasma mass spectrometry (ICP/MS)</td>
</tr>
<tr>
<td>Total Mercury</td>
<td>Soil/Waste</td>
<td>EPA 7471</td>
<td>Laboratory</td>
<td>Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)</td>
</tr>
</tbody>
</table>
## Table 11: Summary of Analytical Parameters and Methods

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Matrix</th>
<th>Method Reference</th>
<th>Method Type</th>
<th>Method Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cation Exchange Capacity (CEC)</td>
<td>Soil</td>
<td>EPA 9081/9080</td>
<td>Laboratory</td>
<td>Cation – Exchange Capacity of Soils (Sodium Acetate or Ammonium Acetate)</td>
</tr>
<tr>
<td>Acid Base Accounting</td>
<td>Soil</td>
<td>EPA 600/2-78-054</td>
<td>Laboratory</td>
<td>Acid Generating Potential/Acid Neutralizing Potential</td>
</tr>
<tr>
<td>Grain Size Analysis by Sieve</td>
<td>Soil</td>
<td>ASTM D422</td>
<td>Laboratory</td>
<td>Particle Size Analysis Test</td>
</tr>
<tr>
<td>Temperature</td>
<td>Soil</td>
<td>SM2550</td>
<td>Field</td>
<td>Temperature</td>
</tr>
</tbody>
</table>

**Notes:**

- **a** = Metals include aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc.

- **b** = CAM 17 metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc. Iron, and manganese will be added.

- **c** = STLC WET will be performed using de-ionized water. California Assessment Manual, CCR Title 22, Soluble Threshold Limit Concentration (STLC) Waste Extraction Test (WET).

**Abbreviations:**

- **EPA** U.S. Environmental Protection Agency
- **SM** Standard Methods for the Examination of Water and Wastewater (1983)
- **ASTM** American Society for Testing and Materials
- **TCLP** Toxicity Characteristic Leaching Procedure
9.0 QUALITY CONTROL

Quality assurance checks include laboratory and field methods. Laboratory quality assurance checks may include the use of blank, spiked, split and duplicate samples, calibration checks and internal standards. These samples will be handled and analyzed using the same procedures as the primary samples.

9.1 Field Quality Control Samples

Field QC samples should be collected in the field and used to evaluate the quality of the field sampling activities. Each project-specific work plan will address the specific field QC sampling requirements listed in this QAPP. Field QC samples may consist of field duplicate samples, field method blanks and/or field equipment rinsate blanks.

9.1.1 Field Duplicate Samples

Field duplicate samples may be collected to assess the accuracy, precision and overall quality of the sampling and analytical procedures. Field duplicates will be collected at a rate of 1 per 10 samples (at least one field duplicate collected per day). Field duplicate samples are collected at the same time and from the same source as the original sample. Duplicate samples will be collected, numbered, packaged, and sealed in the same manner as other samples, and submitted blind to the laboratory for identical analyses as the original sample.

9.1.2 Field Method Blank Samples

Field method blanks consist of source water (often commercially distilled water or laboratory-prepared deionized water, depending on the specific QC requirements) that is placed into the sampling containers at the same time and location of a field sample. Field method blank samples will be collected at a rate of 1 per 20 samples, or at least one per day. The field blank sample is handled in the same manner as other samples, and submitted blind to the laboratory for identical analyses as the other samples. Field blanks are used to evaluate any contamination present during sampling and/or laboratory contamination.

9.1.3 Field Equipment Rinsate Blank Samples

The equipment rinsate blank sample is collected in the same manner as other samples, utilizing any non-dedicated, decontaminated sampling equipment (sample tubing, filters, shovels, etc.). Field equipment rinsate blanks consist of the final rinsate after equipment decontamination directed into a sample container after it is poured over the decontaminated piece of equipment. Field method blank samples will be collected at a rate of 1 per 20 samples per day, or at least one per day. These samples are submitted blind to the laboratory for identical analyses as the other samples. Field equipment rinsate blanks are used to evaluate decontamination procedures of sampling equipment.

9.2 Laboratory Quality Control Samples

Laboratory QC checks are designed to determine analytical precision and accuracy, demonstrate the absence of interferences and contamination from glassware and reagents, and ensure comparability of data. Laboratory QC checks consist of LCS, method blank samples, MS/MSD samples, laboratory
duplicate samples, and other checks specified in the methods. The laboratory also will complete initial calibrations and continuing calibration checks according to specified analytical methods.

9.2.1 Method Blanks

Method blanks will be used for the laboratory processes, as defined by the governing method. A method blank is a volume of deionized water that is carried through the entire sample preparation and analysis procedure. The method blank volume or weight will be approximately equal to the sample volumes or sample weights being processed. Method blanks are used to monitor interference caused by constituents in solvents and reagents and on glassware and other sampling equipment. A method blank is prepared and analyzed with each analytical batch of 20 or fewer samples prepared.

9.2.2 Matrix Spikes

A spike is a sample to which is added a known amount of analyte(s) before analysis. From the concentrations of the analyte in the spiked and unspiked samples, a percent recovery is calculated. Many samples show matrix effects in which other sample components interfere with the determination of the analyte. The value of the percent recovery indicates the extent of the interference. A matrix spike is prepared by adding an analyte to a subsample of a field sample before sample preparation and analysis. For multi-analyte methods, a representative suite containing all of the analytes is used in the matrix spike. If matrix spikes are spiked at too low of a concentration (i.e., less than 3-5 times the native concentration), they may be repeated at a higher spike concentration. An analytical spike is prepared by adding analyte to an aliquot of a processed sample prior to analysis, and is used to determine whether the analysis system provides results that are representative of the sample when a matrix spike is outside its limits.

9.2.3 Laboratory Control Samples (Verification Solutions)

A LCS, or a blank spike, is an aqueous or solid control sample of known composition that is analyzed using the same sample preparation, reagents, and analytical methods employed for the monitoring program samples. An LCS is obtained from an outside source or is prepared in the laboratory by spiking reagent water or a clean solid matrix for a stock solution that is different than that used for the calibration standards. The LCS is the primary indicator of process control used to demonstrate whether the sample preparation and analytical steps are in control, apart from sample matrix effects. LCSs contain the target analytes identified in the method.

9.2.4 Laboratory Duplicate Samples

Duplicate samples are samples that have been divided into two portions at some step in the measurement process. Each portion is then carried through the remaining steps of the process. Duplicate samples provide information on the precision of the operations involved. Analytical duplicates are a pair of subsamples from a field sample that are taken through the entire preparation and analysis procedure; difference between the results indicates the precision of the entire method in the given matrix. Under the laboratory protocols, the matrix spike is duplicated to provide a matrix spike duplicate. Matrix spike duplicates will be prepared for every analytical batch of at least 20 samples. Analytical duplicates are prepared by taking two aliquots of a process sample and analyzing them in the same manner. Both matrix and analytical spike duplicates are used to monitor the precision of the analytical process.
The laboratory will analyze one laboratory duplicate sample per sample delivery group. A sample delivery group is defined as a group of up to 20 samples received within a 14-day period. Laboratory internal QC checks are summarized in Table 12. Table 12 also indicates the required frequency, acceptance criteria, and corrective action for each QC check. Each of these checks and their frequencies are discussed below.
### Table 12: Summary of Laboratory Quality Control Samples

<table>
<thead>
<tr>
<th>QC CHECK SAMPLE</th>
<th>FREQUENCY</th>
<th>ACCEPTANCE CRITERIA</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory control samples</td>
<td>5 percent or 1 per batch, whichever is more</td>
<td>Accuracy 85 to 115% (varies based on method) RPD 15% to 25% (varies with media and method)</td>
<td>1. Evaluate other QC samples in batch. 2. Correct the problem. 3. Repeat the analysis. 4. Flag data in report.</td>
</tr>
<tr>
<td>Method blank</td>
<td>5 percent or 1 per batch, whichever is more</td>
<td>Less than the PQL</td>
<td>1. Terminate the analysis. 2. Correct the problem. 3. Reanalyze affected samples. 4. Flag data in report.</td>
</tr>
<tr>
<td>Instrument blank</td>
<td>At the beginning, end, and after every 10</td>
<td>Less than the PQL</td>
<td>1. Terminate the analysis. 2. Correct the problem. 3. Recalibrate and reanalyze samples. 4. Flag data in report.</td>
</tr>
<tr>
<td>Instrument blank</td>
<td>samples during analysis sequence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory duplicate sample</td>
<td>5 percent or 1 per batch, whichever is more</td>
<td>RPD of 20 (varies based on method)</td>
<td>1. Evaluate other QC samples in the batch. 2. Flag the data in report.</td>
</tr>
<tr>
<td>Matrix Spikes and Duplicate Matrix Spikes</td>
<td>5 percent or 1 per batch, whichever is more</td>
<td>Accuracy 75 to 125%</td>
<td>1. Evaluate other QC samples in the batch. 2. Flag the data in report.</td>
</tr>
<tr>
<td>Matrix Duplicate</td>
<td>5 percent or 1 per batch, whichever is more</td>
<td>RPD of 25</td>
<td>1. Evaluate other QC samples in the batch. 2. Flag the data in report.</td>
</tr>
<tr>
<td>Matrix Duplicate</td>
<td>5 percent or 1 per batch, whichever is more</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- %R  Percent recovery
- RPD  Relative percent difference
- PQL  Practical quantitation limit
- QC   Quality control
10.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

10.1 Calibration of Sampling Equipment

For water sampling, instrumentation and equipment used will generally be limited to filtration apparatus and field meters. The filtration apparatus will be used and maintained in accordance with the manufacturer’s instructions. Field meters, including the air monitoring analyzer, will be calibrated following the manufacturer’s instructions for each analyte of interest and at least once per sampling event.

10.2 Calibration of Laboratory Equipment

All analytical measurement instruments and equipment used by the laboratories will be controlled by a formal calibration and preventive maintenance program. At a minimum, each laboratory will require that equipment be of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. All instruments and equipment that measure a quantity, or whose performance is expected at a stated level, are subject to calibration. In addition, each laboratory’s preventive maintenance program will include the following, as a minimum:

- A listing of the instruments and equipment that will be used;
- The frequency of maintenance considering manufacturer’s recommendations and previous experience with the equipment; and
- A file for each instrument containing a list of spare parts maintained, external contracts, and a listing of the items to be checked or serviced during maintenance.
11.0 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

11.1 Calibration Methods

Physical and chemical calibrations will be performed within each laboratory as described in this subsection. Physical calibration refers to physical measurements that are made on equipment to verify or provide corrections to the observed data. Physical calibrations will be documented on data sheets that are designed for each specific application. At a minimum, the information recorded will include the date, analyst, instrument identification, identification of reference standard, expected values, measured values, and correction factors, if applicable.

Chemical calibration or standardization refers to operations in which instrument response is related to analyzed concentration. The minimum requirements for chemical calibration will be as specified in the applicable method. Chemical calibrations consist of initial and continuing calibrations, which are documented in several ways depending on the type of instrument. For non-computerized data systems such as strip chart recorders and meter readouts, the instrument responses will be transcribed, along with other pertinent information, onto data sheets for each specific analysis. When computerized data systems are used, the data will be collected and stored in computer files, as well as hard-copy printouts, which may either be included with the data package or kept in a central record. With computerized data systems, the run logs provide a cross-reference to the calibration runs. At a minimum, the information recorded for the calibrations will include the data, analyst, instrument identification, standard identification and concentrations, raw instrument responses, file descriptor, and calibration parameters such as regression coefficients, correlation coefficients, or response and calibration factors.

Initial calibration consists of the establishment of a calibration or standard curve, which associates instrument response and analyzed concentration. The curve is constructed by measuring the responses of a series of standard solutions containing the analytes of interest at known concentrations. This initial calibration will be verified each working day by measurement of one or more calibration standards.

11.2 Calibration Apparatus

The use of calibration apparatus, including field instruments and data loggers, will be according to the manufacturer’s instructions or the laboratory’s SOPs.

11.3 Calibration Standards

Primary standards will be obtained as either neat materials, which will be used to prepare stock standard solutions, or as prepared solutions to be used as stock standards. Records will be maintained on primary standards that include date of receipt, source, purity, composition, storage conditions, and expiration dates. Primary standards will be traceable to National Institute of Standards and Technology standards, or will be vendor-certified. The preparation of stock, intermediate, and working standard solutions will be documented in standards preparation logbooks. Each stock, intermediate, and working standard will be assigned a number to permit traceability of preparation from stock to working standards and to reference the analysis of the standards. Logbooks will be completed by the appropriate analysts as they prepare standards and will be subject to supervisory review. At a minimum, working standards will be labeled with preparation data, and the number or designation of
the logbook where information on the standard is recorded. Measurements made during standards preparation will also be recorded.

11.3 Calibration Frequency

The frequency of instrument calibration will be according to the manufacturer’s instructions or the laboratories’ SOPs. Table 13 includes a summary of calibration requirements.
### Table 13: Summary of Laboratory and Field Calibration Requirements for Major Parameters

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>METHOD REFERENCE</th>
<th>CALIBRATION STANDARD AND FREQUENCY</th>
<th>ACCEPTANCE CRITERIA</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Metals</td>
<td>EPA 200.8/SW-846</td>
<td>Mass spectrometer tuning solution representing all of the mass regions of interest analyzed to verify that the resolution and mass calibration of the instrument are within required specifications.</td>
<td>Mass calibration must be no more than 0.1 atomic mass units (amu) from the true value. Peak resolution must also be verified to be less than 0.9 amu full width at 10 percent peak height. Four integrations (measurements) of tuning solution values must be within a relative standard deviation of 5 percent for the analytes contained in the tuning solution.</td>
<td>Mass calibration must be adjusted to the correct value.</td>
</tr>
<tr>
<td></td>
<td>6020A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-level initial calibration (LLICV) standard analyzed daily and at the end of each analysis batch.</td>
<td>All analytes measured values are within ±30 percent of the expected value.</td>
<td>Terminate the sequence, correct the problem, recalibrate the instrument, and reanalyze.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial calibration verification (ICV) immediately following daily calibration (using a second source standard).</td>
<td>Measured value within ±10 percent of the expected value.</td>
<td>Terminate the analysis, correct the problem, and recalibrate the instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial and Continuing Calibration blank (ICB and CCB) immediately following the daily calibration, after every 10th sample, and at the end of the analytical run.</td>
<td>Below the detection limit.</td>
<td>Terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the previous 10 samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuing calibration verification (CCV) immediately following the daily calibration, after every tenth sample, and at the end of the analytical run</td>
<td>Measured value within 10 percent of the expected value.</td>
<td>Terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the previous samples following the last acceptable CCV and CCB.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interference check sample (ICS) at the beginning of each analytical run or weekly after five consecutive daily analyses are within 20% of the expected value</td>
<td>Measured value within 20 percent of the expected value.</td>
<td>Terminate the analysis; determine and correct the cause of the change, update the interelement correction factor, and recalibrate the instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Mercury</td>
<td>EPA Method 1631 E</td>
<td>Initial Blanks (3 System blanks or 3 Bubbler blanks)</td>
<td>Bubbler blanks must contain &lt;50 pg Hg.</td>
<td>Terminate the analysis, correct the problem, reanalyze samples.</td>
</tr>
<tr>
<td>PARAMETER</td>
<td>METHOD REFERENCE</td>
<td>CALIBRATION STANDARD AND FREQUENCY</td>
<td>ACCEPTANCE CRITERIA</td>
<td>CORRECTIVE ACTION</td>
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<tr>
<td>-----------</td>
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</tr>
<tr>
<td>Total Mercury</td>
<td>EPA Method 1631 E</td>
<td>Five non-zero calibration standards. Lowest calibration point must be at the Minimum Level (ML) of 0.5 ng/L</td>
<td>Relative Standard Deviation (RSD) of calibration factors (CF) for all points must be ≤ 15%</td>
<td>If RSD ≤ 15%, calculate the recovery for the lowest standard using mean calibration factor (CFm). If the RSD ≤ 15% and the recovery of the lowest standard is in the range of 75-125%, the calibration is acceptable and CFm may be used to calculate the concentration of Hg in samples. If RSD &gt; 15% or if the recovery of the lowest standard is not in the range of 75-125%, recalibrate the analytical system and repeat the test.</td>
</tr>
<tr>
<td>Initial Precision and Recovery (IPR)</td>
<td>Recovery must be within 79 - 121%</td>
<td></td>
<td>Analyze four replicates of IPR solution. If outside of the acceptance range, correct problem, and repeat the test.</td>
<td></td>
</tr>
<tr>
<td>Method blanks analyzed after every three or four samples.</td>
<td>Bubbler blanks must contain &lt;50 pg Hg.</td>
<td></td>
<td>Terminate the analysis, correct the problem, reanalyze samples.</td>
<td></td>
</tr>
<tr>
<td>On-going precision and recovery (OPR) at beginning and end of each batch.</td>
<td>Recovery must be within 77 to 123%</td>
<td></td>
<td>If system is not in control, correct the problem, repeat ongoing precision and recovery test. If system performance is verified at the end of the sequence using the OPR, analysis of samples and blanks may proceed without recalibration, unless more than 12 hours has elapsed since verification of system performance.</td>
<td></td>
</tr>
<tr>
<td>PARAMETER</td>
<td>METHOD REFERENCE</td>
<td>CALIBRATION STANDARD AND FREQUENCY</td>
<td>ACCEPTANCE CRITERIA</td>
<td>CORRECTIVE ACTION</td>
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</tr>
<tr>
<td>Methyl Mercury</td>
<td>EPA Method 1630</td>
<td>Three method blanks (distillation blanks) with each analytical batch.</td>
<td>Mean blank value &lt; 0.045 ng/L methyl mercury. Variability should be &lt;0.015 ng/L methyl mercury.</td>
<td>Indicates problem with system and unacceptable for low level ambient analysis. Investigate and repeat analysis.</td>
</tr>
<tr>
<td>Methyl Mercury</td>
<td>EPA Method 1630</td>
<td>One Ethylation Blank after OPR and prior to samples. Used to blank correct standards.</td>
<td>Value must be &lt;2 pg methyl mercury.</td>
<td>Indicates problem with reagent water or solution. Investigate, make new batch of ethylation blank solution, repeat analysis.</td>
</tr>
<tr>
<td>Methyl Mercury</td>
<td></td>
<td>Five non-zero calibration standards. Lowest calibration point must be at the ML of 0.06 ng/L methyl mercury.</td>
<td>RSD of CF for all points must be ≤ 15 %</td>
<td>If RSD ≤ 15%, calculate the recovery for the lowest standard using CFm. If the RSD ≤ 15% and the recovery of the lowest standard is in the range of 75-125%, the calibration is acceptable and CFm may be used to calculate the concentration of Hg in samples. If RSD &gt; 15% or if the recovery of the lowest standard is not in the range of 75-125%, recalibrate the analytical system and repeat the test.</td>
</tr>
<tr>
<td>IPR</td>
<td></td>
<td>Recovery must be within 69 -131 %</td>
<td>RSD must be within 31 %</td>
<td>Analyze four replicates of IPR solution. If outside of the acceptance range, correct problem, and repeat the test.</td>
</tr>
<tr>
<td>Method blanks analyzed after every three or four samples.</td>
<td></td>
<td>Bubbler blanks must contain &lt;50 pg Hg.</td>
<td></td>
<td>Terminate the analysis, correct the problem, reanalyze samples.</td>
</tr>
<tr>
<td>OPR at beginning and end of each batch (within 12-hours).</td>
<td></td>
<td>Recovery must be within 67 to 133 %</td>
<td></td>
<td>If system is not in control, correct the problem, repeat ongoing precision and recovery test.</td>
</tr>
<tr>
<td>PARAMETER</td>
<td>METHOD REFERENCE</td>
<td>CALIBRATION STANDARD AND FREQUENCY</td>
<td>ACCEPTANCE CRITERIA</td>
<td>CORRECTIVE ACTION</td>
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</tr>
<tr>
<td>Methyl Mercury</td>
<td>EPA Method 1630</td>
<td>Spectrophotometer Performance Check standard is analyzed to demonstrate performance of spectrophotometer.</td>
<td>Reading must be within 10 percent of the expected absorbance value.</td>
<td>If system performance is verified at the end of the sequence using the OPR, analysis of samples and blanks may proceed without recalibration, unless more than 12 hours has elapsed since verification of system performance.</td>
</tr>
<tr>
<td>Total Organic Carbon</td>
<td>EPA Method 415.3</td>
<td>Initial five point calibration verification with low standard defining the minimum reporting limit (RL).</td>
<td>Measured value within ± 10 percent of the expected value.</td>
<td>Terminate the analysis, correct the problem, and recalibrate the instrument.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCV after every tenth sample, and at the end of the analytical run.</td>
<td>Measured value within 15 percent of the expected value.</td>
<td>Terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the previous 10 samples.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICB and CCB immediately following the daily calibration, after every 10th sample, and at the end of the analytical run.</td>
<td>Below the detection limit.</td>
<td>Terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the previous 10 samples.</td>
</tr>
<tr>
<td>Major Anions – Chloride, Sulfate, Nitrate-N</td>
<td>EPA 300.1</td>
<td>Initial Calibration Standards, 5 calibration standards for each analyte (one at lower and one at upper range of each analyte).</td>
<td>Within 85 to 115 percent accuracy.</td>
<td>Terminate the analysis, correct the problem, and recalibrate the instrument.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initial Calibration Check Standard, daily</td>
<td>Within 85 to 115 percent.</td>
<td>Terminate the analysis, correct the problem, and recalibrate the instrument.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuing Calibration Check Standard, after every 10 samples.</td>
<td>Within 85 to 115 percent.</td>
<td>Terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the previous 10 samples.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End Calibration Check Standard, after last field sample.</td>
<td>Within 85 to 115 percent.</td>
<td>Terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the previous samples after last calibration standard within acceptance criteria.</td>
</tr>
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</table>
Table 13: Summary of Laboratory and Field Calibration Requirements for Major Parameters

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<tr>
<th>PARAMETER</th>
<th>METHOD REFERENCE</th>
<th>CALIBRATION STANDARD AND FREQUENCY</th>
<th>ACCEPTANCE CRITERIA</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory Reagent blank, with each batch of samples.</td>
<td></td>
<td>Below the detection limit.</td>
<td>Terminate the analysis, correct the problem, and reanalyze the samples.</td>
<td></td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>EPA 310.1/SM 2320B</td>
<td>Standardize pH meter using standard buffer solutions, or electrically operated titrator according to manufacturer’s instructions, daily. Calculate normality of standard acids (0.1N or 0.02N) by potentiometric titration with Na₂CO₃.</td>
<td>Expected amount of Na₂CO₃ for normality of standard acid. pH readings within 0.05 pH units.</td>
<td>Repeat titration. Make fresh reagents.</td>
</tr>
<tr>
<td>Turbidity</td>
<td>EPA 180.1</td>
<td>Measure standards on the turbidimeter covering range of interest.</td>
<td>At least one standard should be run in each instrument range to be used. Turbidities exceeding 40 units, dilute with turbidity-free water.</td>
<td>Recalibrate the instrument.</td>
</tr>
<tr>
<td>TSS, TDS</td>
<td>EPA 160.1, 160.2</td>
<td>Gravimetric. Drying oven, 180° C.</td>
<td>Oven temperature should be verified to within ± 2° C. Analytical balance calibrated and capable of weighing to 0.1 mg</td>
<td>Recalibrate the instrument.</td>
</tr>
<tr>
<td>Hardness</td>
<td>SM2340/EPA 200.8</td>
<td>Calculation method, sum of calcium and magnesium concentrations, expressed as calcium carbonate.</td>
<td>See metals</td>
<td>See metals</td>
</tr>
<tr>
<td>pH (field)</td>
<td>EPA 150.1</td>
<td>Calibrate using 3 pH buffer standard solutions, daily.</td>
<td>Within 0.05 pH unit</td>
<td>Rinse electrode, repeat. Replace with fresh buffer solutions.</td>
</tr>
<tr>
<td>ORP (field)</td>
<td>SM2580 AB</td>
<td>Follow manufacturer’s instructions for calibration.</td>
<td>Follow manufacturer’s instructions.</td>
<td>Follow manufacturer’s instructions.</td>
</tr>
<tr>
<td>Dissolved Oxygen (field)</td>
<td>EPA 360.1</td>
<td>Follow manufacturer’s instructions.</td>
<td>Follow manufacturer’s instructions.</td>
<td>Follow manufacturer’s instructions.</td>
</tr>
<tr>
<td>Conductivity (SC) (field)</td>
<td>EPA 120.1</td>
<td>Measure 0.01 M KCl solution, daily. Reading at 25 C is 1413 µmho/cm, adjusted for temperature.</td>
<td>Within 10 µmho</td>
<td>Correct for temperature. Repeat. Replace KCl solution.</td>
</tr>
</tbody>
</table>

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12.0 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All purchased supplies and consumables that support field monitoring and sampling activities or that have a direct relationship to sample quality (e.g. sample containers, decontamination supplies, distilled/de-ionized water) will be inspected upon receipt. At a minimum this inspection will check:

- Part number/physical description matches requisition;
- Supplies are intact and undamaged;
- All required components/documentation is included; and,
- Any non-conforming items will be documented and returned to the supplier for replacement, rework or other action as necessary.
13.0 NON-DIRECT MEASUREMENTS (EXISTING DATA)

All existing data has been summarized in the Phase I Environmental Site Assessment Plymouth Mine Middletown, California (Burleson, 2017c).

14.0 DATA MANAGEMENT

14.1 Field Data Verification and Reporting

Field data will be recorded in field logbooks as the measurements are taken. Integrity of daily field instrument calibrations will be performed by the field staff and/or the Field Manager according to the instrument calibration procedures provided by the equipment manufacturer. The field instrument QC measurements will be reviewed to assure the accuracy and precision of the field screening measurements. As a standard QC procedure, the field staff and/or field coordinator will conduct verification of field data calculations and documentation entries. Prior to entry into the database, field data will be screened to ensure that no transcription errors occurred.

14.2 Laboratory Data Verification/Validation

Any anomalies or limitations for the use of the data will be documented as part of the laboratory’s analytical data packages. The laboratories will establish calibration curves and calculation of sample concentrations from instrument responses. Raw laboratory data will be converted to sample concentrations using formulas defined by applicable laboratory SOPs. The calculations will be performed by computerized data systems interfaced to the instruments by personnel calculators, or through programs installed on stand-alone personnel computers. Each laboratory analyst will be responsible for the reduction of the raw data that they generate. At a minimum, such activities will include:

- Reduction of raw data generated to reportable values;
- An initial review of analytical and QC data;
- Performance of manual calculations and transfer of data onto forms, laboratory reports, and laboratory databases;
- Preparation of computer files for instrumental calculations;
- Generation of data forms for the analytical reports;
- Copying of relevant forms and logs for inclusion in the laboratory reports;
- Submittal of the laboratory report to a supervisor for a QA/QC review; and
- Resolution of discrepancies noted during the QA/QC review.

For non-instrument methods and for methods using instruments without computerized data systems that require manual calculations, the responsible analyst will enter bench-generated data into bound laboratory workbooks with form-specific instrument responses, standard and spike concentrations, sample numbers, and other pertinent information. For instruments that are directly coupled to computerized data systems, raw data consist of instrument responses in the form of printer output or computer-generated data files. Printer output will be filed by sample batch, and the data files archived on disk or magnetic tape. Computer data files will be identified by unique, sequential descriptors cross-
referenced in the run logs to the analysis sequence. At a minimum, strip chart recordings will be labeled with the following information:

- Sample identification number;
- Date and time of analysis;
- Instrument identification;
- Name of analyst(s);
- Applicable operational parameters;
- Date file identification; and
- Positively identified elements or compounds.

Completed analytical packages (hard copies and EDDs) for each sampling round will be routed to the QA Officer for evaluation and preparation of reports. All data will be screened to ensure that data packages are complete and do not contain any obvious entry errors; any observed problems will be referred to the affected laboratory for resolution. At a minimum, the screening process will verify:

- COC forms were properly maintained from the field, to the laboratory, and through all analytical procedures;
- Laboratory reports are complete and contain no transcription errors or omissions;
- Holding time requirements were met;
- Method blanks met method requirements; and
- Quantitation limits did not exceed established values.

**14.3 Data Storage and Retrieval**

Data collected at the site must be in accordance with the QAPP, from sample collection in the field to data quality evaluation and data entry. Each entity collecting and analyzing data is responsible for its own data quality.
15.0 DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

15.1 Data Review and Verification Requirements

Data review is the laboratory in-house examination to ensure that the data have been processed correctly. Data verification refers to the routine checks that the field sampling coordinator or project QA officer, or laboratory staff, conduct in ensuring that the sampling plan and QAPP was followed, as applicable.

At a minimum, data verification will include evaluation of sampling documentation/ representativeness, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, method QC sample results, field duplicates and the presence of any elevated detection limits. The output of data verification includes the verified data package from the laboratory with any applicable laboratory qualifiers. In addition, the lab will provide hard copies of the data with supporting laboratory quality assurance documentation.

15.2 Validation Methods

Data validation refers to the confirmation by independent examination of the data and provides objective evidence that the analytical method-specific and sample-specific procedures were followed by the laboratory and met the particular requirements for the intended use of data. Data validation methodology will differ according to the project’s DQOs. At a minimum, the following items are addressed as part of a cursory data validation process:

- Chain-of-custody forms and laboratory data sheets will be checked to verify that appropriate analyses were run and that the samples were analyzed within specified holding times;
- Review of duplicate, matrix spikes, and blank samples will be used to evaluate method precision and accuracy by the laboratory;
- An overall review of the sample delivery group will be conducted to evaluate the overall quality of the data. Included will be a review for potential transcription errors, detection limit discrepancies, data omissions and suspect or anomalous values; and
- Field data will be reviewed. Anomalous or suspect values will be noted and an explanation provided.

The analytical laboratory that generates the data will be responsible for in-house validation of the results. Laboratory validation checklists for inorganic analyses have been developed for implementation by the laboratory, as indicated in Table 14. The minimum output of data validation activities is a set of validated data with any additional qualifiers and a data validation report summarizing the findings of the data validation. An example of laboratory data flags and qualifiers for inorganic data is included in Table 14. Each laboratory uses their unique set of data qualifiers and QA flags or codes to indicate non-conformance issues.
Table 14: Definitions of Data Flags and Qualifiers for Inorganic Data

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
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</thead>
<tbody>
<tr>
<td><strong>Laboratory Flag(^a)</strong></td>
<td></td>
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<tr>
<td>N</td>
<td>Laboratory spike sample results outside control limits</td>
<td>--</td>
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<tr>
<td>*</td>
<td>Laboratory duplicate results outside control limits</td>
<td>--</td>
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<tr>
<td>E</td>
<td>Sample results qualified because of interference (graphite furnace atomic absorption)</td>
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<td></td>
<td>[GFAA] analytical spike or inductively coupled plasma [ICP] serial dilution</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Duplicate injection precision for GFAA analysis outside control limits</td>
<td>--</td>
</tr>
<tr>
<td>W</td>
<td>Post-digestion spike for GFAA outside control limits</td>
<td>--</td>
</tr>
<tr>
<td>+</td>
<td>Correlation coefficient for Method of Standard Additions (MSA) for GFAA less than 0.995</td>
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</tr>
<tr>
<td>S</td>
<td>The reported value was determined by MSA</td>
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</tr>
<tr>
<td></td>
<td><strong>1.1.1.1.1 Qualifier</strong></td>
<td></td>
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<tr>
<td>R(^b)</td>
<td>Rejected</td>
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</tr>
<tr>
<td>U(^b)</td>
<td>Undetected</td>
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<tr>
<td>J(^b)</td>
<td>Estimated</td>
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16.0 VERIFICATION AND VALIDATION METHODS

16.1 Data Validation Reports

After completing data validation review for a specific analysis type or group of analyses, the review will be summarized in a narrative report that addresses data quality, usability and acceptability in terms of the QAPP requirements. The validation report will be provided to the QA Officer for review in the format of a technical memorandum addressing the following items:

**Introduction:** This section of the memorandum will provide a short introduction to the project and outlines investigation objectives, DQOs, data quality assessment results, investigation site description, and sampling and analysis summary.

**Task and Project Location Name:** This section will identify the specific work plan under which the data have been collected and describe the specific project task. Sampling methods will be outlined and the appropriate QAPP referenced. Analytical results will be summarized and data summary tables included.

**Calculations:** This section of the memorandum will include the procedures used for calculations (if any) and a table indicating the results will be included.

**Deviations and Anomalies:** Any deviations from the approved QAPP or sampling plan will be listed and include a discussion of the usability of the data.

16.2 Corrective and Preventative Action

Corrective action and preventive action is required in response to a nonconformance. A nonconformance is defined as a potential or existing condition that may have an adverse impact on data quality. A nonconformance may be observed during routine project work or during any assessment process. Corrective and preventive action is applicable to both the field and laboratory procedures. In general, any member of the project team who identifies a nonconformance can initiate a corrective and preventive action.

The corrective and preventive action process is designed to identify, correct, and prevent or reduce the likelihood of recurrence of any nonconformance. The process consists of the following steps:

- Identify the problem constituting the potential nonconformance;
- Communicate the problem to the QA Officer, identifying the source of the quality requirement that has not been followed, applicable SOP, laboratory QA/QC procedure, applicable section of QAPP, as well as a description of the nonconformance;
- Project personnel assist in identifying the root cause of the nonconformance and identifying appropriate corrective actions as well as preventive actions;
- QA Officer and Project Manager approve proposed corrective and preventive actions and ensure that they are assigned to appropriate personnel with achievable deadlines;
- Assigned personnel (or external laboratory staff) implement actions and confirm completion;
- The QA Officer verifies completion and verifies that the actions taken were effective; and
- Any impact on data quality that was unable to be corrected must be noted in the data or relevant report.

The resolution of all quality issues will be documented in an internal memo or e-mail under the direction of the QA Officer and retained in the monitoring program records.

### 16.3 Reconciliation with User Requirements

All data quality issues concerning field sampling efforts, laboratory analysis, data validation, and data reporting will be reviewed by the QA Officer. A data quality assessment will be performed by each entity responsible for using the data to determine whether data generated are consistent with the investigation DQOs for each task. Specific issues to be reviewed include conformance with data quality requirements and overall data completeness, and SWAMP compatibility. Also, if data are found to deviate significantly (several orders of magnitude) from previous analyses or surrounding conditions upon which the sampling program was based, the data may be qualified based on the validator’s assessment of the usability of the data for the intended end uses.
17.0 REFERENCES


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Title Page:

Quality Assurance Manual
Approval Signatures

Laboratory Director – Chris Dojlidko

Date 05/12/2017

Quality Manager - Melissa Brewer

Date 05/12/2017
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<td>SF-QA-1700</td>
<td>Training Program (However Named, Sec. 17.3, 19.4.2)</td>
</tr>
<tr>
<td>SF-QA-1218</td>
<td>MDLs (Sec. 19.7)</td>
</tr>
<tr>
<td>SF-QA-1305</td>
<td>Thermometers (Sec. 9.5, 20.3.3)</td>
</tr>
<tr>
<td>SF-QA-0725</td>
<td>Subsampling (Section 22.5)</td>
</tr>
<tr>
<td>SF-SC-0202</td>
<td>Sample Receipt and Login Procedures (Sec. 23.2, 23.3.2)</td>
</tr>
<tr>
<td>SF-QA-1900</td>
<td>Sample Disposal (Sec. 23.7)</td>
</tr>
</tbody>
</table>
SECTION 3.  INTRODUCTION, SCOPE AND APPLICABILITY

3.1  Introduction and Compliance References

TestAmerica Pleasanton’s Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica’s data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance. In addition, the policies and procedures outlined in this manual are compliant with TestAmerica’s Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica’s quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- Toxic Substances Control Act (TSCA).

3.2  Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3  Scope / Fields of Testing
The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 3. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab’s best interest to follow the less stringent requirements.
3.4   Management of the Manual

3.4.1   Review Process
The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed every two years by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory’s clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (refer to SOP No. SF-QA-1203).

Laboratory-specific QAM changes are approved and documented through the laboratory’s Management of Change process (SOP No. CA-Q-S-003).

SECTION 4. MANAGEMENT REQUIREMENTS

4.1   Overview
TestAmerica Pleasanton is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President and Chief Executive Officer (CEO), Chief Operating Officer (COO), Executive Vice President (VP) Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Pleasanton is presented in Figure 4-1.

4.2   Roles and Responsibilities
In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1   Additional Requirements for Laboratories
The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory’s SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica’s Pleasanton laboratory.

4.2.2   Laboratory Director
TestAmerica Pleasanton’s Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective VPO. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.

- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.

- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.

- Ensures TestAmerica’s human resource policies are adhered to and maintained.

- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.

- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.

- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.

- Pursues and maintains appropriate laboratory certification and contract approvals.

- Ensures client specific reporting and quality control requirements are met.

- Captains the management team, consisting of the QA Manager, the Technical Manager(s), Supervisors, Environmental Health and Safety Coordinator, and the Operations Manager as direct reports.

4.2.3 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:
• Serves as the focal point for QA/QC in the laboratory.
• Having functions independent from laboratory operations for which he/she has quality assurance oversight.
• Maintaining and updating the QAM.
• Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
• Monitoring and communicating regulatory changes that may affect the laboratory to management.
• Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
• Have documented training and/or experience in QA/QC procedures and the laboratory’s Quality System.
• Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
• Arranging for or conducting internal audits on quality systems and the technical operation.
• The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
• Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
• Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
• Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
• Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
• Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, evaluate manual calculations, format, holding time, sensibility and completeness of the project file contents.
• Review of external audit reports and data validation requests.
• Follow-up with audits to ensure client QAPP requirements are met.
• Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
• Development of suggestions and recommendations to improve quality systems.
• Research of current state and federal requirements and guidelines.
• Captains the QA team to enable communication and to distribute duties and responsibilities.
• Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
• Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.

• Evaluation of the thoroughness and effectiveness of training.

4.2.4 **Technical Manager or Designee**

The Technical Managers report directly to the Laboratory Director. At the Pleasanton laboratory, the technical manager responsibilities are assigned to the Department Supervisors. He/she is accountable for all analyses and analysts under their experienced. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

• Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i.e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insure that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.

• Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory’s capability and resources, the client’s expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.

• Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.

• Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.

• Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.

• Coordinating sample management from “cradle to grave,” insuring that no time is lost in locating samples.
• Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
• Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
• Coordinates audit responses with the QA Manager.

4.2.5 **Employee Health & Safety Coordinator**

The Employee Health & Safety Coordinator reports directly to the Laboratory Director. The duties consist of:

• Staying current with the hazardous waste regulations.
• Continuing training on hazardous waste issues.
• Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
• Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.
• Conduct ongoing, necessary safety training and conduct new employee safety orientation.
• Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
• Administer dispersal of all Material Safety Data Sheet (MSDS) information.
• Perform regular chemical hygiene and housekeeping instruction.
• Give instruction on proper labeling and practice.
• Serve as chairman of the laboratory safety committee.
• Provide and train personnel on protective equipment.
• Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
• Supervise and schedule fire drills and emergency evacuation drills.
• Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
• When determined necessary, conduct exposure monitoring assessments.
• Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
• Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.2.6 **Waste Disposal Technician**

The Waste Disposal Technician is responsible for proper disposal of spent chemicals, process waste, and unused laboratory samples used in the laboratory according to corporate, federal,
state, and local guidelines. The Waste Disposal Technician reports to the Hazardous Waste Specialist and EH&S Coordinator. The duties consist of:

- Packaging hazardous waste for transport per DOT, RCRA and TSCA guidelines
- Identifying waste streams and maintaining satellite accumulation areas
- Packages expired chemicals for shipment or disposal
- Tracks volume of waste generated for reporting to corporate and EPA
- Prepares and tracks implementation of the Waste Minimization Plan
- Empties satellite containers into bulk containers and returns to the laboratory for reuse

### 4.2.7 Supervisors

Supervisors report to the Laboratory Director. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.

- With regard to analysts, participates in the selection, training (as documented in Section 8.1), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.

- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.

- Ensure all logbooks are maintained, current, and properly labeled or archived.

- Report all non-conformance conditions to the QA Manager, Technical Manager, Operations Manager, and/or Laboratory Director.

- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.

- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.

- Achieve optimum turnaround time on analyses and compliance with holding times.

- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs.
demonstrated), second- and third-generation production techniques/instruments, and long-
term needs for budgetary planning.

- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.8 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He reports directly to the Laboratory Director. He assists the Supervisors in determining the most efficient instrument utilization. More specifically, he:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the QA Manager and in compliance with regulatory requirements.
- Works with the Supervisors to ensure that scheduled instrument maintenance is completed.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.9 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
• Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.10 Laboratory Technicians

Laboratory Technicians are responsible for the preparation of samples and performing all tasks assigned to them by the group leader or supervisor. The Laboratory Technician position at TestAmerica Pleasanton is divided into three levels. These levels are Laboratory Technician I, Laboratory Technician II, and Laboratory Technician III. The level designation is based on experience, expertise, and responsibilities. The responsibilities of the Laboratory Technician are listed below:

• Retrieving samples from Sample Control for analysis
• Performing sample preparation by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
• Documenting standard and sample preparation, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database
• Report all non-conformance situations, sample preparation problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or Laboratory Director.

Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.11 Sample Control Manager

The Sample Control Manager reports to the Laboratory Director. The responsibilities are outlined below:

• Direct the logging of incoming samples into the LIMS.
• Ensure the verification of data entry from login.
• Provide daily assessments of sample receipts.
• Monitor the preparation and shipment of bottle kits to clients.
• Oversee the receipt, log in, and storage of samples.
• Schedules couriers for sample pickup from customer sites.
• Maintain the inventory control system.
• Maintain bottle and cooler inventory.
4.2.12 Sample Control Technician

The Sample Control Technician reports to the Sample Control Manager. The Sample Control Technician position at TestAmerica Pleasanton is divided into levels. These levels range from Sample Control Technician I to Sample Control Technician IV. The level designation is based on experience and responsibilities of the Technician. The Sample Control Technician responsibilities include the following:

- Receive and unload samples or consignments in accordance with DOT regulations
- Verify samples against the Chain of Custody (COC)
- Log in sample into the LIMS to assign a lot number for tracking purposes and distribute the paperwork to the Project Managers and Department Managers
- Label samples with lot number assigned and deliver the samples to the appropriate labs for analysis daily
- Monitor freezer and cooler temperatures daily to confirm that the readings are within SOP guidelines
- Packing in-house samples for shipment to other laboratories
- Ship all subcontracted samples to designated lab in accordance with DOT regulations as needed
- Receiving and distributing incoming supplies
- Preparing and shipping bottle sampling kits to clients or on-site crews

4.2.13 Courier

The Courier reports to the Sample Control Manager. The Courier’s duties include the following:

- Picking up and delivering samples and reports to clients and the laboratory
- Receiving and signing the chain of custody for samples
- Preparing and shipping bottle sampling kits to clients or on-site crews
- Performing preventative maintenance on company vehicles
- Preparing and shipping bottle sampling kits to clients or on-site crews
- Packing in-house samples for shipment to other laboratories

4.2.14 Manager of Project Management

The Manager of Project Management reports to the Director of Client Services and serves as the interface between the laboratory’s technical departments and the laboratory’s clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team
- Technical liaison for the Project Management team
- Human resource management of the Project Management team
4.2.15 **Project Manager (PM)**

The PM reports to the Manager of Project Management (MPM) and serves as the interface between the laboratory’s technical departments and the laboratory’s clients. There is an entire staff of Project Managers that makes up the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Responsible for ensuring that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with clients any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).
4.2.16 **Project Manager Assistant**

The Project Management Assistant reports to the Manager of Project Management (MPM) and designated Project Manager. The Project Management Assistant assists the Project Manager in servicing the client’s needs and communicating those needs to the laboratory. The Project Management Assistant’s responsibilities include:

- Collating data reports, expanded deliverables, data packages and electronic data deliverables (EDD’s) for delivery to clients.
- Writing case narratives accompanying data packages to communicate anomalies to clients
- Entering data from subcontracted laboratories
- Proof reading and filing data reports received from the laboratory
- Assisting Project Managers in changing compound lists, TAT, and setting up tables in Word or Excel
- Monitoring report due dates for timely delivery
- Generating credit or debit invoices to ensure proper payment

4.3 **Deputies**

The following table defines who assumes the responsibilities of key personnel in their absence:

<table>
<thead>
<tr>
<th>Key Personnel</th>
<th>Deputy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chris Dojlidko Laboratory Director</td>
<td>Carl Monforte Operations Manager</td>
</tr>
<tr>
<td>Melissa Brewer Quality Manager</td>
<td>Carl Monforte Operations Manager</td>
</tr>
<tr>
<td>Carl Monforte Operations Manager</td>
<td>Chris Dojlidko Laboratory Director</td>
</tr>
<tr>
<td>Bryan Thomas EHS Coordinator</td>
<td>Chris Dojlidko Laboratory Director</td>
</tr>
<tr>
<td>Jill Kellmann Manager of Project Management</td>
<td>Afsaneh Salimpour Project Manager</td>
</tr>
</tbody>
</table>
Figure 4-1. Corporate and Laboratory Organization Charts
Pleasanton Laboratory Organization

Fred Haley
Vice President Operations

Joe Schermer
EHS Manager Corporate

Chris Dolakio
Laboratory Director

Michelle Prasad
HR Manager - West Region & EHS

David Herbert
Client Services Director

Melissa Brewer
QA Manager

Bryan Thomas
Health & Safety

Carl Mentores
Operations Manager

Dana Rowden
Environmental

Tara Tiffany
Chemistry Lab Prep

Bijay Lahiri
QC/MS VQA

Cesar Hayashi
QC/MS VQA

Josh Mullen
Sample Control & Field Services

Will Hefner
Manager of Project Management

Project Managers
Jim Kasko
Evan Jones
Nate Harlow

PMT Assistant
David Copeland
Charli Coelho

Note: QA Manager and EHS Manager have a direct reporting relationship to both operations leadership and corporate functional leadership.

Effective 05/10/17

Company Confidential & Proprietary
SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica’s Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.

- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.

- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management’s commitment and support as well as the involvement of the entire staff.

- Provide clients with the highest level of professionalism and the best service practices in the industry.

- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica’s Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002).
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-Q-S-005).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
• Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
• Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
• Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
• Educate clients as to the extent and kinds of services available.
• Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
• Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation
The laboratory’s Quality System is communicated through a variety of documents.
• Quality Assurance Manual – Each laboratory has a lab-specific quality assurance manual.
• Corporate SOPs and Policies – Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory’s normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
• Work Instructions – A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
• Laboratory SOPs – General and Technical
• Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence
In the event of a conflict or discrepancy between policies, the order of precedence is as follows:
• Corporate Quality Management Plan (CQMP)
• Corporate SOPs and Policies
• Laboratory Quality Assurance Manual (QAM)
• Laboratory SOPs and Policies
• Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory’s QAM shall take precedence over the CQMP in those cases.
5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term “analytical quality control”. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the
procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to those quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).
5.5 Criteria for Quality Indicators

The laboratory maintains a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for performed analyses. The effective date in TALS is updated each time new limits are created. Control limit tracking and updates are managed by the laboratory’s QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in Section 24.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory under the Control Chart Logs. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated showing warning and control limits for the purpose of evaluating trends. The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file.
5.7 **Quality System Metrics**

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

**SECTION 6. DOCUMENT CONTROL**

6.1 **Overview**

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. SF-QA-1203.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 **Document Approval and Issue**

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.
Controlled documents are authorized by the QA Department. In order to develop a new document, a department manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 Procedures for Document Control Policy

For changes to the QA Manual, refer to SOP No. SF-QA-1203. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in the QA folder for the applicable revision.

For changes to SOPs, refer to SOP No. CW-Q-S-002, Writing a Standard Operating Procedure SOP. The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions and information are organized by department in the QA electronic files. The procedure for the care of these documents is in SOP SF-QA-1203.

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. SF-QA-1203.

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory’s capability and resources to meet the contract’s requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily “fit” into a standard laboratory service or product. It is the laboratory’s intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab’s capability to perform them must be established. Projects, proposals and contracts are reviewed for
adequately defined requirements and the laboratory’s capability to meet those requirements. Alternate test methods that are capable of meeting the clients’ requirements may be proposed by the lab. A review of the lab’s capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client’s requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory’s test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory’s equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory’s capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client’s requirements and the laboratory’s capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.
7.2 **Review Sequence and Key Personnel**

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients’ data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica’s Corporate SOP No. CA-L-P-002, Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contract Administrator
- VP of Operations
- Laboratory Project Manager
- Laboratory Directors and/or Corporate Technical Managers
- Laboratory Directors and/or Corporate Information Technology Managers
- Account Executives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The **Sales Director, Contract Administrator, Account Executive or Proposal Coordinator** then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts, as well as electronic copies maintained on the Public server by the laboratory’s Project Manager Assistant.
7.3 **Documentation**

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. This information is archived with the lab’s Project Manager Assistant.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the Laboratory Director.

Records are maintained of pertinent discussions with a client relating to the client’s requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client.

### 7.3.1 **Project-Specific Quality Planning**

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM’s responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM’s are the primary client contact and they ensure resources are available to meet project requirements. Although PM’s do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client’s project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during production meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).
The laboratory strongly encourages client visits to the laboratory for formal/informal information sharing sessions with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory’s performance in relation to work performed for the client. It is the laboratory’s goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

The laboratory’s standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client’s contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

The Technical Manager and Department Manager are available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica’s Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase “work sharing” refers to internal transfers
of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because of project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica’s Corporate SOP’s on Subcontracting Procedures (CW-L-S-004) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document and the requirements specified the client’s Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client’s analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report.

Project Managers (PMs), Client Relationship Managers or Account Executives (AE) (or others as defined by the lab) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract arrangement in writing and when possible approval from the client shall be retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

**Note:** In addition to the client, some regulating agencies (e.g., USDA) or contracts (e.g., certain USACE projects) may require notification prior to placing such work.

### 8.2 Qualifying and Monitoring Subcontractors

Whenever a PM [or Account Executive (AE) or Client Relationship Manager, etc.] becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- **Subcontractors specified by the client** - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.

- **Subcontractors reviewed by TestAmerica** – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.

A listing of vendors is available on the TestAmerica intranet site.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that
the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

8.2.1 When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Client Relations Manager (CRM) or Laboratory Director. The CRM or Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CW-L-S-004, Subcontracting Procedures.

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. After the Corporate QIM reviews the documents for completeness, the information is forwarded to the Finance Department for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractors on our approved list can only be recommended to the extent that we would use them.

8.3 Oversight and Reporting

8.3.1 The status and performance of qualified subcontractors will be monitored by the Corporate Quality department. Any problems identified will be brought to the attention of TestAmerica’s Corporate Finance, Legal and Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor’s file on the intranet site. Complaints are posted using the Vendor Performance Report.

- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing will be retained on the intranet listing. CSO personnel will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers and Sales Personnel.

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it’s current and scope-inclusive. The information is documented within the project records.
8.3.2 For continued use of a subcontractor, verification of certification is placed upon the subcontractor for the defined project. Samples are subcontracted under Chain of Custody with the program defined as ‘Accreditation Required’ and the following statement for verification upon sample receipt:

**Note:** Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under Chain of Custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analytes/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

For TestAmerica laboratories, certifications can be viewed on the company’s TotalAccess Database.

8.3.3 All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor’s report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

**Note:** The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The full qualification of a subcontractor may be waived to meet emergency needs; however, this decision & justification must be documented in the project files, and the ‘Purchase Order Terms And Conditions For Subcontracted Laboratory Services’ must be sent with the samples and COC.

In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation
requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time.

The use of any emergency subcontractor will require the PM to complete a JDE New Vendor Add Form in order to process payment to the vendor and add them to TALS. This form requires the user to define the subcontractor’s category/s of testing and the reason for testing.
SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica’s Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica’s Company-Wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP’s) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica’s Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP’s allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica’s Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst completes the Material Request Sheet when requesting reagents, standards, or supplies. The analyst must provide the master item number (from the master item list that has been approved by the Technical Manager, item description, package size, catalogue page number, and the quantity
needed. If an item being ordered is not the exact item requested, approval must be obtained from the Technical Manager prior to placing the order. The purchasing manager (the laboratory’s Administrative Assistant) places the order.

9.3.2 Receiving

It is the responsibility of Sample Receiving and the purchasing manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date materials were received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. This is documented through the addition of the received date and initials to the information present on the daily order log.

The purchasing manager verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared “public” folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company’s intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer’s expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer’s or SOPs expiration date unless ‘verified’ (refer to item 3 listed below).

- An expiration date cannot be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained in the QA Validation Folder.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1 - µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water’s specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified “clean” by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer’s certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.
9.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica’s Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the QA Department. Software certificates supplied by the vendors are filed with the QA Manager. The manufacturer’s operation manual is retained at the bench.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Department Managers and Laboratory Director.

Analytical balances are serviced and calibrated annually in accordance with SOP SF-QA-1305. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor’s services, the vendor’s accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the certification certificates. The equipment is then returned to service within the laboratory.

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items.
of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors.

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10.  COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures ‘client knowledge’ that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted
discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following SOP SF-QA-1201.
10.2 **External Complaints**

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to (SOP SF-QA-1201).

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 **Internal Complaints**

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 **Management Review**

The number and nature of client complaints is reported by the QA Manager to the laboratory and Quality Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

**SECTION 11. CONTROL OF NON-CONFORMING WORK**

11.1 **Overview**

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory’s corrective action system (refer to Section 12).
Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director and QA Manager, documented and included in the project folder. Deviations must also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run.

11.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory’s corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Technical Managers. The reporting of issues involving alleged violations of the company’s Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO) (e.g., the VP-QA/EHS) and the laboratory’s Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, VP of Operations and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken
For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company’s ethics policy.

Laboratory level decisions are documented and approved using the laboratory’s standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica’s Corporate SOP No. CW-Q-S-005.

11.4 Prevention of NonConforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory’s corrective action system. Periodically, as defined by the laboratory’s preventive action schedule, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory’s corrective action process may be followed.

11.5 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for
viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory’s ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview
A major component of TestAmerica’s Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory’s system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1).

12.2 General
Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
• Client complaints

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

• Questionable trends that are found in the review of NCMs
• Issues found while reviewing NCMs that warrant further investigation
• Internal and external audit findings
• Failed or unacceptable PT results.
• Corrective actions that cross multiple departments in the laboratory.
• Systematic reporting / calculation errors
• Client complaints
• Data recall investigations
• Identified poor process or method performance trends
• Excessive revised reports
• Health and Safety violations

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

• Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
• The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
• If the cause is not readily obvious, the Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

• Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
• Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
• Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the root causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the root cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

• The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.

• Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.

• Each NCM and CAR is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.

• TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local database [name of local system here] served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client
service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.

- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.

- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory’s compliance with its own policies and procedures, or on its compliance with state or federal requirements.

- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.
12.5 **Basic Corrections**

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Corrective Action Report
<table>
<thead>
<tr>
<th>QC Activity (Individual Responsible for Initiation/Assessment)</th>
<th>Acceptance Criteria</th>
<th>Recommended Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Instrument Blank (Analyst)</td>
<td>Instrument response &lt; MDL.</td>
<td>- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..</td>
</tr>
<tr>
<td>Initial Calibration Standards (Analyst, Technical Manager(s))</td>
<td>Correlation coefficient &gt; 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.</td>
<td>- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.</td>
</tr>
<tr>
<td>Independent Calibration Verification (Second Source) (Analyst, Technical Manager(s))</td>
<td>% Recovery within control limits.</td>
<td>- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.</td>
</tr>
<tr>
<td>Continuing Calibration Standards (Analyst, Data Reviewer)</td>
<td>% Recovery within control limits.</td>
<td>- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.</td>
</tr>
<tr>
<td>Matrix Spike / Matrix Spike Duplicate (MS/MSD) (Analyst, Data Reviewer)</td>
<td>% Recovery within limits documented in the LIMS.</td>
<td>- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.</td>
</tr>
<tr>
<td>QC Activity (Individual Responsible for Initiation/Assessment)</td>
<td>Acceptance Criteria</td>
<td>Recommended Corrective Action</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>---------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Laboratory Control Sample (LCS) (Analyst, Data Reviewer)</td>
<td>% Recovery within limits specified in the LIMS.</td>
<td>Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. <strong>Note:</strong> If there is insufficient sample or the holding time cannot be met, contact client and report with flags.</td>
</tr>
<tr>
<td>Surrogates (Analyst, Data Reviewer)</td>
<td>% Recovery within limits of method or within three standard deviations of the historical mean.</td>
<td>Individual sample must be repeated. Place comment in LIMS. Surrogate results outside criteria shall be reported with qualifiers.</td>
</tr>
<tr>
<td>Method Blank (MB) (Analyst, Data Reviewer)</td>
<td>Reporting Limit[^1^]</td>
<td>Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is &gt; 1/10 of the amount measured in the sample.</td>
</tr>
<tr>
<td>Proficiency Testing (PT) Samples (QA Manager, Technical Manager(s))</td>
<td>Criteria supplied by PT Supplier.</td>
<td>Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.</td>
</tr>
<tr>
<td>Internal / External Audits (QA Manager, Technical Manager(s), Laboratory Director)</td>
<td>Defined in Quality System documentation such as SOPs, QAM, etc.</td>
<td>Non-conformances must be investigated through CAR system and necessary corrections must be made.</td>
</tr>
</tbody>
</table>

[^1^]: Reporting Limit is a formal limit specified for method performance. It varies by method and is usually defined in the LIMS or equivalent.
<table>
<thead>
<tr>
<th>QC Activity (Individual Responsible for Initiation/Assessment)</th>
<th>Acceptance Criteria</th>
<th>Recommended Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting / Calculation Errors</td>
<td>- SOP CW-Q-S-005, Data Recall.</td>
<td>- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 or your lab’s CA SOP.</td>
</tr>
<tr>
<td>(Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Technical Managers, QA Manager, Corporate QA, Corporate Management)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client Complaints (Project Managers, Lab Director/Manager, Sales and Marketing)</td>
<td>-</td>
<td>- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).</td>
</tr>
<tr>
<td>QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director/Manager, Technical Manager(s))</td>
<td>- QAM, SOPs.</td>
<td>- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.</td>
</tr>
<tr>
<td>Health and Safety Violation (Safety Officer, Lab Director/Manager, Technical Manager(s))</td>
<td>- Environmental Health and Safety (EHS) Manual.</td>
<td>- Non-conformance is investigated and corrected through CAR system.</td>
</tr>
</tbody>
</table>

**Note:**
1. Except as noted below for certain compounds, the method blank should be below the detection limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates provided they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

**SECTION 13. PREVENTIVE ACTION / IMPROVEMENT**
13.1 Overview

The laboratory’s preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory’s commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:
- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly by the laboratory management, Corporate QA and TestAmerica’s Executive Committee. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory’s corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action/process improvement system:
- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
• Define the measurements of the effectiveness of the process once undertaken.
• Execution of the preventive action or improvement.
• Evaluation of the plan using the defined measurements.
• Verification of the effectiveness of the preventive action or improvement.
• Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/Process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions/Process Improvement undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 Management of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division’s Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. More detailed information on retention of specific records is provided in CW-L-P-001, Records Retention Policy and CW-L-WI-001, TestAmerica Records Retention/Storage Schedule. Quality records are maintained by the QA department in a database, which is backed up as part of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the IT Department.
### Table 14-1. Record Index

<table>
<thead>
<tr>
<th>Record Types</th>
<th>Retention Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Records</strong></td>
<td>5 Years from analytical report issue*</td>
</tr>
<tr>
<td>- Raw Data</td>
<td></td>
</tr>
<tr>
<td>- Logbooks</td>
<td></td>
</tr>
<tr>
<td>- Standards</td>
<td></td>
</tr>
<tr>
<td>- Certificates</td>
<td></td>
</tr>
<tr>
<td>- Analytical Records</td>
<td></td>
</tr>
<tr>
<td>- MDLs/IDLs/DOCs</td>
<td></td>
</tr>
<tr>
<td>- Lab Reports</td>
<td></td>
</tr>
<tr>
<td><strong>Official Documents</strong></td>
<td>Indefinitely</td>
</tr>
<tr>
<td>- Quality Assurance Manual (QAM)</td>
<td></td>
</tr>
<tr>
<td>- Work Instructions</td>
<td></td>
</tr>
<tr>
<td>- Policies</td>
<td></td>
</tr>
<tr>
<td>- SOPs</td>
<td></td>
</tr>
<tr>
<td>- Policy Memorandums</td>
<td></td>
</tr>
<tr>
<td>- Manuals</td>
<td></td>
</tr>
<tr>
<td>- Published Methods</td>
<td></td>
</tr>
<tr>
<td><strong>QA Records</strong></td>
<td>Indefinitely</td>
</tr>
<tr>
<td>- Certifications</td>
<td></td>
</tr>
<tr>
<td>- Method and Software Validation / Verification Data</td>
<td></td>
</tr>
<tr>
<td><strong>QA Records</strong></td>
<td>5 Years from archival*</td>
</tr>
<tr>
<td>Internal &amp; External Audits/Responses</td>
<td></td>
</tr>
<tr>
<td>Corrective/Preventive Actions</td>
<td></td>
</tr>
<tr>
<td>Management Reviews</td>
<td></td>
</tr>
<tr>
<td>Data Investigation</td>
<td>Data Investigation: 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)</td>
</tr>
<tr>
<td><strong>Project Records</strong></td>
<td>5 Years from analytical report issue*</td>
</tr>
<tr>
<td>- Sample Receipt &amp; COC Documents</td>
<td></td>
</tr>
<tr>
<td>- Contracts and Amendments</td>
<td></td>
</tr>
<tr>
<td>- Correspondence</td>
<td></td>
</tr>
<tr>
<td>- QAPP</td>
<td></td>
</tr>
<tr>
<td>- SAP</td>
<td></td>
</tr>
<tr>
<td>- Telephone Logbooks</td>
<td></td>
</tr>
<tr>
<td>- Lab Reports</td>
<td></td>
</tr>
<tr>
<td><strong>Administrative Records</strong></td>
<td>Refer to CW-L-WI-001</td>
</tr>
<tr>
<td>Finance and Business Operations</td>
<td></td>
</tr>
<tr>
<td>EHS Manual, Permits</td>
<td>Indefinitely</td>
</tr>
<tr>
<td>Disposal Records</td>
<td>Indefinitely</td>
</tr>
<tr>
<td>Employee Handbook</td>
<td>Indefinitely</td>
</tr>
<tr>
<td>Personnel files, Employee Signature &amp; Initials, Administrative Training Records (e.g., Ethics)</td>
<td>Refer to HR Manual</td>
</tr>
<tr>
<td>Administrative Policies</td>
<td>Indefinitely</td>
</tr>
<tr>
<td>Technical Training Records</td>
<td>7 years</td>
</tr>
<tr>
<td>Legal Records</td>
<td>Indefinitely</td>
</tr>
<tr>
<td>HR Records</td>
<td>Refer to CW-L-WI-001</td>
</tr>
<tr>
<td>IT Records</td>
<td>Refer to CW-L-WI-001</td>
</tr>
<tr>
<td>Corporate Governance Records</td>
<td>Refer to CW-L-WI-001</td>
</tr>
<tr>
<td>Sales &amp; Marketing</td>
<td>5 years</td>
</tr>
<tr>
<td>Real Estate</td>
<td>Indefinitely</td>
</tr>
</tbody>
</table>
1 Record Types encompass hardcopy and electronic records.
2 Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log. Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for at least 2 months after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

<table>
<thead>
<tr>
<th>Program</th>
<th>Retention Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Water – All States</td>
<td>10 years (lab reports and raw data)</td>
</tr>
<tr>
<td></td>
<td>10 years - Radiochemistry (project records)</td>
</tr>
<tr>
<td>Drinking Water Lead and Copper Rule</td>
<td>12 years (project records)</td>
</tr>
<tr>
<td>Navy Facilities Engineering Service Center (NFESC)</td>
<td>10 years</td>
</tr>
<tr>
<td>Housing and Urban Development (HUD) Environmental Lead Testing</td>
<td>10 years</td>
</tr>
<tr>
<td>TSCA - 40 CFR Part 792</td>
<td>10 years after publication of final test rule or negotiated test agreement</td>
</tr>
<tr>
<td>OSHA</td>
<td>30 years</td>
</tr>
</tbody>
</table>
1Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.14.1 for more information, as well as SF-IT-0001.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory’s copy of the COC is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day’s analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day’s run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as “sampled by,” “prepared by,” “reviewed by”, or “analyzed by”.

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory’s ability to retrieve the information prior to the destruction of the hard copy that was scanned. This laboratory does not scan data into PDF format.
14.2 Technical and Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code;
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;
- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware
audits, backups, and records of any changes to automated data entries; and

- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a monthly basis.

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.
14.5 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access.

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data. Records are considered archived when noted as such in the records management system (a.k.a., document control.)

14.5.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client’s instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a “Certificate of Destruction” is required.

SECTION 15. AUDITS
15.1 **Internal Audits**

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab’s quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and, when requested, to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

**Table 15-1. Types of Internal Audits and Frequency**

<table>
<thead>
<tr>
<th>Description</th>
<th>Performed by</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Systems Audits</td>
<td>QA Department, QA approved designee, or Corporate QA</td>
<td>All areas of the laboratory annually</td>
</tr>
<tr>
<td>Method Audits</td>
<td><strong>QA Technical Audits</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Joint responsibility:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) QA Manager or designee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Technical Manager or Designee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Refer to CW-Q-S-003)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QA Technical Audits Frequency:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50% of methods annually</td>
<td></td>
</tr>
<tr>
<td>SOP Method Compliance</td>
<td>Joint responsibility:</td>
<td>SOP Compliance Review Frequency:</td>
</tr>
<tr>
<td></td>
<td>a) QA Manager or designee</td>
<td>• Every 2 years</td>
</tr>
<tr>
<td></td>
<td>b) Technical Manager or Designee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Refer to CW-Q-S-003)</td>
<td></td>
</tr>
<tr>
<td>Special</td>
<td>QA Department or Designee</td>
<td>Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.</td>
</tr>
<tr>
<td>Performance Testing</td>
<td>Analysts with QA oversight</td>
<td>One successful per year or as dictated by regulatory requirements</td>
</tr>
</tbody>
</table>
15.1.1 **Annual Quality Systems Audit**

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 **QA Technical Audits**

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least one QA Technical Audit.

15.1.3 **SOP Method Compliance**

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Department Manager or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 **Special Audits**

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 **Performance Testing**

The laboratory participates annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Nonpotable Water, Soil, and UST samples.

It is TestAmerica’s policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique
request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the lab's corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as “a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment.” When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as “trade secret”, “proprietary” or “company confidential”. Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process and database. The laboratory’s corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a
copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory’s test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory’s QA Department and forwarded to the Laboratory Director, Project Managers, their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, Department Managers, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, & objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CW-Q-S-004 & Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the “big picture” by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific
existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate VP of Operations and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica’s Corporate Internal Investigations SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica’s President and CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations and Quality Directors receive a monthly report from the VP-QA/EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.
SECTION 17. PERSONNEL

17.1 Overview

The laboratory’s management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory’s quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual’s experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site’s Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).
As a general rule for analytical staff:

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Education</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses</td>
<td>H.S. Diploma</td>
<td>On the job training (OJT)</td>
</tr>
<tr>
<td>GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC</td>
<td>A college degree in an applied science or 2 years of college and at least 1 year of college chemistry</td>
<td>Or 2 years prior analytical experience is required</td>
</tr>
<tr>
<td>ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS</td>
<td>A college degree in an applied science or 2 years of college chemistry</td>
<td>Or 5 years of prior analytical experience</td>
</tr>
<tr>
<td>Spectra Interpretation</td>
<td>A college degree in an applied science or 2 years of college chemistry</td>
<td>And 2 years relevant experience Or 5 years of prior analytical experience</td>
</tr>
<tr>
<td>Technical Managers – <strong>General</strong></td>
<td>Bachelor’s Degree in an applied science or engineering with 24 semester hours in chemistry</td>
<td>And 2 years experience in environmental analysis of representative analytes for which they will oversee</td>
</tr>
<tr>
<td>Technical Managers – <strong>Wet Chem</strong> only (no advanced instrumentation)</td>
<td>Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry</td>
<td>And 2 years relevant experience</td>
</tr>
<tr>
<td>Technical Managers - <strong>Microbiology</strong></td>
<td>Bachelor’s degree in applied science with at least 16 semester hours in general microbiology and biology</td>
<td>And 2 years of relevant experience</td>
</tr>
</tbody>
</table>

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical Manager, and are considered an
analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory’s policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

<table>
<thead>
<tr>
<th>Required Training</th>
<th>Time Frame</th>
<th>Employee Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Health &amp; Safety</td>
<td>Prior to lab work</td>
<td>All</td>
</tr>
<tr>
<td>Ethics – New Hires</td>
<td>1 week of hire</td>
<td>All</td>
</tr>
<tr>
<td>Ethics – Comprehensive</td>
<td>90 days of hire</td>
<td>All</td>
</tr>
<tr>
<td>Data Integrity</td>
<td>30 days of hire</td>
<td>Technical and PMs</td>
</tr>
<tr>
<td>Quality Assurance</td>
<td>90 days of hire</td>
<td>All</td>
</tr>
<tr>
<td>Ethics – Comprehensive Refresher</td>
<td>Annually</td>
<td>All</td>
</tr>
<tr>
<td>Initial Demonstration of Capability (DOC)</td>
<td>Prior to unsupervised method performance</td>
<td>Technical</td>
</tr>
</tbody>
</table>

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to “Demonstration of Capability” in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee’s secured personnel file.

**Evidence of successful training could include such items as:**

**Company Confidential & Proprietary**
• Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
• Analysts knowledge to refer to QA Manual for quality issues.
• Analysts following SOPs, i.e., practice matches SOPs.
• Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP (SF-QA-1700).

17.4 Data Integrity and Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

• Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.

• Ethics Policy

• How and when to report ethical/data integrity issues. Confidential reporting.

• Record keeping.

• Discussion regarding data integrity procedures.

• Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)

• Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.

- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 21,000 ft² secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant
specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building keys and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor’s logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with
the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor’s logbook.

SECTION 19.  TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients’ requirements and that are within the scope of the laboratory’s capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory’s approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica’s Corporate SOP entitled ‘Writing a Standard Operating Procedure’, No. CW-Q-S-002 or the laboratory’s SOP SF-QA-1203.
- SOPs are reviewed at a minimum of every 2 years, and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.
The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:


- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.
Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory’s recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC, Lab SOP SF-QA-1700) is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst hasn’t performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory’s nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be
higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).

- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: Reporting Limit based on the low standard of the calibration curve.

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst’s training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new
record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory’s quality control acceptance limits.

19.5 Laboratory Developed Methods and Non-Standard Methods
Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods
Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled. All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.
19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity – Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity – Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL) – An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences – A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range – Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision – Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method – The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.
19.6.1.8 Continued Demonstration of Method Performance – Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL) / Limits of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value can be differentiated from blanks. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used.

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory’s SOP No. SF-QA-1218 for details on the laboratory’s MDL process.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument’s sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL
does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.10 Retention Time Windows
Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte’s retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity
The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation of Uncertainty of Measurement
19.12.1 Uncertainty is “a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result’s validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an “expanded uncertainty”: the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.
19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/L.

19.12.5 In the case where a well-recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as ‘reanalysis’) may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client’s request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within ± 1 reporting limit for samples ≤ 5x the reporting limit, the original analysis will be reported. At the client’s request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Supervisor or Laboratory Director if unsure.

19.14 Control of Data
The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOP SF-IT-0001. The laboratory is currently running TALS which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes .NET which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity – Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 Ensure Information Availability – Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 Maintain Confidentiality – Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, Acceptable Manual Integration Practices.
Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer’s indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1%. Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out ‘real time’ and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be “Z”d out, signed and dated.
- Worksheets are created with the approval of the Laboratory Director/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures
Review procedures are outlined in several SOPs (e.g. Sample Control, Data Review, Project Management) to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data [Corp SOP# CA-S-002 Manual Integration]. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review- The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day’s analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day’s analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality
Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to verifying that the COC is followed, cover letters / narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships.

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The Project Manager also checks the invoice for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.8 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica’s Corporate SOP (CA-Q-S-002).

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.
19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.
Figure 19-1. Example - Demonstration of Capability Documentation

Analyst Demonstration of Capability

TestAmerica Pleasanton

Earl Takenaka

7/1/2013

Preparation Method(s):  
Analytical Method(s):  SBD 254D
Matrix:  Water
Method Description:  Solids, Total Suspended (TSS)

Preparation SOP No:  
Analytical SOP No:  SF-WC-0716

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method with the specifications in the cited SOP, which is in use at this facility for the analysis of samples under the laboratory’s Quality Assurance Plan, has completed the Demonstration of Capability (DOC).
2. The test method(s) was performed by the analyst identified on this certificate.
3. A copy of test method(s) and laboratory SOPs are available for all personnel on-site.
4. The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility. The associated information is organized and available for review.

__________________________  
Crystal A. Pollock
Technical Director

__________________________  
Melissa Brewer
Quality Assurance Officer

Signature  Date

Page 1 of 2
**Analyst Demonstration of Capability**

**Method**
SM 2540D

**Method Desc:** Solids, Total Suspended (TSS)

**Analyst:** Earl Takenaka

**Limit Group:** 2540D

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**ANALYST DEMONSTRATION OF CAPABILITY**

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>TestAmerica Pleasanton</th>
</tr>
</thead>
</table>

**Analysis Dates:** 2/1/2013 to 6/28/2013

---

**Total Suspended Solids**

<table>
<thead>
<tr>
<th>Recovery</th>
<th>Precision</th>
<th>RPD</th>
</tr>
</thead>
</table>
| 69       | 117       | 20  |%

---

**Demonstration of Capability**

<table>
<thead>
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<th>Recovery</th>
<th>Precision</th>
<th>RPD</th>
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<td>Std. Dev.</td>
<td>Units</td>
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<tr>
<td>5.62</td>
<td>4.51783</td>
<td>%</td>
</tr>
</tbody>
</table>

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**Precision = standard deviation of percent recoveries of spiked control samples.**

7/1/2013
Figure 19-2. Example: Work Flow
SECTION 20. EQUIPMENT and CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer’s instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

- Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on ‘date’ was acceptable, or
instrument recalibrated on ‘date’ with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back-up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 **Support Equipment**

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 **Weights and Balances**

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).
All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file.

**20.3.2 pH, Conductivity, and Turbidity Meters**

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

**20.3.3 Thermometers**

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

IR thermometers, digital probes and thermocouples are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, iced (4°C) and frozen (0°C to -5°C), per the Drinking Water Manual.

The mercury/digital NIST thermometer is recalibrated every five years/one year (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP SF-QA-1305.

**20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators**

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.
Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and < 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified cannot be used for any quantitative measurements.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.3.6 Autoclaves

This facility does not use an autoclave.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.
If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

**Note:** Instruments are calibrated initially and as needed after that and at least annually.

### 20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules is ICP and ICPMS which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

#### 20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

**Note:** The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the
calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used, then bracketing calibration verification standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12-hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after every 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions:

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by
the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

**20.4.1.2 Verification of Linear and Non-Linear Calibrations**

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

**20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis**

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

**Note:** If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as
a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

TestAmerica Pleasanton Instrument List
<table>
<thead>
<tr>
<th>Equipment/Instrument</th>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Serial Number</th>
<th>Year Put into Service</th>
<th>Condition When Received</th>
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Table 20-2. Example: Schedule of Routine Maintenance

**INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETER (ICP-MS)**

**DAILY OR AS NEEDED**

- Check disk space delete old files if necessary
- Inspect the torch, glassware, and aerosol injector tube
- Check the nebulizer and the sample capillary tubing.
- Replace pump tubing when worn
- Clean sampler and skimmer cones
- Check the pump oil level

**QUARTERLY TO YEARLY**

- Clean torch to remove accumulated deposits.
- Check coil for any deformations or buildup and replace if there are any signs of pitting
- Check the nebulizer spray pattern with deionized water and clean or replace the nebulizer as necessary
- Inspect the spray chamber for deposits.
- Change the vacuum pump oil.
- Check pump rollers and remove and clean the pump head if necessary
- Evaluate present and past detection limit studies for instrument performance

**SPARE PARTS**

- Pump tubing
- Torch
- Teflon Concentric Nebulizer
- Sampler and skimmer cones
- Vacuum pump oil

**INDUCTIVELY COUPLED PLASMA**

**DAILY OR AS NEEDED**

- Wavelength and refractor calibration
- Replace pump tubing when worn
- Check the autosampler arm for alignment

**QUARTERLY TO YEARLY**

- Clean optical windows for maximum wavelength intensity
- Replace water in water cooler
- Check instrument for signs of wear or corrosion from fumes
- Evaluate present and past detection limit studies for instrument performance
SPARE PARTS

- Sample pump tubing
- Torch
- Nebulizer

MERCURY ANALYZER

DAILY OR AS NEEDED

- Inspect or replace pump tubing
- Inspect or clean mixing chamber

SPARE PARTS

- Sample pump tubing

ION CHROMATOGRAPH

DAILY OR AS NEEDED

- Check for leaks around fittings
- Change Filters
- Change Guard Column
- Change Analytical Column
- Change Suppressor

WEEKLY

- Change eluent

SPARE PARTS

- Assorted pump parts
- Ferrules
- Filters for the guard and analytical column

SEMIVOLATILE GAS CHROMATOGRAPH

DAILY OR AS NEEDED

- Inspect for leaks
• Refill solvent rinse vials and empty solvent waste vials
• All gas cylinders are checked and changed if the pressure is less than 500 psi
• Ensure proper peak shape,(gaussian, minimal tailing,no splitting,proper baseline)
• Inlet seals, ferrules and o-rings are checked and if necessary replaced
• Replace injector septa for each inlet

MONTHLY OR AS NEEDED

• FID jet is removed and cleaned
• ECD, Are many negative peaks present?, if so and the signal for the detectors is > 50 consider sending the detector in for cleaning or refoiling.

6 MONTHS

• Wipe test ECD detectors
  • Every 6 months for Agilent ECDs
  • Every 3 years for Varian ECDs
• Change gas tank filters traps

SPARE PARTS

• Graphite and/or graphite/vespel ferrules
• Injector Septa
• Inlet liners
• O-rings
• Gold Seals (SS for PCB)
• Wipe Test Kits
• Column Cutter
• Flow measurement devices
• GC Tools and wrenches
• Electronic leak detector
• Gas Filters

VOLATILE GAS CHROMATOGRAPH

DAILY

• All gas cylinders are checked and changed if the pressure is less than 500 psi
• Ensure proper peak shape,(gaussian, minimal tailing,no splitting,proper baseline)
• Verify DI water reservoir for autosamplers is full, fill if necessary
• Check internal standard and surrogate levels in Archon are okay
• Empty autosampler waste water container

MONTHLY

• Wipe Archon drive rods clean with Isopropanol.
- Calibrate robotics, Archon
- Inspect autosampler probes for hardness build-up, clean if necessary

**ANNUALLY (MINIMUM), BEFORE A CALIBRATION OR AS NEEDED**

- Perform injection port maintenance, replace o-ring, liner, gold seal washer, clip column
- Replace in-line filters and traps
- Verify correct column flow or linear velocity
- Pressure test injection port EPC unit
- Replace transfer line

**SPARE PARTS**

- Graphite and/or graphite/vespel ferrules
- Injector Septa
- Inlet liners
- O-rings
- Gold Seals
- Column Cutter
- Flow measurement devices
- GC Tools and wrenches
- Electronic leak detector
- Universal and Hydrocarbon traps
- Methanol

**GAS CHROMATOGRAPH/MASS SPECTROMETER**

In addition to the Gas Chromatography maintenance identified in the previous section, the following maintenance must be scheduled for the Mass Spectrometry systems:

**PERFORMED AS REQUIRED**

- Print out PFTBA spectra, confirm peak widths and ion ratios are normal
- Perform air/water leak check
- Replenish rough vacuum pump oil
- Clean ion source or ion trap
- Check diff pump fluid level, change if necessary

**SPARE PARTS**

- Pump Oil and Filters
- Column Cutter
- GC Tools and wrenches

**Electronic leak detector**
SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia-Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
• Analytes or parameters calibrated
• Identification or lot number
• Calibration method
• Concentration with associated uncertainties
• Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the ‘true’ value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer’s requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company-wide purchase. [Refer to TestAmerica’s Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.]

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in the LIMS. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs.
Commercial materials purchased for preparation of calibration solutions, spike solutions, etc., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory’s LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer’s name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer’s name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID from LIMS
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be
available to the analyst. This information is maintained in the method SOPs and associated/referenced SDS sheets.

21.4.3 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer’s label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer’s recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22. SAMPLING

22.1 Overview
The laboratory does not provide sampling services. The laboratory’s responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.

22.2 Sampling Containers
The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives
Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether
prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 **Definition of Holding Time**

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in “days” (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in “hours” (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 **Sampling Containers, Preservation Requirements, Holding Times**

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or “ASAP” is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 **Sample Aliquots / Subsampling**

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory’s responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located SOP SF-QA-0725.

**SECTION 23. HANDLING OF SAMPLES**

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.
23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory’s custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client’s field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the COC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be
received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

**Note:** Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler.

### 23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections. See SOP SF-SC-0202.

#### 23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on a log-in checklist and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

#### 23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 720 - 49608 - A - 1

- **Location ID**
- **Login ID**
- **Container Occurrence**
- **Sample Number**
The above example states that TestAmerica Pleasanton Laboratory (Location 720). Login ID is 49608 (unique to a particular client/job occurrence). The container code indicates it is the first container (“A”) of Sample #1.

If the primary container goes through a prep step that creates a “new” container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example:  720 - 49608 - A - 1 - A ← Secondary Container Occurrence

Example:  720-49608-A-1-A would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.
23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. SF-SC-0202.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. Waters for metals analysis are stored at room temperature. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.
Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area, except used glass amber containers which are disposed of and used VOA vials which are temporarily saved separately unrefrigerated in order of analysis. All samples are kept in the refrigerators for 45 days, which meets or exceeds most sample holding times. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. These include all oily or smelly samples and all samples for PCB analysis. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°F during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded.
Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory’s waste disposal procedures (SOP: SF-QA-1900). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.
Figure 23-1. Example: Chain of Custody (COC)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Name</th>
<th>Signature</th>
<th>Category</th>
<th>Sample ID</th>
<th>Project ID</th>
<th>Project Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>AM</td>
<td>John Smith</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td>PM</td>
<td>Jane Doe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td>AM</td>
<td>Bob Johnson</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 4</td>
<td>PM</td>
<td>Alice Gray</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: This is a sample chain of custody form with fields for date, time, name, signature, category, sample ID, project ID, project name, and notes.
Figure 23-2. Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - Client name, address, phone number and fax number (if available)
   - Project name and/or number
   - The sample identification
   - Date, time and location of sampling
   - The collectors name
   - The matrix description
   - The container description
   - The total number of each type of container
   - Preservatives used
   - Analysis requested
   - Requested turnaround time (TAT)
   - Any special instructions
   - Purchase Order number or billing information (e.g. quote number) if available
   - The date and time that each person received or relinquished the sample(s), including their signed name. (All pages of the COC must be signed by everyone who has custody of the samples.)
   - The date and time of receipt must be recorded between the last person to relinquish the samples and the person who receives the samples in the lab, and they must be exactly the same.
   - Information must be legible

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sample ID
   - Include preservative used.
   - Use indelible ink
   - Information must be legible

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested (See Lab Sampling Guide). If an MS/MSD set is required for a water sample, submit three times the regular volume for that sample. Sample bottles for Alkalinity or Sulfide should be filled completely. Perchlorate samples should be received with headspace (i.e. 1/3 of bottle capacity).

4) Samples must be preserved according to the requirements of the requested analytical method (See Sampling Guide).

5) Most analytical methods require chilling samples to 4°C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6°C and above freezing (0°C). For methods with other temperature criteria (e.g. some bacteriological methods require < 10°C), the samples must arrive within ± 2°C of the required temperature or within the method specified range.

   5i.) Samples that are delivered to the laboratory on the same day they are collected may not meet the requirements of Section 5. In these cases, the samples shall be considered acceptable if the samples were received on ice.

   5ii.) If sample analysis is begun within fifteen (15) minutes of collection, thermal preservation is not required.

   5iii.) Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen (15) minutes of collection.
Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

For Volatile Organic analyses in drinking water (Methods 502.2 or 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:

1. Test for residual chlorine in the field prior to sampling.
   - If no chlorine is present, the samples are to be preserved using HCl as usual.
   - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.

2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.

FOR WATER SAMPLES TESTED FOR CYANIDE (by Standard Methods or EPA 335)

In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.

It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

6) Sample Holding Times

TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

Analyses that are designated as “field” analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for “field” analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. Samples analyzed in the laboratory will be qualified on the final report with an ‘HF’ to indicate holding time exceedance.

7) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply a blank with the bottle order.

8) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

9) Recommendations for packing samples for shipment.

- Pack samples in Ice rather than “Blue” ice packs.
- Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.
- Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.
- Fill extra cooler space with bubble wrap.

10) We do not accept samples known to contain:

- Blood, urine or human tissue
- Hydrofluoric Acid
- Radioactivity
### Figure 23-3. Example: Cooler Receipt Form

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radioactivity wasn't checked or is &lt;60 background as measured by a survey meter.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>The cooler's custody seal, if present, is intact.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Sample custody seals, if present, are intact.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>The cooler or samples do not appear to have been compromised or tampered with.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Samples were received on ice.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Cooler Temperature is acceptable.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Cooler Temperature is recorded.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>COC is present.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>COC is filled out in ink and legible.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>COC is filled out with all pertinent information.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Is the Field Sampler's name present on COC?</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>There are no discrepancies between the containers received and the COC.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Samples are received within Holding Time.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Sample containers have legible labels.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Containers are not broken or leaking.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Sample collection date/time is provided.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Appropriate sample containers are used.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Sample bottles are completely filled.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Sample Preservation Verified.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Containers requiring zero headspace have no headspace or bubble is &lt;6mm (1/4”).</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Multiphasic samples are not present.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Samples do not require splitting or composting.</td>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Residual Chlorine Checked.</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method Blank (MB)</td>
<td>are used to assess preparation and analysis for possible contamination during the preparation and processing steps.</td>
</tr>
<tr>
<td></td>
<td>The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.</td>
</tr>
<tr>
<td></td>
<td>The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples.</td>
</tr>
<tr>
<td></td>
<td>The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).</td>
</tr>
<tr>
<td></td>
<td>Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.</td>
</tr>
<tr>
<td>Calibration Blanks</td>
<td>are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.</td>
</tr>
<tr>
<td>Instrument Blanks</td>
<td>are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.</td>
</tr>
</tbody>
</table>
Table 24-1. Example – Negative Controls

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip Blank</td>
<td>are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client’s project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.</td>
</tr>
<tr>
<td>Field Blanks</td>
<td>sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)</td>
</tr>
<tr>
<td>Equipment Blanks</td>
<td>are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)</td>
</tr>
<tr>
<td>Holding Blanks</td>
<td>also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory</td>
</tr>
</tbody>
</table>

1 When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the
field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS’s may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

### 24.5 Sample Matrix Controls

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matrix Spikes (MS)</td>
<td>Used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;</td>
</tr>
</tbody>
</table>
Table 24-3. Sample Matrix Control

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Frequency 1</td>
<td>At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details.</td>
</tr>
<tr>
<td>Description</td>
<td>Essentially a sample fortified with a known amount of the test analyte(s).</td>
</tr>
<tr>
<td>Surrogate</td>
<td>Use Measures method performance to sample matrix (organics only).</td>
</tr>
<tr>
<td>Typical Frequency 1</td>
<td>Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.</td>
</tr>
<tr>
<td>Description</td>
<td>Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.</td>
</tr>
<tr>
<td>Duplicates 2</td>
<td>Use For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.</td>
</tr>
<tr>
<td>Typical Frequency 1</td>
<td>Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.</td>
</tr>
<tr>
<td>Description</td>
<td>Performed by analyzing two aliquots of the same field sample independently or an additional LCS.</td>
</tr>
<tr>
<td>Internal Standards</td>
<td>Use Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.</td>
</tr>
<tr>
<td>Typical Frequency 1</td>
<td>All organic and ICP methods as required by the analytical method.</td>
</tr>
<tr>
<td>Description</td>
<td>Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.</td>
</tr>
</tbody>
</table>

1 See the specific analytical SOP for type and frequency of sample matrix control samples.
2 LCSD’s are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as “Relative Percent Difference” (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory’s in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are
Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory’s statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 150%.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by ≤ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits.

The QA department generates a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Pleasanton. This summary includes an effective date, is updated each time new limits are generated and is located the LIMS. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:
• The analyte results are below the reporting limit and the LCS is above the upper control limit.

• If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

Or, for TNI and Department Of Defense (DOD) work, there are an allowable number of Marginal Exceedances (ME):

<table>
<thead>
<tr>
<th>&lt;11 analytes</th>
<th>0 marginal exceedances are allowed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 – 30 Analytes</td>
<td>1 marginal exceedance is allowed</td>
</tr>
<tr>
<td>31-50 Analytes</td>
<td>2 marginal exceedances are allowed</td>
</tr>
<tr>
<td>51-70 Analytes</td>
<td>3 marginal exceedances are allowed</td>
</tr>
<tr>
<td>71-90 Analytes</td>
<td>4 marginal exceedances are allowed</td>
</tr>
<tr>
<td>&gt; 90 Analytes</td>
<td>5 marginal exceedances are allowed</td>
</tr>
</tbody>
</table>

• Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).

• Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

Though marginal exceedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab’s method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).
A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Section 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratories sample acceptance policy is included in Section 23.

SECTION 25. REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory’s ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client. Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report For Samples) with a “sample results” column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. work order number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.
Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc.).

25.2.11 Reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers.

25.2.19 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.
25.2.20  The laboratory includes a cover letter.

25.2.21  Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.22  When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.23  Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.24  If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., partial report, or how your lab identifies it). A complete report must be sent once all of the work has been completed.

25.2.25  Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.26  A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3  Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above, excluding 25.2.15 (QC data).
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1  Electronic Data Deliverables (EDDs)
EDDs are routinely offered as part of TestAmerica’s services in addition to the test report as described in section 25.2. TestAmerica Pleasanton offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.

```
AdaPT_Fdep_Result
ADR_8.1_2file_LimsValues
Boeing
EDF1.2
EDF_1.2i_Csv
EDF_Weiss
EIM_Cvx_Rcra
EIM_Cvx_Rtbu
EIM_Cvx_Rtbu_Smpl
EIM_Honeywell_EDF
Eim_ParsonsFMC
Element_Ta
Equ_Cra
Equ_Cra_Ez
Equ_Golder_NorthHaven
Equ_Shell_2File
Geomatrix
Geosyntec
LevineFricke_Apr2001
Mactec_MontWat
Secor_HP
Sedd_5.0_2a
Sk01_Cc
Std_Sav_STD1
std_Sav_Std1a
Std_SF_QcN
Std_SF_QcY
Std_Sl
TRC Alton GeoScience
Trc_Vectre
Urs_Mission
WccTI_Ashland_Escambia
```

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD
format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information for Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of “interpretation” of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP No. CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory
outside of TestAmerica are reported to the client on the subcontract laboratory’s original report stationary and the report includes any accompanying documentation.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity’s proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are to meet all requirements of this document, include a cover letter.

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory’s corrective action system (refer to Section 12).

The revised report is electronically archived off-site, as is the original report. The revised report will be noted as such on the cover page.

When the report is re-issued, a notation of “report re-issue “is placed on the cover/signature page of the report or at the top of the narrative page with a brief explanation of reason for the re-issue and a reference back to the last final report generated. For Example: Report was revised on 11/3/08 to include toluene in sample NQA1504 per client’s request. This final report replaces the final report generated on 10/27/08 at 10:47am.

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely no possible impact on the interpretation of the analytical results and there is no possibility of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.
Appendix 1. Laboratory Floor Plan
Appendix 2. Glossary/Acronyms (EL-V1M2 Sec. 3.1)

Glossary:

**Acceptance Criteria:** Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

**Accreditation:** The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

**Accuracy:** The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

**Analyst:** The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

**Analytical Uncertainty:** A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

**Anomaly:** A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory’s control or not.

**Assessment:** The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

**Audit:** A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

**Batch:** Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

**Bias:** The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample’s true value). (TNI)

**Blank:** A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)
**Calibration:** A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

**Calibration Curve:** The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

**Calibration Standard:** A substance or reference material used to calibrate an instrument (QAMS)

**Certified Reference Material (CRM):** A reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

**Chain of Custody (COC) Form:** Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

**Compromised Samples:** Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

**Confidential Business Information (CBI):** Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguard identified CBI and to maintain all information identified as such in full confidentiality.

**Confirmation:** Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

**Conformance:** An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

**Correction:** Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis. No significant action is taken to change behavior, process or procedure.

**Corrective Action:** The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)
**Data Audit:** A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria).

**Data Reduction:** The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

**Deficiency:** An unauthorized deviation from acceptable procedures or practices, or a defect in an item (ASQC), whether in the laboratory’s control or not.

**Demonstration of Capability:** A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

**Document Control:** The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

**Duplicate Analyses:** The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

**Equipment Blank:** Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

**External Standard Calibration:** Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

**Field Blank:** Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

**Field of Accreditation:** Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

**Holding Times:** The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

**Internal Standard:** A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

**Internal Standard Calibration:** Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

**Instrument Blank:** A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

**Instrument Detection Limit (IDL):** The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.
Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory’s estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts.

Drinking Water: Any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.
**Air & Emissions:** Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

**Matrix Spike (spiked sample or fortified sample):** A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

**Matrix Spike Duplicate (spiked sample or fortified sample duplicate):** A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

**Method Blank:** A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

**Method Detection Limit:** The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

**Negative Control:** Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

**Non-conformance:** An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

**Observation:** A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

**Performance Audit:** The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

**Positive Control:** Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

**Precision:** The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

**Preservation:** Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

**Proficiency Testing:** A means of evaluating a laboratory’s performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

**Proficiency Testing Program:** The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)
**Proficiency Test Sample (PT):** A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

**Quality Assurance:** An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item or service is of the type of quality needed and expected by the client. (TNI)

**Quality Assurance [Project] Plan (QAPP):** A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

**Quality Control:** The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality. (TNI)

**Quality Control Sample:** A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

**Quality Manual:** A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

**Quality System:** A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

**Raw Data:** The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

**Record Retention:** The systematic collection, indexing and storing of documented information under secure conditions.

**Reference Material:** Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

**Reference Standard:** Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

**Sampling:** Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

**Second Order Polynomial Curve (Quadratic):** The 2\textsuperscript{nd} order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2\textsuperscript{nd} order regression will generate a
Coefficient of determination (COD or \( r^2 \)) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, \( r^2 \) must be greater than or equal to 0.99.

**Selectivity:** The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

**Sensitivity:** The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

**Spike:** A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

**Standard:** The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

**Standard Operating Procedures (SOPs):** A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

**Storage Blank:** A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

**Surrogate:** A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

**Systems Audit (also Technical Systems Audit):** A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

**Technical Manager:** A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

**Technology:** A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

**Traceability:** The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

**Trip Blank:** A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

**Uncertainty:** A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.
Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
SDS - Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP – Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound
Appendix 3. Laboratory Certifications, Accreditations, Validations

TestAmerica Pleasanton maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.
Appendix B
Site-Specific HSP Checklist for Site Surveys and Sampling Activities
<table>
<thead>
<tr>
<th>Project Name: Westside Brownfields Coalition Assessment</th>
<th>Project Manager: Greg Reller, Burleson Inc.</th>
<th>Telephone: (916) 709-8487 ext. 111</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: Lake County, Napa County, Solano County, Yolo County, California</td>
<td>Client Contact: Stephen McCord, McCord Environmental, Inc.</td>
<td>Telephone: (530) 220-3165</td>
</tr>
<tr>
<td>EPA I.D. No. Not applicable</td>
<td>Prepared By: Greg Reller, Burleson Inc.</td>
<td>Date: January 20, 2017</td>
</tr>
<tr>
<td>Project No. 99T30301</td>
<td>Date of Activities: February 2017 – December 2018</td>
<td></td>
</tr>
<tr>
<td>Objectives: Conduct six Phase I and two Phase II Environmental Site Assessments, prepare two Site Cleanup Plans.</td>
<td>Site Type: Check as many as applicable.</td>
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<tr>
<td></td>
<td></td>
<td>□ Active</td>
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<td></td>
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<td>□ Inactive</td>
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<td>□ Secured</td>
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<td></td>
<td></td>
<td>□ Unsecured</td>
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<tr>
<td>Initial Site information</td>
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<tr>
<td>The focus of project field efforts will include:</td>
<td></td>
<td></td>
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<tr>
<td>Phase I: Non-intrusive site visit to allow visual inspections at six separate locations that are to be determined.</td>
<td></td>
<td></td>
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<tr>
<td>Phase II: Site visit to complete soil and water sampling at two of the six Phase I sites.</td>
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<td></td>
</tr>
<tr>
<td>1. Mine feature mapping</td>
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<tr>
<td>2. Manual sampling of soil, mine waste, and water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Possible use of mechanical equipment such as a back hoe or geoprobe to access samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Speed and Direction (Approach from upwind): Provide on arrival at site (NA)</td>
<td>Temperature (°F): Wet, cool winters, and warm, dry summers</td>
<td>Precipitation: Average annual precipitation of 36 inches. January is the wettest month.</td>
</tr>
</tbody>
</table>
### Contaminants of Concern
The contaminants of concern include mercury and nickel in water and soil.

There may also be acid drainage.

**Isolation and Protection Action Zones Based on Air Monitoring Results:** Avoid dust, Stay away from mine related apparatus, such as furnaces, where concentrations of mercury would be highest in soil. Do not enter adits or old structures; Confined space entry is not required, and will not be performed.

<table>
<thead>
<tr>
<th>Waste Type:</th>
<th>Liquid</th>
<th>Solid</th>
<th>Sludge</th>
<th>Gas</th>
<th>Unknown</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Waste Characteristics:</th>
<th>Check as many as applicable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗ Corrosive</td>
<td>☐ Flammable</td>
</tr>
<tr>
<td>✗ Toxic</td>
<td>☐ Volatile</td>
</tr>
<tr>
<td>✗ Inert</td>
<td>☐ Reactive</td>
</tr>
<tr>
<td>☐ Ignitable</td>
<td>☐ Radioactive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazard(s) of Concern:</th>
<th>Check as many as applicable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗ Heat stress</td>
<td>☐ Overhead utilities</td>
</tr>
<tr>
<td>✗ Cold stress</td>
<td>☐ Confined space(s)</td>
</tr>
<tr>
<td>☐ Explosion or fire hazard</td>
<td>☐ Noise (During construction wear ear protection)</td>
</tr>
<tr>
<td>☐ Oxygen deficiency</td>
<td>☐ Biological hazard: poison oak, wildlife (e.g., black bears, skunks, bobcats, mountain lions), rattlesnakes, ticks, giardia</td>
</tr>
<tr>
<td>☐ Radiological hazard</td>
<td>☐ Inorganic chemicals</td>
</tr>
<tr>
<td>☐ Underground storage tanks</td>
<td>☐ Organic chemicals</td>
</tr>
<tr>
<td>✗ Surface tanks</td>
<td>☐ Heavy equipment</td>
</tr>
<tr>
<td>☐ Buried utilities</td>
<td>☐ Other (specify) Unauthorized target shooting area, forest fires, naturally occurring asbestos, adverse weather conditions. Steep terrain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explosion or Fire Potential:</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Unknown</th>
</tr>
</thead>
</table>

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---
Chemical Products Project Team Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- Alconox or Liquinox
- Hydrochloric acid (HCl)
- Nitric acid (HNO₃)
- pH Calibration Standards
- Ethanol
- SulphoRhodamine B dye
- Calibration gas (Pentane)
- Hydrogen gas
- Hexane
- Household bleach (NaOCl)
- Calibration gas (Methane)
- Sulfuric acid (H₂SO₄)
- Mark I Kits (number?)
- Acetic acid
- Other (specify)

Site Hazards/Activities:
Check as many as applicable

- General Safe Work Practices
- Control of Hazardous Energy Sources (Lockout/Tagout)
- Safe Drilling Practices
- Excavation Practices
- Working Over or Near Water
- Hot Work Practices
- Special Site Hazards
- Safe Electrical Work Practices
- Fall Protection Practices
- Portable Ladder Safety
- Drum and Container Handling Practices
- Shipping Dangerous Goods
- Flammable Hazards and Ignition Sources
- Spill and Discharge Control Practices
- Heat Stress
- Cold Stress
- Biohazards
- Underground Storage Tank Removal Practices
- Work Around Heavy Equipment
- Respirator Cleaning Procedures
- Safe Work Practices for Use of Air Purifying Respirators
- Respirator Qualitative Fit Testing Procedures

Burleson Employee Training and Medical Requirements:

Basic Training and Medical

- Initial 40 Hour Training
- 8-Hour Supervisor Training (one-time)
- Current 8-Hour Refresher Training
- Current Medical Clearance (including respirator use)
- Current First Aid Training (minimum 1 Burleson employee on site)
- Current CPR Training (minimum 1 Burleson employee on site)

Other Specific Training

- Confined Space Training
- Level A Training
- Radiation Training
- Atropine (Nerve Agent Antidote) Injector Training
- Other
<table>
<thead>
<tr>
<th>Materials Present or Suspected at Site</th>
<th>Highest Observed Concentration (specify units and media)</th>
<th>PEL/TLV Exposure Limit (specify ppm or mg/m³)</th>
<th>IDLH Level (specify ppm or mg/m³)</th>
<th>Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, etc.)</th>
<th>Symptoms and Effects of Acute Exposure</th>
<th>Photo-ionization Potential (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>Not available</td>
<td>0.1 mg/m³-air/0.025 mg/m³-air</td>
<td>10 mg/m³ (as Hg)</td>
<td>Toxic</td>
<td>Acute exposure to high concentrations of mercury vapor causes severe respiratory damage, while chronic exposure to lower levels is primarily associated with central nervous system damage</td>
<td>NA</td>
</tr>
<tr>
<td>Nickel</td>
<td>Not available</td>
<td>0.1 mg/m³ (inhalable fraction)</td>
<td>Ca [10 mg/m³ (as Ni)]</td>
<td>Toxic</td>
<td>Sensitization dermatitis, allergic asthma, pneumonitis; lung damage; nasal cancer</td>
<td>NA</td>
</tr>
</tbody>
</table>

Information Source(s):

- Site information based on professional experience.

Note: Use the following short forms to complete the table above.

- IDLH = Immediately dangerous to life or health
- PEL = Permissible exposure limit
- ppm = Part per million
- TLVL = Threshold limit value
- mg/m³ = Milligram per cubic meter
- Ca = carcinogen,
### Field Activities Covered Under This Plan:

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Level of Protection</th>
<th>Date of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Phase I Site Visit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Phase II Sampling of soil, mine waste, and water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Site Personnel and Responsibilities (include subcontractors):

<table>
<thead>
<tr>
<th>Employee Name</th>
<th>Task(s)</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greg Reller, Burleson Consulting, Inc.</td>
<td>All</td>
<td>• Project Manager or Field Team Leader: Directs project site activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary.</td>
</tr>
<tr>
<td>Chris Scudder, Burleson Consulting, Inc.</td>
<td>All</td>
<td>• Field Personnel: Completes tasks as directed by the project manager, field team leader, and SSC, and follows all procedures and guidelines established in activity specific Health and Safety Manual.</td>
</tr>
<tr>
<td>Chris Scudder, Burleson Consulting, Inc.</td>
<td>All</td>
<td>• Site Safety Coordinator: Completes tasks as directed by the project manager, field team leader, and SSC, and follows all procedures and guidelines established in the activity specific Health and Safety Manual.</td>
</tr>
</tbody>
</table>

Note: 1 See next page for details regarding levels of protection
### Protective Equipment

(Indicate type or material as necessary for each task.)

<table>
<thead>
<tr>
<th>Task</th>
<th>Primary Level of Protection (A,B,C,D)</th>
<th>PPE Component Description (Primary)</th>
<th>Contingency Level of Protection (A, B, C, D)</th>
<th>PPE Component Description (Contingency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D</td>
<td>CPC material: Leather, Nitrile or Latex when in contact with contaminated materials (water and soil)</td>
<td>D</td>
<td>If on-site observation indicates potentially unsafe work conditions, work will stop and appropriate engineering controls will be implemented to remove the unsafe condition(s). If engineering controls are not effective, work will stop until increased levels of protection are identified and properly implemented.</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>Other: Long sleeves and long pants. Protective eye-wear and hearing protection during drilling and as necessary. Weather gear as necessary</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

All levels of protection must include eye, head, and foot protection.

- **CPC** = Chemical protective clothing
- **PPE = Personal Protective Equipment**
- **A** = Highest level of respiratory, skin, eye, and mucous membrane protection.
- **B** = Highest level of respiratory protection, lesser level of skin and eye protection.
- **C** = Airborne substance known and meets criteria for air-purifying respirators. Skin and eye exposure unlikely.
- **D** = Work uniform for nuisance contamination. Requires coveralls or dedicated work clothing, and safety shoes/boots. Other PPE based on situation.

*Level C may be acceptable for certain tasks in some situations. If you are uncertain whether Level C is appropriate, consult the Corporate Safety Officer. Additionally, when working with unknown respiratory hazards, Level C cartridge must provide protection for organic vapors, acid gases, ammonia, amines, formaldehyde, hydrogen fluoride, and particulate aerosols.*
### SITE SPECIFIC HSP CHECKLIST FOR SITE SURVEYS AND SAMPLING ACTIVITIES

#### Westside Brownfields Sites

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Task</th>
<th>Instrument Reading</th>
<th>Action Guideline</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Combustible gas indicator model:</strong> GasTech or similar</td>
<td>1</td>
<td>0 to 10% LEL</td>
<td>Monitor; evacuate if confined space</td>
<td>Burleson to monitor breathing zone during drilling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 to 25% LEL</td>
<td>Potential explosion hazard; notify SSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;25% LEL</td>
<td>Explosion hazard; interrupt task; evacuate site; notify SSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>Not needed</td>
</tr>
<tr>
<td><strong>Oxygen meter model:</strong></td>
<td>1</td>
<td>&gt;23.5% Oxygen</td>
<td>Potential fire hazard; evacuate site</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>23.5 to 19.5% Oxygen</td>
<td>Oxygen level normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;19.5% Oxygen</td>
<td>Oxygen deficiency; interrupt task; evacuate site; notify SSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>Not needed</td>
</tr>
<tr>
<td><strong>Radiation survey meter model:</strong></td>
<td>1</td>
<td>Normal background</td>
<td>Proceed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two to three times background</td>
<td>Notify SSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;Three times background</td>
<td>Radiological hazard; interrupt task; evacuate site; notify Health Physicist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>Annual exposure not to exceed 1,250 mrem per quarter</td>
</tr>
<tr>
<td><strong>Photoionization detector model:</strong></td>
<td>1</td>
<td>Any response above background to 5 ppm above background</td>
<td>Level C is acceptable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 5 to 500 ppm above background</td>
<td>Level B is recommended</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 500 ppm above background</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved.</td>
</tr>
<tr>
<td><strong>Mercury Vapor Detector</strong></td>
<td>1</td>
<td>Any response up to the PEL (0.1 mg/m³) = PEL</td>
<td>Proceed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; PEL</td>
<td>Implement engineering controls and reevaluate, if reading remains above the PEL respiratory protection is necessary. Stop work in this area and contact the project manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Any response up to the PEL (0.1 mg/m³ based on dust with maximum reported Hg concentration)</td>
<td>Proceed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; background + 0.1 mg/m³</td>
<td>Implement engineering controls and reevaluate, if reading remains above the PEL respiratory protection is necessary. Level C is adequate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Background readings to be taken in area not affected by site activity.</td>
</tr>
</tbody>
</table>

**Notes:**
- eV = electron volt
- LEL = Lower explosive limit
- mrem = Millirem
- PEL = Permissible exposure limit
- ppm = Part per million
### Site Map: to be provided for each site before leaving the office

#### Attach Maps

As appropriate for each specific activity, label the following items on your maps:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Orientation</td>
</tr>
<tr>
<td>2.</td>
<td>Wind direction</td>
</tr>
<tr>
<td>3.</td>
<td>Muster Point and Evacuation route</td>
</tr>
<tr>
<td>4.</td>
<td>Area of safe refuge</td>
</tr>
<tr>
<td>5.</td>
<td>Exclusion zone</td>
</tr>
<tr>
<td>6.</td>
<td>Contamination reduction zone (CRZ)</td>
</tr>
<tr>
<td>7.</td>
<td>Support zone</td>
</tr>
<tr>
<td>8.</td>
<td>Location(s) of hazardous materials</td>
</tr>
<tr>
<td>9.</td>
<td>Monitoring Location(s)</td>
</tr>
<tr>
<td>10.</td>
<td>Sampling location(s)</td>
</tr>
<tr>
<td>11.</td>
<td>Command post</td>
</tr>
</tbody>
</table>
## Emergency Contacts:

<table>
<thead>
<tr>
<th></th>
<th>Telephone No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Napa, Lake, Solano, Yolo County Emergency Response</td>
<td>911</td>
</tr>
<tr>
<td>U.S. Coast Guard National Response Center</td>
<td>(800) 424-8802</td>
</tr>
<tr>
<td>National Poison Control</td>
<td>(800) 222-1222</td>
</tr>
<tr>
<td>Fire department</td>
<td>911</td>
</tr>
<tr>
<td>Solano County Sheriff</td>
<td>(707) 421-7090</td>
</tr>
<tr>
<td>Solano County EMS</td>
<td>(707) 784-8155</td>
</tr>
<tr>
<td>Vallejo EMS</td>
<td>(707) 784-8155</td>
</tr>
<tr>
<td>Burleson Consulting Inc. Personnel:</td>
<td></td>
</tr>
<tr>
<td>Project Manager: Greg Reller</td>
<td>(916) 984-4651 ext 111</td>
</tr>
<tr>
<td>SSC: Chris Scudder</td>
<td>(916) 984-4651 ext 113</td>
</tr>
</tbody>
</table>

## Medical and Site Emergencies:

Signal a site and/or medical emergency with three blasts of a loud horn (car horn, fog horn, etc.). Site personnel should evacuate to the area of safe refuge designated on the site map.

To be provided for each site

Step-by-step Route to Hospital: (see route map)

To be provided for each site


Note: This page must be posted on site.
EMERGENCY INFORMATION
POST ON SITE
Hospital Route To Be Provided Before Leaving Office

From Saint Johns Mine Road

1. Start out going southwest on Saint Johns Mine Road
2. Turn RIGHT onto Columbus Parkway
3. Continue on Columbus Parkway and turn LEFT onto Fairgrounds Drive
4. Continue on Fairgrounds Drive and turn RIGHT onto Sereno Drive
5. Continue on Sereno Drive and turn RIGHT onto Tuolumne Street
6. Continue on Tuolumne Street and turn RIGHT onto Hospital Drive

Approximately 5 miles, around 15 minutes one way trip
APPROVAL AND SIGN-OFF FORM

Project No.: __________________

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator as well as recommended procedures and guidelines provided in this plan. I understand the training and medical requirements for conducting field work and have met these requirements.

________________________________________________________________________

Name ____________________________ Date ____________________________

________________________________________________________________________

Name ____________________________ Date ____________________________

________________________________________________________________________

Name ____________________________ Date ____________________________

________________________________________________________________________

Name ____________________________ Date ____________________________

APPROVALS (Two Signatures Required):

________________________________________________________________________

Site Safety Coordinator Date ____________________________

________________________________________________________________________

Health and Safety Plan Reviewer/Approver Date ____________________________
DEFINITIONS AND NOTES

Emergency Contacts

**U.S. Coast Guard National Response Center** - For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Limitations:

The Project HSP is not appropriate for projects involving unexploded ordnance, radiation sources as the primary hazard, or known chemical/biological weapons site must employ the Long Form HSP

Decontamination:

Decontamination Solutions for Chemical and Biological Warfare Agents*: PPE and equipment can be decontaminated using 0.5% bleach (1 gallon laundry bleach to 9 gallons water) for biological agents (15 minutes of contact time for anthrax spores; 3 minutes for others) followed by water rinse for chemical and biological agents. In the absence of bleach, dry powders such as soap detergents, earth, and flour can be used. The powders should be applied and then wiped off using wet tissue paper. Finally, water and water/soap solutions can be used to physically remove or dilute chemical and biological agents. Do not use bleach solution on bare skin; use soap and water. Protect decon workers from exposure to bleach.

Decontamination for Radiological and Other Chemicals: For primary decontamination, staff should use Alconox and water unless otherwise specified in chemical-specific information resources. The effectiveness of radiation decontamination should be checked using a radiation survey instrument. Decontamination procedures should be repeated until the radiation meter reads less than 100 counts per minute over a 100 square centimeter area when the probe is held 1 centimeter from the surface and moving slower than 2.5 centimeters per second.

Decontamination Corridor: The decontamination set-up can be adjusted to meet the needs of the situation. The Level A decontamination set-up is included on Page 10 because it is the most complicated and critical. When compound- and site-specific information is available, the decontamination procedures can be altered to meet the needs of the specific situation.

Decontamination Waste: All disposable equipment, clothing, and decontamination solutions will be double-bagged or containerized in an acceptable manner and disposed of with investigation-derived waste.

Decontamination Personnel: Decontamination personnel should dress in the same level of PPE or one level below the entry team PPE level.

Most investigation-derived waste should be contained in trash bags and placed in regular trash. All investigation-derived waste considered to be grossly contaminated should be left on-site with the permission of the property owner. DO NOT dispose of contaminated waste until proper procedures are established.

Notes:

Attachments

Site Hazard/Activity Descriptions

MSDS for Alconox for cleaning sampling equipment

MSDS for Nitric Acid used to preserve Sample Containers

MSDC for Hydrochloric Acid used to preserve Sample Containers

Detailed Site Maps (To be provided for each site)
SITE HAZARDS/ACTIVITY DESCRIPTIONS

GENERAL

This section provides information on potential hazards from performing site surveys and soil and water sampling activities and at various sites located in Napa County, Yolo County, Solano County, and Lake County, California. Field activities and physical features of the site may expose field personnel to a variety of physical and biological hazards. The sites are remote; therefore, all staff will employ the buddy system while working at the site. Two or more personnel will perform the field work, or alternatively an employee could be accompanied by another consultant or the ranch supervisor to perform the work so long as two people remain on site during field work.

Injuries resulting from physical and biological hazards can be avoided by following appropriate guidelines and employing caution. To ensure a safe workplace, each person working on site will coordinate with the Site Safety Coordinator (SSC) and document regular safety inspections and will make sure that all workers and visitors are informed of any potential physical and biological hazards related to the site.

The following guidelines are provided to ensure worker safety at the site.

GENERAL SAFE WORK PRACTICES

Site workers will follow these general safe work practices:

- Hazard assessment is a continual process; personnel must be aware of their surroundings and the chemical, physical, biological, and radiological hazards.
- Individuals will be familiar with the physical characteristics of a site including: wind direction; accessibility to associates, equipment, vehicles, and communication; areas of known or suspected contamination; site access; and water sources.
- The number of people should be limited to only those necessary to complete the work tasks in a safe and efficient manner.
- Eating, drinking, chewing tobacco, smoking, and carrying matches or lighters are prohibited in a contaminated or potentially contaminated area or where the possibility for contamination transfer exists.
- If flammable materials are to be ignited, equipment will be bonded and grounded, spark-proof, and explosion-resistant, as appropriate. Smoking and any other sources of ignition are prohibited within 50 feet of any work area and sources of flammable/combustible chemicals.
- Avoid contact with potentially contaminated substances or materials. Do not walk through stained soils, puddles, pools, or mud, or handle soils without protective clothing. Avoid, whenever possible, kneeling on the ground, leaning, or sitting on equipment or the ground. Do not place monitoring equipment on the ground or other potentially contaminated surfaces.
- Under no circumstances will personnel enter any mine openings. Any evidence for a mine opening will be immediately communicated to all site personnel.
- Personnel are required to work using the buddy system unless specifically stated.
- All field-crew members should be alert to potentially dangerous situations, such as the presence of strong, irritating, unusual, or nauseating odors.
• Use protective equipment as specified.
• Use of heavy equipment on-site, such as backhoes, trucks, and bobcats, may be hazardous to site workers. For example, the vision of a backhoe operator is limited; therefore, all field crewmembers should stay clear when heavy equipment is operating.
• Wearing PPE can impair the ability to operate site equipment. Field-crew members should pay specific attention to decreased performance capabilities resulting from the use of PPE, such as poor tactile skills when wearing gloves. Prior knowledge of limitations associated with such equipment will allow the worker to assess his or her own decrease in capability to perform field operations in a safe manner.
• Wearing of jewelry, such as rings and loose bracelets and necklaces, is prohibited. Jewelry can become entangled in site machinery.
• Site personnel will perform only those tasks that they are qualified to perform.
• Site visitors are to be escorted by qualified personnel at all times.
• Running and horseplay are prohibited in all areas of the site.

PHYSICAL HAZARDS

Physical hazards that have been identified at these sites include the following:

• Driving to/from and at the site
• Slip-Trip-Fall and working and hiking in steep terrain
• Work around heavy equipment

Driving To/From the Site

The safety hazards associated with the operation of motorized equipment, including trucks and other vehicles, can be effectively controlled by the driver if a constant awareness of these hazards is maintained. All traffic regulations and rules of the road will be followed by personnel. Drivers will be alert and well rested. Use of a cell phone during driving is prohibited, drivers needing to make a phone call will park in a safe area and make the call while parked and resume driving only after the phone call is ended.

• Headlights will be turned on at all times.
• A 15-mile-per-hour (mph) speed limit on dirt roads at each site will be observed.

Personnel will not enter a site until Livermore Ranch personnel confirm access.

Slip-Trip-Fall Hazards

While it is difficult to prevent slip-trip-fall hazards, injuries can be prevented by proper site control measures and by keeping the work area free of obstructions. Each contractor or the SSC is responsible for monitoring the work site daily and ensuring that good housekeeping is maintained. The work surfaces and steps on equipment shall be kept clean. Materials and equipment not in use will be properly stored in a manner that does not interfere with ongoing work. Personnel will use established entry/exit points during the field activities, which will be kept clear of obstructions. Personnel will use established trails and access corridors to minimize the chance for trips and falls. Sturdy hiking boots are recommended and hiking poles are helpful.
Work Around Heavy Equipment

The hazards associated with the operation of heavy equipment can be effectively managed through adequate training and constant awareness. Consistent visual or verbal contact with the equipment operator will facilitate such awareness. All personnel working around heavy equipment will wear hard hats, safety glasses, steel-toed boots, hearing protection, and orange vests or shirts. Personnel will not approach the work area in which heavy equipment is being used without first making eye contact with the operator and verifying that the operator has seen the personnel via hand signals. In addition, personnel should keep an air-horn on site to allow instantaneous communication with the equipment operator. A system of air-horn signals will be agreed upon with the equipment operator to allow rapid communication.

Working near heavy equipment can subject workers to noise exposures in excess of allowable limits. The use of ear plugs or ear muffis is mandatory when noise prevents conversation in a normal voice at a distance of 3 feet. This “rule of thumb” is an indication that noise levels may exceed the OSHA action level of 85 decibels. All personnel required to wear hearing protection, as provided by this section, shall be in a hearing conservation program in compliance with 29 CFR Section 1910.95 and 8 CCR Section 5096. When the work area is noisy or workers are wearing hearing protection, workers must be more alert to account for the decrease in communication ability.

HEAT/COLD STRESS HAZARDS

Severe heat/cold stress hazards are not anticipated for this project. Work will be scheduled around severe weather events. Work activities do not include strenuous work tasks; however, avoid over-exertion when hiking on steep grades. Employees will use appropriate weather equipment. Bring adequate water.

BIOLOGICAL HAZARDS

Biological hazards associated with site activities present a potential threat to on-site personnel. Dangers are posed by poison oak, stinging insects (bees and wasps), black widow spiders, ticks, rattlesnakes, large animals (bears and mountain lions), dehydration, and giardia.

The chance for injuries from biological hazards may be minimized by following these guidelines, and avoiding areas of reported wildlife activity. To ensure a safe workplace, the SSC may conduct and document regular safety inspections and will make sure that all workers and visitors are informed of any potential biological hazards related to the site.

Giardia

Workers should assume that all fresh water streams are infected with the giardia organism and not drink any untreated water. Workers collecting sediment and water samples from streams should wash their hands thoroughly with soap and water after collecting the samples.

Poison Oak (R. diversiloba)

Poison oak is a shrub, climbing plant that grows up to 8 feet height, with three leaflet leaves. It is usually not found above 4,000 feet elevation. The tissues of this plant (leaves, branches, roots) contain a poisonous oil called urushiol, which is extremely irritating to the skin and causes a rash. It may be brushed onto the clothing or skin of people coming in contact with the plants, or onto pets. Contact with the plants should be avoided. After the oil has touched the skin, it usually takes some time for it to penetrate. Wash the skin thoroughly several times with plenty of soap (such as Technu) and water.
Venomous Arthropods and Snakes

Snakes and venomous arthropods, including insects, spiders, ticks, scorpions, centipedes, millipedes, and others, create a hazard when their habitats are disturbed. Wasp and bee stings account for a number of fatalities each year. In the United States, snake bites rarely cause fatalities because effective treatments have been developed. The best defense is to understand where these creatures may be found and avoid them before they can cause harm. Should a bite or sting occur, first aid should be applied immediately and medical treatment sought.

The likelihood for bites or stings can be reduced by refraining from placing hands and feet in areas that are not readily visible, by carefully inspecting the area before entering, by carefully inspecting the ground before sitting down, and by carefully inspecting objects before picking them up for examination.

Encounters with Large Animals

Large animals that could be present at the sites include bears and mountain lions. Mountain lions may be found in the vicinity, particularly if deer are present. Bears may also be found in the region.

Large animals should be avoided to prevent worker injuries. If large animal activity is noticed or reported in an area, then the area should be avoided until such activity has stopped. The following text summarizes what to do if a bear or mountain lion is encountered.

Black Bear

- While hiking, make noise to avoid a surprise.
- Never approach a bear. Give it plenty of room to pass by. Most black bears try to avoid confrontation when given a chance.
- Do not run from a bear. Running away from a black bear may stimulate its instinct to chase. You cannot outrun a bear. Instead, stand and face the animal.
- Make eye contact without staring.
- Give the bear room so that it can avoid you.
- If you encounter a bear cub, do not approach it! You run the risk of being attacked by a protective mother bear.

If a Black Bear approaches: Try to demonstrate to the bear that you may be a danger to it. Make yourself appear larger, stand up, raise your arms and open your jacket. Yell at the bear, bang pots and pans or whatever objects you may have with you, and create a general commotion.

If a Black Bear attacks: Research indicates that bear attacks have been avoided or injuries reduced when the victims fought back using any means available. Throwing rocks and striking the bear with branches or camping equipment have been shown to be effective.

Mountain Lion

Mountain lions are quiet, solitary and elusive, and typically avoid people. Mountain lion attacks on humans are extremely rare. However, conflicts are increasing as California’s human population expands into mountain lion habitat.

- Avoid hiking when mountain lions are most active–dawn, dusk, and at night.
- Do not approach a mountain lion.
If you encounter a mountain lion, do not run; instead, face the animal, make noise and try to look bigger by waving your arms; throw rocks or other objects.

If attacked, fight back.

EXCAVATIONS

Hazards associated with excavations include: potential collapse of the sides; employees or equipment falling into excavations; damaging utilities; and exposures to site contaminants.

A “competent person” (someone knowledgeable about the hazards and authorized to implement controls) will oversee excavation activities. Protective measures such as sloping, benching, or shoring will be implemented depending on the nature of the entry and soil classification. All trenching and excavation activities will conform to the requirements of T8 CCR Sections 1539 - 1543.

Excavation to depths greater than 5 feet requiring personnel entry are not anticipated. A permit will be obtained from Cal/OSHA (T8 CCR Section 341) before starting work on an excavation 5 feet deep or greater that personnel are required to enter.

Particulate Monitoring

Dust and airborne particulates are frequently generated during excavation and remediation activities, so inhalation of contaminants in fugitive dust or entrained soil particles represent an occupation exposure concern. A direct-reading dust monitor, such as the MiniRam or equivalent, may be used to measure particulates in the air. If elevated (visible) particulate matter conditions persist for 15 minutes or longer, the FM/SSHO is responsible for sampling the breathing zone with a particulate monitor. If dust control does not reduce dust generation, work will be temporarily stopped in affected area until monitoring equipment is obtained or until the visible dust has subsided to below the above limit.

DRILLING HAZARDS

Potential hazards associated with drilling operations include exposure to site contaminants; electrical hazards such as overhead power lines and underground utilities; rolling, spreading, or sliding tools and supplies; and rotating machinery. No drilling will be allowed within 5 feet of marked underground utilities or within 20 feet of overhead high-voltage electrical hazards. Whenever equipment operations must be performed closer than 20 feet from overhead power lines, the site safety manager must be notified.

Before the start of work, the drilling subcontractor will inspect all drilling equipment in the presence of the site safety officer. In addition to verifying that all drilling equipment is in good condition, the lead driller shall demonstrate that all safety interlock switches on the drilling equipment operate correctly. Drilling equipment inspections will be conducted at least weekly.

SPILLS OR LEAKS

If a hazardous waste spill or material release to the air, soil, or water at the site is observed, the site safety officer will notify the PM. An assessment will be made of the magnitude and potential impact of the release.

The PM will be notified immediately in the event of an emergency. The PM will immediately evaluate the incident and, if necessary, notify the appropriate emergency support services and the client. The authority to order personnel to evacuate the area rests with the PM or a qualified representative.
Transportation routes and maps will be posted in the project office and in each site vehicle prior to the initiation of on-site activities. The Emergency Notification Sheet will be posted next to the directions to the hospital. Emergency contacts, phone numbers and maps are shown at the front of this SSHSP.

Pre-planning measures to avoid personal injury or exposure include employee training, fire and explosion prevention and protection, chemical spill and discharge prevention and protection, and safe work practices. Before the start of the project, all personnel will review the project emergency response procedures including:

- Escape routes;
- Critical operations;
- Rescue/medical duties;
- Emergency reporting; and
- Emergency contacts.

During any on-site emergency, work activities in the affected area will cease until the emergency is bought under control.

Qualified first aid and CPR providers will treat minor injuries on site. If additional treatment beyond first aid is required, the injured personnel will be transported to the identified emergency medical care.

**SPILLS**

**Drummed Soil Cuttings and Decontamination Water:** 1) Drums of soil cuttings generated during direct push drilling and monitoring well installation will be stored upright on a pallet in an area of low vehicle traffic to minimize the potential for an accidental release. Drums will be clearly labeled as IDW and the contents will be specified. Before handling a drum, bung lids will be checked to be sure they are tight to prevent leaks should the drum inadvertently fall or be knocked over. 2) Full drums shall be moved only by heavy equipment to minimize the risk of worker injury or of tipping the drum over.

**Vehicle and Equipment Fluids:** 1) Materials that may cause contamination will be present in radiators, fuel tanks, hydraulic reservoirs, fuel cans, and oil cans. Vehicles and equipment will be inspected daily and immediately taken out of service in the event of leaks. Cans containing fuels or oils will be labeled and stored appropriately. 2) Non-emergency maintenance of heavy equipment or vehicles will not be performed on site. In the event on-site equipment maintenance is required, precautions such as buckets and plastic sheeting will be used to ensure contaminants are not released to the environment.

**Stock Piles:** Excavated soil will be stockpiled on-site pending backfill of the excavation. Transport of these materials by wind or rain erosion poses a potential hazard to operations and nearby surface water. Erosion will be mitigated by placing the stock piles on plastic sheeting and covering with plastic sheeting. Regular inspections and maintenance of the sheeting will be conducted to ensure it is maintained in good working order. It is recommended that a temporary earthen containment berm be constructed or silt fence be installed around the perimeter of the pile.
Material Safety Data Sheets

MSDS for Alconox for cleaning sampling equipment
MSDS for Nitric Acid used to preserve Sample Containers
MSDS for pH Meter Calibration Standards
Detailed Site Figures

To be Provided Before Leaving Office
Appendix C
Field Forms
Solid Matrix Sampling Procedure

1. Prepare rough sketch of site on form.
2. Identify specific location for sampling in accordance with objectives and site features.
3. Remove vegetation, debris, pebbles etc. from ground surface to expose underlying soil.
4. Excavate to target sampling depth.
5. Remove sample, taking care to avoid including loose material that may have fallen into the hole.
6. Place sample on No. 10 sieve and agitate for 5 minutes.
7. Place the fraction of soil passing the No. 10 sieve in a sealable plastic bag.
8. Visually describe soil retained and passing No. 10 Sieve on solid matrix sampling form.

Note: For wet and/or cohesive soil, the sieving step may be omitted, and any material greater than approximately 0.25 inch should be removed from the sample then proceed as for sieved samples.

Decontamination
1. Inspect and brush the No. 10 sieve to ensure that no soil fragments are adhering to the screen or stuck in the sieve openings.
2. Inspect and wipe the No. 10 sieve bottom tray with a moist cloth to remove any adhering soil particles.
3. Allow sieve and tray to dry.
4. Brush off and wipe down the trowel/scoop and inspect to remove any adhering soil particles.
Site Name: ________________________________

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<th>Date</th>
<th>Weather Conditions</th>
<th>Sampling Personnel</th>
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<td>Soil</td>
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<td>Sediment</td>
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<tr>
<td>Waste Rock</td>
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<thead>
<tr>
<th>Sampling Equipment</th>
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<td>Containers</td>
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Sample Location Sketch
## Solid Matrix Sampling and Form

(Site Name and Task)  
Date: ______________________

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<td>Feature</td>
<td>Measured Hg Vapor (ng/m³)</td>
<td>Comparison Criteria Hg Vapor (ng/m³)</td>
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<td></td>
<td>Ground</td>
<td>Breathing Zone</td>
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<td>T</td>
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<td>5 – 10 ng/m³</td>
<td>Suggested Action Levels for Indoor Air Hg Vapor:</td>
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<td>5 – 10 ng/m³</td>
<td>&lt;1,000 ng/m³</td>
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<td></td>
<td>World Health Organization (2000) Air Quality Guidelines—2nd Edition, Chapter 6.9 Mercury</td>
<td>Level acceptable for occupancy of any structure after a spill (also called the residential occupancy level.)</td>
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<td>OSHA Permissible Exposure Limit 8 hour Time Weighted Average</td>
<td>EPA Acute Exposure Guideline Levels (AEGL) for AEGL 2 Hg /8hours</td>
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<td>100,000 ng/m³</td>
<td>Airborne concentration above which irreversible or other serious, long-lasting adverse health effects, or an impaired ability to escape is predicted to be experienced by the general population</td>
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<td>Exposure limit for no more than 10 hours per day, 40 hours per week</td>
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# Chain of Custody Record

## Report To:

Bill To:  

Company:  

E-Mail:  

Tele: ( )  

Fax: ( )  

Project #:  

Project Name:  

Project Location:  

Sample Signature:  

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TURN AROUND TIME