Prepared for:

Chapman University

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Orange, California 92866

REVISION NO. 2 - SUPPLEMENTAL SITE INVESTIGATION WORK PLAN

FORMER ANACONDA WIRE AND CABLE FACILITY

ORANGE, CALIFORNIA

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Project Number

HR1324-02

23 July 2013

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1. INTRODUCTION

1.1 Terms of Reference

This Work Plan has been prepared to collect environmental data regarding the characterization of subsurface impacts at the former Anaconda Wire & Cable facility (the Site) located on the Chapman University (Chapman) campus in the City of Orange, California. This Work Plan was prepared by Mr. Mike Reardon, P.E. of Geosyntec Consultants (Geosyntec), and reviewed by Mr. Robert Ettinger, also of Geosyntec, in accordance with the internal peer review policy of the firm. Geosyntec has prepared this Report on behalf of its client, Chapman University (Chapman) for submittal to the California Santa Ana Regional Water Quality Control Board (RWQCB) and the Orange County Health Care Agency (OCHCA).

1.2 Overview

This work plan is Revision No.2 of the initial work plan for supplemental investigation submitted to the OCHCA and the RWQCB (the Agencies) on 9 November 2012. The initial work plan was revised and submitted to the RWQCB and OCHCA on 18 June 2013 to modify the proposed groundwater investigation based on recent source area investigation data and to include additional on-site assessment of deep soil and soil vapor and a conceptual plan for conducting soil vapor extraction (SVE) pilot testing of deep soils. Revision No.2 of the work plan was prepared in response to RWQCB comments received via e-mail on 15 July 2013, requesting the installation of three additional groundwater wells.

These tasks are proposed to collect necessary information for the design of remedial actions for Site. The scope of work relies on, and expands upon, the foundational work regarding the Site previously completed by Block Environmental and the recent supplemental source area investigation completed by The Source Group.

This work is being done consistent with the requirements of the National Oil and Hazardous Substances Contingency Plan (the "NCP"), 40 C.F.R. Part 300. Specifically, as required by 40 C.F.R. § 300.430(b)(8), this work plan describes a sampling and analysis plan consistent with these requirements. The site-specific health and safety plan, and the quality assurance project plan, which plans are required by 40 C.F.R. § 300.430(b)(6) and § 300.430(b)(6)(ii) respectively, are attached to this work plan and are to be adopted by the entity that executes the efforts outlined in this work plan. The site-specific health and safety plan and the quality assurance project plan have also been used for the Supplemental Source Area Investigation previously performed by the

Source Group, Inc. at the Site, and the quality assurance project plan was updated to reflect the scope of work in this work plan.

1.3 Work Plan Organization

The remainder of this Work Plan is organized into the following sections:

- Section 2, Background;
- Section 3, Technical Approach; and
- Section 4, Scope of Work

Referenced figures are included in a separate section at the end of this Work Plan.

2. BACKGROUND

Representatives of Chapman and the Agencies initially met on 30 May 2012 at the offices of the RWQCB to discuss the Site. OCHCA was not in attendance, but Mr. Lodrigueza of OCHCA gave his input to Mr. Saremi of the RWQCB for presentation at the meeting. At this meeting, Mr. Saremi indicated that the Agencies had determined that more work is necessary to characterize the Site.

Specifically, Mr. Saremi identified the following work elements to be completed:

- Agency approval of a Soil Contingency Plan (SCP) to address impacted soils that may be encountered during the planned demolition for the Site buildings in lieu of the slabs being left in place following demolition per an earlier request of the Agencies;
- Installation of six additional groundwater monitoring wells and groundwater sampling and analysis to delineate the extent of volatile organic compounds (VOC) impacts to groundwater at the Site in locations specified by Mr. Saremi (see Figure 1, map of well locations provided by Mr. Saremi at the 30 May 2012 meeting);
- Installation of soil vapor probes to be co-located with the six additional groundwater monitoring wells to assess soil vapor conditions at depths greater than 20 feet bgs;
- Delineation of the extent of VOCs in soil and soil vapor at the Site and the neighboring Marion Knott Studios (MKS), including two to three samples at depths ranging from 5-30 feet under Building 220, the building to be left on the Site after demolition and samples in a semi-circle around the MKS building to the east of the Site; and
- Remedial action (e.g., soil excavation and/or soil vapor extraction) to address elevated concentrations of VOCs detected in the source area.

After the 30 May 2012 meeting, the initial focus was on the SCP to be implemented during building demolition activities, with an understanding that site characterization work would follow. The SCP was submitted to the Agencies on 28 June 2012 and approved by the Agencies on 27 July 2012. Chapman is currently conducting demolition and implementing the SCP. As described in the SCP, this includes demolition of a majority of the Site structures and building slabs, removal of subsurface features (sumps, pits, etc.) that may be identified and excavation and off-site disposal of impacted soils from select areas.

In March 2013, a soil and groundwater investigation was conducted in the suspected source area at the Site. The results of this investigation were summarized in the Supplemental Source Area Investigation Report [The Source Group, 2013], submitted to the Agencies on 25 April 2013.

With demolition work at the Site underway, a subsequent meeting was held with the Regional Board on 5 June 2013 to discuss revisions to the initial scope of work for supplemental characterization including characterization of deep soil and soil vapor on site and conducting an SVE pilot test of deep on-site soils with the ultimate objective of completing the characterization and obtaining data to support design of the final remedies. This scope of work was incorporated into the revised work plan submitted to the Agencies on 18 June 2013. RWQCB comments on the revised work plan were received via e-mail on 15 July 2013 requested three additional groundwater wells; one off-site well located in the southeast corner of the Marion Knights Studios parking lot, one well along the west side of the Site, approximately west of existing well MW-3, and one well in an off-site area near the southwest corner of the Site.

3. TECHNICAL APPROACH – REVISED WORK PLAN

The following approach is proposed to collect additional Site characterization and remediation information determined by the Agencies to be necessary to implement a corrective action strategy necessary to obtain a no further action determination from the Agencies. This approach builds on the foundational work conducted by Block Environmental and the supplemental source area investigation conducted by The Source Group that were previously submitted to the Agencies. The revised work plan consists of the following components:

- Installation of seven additional and one contingent groundwater monitoring wells in the approximate locations shown on Figure 2. The contingent well, one of three additional wells requested by the RWQCB is located in the bus/train station area just south of the Site and permission for access will be required from the City of Orange and/or the Orange County Transportation Authority (OCTA). Given the difficult logistics to obtain access to install a well at this location, we propose to install and monitor the seven additional wells identified on Figure 2. After groundwater elevation and concentration data are obtained and reviewed from the expanded monitoring well network (10 wells total), a decision on the need to install this contingent well will be made. For example, if the groundwater flow direction based on the expanded network is not to the southwest, then the contingent well will not be needed. If it is determined that the contingent well is required, permission to install the well will be sought, but if permission is not granted, it may not be possible to install the well. Following the installation of the wells, four quarterly groundwater monitoring events of the existing and new wells will be conducted.
- Installation of 15 additional multi-depth soil vapor probes at six locations along the north, south and east sides of the MKS building (Figure 3). Soil samples will be collected during the installation of these soil vapor probes.
- Supplemental on-site characterization of deep soil and soil vapor through the installation and sampling ten permanent multi-depth and one single-depth soil vapor probes in the approximate locations shown on Figure 4. The deep soil vapor assessment will also include collection of soil vapor samples from the 3 existing shallow (0-15 ft.) and intermediate (15-45 ft.) depth SVE wells installed by Block Environmental and the exposed screens of the on-Site groundwater wells.
- Following completion of the deep soil and soil vapor assessment, an SVE pilot test of deep soils will be conducted. Results of the deep soil SVE pilot test the previous shallow and intermediate depth SVE pilot testing performed by Block Environmental will be evaluated to support design of the soil remediation system.

4. SCOPE OF WORK

4.1 General

This section provides details for the work tasks to be completed under this work plan;

- Groundwater Well Installation;
- MKS Soil Vapor Assessment;
- On-site Deep Soil and Soil Vapor Assessment; and
- Deep Soil SVE Pilot Test.

4.2 Groundwater Well Installation

The proposed locations for the seven additional and one contingent groundwater wells are shown on Figure 2. Three groundwater wells have already been installed at the Site and results of two groundwater gauging events indicate variable groundwater gradient at the Site ranging from easterly to west-southwest. Data from other facilities in the forebay region of the Orange County basin indicate southerly or southwesterly gradients. Groundwater flow gradient in the vicinity of the Site may be affected by recharge or pumping operations conducted in the region. Due to the potential variability in interpreted groundwater flow directions, the additional wells will be installed in locations ranging from east, south, and west of the Site in an effort to delineate the lateral extent of VOCs in groundwater and better define groundwater flow direction. An additional well will be installed to the northeast of the Site, which may be used to define background water quality and further assist in defining the groundwater gradient. Given the access logistics, the need for the contingent well will be assessed following the installation of the other seven wells and completion of the first sampling event. The additional wells will each be installed using the same methods and materials described below.

With the exception of the contingent well, the proposed groundwater wells will be installed on Chapman property. Should the contingent well be installed, an encroachment permit will be sought from the City of Orange and/or OCTA. Well permits will be obtained from the County of Orange and a worker health and safety plan will be prepared. Underground Service Alert will be notified 48 hours prior to drilling and each well location will be cleared of utilities by conducting a geophysical survey. In addition, the drilling locations will be hand augered or air-knifed to a minimum of 5 ft below grade.

4.2.1 Well Drilling and Installation

The boreholes will be drilled to approximately 120 feet below ground surface (ft bgs) using a sonic drill rig. Using sonic drilling methodology, the boreholes will be continuously sampled for lithological logging purposes. Upon reaching total depth at each borehole, a 4-inch diameter Schedule 40 PVC groundwater monitoring well with approximately 30 feet of 0.020-inch factory slotted screen and 90 feet of Schedule 40 PVC blank casing will be installed. Final well construction, including screen length and location will be based on Site lithology and groundwater conditions encountered. The filter pack will consist of prewashed #3 filter sand placed a minimum of 1 foot above top of screen with 1 foot of #30 transition sand. The filter pack will be sealed with a minimum of 3 feet of bentonite chips. The well annulus will be sealed with bentonite grout from top of bentonite chip well seal to 3 ft bgs. The groundwater monitoring well casings will be capped following construction. The wells will then be completed with traffic rated flush-mount well boxes. Each groundwater monitoring well will be constructed to State of California standards for observation and monitoring wells. Drill cuttings will be placed in drums or roll-off bins for off-site disposal.

4.2.2 Groundwater Well Development and Survey

The groundwater monitoring wells will be developed following a minimum of 48 hours after installation. Development will consist of surging and bailing of sediment, followed by sustained pumping. Pumping will be conducted with a 1.8-inch diameter submersible pump (Grundfos Redi-Flo 2 or equivalent) and will continue until turbidity values reach 10 NTUs or stabilizes whichever occurs first. Stabilization occurs when 3 consecutive readings fall within a 10% range between the three readings. Development water will be temporarily stored in drums pending off-site disposal. Following completion of development, the horizontal and vertical locations of the casings will be surveyed.

4.2.3 Groundwater Monitoring

Once installation, development and survey are completed, groundwater sampling of the newly installed wells and the three existing wells will be conducted. The newly installed wells will be sampled no sooner than one week following installation. It is proposed to conduct groundwater sampling on a quarterly basis for an initial one year period. It is anticipated that one year of quarterly monitoring will provide sufficient data to identify data gaps that may need to be addressed to complete the delineation of VOCs in groundwater, establish the groundwater gradient at the Site, and support development of a feasibility study of potential groundwater remedial measures. Each

groundwater sampling event will be conducted using the following methods and materials.

Prior to collecting groundwater samples, the depth to water will be measured in the monitoring wells using a water level meter. Groundwater samples will be collected using a low-flow sampling protocol as described by Puls and Barcelona [1996]. Non-dedicated pumps will be used to purge each well at rates ranging from 100 to 500 mL/min. Field parameters of turbidity, oxidation reduction potential (ORP), conductivity, pH, dissolved oxygen, and temperature will be monitored during purging.

Upon reaching stability as defined by the low-flow sampling protocol, groundwater samples will be collected in laboratory supplied containers. The samples will be labeled, double-bagged in plastic bags, and placed in an insulated cooler with ice for transportation to Calscience Laboratories under chain of custody protocols. Groundwater samples will be analyzed for VOCs by EPA Method 8260B, 1,4-dioxane by EPA Method 522 and dissolved hexavalent chromium by EPA Method 218.6. Hexavalent chromium samples will be collected in unpreserved containers and filtered by the laboratory prior to analysis.

Field duplicate samples are typically collected from approximately 10 percent of the total number of groundwater samples collected. Accordingly, one duplicate groundwater sample will be collected during the monitoring event. Samples will be stored and transported to the laboratory with a trip blank sample.

Reusable groundwater sampling equipment (water level meter, electrical submersible pump, flow thru cell, etc.) will be washed using a three stage decontamination procedure prior to groundwater purging and sample collection at each well. An equipment decontamination blank sample will be collected on each day non-dedicated sampling equipment is used in the field. Trip and equipment decontamination blank samples will be analyzed for VOCs. Purge water from groundwater wells and decontamination liquids will be placed into labeled 55-gallon drums for storage at the designated Site location for subsequent off-site disposal.

4.2.4 Reporting

Well installation, development and initial sampling activities will be documented in a report submitted to the Agencies. The report will include borehole logs and construction diagrams for each of the wells, laboratory data from groundwater samples and recommendations for additional groundwater investigation, as warranted. Results of successive quarterly sampling events will be submitted to the Agencies in separate

reports following the completion of each event. In addition, the first monitoring report will include an assessment of the need for the contingent well.

4.3 MKS Soil Vapor Assessment

As shown on Figure 3, six soil borings will be installed along the north, south, and east sides of the MKS building. At each of these locations multi-depth soil vapor probes will be installed to complete the characterization of soil vapor performed by Block Environmental along the western side of MKS. For reference, figures illustrating existing soil vapor data for the Site and surrounding properties (MKS, Time Warner and VPO) are included in Attachment A.

At the six locations, soil vapor probes will be constructed with sample screens at depths of 5 and approximately 15 ft bgs. In addition, at three of the locations, an additional sample screen will be installed in the coarse-grained or relatively permeable soils at depths of up to 50 ft bgs (or refusal of the direct push drill rig) to assess the potential for deeper migration of VOCs in soil vapor. Details regarding probe installation and sampling are included below.

4.3.1 Soil Borings

Soil borings will be installed using a direct push drill rig. Soil borings will be drilled to target depths of either 20 or 50 ft bgs, or until refusal. Boreholes will be advanced into the coarse grained soils for installation of soil vapor probes. Based on findings from previous soil borings drilled at the Site, a coarse grained soil layer has been identified at depths between 15 and 20 ft bgs with possible deeper layers at depths up to 50 ft. The 5- and 15-ft multi-depth probes will be installed in the same borehole as dual completion probes while the deeper 50-ft probes will be installed as single completion probes in a separate borehole installed adjacent to the dual completion location.

Underground Services Alert will be contacted 48 hours prior to drilling and each borehole location will be cleared of utilities by conducting a geophysical survey. Concrete or asphalt materials at each borehole location will be cored by the driller. As an added precaution, the upper 5 ft of each borehole will be advanced using a hand auger. The remaining portion of each borehole will be advanced using the direct push drill rig. Soil samples will be continuously (depending on recovery) collected over the entire borehole depth using a 2- or 4-ft sampler lined with acetate sleeves. Soil samples will be screened using a photoionization detector (PID) and visually evaluated for evidence of impacts, staining or odors. Up to two soil samples per boring will be retained for laboratory analytical testing. Soil samples will be collected from depths exhibiting elevated PID readings or other evidence of impacts (odor, visual staining,

etc). Should evidence of impacts not be identified, soil samples will be collected from the depths where the soil vapor screens will be installed. Samples will be stored in a cooler on ice pending shipment to Calscience Laboratories under chain of custody protocol. Soil samples will be analyzed for VOCs by EPA Method 8260B, 1,4-dioxane by EPA Method 8270C, and hexavalent chromium by EPA Method 7199. Samples for VOC analysis will be collected in Encore or equivalent samplers for extraction by the laboratory under EPA Method 5035.

Boreholes will be logged through evaluation of drill cuttings and soil samples. Drill rods will be decontaminated with a three-stage rinse between borehole locations. The direct push method does not produce significant drill cuttings; however, some waste cuttings and decontamination water will be generated. Investigation-derived wastes will be stored in drums for off-site disposal.

4.3.2 Soil Vapor Probe Installation

The soil vapor investigation will be conducted by installing soil vapor probes at each of the six soil boring locations with soil vapor screens at depths of 5 and approximately 15 ft bgs. In addition a deeper single completion probe will be installed at three locations with soil vapor screen at a depth of 50-ft bgs or within a relatively permeable unit at nearby depths. Once soil borings are advanced to the target depth into the coarse grained soil layer (between 15 and 20 ft bgs or 50 ft bgs), the soil vapor probes will be constructed in the borehole. Soil vapor probes will be installed in general accordance with the Department of Toxic Substances Control (DTSC) and Los Angeles and San Francisco Regional Water Quality Control Boards (RWQCB) "Advisory for Active Soil Gas Investigations" [DTSC and RWQCB, 2012]. Depths of soil vapor probe screens or probe construction may be adjusted based on encountered soil lithology (presence of clay layers, etc). Adjustments and technical rationale for such adjustments, if necessary, will be provided in the discussion of field work activities to be included in the data report. Soil vapor probes will be completed at the surface with traffic rated vaults.

4.3.3 Soil Vapor Sampling

Per regulatory guidance, it is recommended that soil vapor sampling be conducted no sooner than 2 hours following probe installation using direct push methodologies and not be conducted during or immediately after a significant rain event (e.g. ½ -inch or greater). Soil vapor samples will be collected from each of the 15 soil vapor probes and analyzed on-site using a mobile laboratory in general accordance with the DTSC / RWQCB "Advisory for Active Soil Gas Investigations" [DTSC and RWQCB, 2012].

Sample collection procedures will include conducting a shut-in test of the sampling train, a purge volume test performed at the first sampling location to determine the purge volumes to be used for successive samples, and the use of a leak check compound. Efforts will be made to collect soil vapor samples at flow rates less than 200 milliliters per minute and at applied vacuums of less than 100 inches of water. Soil vapor samples will be analyzed on site by a State of California certified mobile laboratory or fixed laboratory for VOCs by EPA Method 8260B or TO-15.

4.3.4 Data Analysis and Report

A report will be prepared summarizing the MKS property soil and soil vapor data. The report will document field activities and present the data and findings of the assessment. The report will include figures illustrating sampling locations and copies of laboratory data. Borings logs will also be prepared and included in the report.

4.4 On-Site Deep Soil and Soil Vapor Assessment

4.4.1 Soil Sampling

Eleven locations have been selected for deep soil assessment based on the existing data (Figure 4). Soil borings will be drilled to target depths of approximately 90 ft bgs. Underground Services Alert will be contacted 48 hours prior to drilling and each borehole location. If present, concrete or asphalt materials at each borehole location will be cored by the driller. As an added precaution, the upper 5 ft of each borehole will be advanced using a hand auger. The remaining portion of each borehole will be advanced using a hollow-stem auger drill rig. Soil samples will be sampled at 5 ft intervals using a California split spoon sampler. Recovered soil samples will be screened using a PID and visually evaluated for evidence of impacts, staining or odors. Soil samples will be collected from depths exhibiting elevated PID readings or other evidence of impacts (odor, visual staining, etc). Should evidence of impacts not be identified, soil samples will be collected from the depths where the soil vapor screens will be installed as detailed in Section 4.4.2. Samples will be stored in a cooler on ice pending shipment to Calscience Laboratories under chain of custody protocol. Soil samples will be analyzed for VOCs by EPA Method 8260B, 1,4-dioxane by EPA Method 8270C, Title 22 metals by EPA Method 6010B/7471A, and hexavalent chromium by EPA Method 7199. Samples for VOC analysis will be collected in Encore or equivalent samplers for extraction by the laboratory under EPA Method 5035.

Split-spoon samplers will be decontaminated with a three-stage rinse between sample intervals. Drill augers will be decontaminated between borehole locations.

Investigation-derived wastes will be stored in drums or roll-off bins for off-site disposal.

4.4.2 Soil Vapor Probe Installation and Sampling

Multi-depth soil vapor probes will be installed at approximate depths of 30, 60, and 90 ft bgs. Soil vapor probes will be installed at these depths in each of the eleven soil boring locations (Figure 4) with the exception of the 30 and 90 ft bgs depth intervals for the location near existing vapor extraction well VEW-3 and groundwater monitoring well MW-2. This boring will be drilled to 60 ft bgs with a soil vapor probe installed at approximately 60 ft bgs. Existing vapor extraction wells (the 33-45 ft bgs depth interval) and groundwater monitoring wells (90 ft bgs depth) will be sampled for soil vapor in lieu of constructing new probes at these depths and locations. The permanent multi-depth soil vapor probes will be constructed with either; ¼-inch diameter tubing and 6-inch screens attached to a 1-inch PVC probe support, or 1-inch diameter PVC blank casing and 5-foot screens. Soil vapor probes will be constructed in general accordance with the Advisory for Active Soil Gas Investigations [DTSC and RWQCB, 2012] with sand packs around screen zones, bentonite seals and cement-bentonite grout to fill remaining borehole voids to ground surface. Depths of soil vapor probe screens or probe construction may be adjusted based on encountered soil lithology (presence of clay layers, etc). Adjustments and technical rationale for such adjustments, if necessary, will be provided in the discussion of field work activities to be included in the data report. The surface at each deep soil vapor probe location will be completed with flush-mount traffic rated well boxes.

Sampling of the soil vapor probes will be conducted in accordance with the Advisory for Active Soil Gas Investigations [DTSC and RWQCB, 2012]. Samples will be analyzed by a mobile laboratory or fixed laboratory via EPA Method 8260B or TO-15 for VOC analysis.

4.4.3 Data Analysis and Report

A report will be prepared summarizing the deep soil and soil vapor data. The report will document field activities and present the data and findings of the assessment. The report will include figures illustrating sampling locations and copies of laboratory data. Borings logs will also be prepared and included in the report. Depending on the sequencing of the other investigation tasks, reporting efforts may be combined. The deep soil and soil vapor assessment report will also include details regarding the installation of select deep SVE wells and equipment to be used for the deep soil SVE pilot test (see next section).

4.5 Deep Soil SVE Pilot Test

SVE is the presumptive remedy for on-site soils at the Site. Three dual completion wells (VEW-1, VEW-2, and VEW-3; Figure 3) have already been constructed at the Site, each with screened intervals at 10 to 15 and 33 to 45 feet bgs. Although SVE pilot testing has been previously conducted at these wells in 2012, subsequent investigations have identified VOC impacts in deeper soils, and the feasibility of SVE for these deeper soils has not been assessed. As such, a deep soils SVE pilot test is proposed to be conducted following completion of the deep soil and soil vapor investigation.

Using the data collected from the deep soil and soil vapor investigation, up to three locations will be selected for installation of deep (greater than 50 ft bgs) SVE wells to be used for pilot testing. The deep soil and soil investigation report will include the specific proposed locations, screen intervals and other construction details. As vacuums are applied to the newly installed deep SVE wells, vacuum response can be monitored in deep multi-depth soil vapor probes, exposed screens of groundwater wells and the existing dual completion shallow and intermediate SVE wells.

The primary objectives of the pilot testing are to: (1) evaluate the feasibility of SVE as a remedial technology to address the VOC-impacted deep unsaturated soil, and (2) to collect data necessary for full-scale SVE design. To achieve these objectives, the following specific data will be collected during the pilot test:

- Vacuum pressure versus flow relationship for the extraction wells in deep soil zones;
- Vacuum response at various distances from the SVE well in shallow, intermediate and deep zones;
- Concentration and composition of extracted vapors; and
- Extracted water/condensate generation rate.

At this time, it is estimated that the SVE pilot test will be performed using a skid-mounted extraction treatment system operated under a various locations South Coast Air Quality Management District (SCAQMD) permit. The SVE unit will include a blower estimated to be capable of a flow of 200 standard cubic feet per minute (scfm) at 25 inches of mercury (in-Hg), and a minimum two vapor-phase granular activated carbon (GAC) canisters for treatment of the extracted vapors generated during the test.

The pilot test will consist of short duration step-tests, performed on each extraction well screen, followed by an extended constant rate test with concurrent extraction from all of the deep extraction wells. Field data will be collected at regular intervals during the pilot test including the following:

- Measurement of vapor flow rate and vacuum at the treatment unit header and at each of the extraction wells being operated;
- Measurements of induced vacuum at deep, intermediate and shallow vapor monitoring points; and
- Concentrations of VOCs using a PID at each extraction well, the treatment unit header and before, between and after the GAC canisters. Influent vapor samples to the treatment unit will also be periodically collected for fixed laboratory analysis of VOCs.

The Agencies will be informed of additional details regarding the deep SVE pilot testing, including locations and design of deep SVE wells following completion of the deep soil and soil vapor assessment.

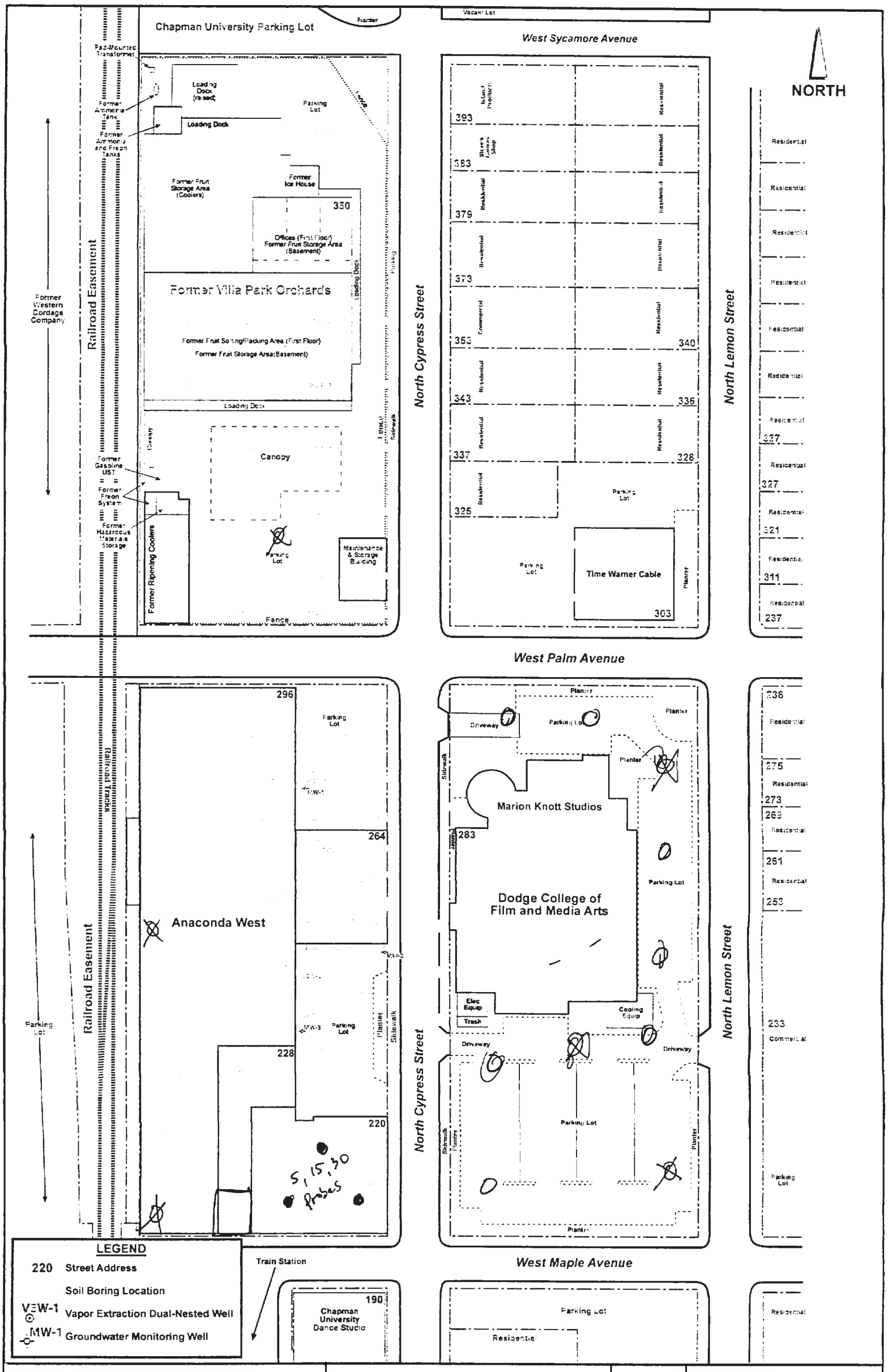
5. REFERENCES

California Department of Toxic Substances Control (DTSC) and California Regional Water Quality Control Board – Los Angeles Region (LARWQCB) 2012. Advisory Active Soil Gas Investigations. April.

Puls, R.W. and M.J. Barcelona, 1996, Low flow (minimal drawdown) Groundwater Sampling Procedure, EPA/540/S-95/504, 12pp.

Source Group, 2013, Supplemental Source Area Investigation, Former Anaconda Wire and Cable Facility, 220-296 N. Cypress St, Orange CA. April 25.

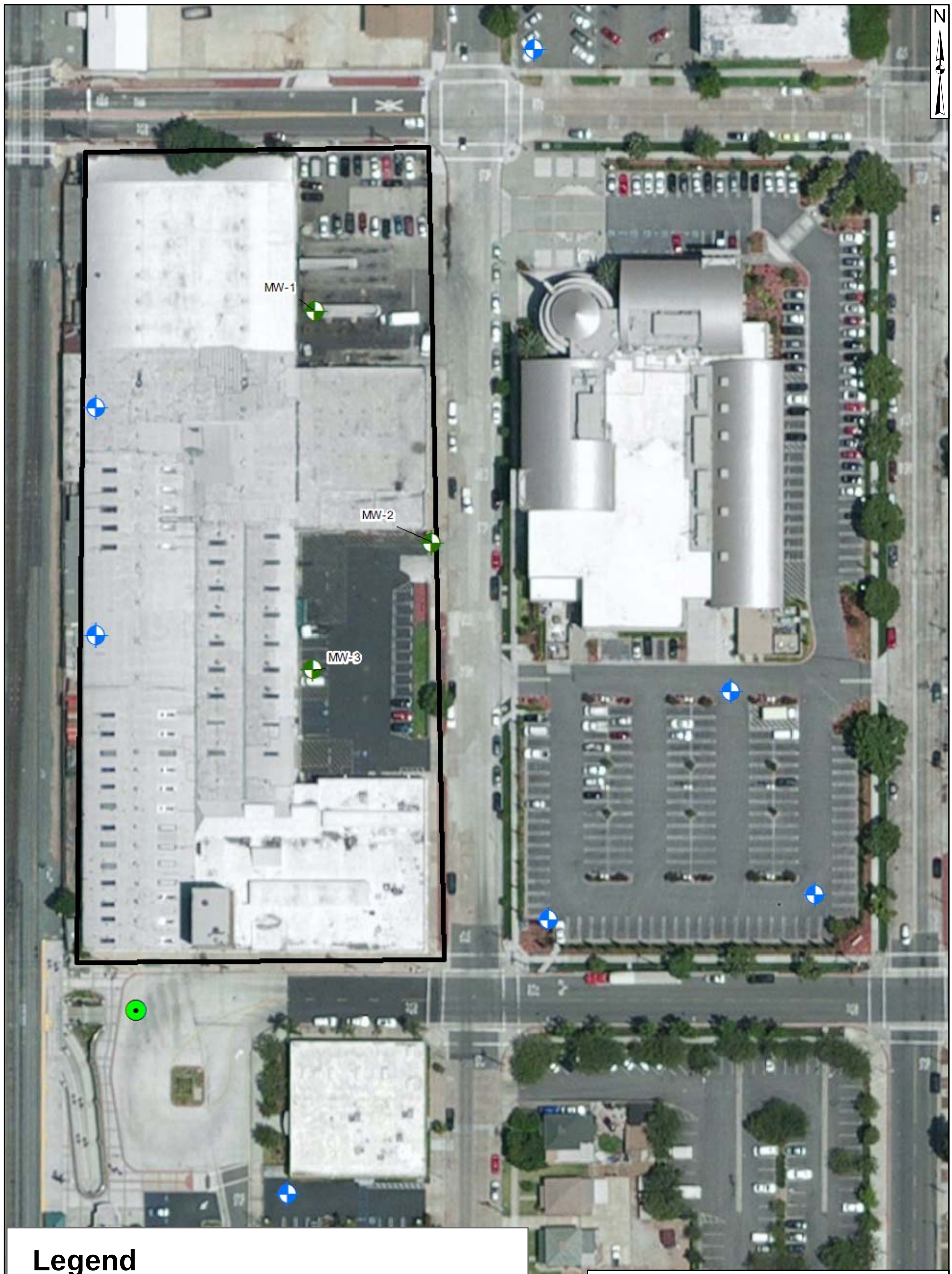
FIGURES



we'll
boring
Soil probes

5, 15, 30 Probes

Chapman University Properties **220-350 North Cypress Street** **Orange, California**	**Groundwater Monitoring Well Locations Identified by RWQCB at 30 May 2012 Meeting**	**Figure 1**	**BLOCK ENVIRONMENTAL** 23 Musick, Suite 100 Irvine, California 92618



Legend

- Proposed Groundwater Monitoring Well
- Existing Groundwater Monitoring Well
- Contingent Groundwater Monitoring Well
- Site Boundary

On-Site locations may adjusted based on development plans

Proposed Groundwater Well Locations

Former Anaconda Wire and Cable Facility
Orange, California

60 30 0 60 120
Feet

Geosyntec consultants

Figure
2

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July 2013

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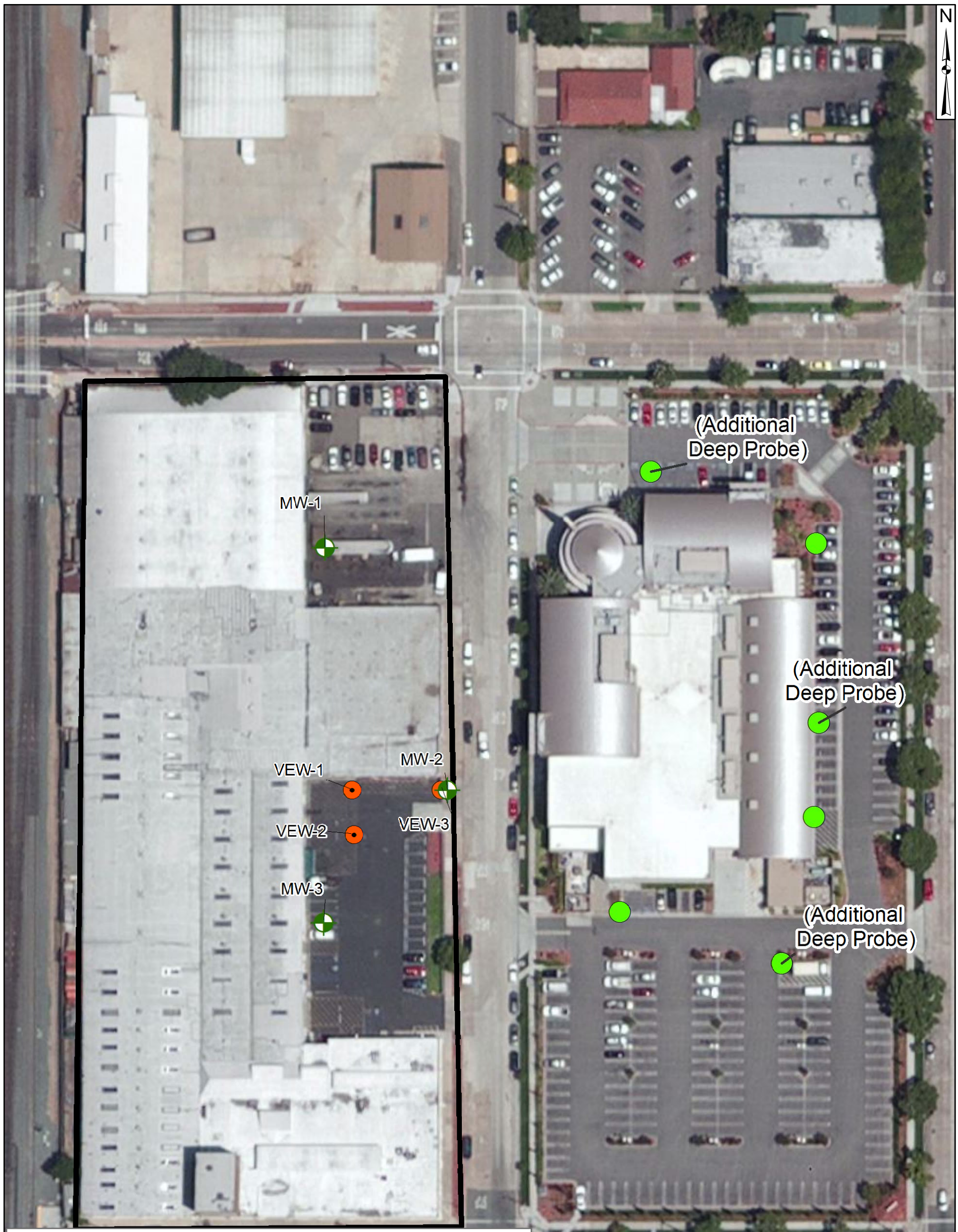

Legend

- Proposed Soil Vapor Locations
- Existing Groundwater Monitoring Well
- Vapor Extraction Dual-Nested Well
- Site Boundary

On-Site Locations may be adjusted based on development plans

Proposed off-site Soil Vapor Locations

Former Anaconda Wire and Cable Facility
Orange, California

60 30 0 60 120
Feet

Geosyntec consultants

Figure
3

Project No: HR1324

June 2013

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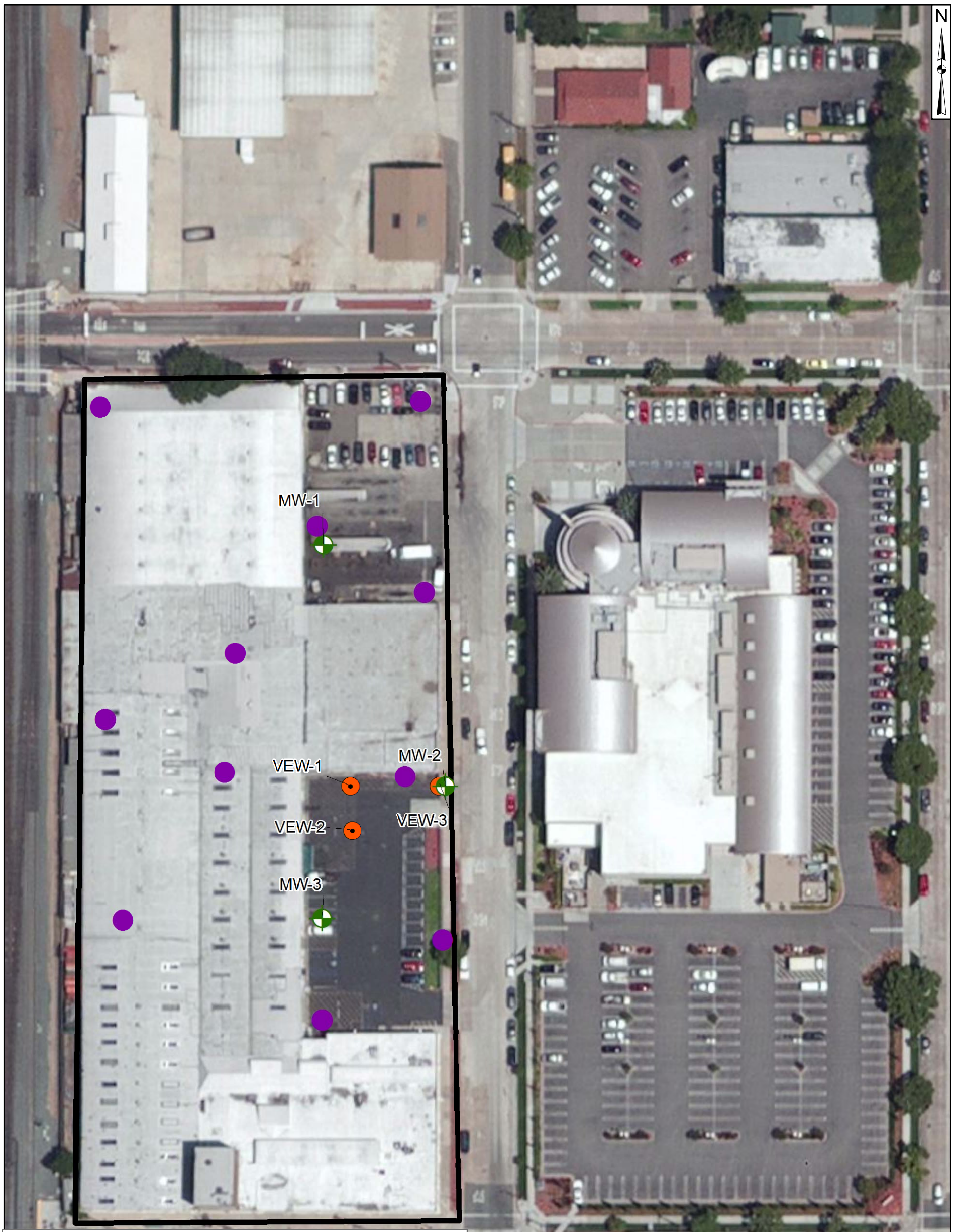

Legend

- Proposed Deep Soil Locations
- Existing Groundwater Monitoring Well
- Vapor Extraction Dual-Nested Well
- Site Boundary

On-Site Locations may be adjusted based on development plans

Proposed Deep Soil/Soil Vapor Locations

Former Anaconda Wire and Cable Facility
Orange, California

60 30 0 60 120
Feet

Geosyntec consultants

Figure 4

Project No: HR1324

June 2013

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Geosyntec consultants

ATTACHMENT A

HEALTH AND SAFETY PLAN

SITE HEALTH AND SAFETY PLAN

ENVIRONMENTAL CONSULTING SERVICES

FORMER ANACONDA WIRE AND CABLE FACILITY

04-ANA-001

Prepared For:

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Orange, California, 92866

Prepared By:

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1962 Freeman Avenue
Signal Hill, CA 90755
January 7, 2013

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LIST OF APPENDICES

HEALTH AND SAFETY PLAN REVIEW AND APPROVAL

Client: Chapman University **Site Name:** Anaconda Wire

Project: Environmental Consulting **Project Number:** 04-ANA-001

Angela Czuba Plan Completed/Updated By	_____ *Signature*	January 7, 2013 *Date*
Neil Irish Principal-in-Charge	_____ *Signature*	_____ *Date*
Walter Morales Site Health and Safety Coordinator	_____ *Signature*	_____ *Date*

This Site Health and Safety Plan (HASP) has been written for the use of The Source Group, Inc. (SGI), and its employees only. It may also be used as a guidance document by properly trained and experienced SGI subcontractors. However, SGI does not guarantee the health or safety of any person entering this Site. All subcontractors under contract with SGI will be required to follow the requirements in this Health and Safety document.

Due to the potential hazardous nature of this Site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards, which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this Site. The health and safety guidelines in this HASP were prepared specifically for this Site and should not be used on any other site without prior research by trained health and safety specialists.

SGI claims no responsibility for its use by others. The Site HASP is written for the specific site conditions, purposes, and personnel specified and must be amended if these conditions change. Changes to the requirements for health and safety guidelines must be approved by the SGI Health and Safety Coordinator.

PROJECT TELEPHONE NUMBERS

PROJECT TELEPHONE NUMBERS

LOCAL EMERGENCY TELEPHONE NUMBERS

CONTACT	NAME	TELEPHONE NO.
IN AN EMERGENCY CALL 911		
Fire	Fire Department	911
Police	Police Department	911
Hospital	St. Joseph Hospital	(714) 771-8000
Urgent Care	St. Joseph Urgent Care	(714) 628-3300

PROJECT PERSONNEL TELEPHONE NUMBERS

PROJECT RESPONSIBILITY	NAME	TELEPHONE NO.
SGI Site Health & Safety Coordinator	Walter Morales The Source Group, Inc.	(562) 597-1055 ext 105 Mobile (562) 244-8842
SGI Project Manager and Principal in Charge	Neil Irish The Source Group, Inc.	(562) 597-1055 Mobile (562) 760-8659
Site Contact	Deryck Roberts	Mobile(562) 343-4016
Client Contact	Jordan Zell	(949) 864-2947
SGI Health and Safety Director	Eileen Bullen The Source Group, Inc.	 Mobile (248) 921-1665

REGULATORY TELEPHONE NUMBERS:

AGENCY	NAME	TELEPHONE NO.
Orange County Health Care Agency		(714) 433-6000

IN THE EVENT OF DAMAGE TO AN UNDERGROUND UTILITY:

AGENCY	TELEPHONE NO.
If it is life threatening, clear the area and call:	911 and the utility owner
If it is NOT life threatening call:	utility owner
For utility owner emergency phone numbers contact USA and refer to the USA Ticket Number for the project	811

IN THE EVENT OF A HAZARDOUS WASTE SPILL/RELEASE,
THE SGI PROJECT MANAGER SHOULD CONTACT THE FOLLOWING:

AGENCY	TELEPHONE NO.
California Office of Emergency Services	800-852-7550

Refer to the Emergency Spill Response section of this HASP, for additional notification requirements and procedures.

FIGURES

TABLES

1.0 INTRODUCTION

The Source Group, Inc. (SGI) has prepared this Site Health and Safety Plan (HASP; the "Plan") on behalf of Chapman University. This HASP addresses site safety issues associated with planned activities at the former Anaconda Wire Company site, located at 220, 228, 264, and 296 North Cypress Street, Orange, California (the Site, Figure 1). The Site activities are to be performed by SGI personnel and its subcontractors. In this HASP, the term "subcontractors" refers to subcontractors under contract with SGI. This Site HASP has been developed for the use of SGI personnel and its subcontractors, and is specific to the tasks being conducted by SGI.

1.1 Purpose

The primary purpose of this HASP is to provide SGI and subcontractor personnel with an understanding of the potential physical and chemical hazards that exist or may arise during Site activities. Additionally, the information contained herein will define the safety precautions necessary to respond to such hazards should they occur.

1.2 Objective

The primary objective is to ensure the well being of all field personnel and the community surrounding the Site. In order to accomplish this, project staff and approved subcontractors shall acknowledge and adhere to the policies and procedures established herein.

1.3 Project Description and Scope of Work

The scope of work to be conducted includes investigation of soil, soil gas, ambient air and soil sampling potentially using hand tools, Geoprobe, hand auger and hollow stem auger drilling

The specific tasks planned include;

1. Monitoring of Site demolition and excavation
2. Subsurface investigation
3. Geoprobe
4. Hand Auger

The task numbers assigned above will be referred to throughout the HASP.

2.0 PROJECT PERSONNEL

SGI and subcontractor personnel will act in accordance with applicable federal, state, regional, and local regulations during all phases of the project. All subcontractor personnel working on the Site are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. At the time of job assignment, special training will be provided to Site personnel who may be exposed to unique or special hazards. The training and medical requirements and responsibilities for Site personnel are discussed below.

All subcontractor personnel assigned to this project shall have appropriate training and medical clearance. The subcontractor supervisor or manager is required to sign the Subcontractor Training and Medical Clearance Record Form (Appendix A). Subcontractor personnel without proper training and medical clearance will not be allowed to work on the Site.

2.1 SGI Key Personnel

Each person on the Site has responsibility for their own health and safety, as well as assisting others in carrying out the HASP. Any person observed to be in violation of the HASP should be assisted in complying with the HASP, or reported to the Site Health and Safety Coordinator. Any Site personnel may shut down field activities if there is a real or perceived immediate danger to life or health or the environment.

The implementation of health and safety protective measures at the Site will be an integrated effort among the SGI Project Manager, the appointed Site Health and Safety Coordinator, and the Health and Safety Director. The specific personnel that will fill these roles for this project are identified below.

Project Manager: .....Neil Irish

Site Health and Safety Coordinator: .....Walter Morales

Health and Safety Director: .....Eileen Bullen

2.1.1 Project Manager

The Project Manager is, by definition, the individual who has primary responsibility for ensuring health and safety compliance on this project. The Project Manager, therefore, is ultimately responsible for implementing the requirements of this HASP. Some of the Project Manager's specific responsibilities include:

- Ensuring all SGI employees training and medical clearances are confirmed.

- Ensuring that subcontractor personnel assigned to this project have appropriate training and medical clearance. The subcontractor supervisor or manager is required to sign the Subcontractor Training and Medical Clearance Record Form (Appendix A).
- Verifying all utility clearances.
- Maintaining regular communication with the Site Health and Safety Coordinator.

2.1.2 Site Health and Safety Coordinator

The Site Health and Safety Coordinator is responsible for enforcing the requirements of this HASP once Site work begins and has the authority to immediately correct all situations where noncompliance with this HASP is noted, including the immediate stoppage of work in cases where an immediate danger is perceived. Some of the Site Health and Safety Coordinator's specific responsibilities include:

- Ensuring that all Site personnel (SGI, subcontractor, visitor) have read and understand this HASP and have completed the HASP Acknowledgement and Agreement Form (Appendix B).
- Conducting a tailgate safety meeting (Appendix C) for all Site personnel (SGI, subcontractor, visitor), prior to performing work at the Site, apprising them of the contents of the HASP and potential site-specific hazards.
- Assuring that sufficient personal protective equipment (PPE), as required by this HASP, is available at the Site.
- Calibrating air monitoring instrumentation, performing air monitoring, and maintaining air monitoring logs, if required.
- Setting up and maintaining the personnel decontamination facility.
- Notifying the Project Manager of all noncompliance situations.
- Supervising and monitoring the safety performance of all personnel to ensure that required health and safety procedures are followed, and correcting any deficiencies.
- Conducting near miss and incident investigations and preparing appropriate reports (Appendix D).
- Initiating and supervising emergency response procedures.

2.1.3 Health and Safety Director

The Health and Safety Director is the individual responsible for the interpretation and modification of the HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the Project Manager or the Site Health and Safety Coordinator without the approval

of the Health and Safety Director. Some of the Health and Safety Director's specific responsibilities include:

- Advising the Project Manager and Site Health and Safety Coordinator on matters relating to health and safety on this project.
- Coordinating field audits to monitor the effectiveness of this HASP and to assure compliance with it.
- Supporting the Project Manager as needed to evaluate site conditions and new information which might require modifications to the HASP.

2.2 Minimum Training, Respirator Fit-Testing, and Medical Surveillance Requirements for SGI Personnel

- 40 hr. Hazardous Waste Operations Training (HAZWOPER) 29CFR1910.120.
- 8 hr. Annual HAZWOPER Refresher Training (current).
- 8 hr. Supervisor HAZWOPER Training for Site Health and Safety Coordinator.
- Annual Respirator Fit Testing.
- Annual Medical Clearance and Respirator Clearance by a physician.

2.3 Site Visitor

Occasionally, visitors may arrive at the Site during field activities. In general, most visitors can be accommodated by providing a viewing area in a safe location away from the active work zones and presenting a briefing conducted by the Site Health and Safety Coordinator. All visitors will sign into the Site. All visitors will read, understand, and sign the Health and Safety Acknowledgement and Agreement Form (Appendix B), acknowledging they have read and understand the HASP.

In some instances, visitors may require access to restricted zones of the Site. If a visitor desires access to the Site, the Site Health and Safety Coordinator will make arrangements for entry. The required level of PPE within the exclusion area will be strictly adhered to. Visitors must be escorted at all times. Visitors who cannot show proof of the required documentation of employee training and participation in a medical monitoring program as mandated by California Occupational Safety and Health Administration (CAL-OSHA) will not be allowed access to the exclusion areas. If respiratory protection is required, the visitor must furnish their own, and the respirator type must match the specifications detailed in this HASP.

If a workable, safe arrangement cannot be agreed upon, or if the activities of the visitor jeopardize Site activities, the Site Health and Safety Coordinator should immediately contact the Project Manager, who may decide to stop work activities immediately.

3.0 GENERAL HEALTH AND SAFETY PROCEDURES

- Utility Clearance will be completed prior to beginning any subsurface work.
- The Site Health and Safety Coordinator is responsible to ensure that the health and safety plan procedures are followed. Any subcontractor or other person subject to the plan will be dismissed for failure to comply.
- Daily tailgate safety meetings will be held by the Site Health and Safety Coordinator.
- All personnel who will be working in the contamination control zone will undergo an industrial hygiene baseline medical examination before commencing work. This requirement does not apply to individuals who have taken the examination during the last 12 months.
- The same personnel must be fitted and fully instructed on the use of respirators prior to starting work. Beards or other facial hair that interfere with respirator fit are prohibited for those individuals who may be required to use respiratory protection.
- Hearing protection in the form of disposable earplugs will be worn around heavy equipment, machinery, or when two individuals five feet or less apart need to shout to be heard.
- Potable water must always be available at the Site.
- Hands must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.
- If toilet facilities are not located within a 5-minute walk from the decontamination facilities, either provide a chemical toilet and hand washing facilities or have a vehicle available (not the emergency vehicle) for transport to nearby facilities.
- Establish Exclusion Zone, and set up Contamination Reduction Zone and Support Zone when upgrading to Level C.
- If necessary, provide dust control by spraying soils with water or a surfactant/water solution.
- Perform regular air monitoring in working zone.
- Use ground fault circuit interrupters for plug-in electrical devices and extension cords.
- Be aware of tripping hazards with extension cords, tools, hoses, augers, etc.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer of materials is prohibited in the work areas.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, don't walk through puddles, mud and other discolored surfaces; don’t kneel on ground; don’t lean, sit or place equipment on drums, containers, vehicles or the

ground which are contaminated or being used to store or handle contaminated material. Try to remain upwind when collecting samples, venting wells, etc. It is important to avoid contact with chemicals.

- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel where the potential for adsorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician.
- Non-disposable safety gear and equipment should be cleaned before taken offsite. Equipment which comes in contact with contaminated soil or liquids will be cleaned and placed in designated areas or containers.
- SGI and subcontractor personnel shall be responsible for good housekeeping. The work area shall be kept clean as possible during the course of field activities. It is absolutely required that the area be left in a safe condition when leaving for the day as certain areas could be subject to traffic during the nights and weekends. All work areas will be provided with flashing barricades, fencing and/or other appropriate safety measures to prevent unauthorized entry.
- Before any machinery or electrical equipment is placed in use, it shall be inspected by a competent person to be in a safe operating condition. If the machinery or electrical device is not found to be in a safe operating condition or develops a problem, it shall be tagged "out of service", removed from the Site and not used until the problem(s) is/are corrected.
- Subcontractor personnel at the Site will abide by applicable safety standards for their associated work.
- Subcontractor personnel will perform daily inspections at the Site to insure compliance with this HASP.
- The number of individuals involved in the field operations should be kept to an appropriate level. Observers should stand a safe distance upwind of the project activities. No observers are allowed in these areas unless they are wearing OSHA/NIOSH approved hard hats, appropriate safety glasses and other protective equipment.

4.0 PROJECT HAZARD ANALYSIS

The potential for unknown hazards cannot be eliminated. Hazards can exist for all exposure routes; such as, inhalation, dermal contact, ingestion, and eye contact. Physical hazards which may be encountered during the preliminary assessment activities include heavy equipment, temperature, electrical, utilities, biological, and uneven work surfaces. Table 1 outlines the physical hazards that are anticipated.

Innumerable tasks will be carried out during future Site activities. The job safety analysis (JSA) presents a table that identifies job steps, PPE, potential hazards, and critical actions for tasks associated with a specific Site activity. Applicable JSAs are provided in Appendix E of this Site HASP.

4.1 Task-Specific Hazards

Task		Hazard Rating	Identified / Anticipated Hazards	
			Physical	Chemical
1	Monitoring of site demolition and excavation	Low	• Noise • Traffic	• Chemical exposure
2	Subsurface investigation	Low	• Noise • Traffic	• Chemical exposure
3	Geoprobe	Moderate	• Machinery • Noise • Traffic	• Chemical exposure
4	Hand Auger	Moderate	• Machinery • Noise • Traffic	• Chemical exposure

Task numbers correspond to those outlined in Section 1.3.

4.1.1 Physical Hazards

The identified and anticipated physical hazards (Section 4.1) and other general physical hazards which may be encountered during the Site activities are described in Appendix F. Prior to conducting any soil invasive site activities, SGI will make all attempts to identify existing underground utilities in the areas surrounding the activity. The Utility Clearance Log/Map are available in Appendix G.

4.1.2 Chemical Hazards

Contaminants of concern at the Site are summarized in the following table.

Substance	Source of Sample	Maximum Sample Concentration (mg/kg / μg/L)
1,1-Dicholoroethene (1,1-DCE)	Soil / Water	Above California MCL
1,1-Dichloroethane (1,1-DCA)	Soil / Water	present
Trichloroethene (TCE)	Soil / Water	present
Tetrachloroethene (PCE)	Soil / Water	Above California MCL

Potential effects of any exposure are dependent on several factors; such as, toxicity of a chemical, exposure duration, concentration of chemical producing the exposure, general health of person exposed, and individual use of hazard reduction methods. The exposure limits, physical descriptions, and toxicological effects for contaminants of concern at the Site are presented in Table 2.

4.2 Task-Specific Personnel Protective Equipment (PPE) Requirements

Table below indicates initial level of PPE and potential PPE upgrade required for this job.

Task	Level of PPE Required	
	PPE Start	PPE Upgrade
1	D	C
2	D	C
3	D	C
4	D	C
5	D	C

The different levels of PPE are described below.

4.2.1 Level D

- Safety glasses, hard hat, disposable ear plugs, shirt, pants, and steel-toe boots. For contact with moist soil or liquid:
- Gloves: Latex or Nitrile Standard leather gloves if no direct contact with soil.
- Chemical resistant boots or boot covers: Chemical resistant boots if contacting liquids or moist soil.
- Dirt & Dust protection: Tyvek coveralls (optional).

4.2.2 Level C / Level D Modified

- Air-purifying Respirator (Half- or Full-Face): North full or half face or equivalent (Level C).
- Cartridges: Organic Vapors / Acid gas / HEPA.
- Gloves: Inner: Latex; Outer: Nitrile / Solvex / Gauntlet.
- Chemical resistant boots or boot covers: PVC boot covers.
- Dust & Dirt/Chemical resistant suit: Tyvek coveralls.
- Other: Hard hat and safety glasses/goggles, steel toed boots, hearing protection.

Maintenance and decontamination of respiratory protection is discussed in Sections 6.0 and 8.0, respectively.

4.2.3 Level B

Level B personal protection is required in the area where maximum respiratory protection (i.e., supplied air) is required; however, there is a low probability of dermal toxicity. The use of Level B is not anticipated at the Site.

4.2.4 Level A

Level A personal protection is required in the areas where maximum respiratory, skin, and eye protection are required. The use of Level A is not anticipated at the Site.

5.0 AIR MONITORING

Whenever work is performed that might generate gases, organic vapors, dusts, fumes, mists, or other airborne hazardous materials, air monitoring will be conducted. Breathing zone air monitoring will be conducted periodically throughout the day while work is being performed under above conditions, and results will be documented (see Appendix H). The following instruments may be used to monitor air quality:

- Photoionization Detector (PID) – It will be used to detect trace concentrations of certain organic gases and a few inorganic gases in the air. The PID detects mixtures of compounds simultaneously. PID readings do not measure concentrations of any individual compound when a mixture of compounds is present. The PID will serve as the primary instrument for personnel exposure monitoring. The breathing zone will be monitored at least two times per hour.
- Colorimetric Tubes - If the PID readings indicate the potential for exposures exceeding actions levels, hand pumps with chemical-specific colorimetric tubes will be used. In general, at a site suspected to contain volatile organic compounds, chemical-specific colorimetric tubes should be available for site-related VOCs (e.g., benzene, trichloroethene, tetrachloroethene, vinyl chloride).
- Combustible Gas Indicator/Oxygen – During operations involving known combustible materials (e.g., free product) or operations conducted in an oxygen deficient environment (e.g., confined space), an approved Combustible Gas Indicator/Oxygen Meter and/or a four gas meter will be used to measure the concentration of flammable vapors and gases and oxygen in the air during field activities. Flammable gas concentrations are measured as percentages of the Lower Explosive Limit (LEL). Oxygen content is measured as a percentage of air.

All equipment should be calibrated and maintained in accordance with the Equipment Calibration and Maintenance table in Appendix H. All air monitoring should be logged on the Air Monitoring Log in Appendix H.

Table 3 presents the action levels for air quality monitoring. As data is collected, work procedures, engineering controls and PPE will be evaluated.

6.0 MAINTENANCE AND CALIBRATION OF EQUIPMENT

6.1 Respiratory Protection

Respirators can be used to prevent dust and chemical exposure during Site activities. If respirators are required personal protective equipment (PPE), they will be cleaned daily according to procedures described below. Cartridges will be replaced when breakthrough is detected at any time while in use. Breakthrough for high efficiency particulate air (HEPA) cartridges will be determined by an increased resistance to breathing. All employees will be fit tested according to CCR Title 8 Section 5144 prior to working at the Site. The following checks will be performed daily, in addition to the above:

- Exhalation valve – pull off plastic cover and check valve for debris or for tears in the neoprene valve, which could cause leakage.
- Inhalation valves – screw off both cartridges and visually inspect neoprene valves for tears. Make sure that the inhalation valves and cartridge receptacle gaskets are in place.
- Make sure a protective lens cover is in place (full-face respirator).
- Make sure you have the proper HEPA cartridges.
- Make sure that the facepiece harness is not damaged. The serrated portion of the harness can fragment which will prevent proper face seal adjustment.
- Make sure the speaking diaphragm retainer ring is hand tight.

6.1.1 Respirator Leak Test

Test the respirator for leakage by using both the positive- and the negative-pressure method. Lightly place your palm over the exhalation valve cover. Exhale gently. The body of the respirator should bulge slightly outward from your face. If any leakage is detected around the face seal, readjust the head harness straps and repeat the test until there is no leakage. If leakage is detected other than in the face seal, the condition must be investigated and corrected before another test is made. The negative-pressure test must also be made. Lightly place your palms or some impervious material, like Saran Wrap® over the cartridges or filter holders. Inhale gently. The face-piece should collapse against the face. The respirator must pass these two tightness tests before the respirator is used. The respirator will not furnish protection unless all inhaled air is drawn through suitable cartridges or filters. Respirators will not provide protection in oxygen-deficient atmospheres.

6.1.2 Decontamination of Respirators

After respirator use, the following steps should be used to clean your respirator:

- Wash with Alconox® solution and brush gently. (This step will remove any soil/solid particulate matter that may have been collected on the respirator during field activities.)
- Rinse with distilled/de-ionized water, making sure the inhalation and exhalation valves are clean and unobstructed.
- Rinse with distilled/de-ionized water.
- Wipe with sanitizing solution. (This step will assure the sterility of the respirator.)
- Allow your respirator to air dry.
- Place the respirator inside a sealed bag or a clean area away from extreme heat or extreme cold.

6.2 Air Monitoring

Calibration and periodic maintenance will be required for air monitoring equipment. The methods and frequency for equipment calibration and maintenance are summarized in Appendix H.

7.0 SITE CONTROL MEASURES

7.1 Designation of Work Zones

Specific work zones are identified for projects where contaminated soils are exposed and may release their contaminants to the air, or come in contact with field personnel. To minimize the migration of contaminant from the Site to uncontaminated areas, the following three work zones will be set up:

- Zone 1 – Exclusion Zone
- Zone 2 – Contamination Reduction Zone
- Zone 3 – Support Zone

The Exclusion Zone is the area where contamination occurs or could occur. Initially, the Exclusion Zone should extend a distance of 25 feet from the edge of intrusive activity unless conditions at the Site warrant either a larger or smaller distance as determined by the Site Health and Safety Coordinator. All persons entering the Exclusion Zone must wear the applicable level of protection. It is anticipated that work zones will be established at each individual area of intrusive work rather than encompass the entire Site.

Between the Exclusion Zone and Support Zone is the Contamination Reduction Zone, which provides a transition between the contaminated and clean areas of the Site. The Contamination Reduction Zone will be located directly outside the Exclusion Zone. All personnel must decontaminate when leaving the Exclusion Zone. A Contamination Reduction Zone (decontamination area) will be established adjacent to each individual area of intrusive work.

The Support Zone is the area of the Site where significant exposure to contamination is not expected to occur during non-intrusive activities. The Support Zone is considered to be the “clean area” of the Site.

7.2 Confined Space Entry

Confined space entry is not anticipated as part of this scope of work. If needed in the future, confined space entry protocols will be described in an Appendix to this HASP and will require specific health and safety measures.

7.3 Emergency Exit

Evacuation routes will be discussed in the tailgate safety meeting and included in the site plan as appropriate (Figure 2). During an emergency, these routes should be followed unless conditions

such as wind direction or physical hazards do not allow access to the prescribed evacuation routes. In such cases, evacuate by the safest route available and decontaminate to the greatest extent possible.

8.0 DECONTAMINATION PROCEDURES

1. Personnel:
    - Wash face and hands with soap and water.
2. Sampling Apparatus:
    - Triple rinse in water; soapy water (liquinox)/tap water/de-ionized water.
3. Heavy Equipment (to be done by subcontractor):
    - Rinse with water, remove soil.
4. Level C Decontamination Stations (in order from the Exclusion Zone to Support Zone):
    - Wash and rinse outer garment, boots, and gloves;
    - Remove outer boots and gloves;
    - Change respirator cartridges (if returning to Exclusion Zone);
    - Remove inner gloves and outer garment;
    - Remove respirator; and
    - Clean hands and face.
5. The following equipment will be made available, or equivalent:
    - Emergency eyewash;
    - Soap/detergent solution and water rinse;
    - Soap gel or disposable wipes;
    - Disposable towels;
    - Plastic sheeting; and
    - Cleaning brushes and tubs.
6. Solid and liquid wastes:
    - Stored in properly labeled 55-gallon drums. Contaminated soil and groundwater will be disposed in accordance with the project specifications under the direction of the Project Manager.

9.0 EMERGENCY RESPONSE PLAN

The following sections describe the emergency response plan for safe and effective responses in the event of an emergency while performing Site activities.

9.1 Near Miss or Incident

If a near miss or incident occurs, take the following action:

- Notify the Site Health and Safety Coordinator immediately. The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting a Near Miss Report or Incident Report to the Health and Safety Director within 24 hours. Near Miss Report or Incident Report forms are available in Appendix D for use in the field at the time of the near miss or incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.

9.2 Injury or Illness

If an injury or illness occurs, take the following action:

- Summon for help. If emergency personnel (fire/ambulance) are necessary, call 911. If it makes sense to take an individual to the hospital, see Figure 3 for route to nearest hospital.
- Begin first aid for the person immediately. Use and complete the First Aid Assessment Form in Appendix D.
- Notify the Site Health and Safety Coordinator. The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting an Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. Incident Report forms are available in Appendix D for use in the field at the time of the incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.
- If a subcontractor employee is injured, the Subcontractor Supervisor or Manager will also complete their own injury/illness investigation and submit a copy of their report to SGI's Health and Safety Director as well.
- The Site Health and Safety Coordinator will assume charge during a medical emergency until more qualified emergency response personnel arrive at the Site.

In the event of a medical situation, NOT requiring an ambulance (i.e., minor lacerations, minor sprains, etc.):

- If necessary, transport the individual to the hospital for treatment; see Figure 3 for route to nearest hospital.
- A representative of SGI should always drive the injured employee to the hospital and remain at the facility until the employee is ready to be released. For subcontractor employees, a representative of the subcontractor should accompany the injured subcontractor employee to the hospital.

In the event of a medical situation, requiring an ambulance (i.e., severe head injuries, amputations, heart attacks, etc.):

- Call 911.
- Administer first aid until an ambulance arrives. Use and complete the First Aid Assessment Form in Appendix D.
- A representative of SGI should always accompany the injured employee to the hospital and remain at the facility until final diagnosis and other relevant information is obtained. For subcontractor employees, a representative of the subcontractor should accompany the injured subcontractor employee to the hospital.

In either situation, if the Site Health and Safety Coordinator leaves the Site to accompany an injured employee, arrangements must be made to have another SGI employee to act as the temporary Site Health and Safety Coordinator.

9.3 Local Emergency and Project Telephone Numbers

See Project Telephone Numbers at the beginning of this HASP. These numbers also include emergency response numbers.

9.4 Emergency Medical Treatment and First Aid Procedures

Emergency medical treatment or First Aid may be administered at the Site by the Site Health and Safety Coordinator or other personnel who have been certified in first aid. Use and complete the First Aid Assessment Form in Appendix D.

General emergency medical and first aid procedures are as follows:

- Call for help.
- Remove the injured or exposed person(s) from immediate danger.
- Render first aid as needed; decontaminate affected personnel, if necessary.
- Call an ambulance for transport to local hospital immediately. This procedure should be followed even if there is no apparent serious injury.

- Evacuate other personnel at the Site to safe places until the Site Health and Safety Coordinator determines that it is safe for work to resume.
- The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting an Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. Incident Report forms are available in Appendix D for use in the field at the time of the incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.

9.5 Decontamination Procedures during an Emergency

Decontamination of an injured or exposed worker or during a Site emergency should be performed only if decontamination does not interfere with essential treatment or evacuation. If a worker has been injured or exposed and decontamination can be done, then wash, rinse, and/or cut off protective clothing and equipment.

If a worker has been injured or exposed and cannot be decontaminated, then perform the following tasks:

- Wrap the victim in blankets, plastic, or rubber to reduce contamination of other personnel;
- Alert emergency and offsite medical personnel to potential contamination; and
- Have the Site Health and Safety Coordinator or other personnel familiar with the incident and contaminants at the Site accompany the victim to the hospital. If possible, send a copy of the appropriate Material Safety Data Sheets (MSDSs) with the victim.

9.6 Directions to the Hospital from the Site

The route and directions to the nearest local hospital from the Site are illustrated in Figure 3.

9.7 Spill Control

To minimize the potential for spills, proper handling of chemicals is important. The primary risk for spills will come from investigative derived waste consisting of water generated from the decontamination of equipment, and purge water generated from well sampling and well development. Purge water and decontamination water will be stored onsite in 55-gallon drums, therefore proper drum handling practices is crucial in the prevention of accidental spills. To minimize the potential for spills to occur, workers will adhere to the hazard mitigator for drum handling and to the requirements of 8 CCR 5192(j). Drum hazard mitigators are as follows:

- Use only drums and containers that meet the appropriate DOT, OSHA, and EPA regulations;

- Be aware of the potential hazards of the contents of drums or containers before handling;
- Inspect the integrity of the drum or container before moving. Any drum or container lacking integrity shall be over-packed;
- Consider any unlabeled drum or container containing hazardous substance and leave alone until contents are properly identified and labeled;
- Organize site operations to minimize the amount of drum or container movement;
- Never stand on drums or containers;
- Know the bulging drums or containers are an indication of pressure build-up. Contact the Project Manager or Site Health and Safety Coordinator for guidance;
- Utilize drum/container handling equipment whenever possible. The equipment utilized should have a sufficiently rated load capacity, and should be able to operate smoothly on the available surface;
- Use proper lifting and moving techniques to prevent back injuries, if handling equipment is not available;
- Have a clear view of the available pathway when moving drums. If needed, an additional person should be available to provide guidance;
- Setup drum/container staging areas to safely identify and classify contents for proper shipment. Staging areas shall be provided with adequate ingress and egress routes; and
- Label and identify drums and containers as to their contents when moved to the staging area.
- At least one ABC-type dry-chemical fire extinguisher and a first aid kit will be available onsite.
- Designate at least one vehicle for emergency use.

9.8 Emergency Spill Response

If a spill should occur, immediate measures will be taken to control spill runoff. Measures that may be taken include the use of absorbent pads or booms.

In the event of a release of hazardous materials, specific notification procedures should be followed. The remainder of this section provides important definitions and describes the notification procedures.

"Release" means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, unless permitted or authorized by a regulatory agency.

"Threatened release" means a condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment.

"Hazardous material" means any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or threatened hazard to human health and safety or to the environment, if released into the workplace or the environment.

In the event of a significant release or threatened release of hazardous materials, it must be reported IMMEDIATELY to the Project Manager or Principal-in-Charge. They will handle the appropriate reporting requirements. Be prepared to provide the Project Manager with the following information as State notification requirements for a spill or threatened release include:

- Identity of caller
- Location, date and time of spill, release, or threatened release
- Location of threatened or involved waterway or stormdrains
- Substance, quantity involved, and isotope if necessary.
- Chemical name (if known, it should be reported if the chemical if extremely hazardous)
- Description of what happened.

The Project Manager should call the following:

- California Office of Emergency Services (OES), California State Warning Center 800-852-7550
  Outside California call 916-845-8911
- If appropriate, 911 or Fire Department in the event of real or perceived immediate danger to life or health or the environment.
- If appropriate, California Highway Patrol for spills occurring on highways in the State of California

Upon receiving a report concerning a spill, unauthorized release, or other accidental release involving hazardous materials, the OES will immediately inform appropriate agencies.

Additional information on spill/release notification and reporting in California can be found on SGI's intranet at http:/www.intranet.thesourcegroup.net under "Safety Resources" or at the following website:
http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/Spill%20Notification%20Guide/$file/SpillNotif06.pdf.

such as wind direction or physical hazards do not allow access to the prescribed evacuation routes. In such cases, evacuate by the safest route available and decontaminate to the greatest extent possible.

8.0 DECONTAMINATION PROCEDURES

1. Personnel:
    - Wash face and hands with soap and water.
2. Sampling Apparatus:
    - Triple rinse in water; soapy water (liquinox)/tap water/de-ionized water.
3. Heavy Equipment (to be done by subcontractor):
    - Rinse with water, remove soil.
4. Level C Decontamination Stations (in order from the Exclusion Zone to Support Zone):
    - Wash and rinse outer garment, boots, and gloves;
    - Remove outer boots and gloves;
    - Change respirator cartridges (if returning to Exclusion Zone);
    - Remove inner gloves and outer garment;
    - Remove respirator; and
    - Clean hands and face.
5. The following equipment will be made available, or equivalent:
    - Emergency eyewash;
    - Soap/detergent solution and water rinse;
    - Soap gel or disposable wipes;
    - Disposable towels;
    - Plastic sheeting; and
    - Cleaning brushes and tubs.
6. Solid and liquid wastes:
    - Stored in properly labeled 55-gallon drums. Contaminated soil and groundwater will be disposed in accordance with the project specifications under the direction of the Project Manager.

9.0 EMERGENCY RESPONSE PLAN

The following sections describe the emergency response plan for safe and effective responses in the event of an emergency while performing Site activities.

9.1 Near Miss or Incident

If a near miss or incident occurs, take the following action:

- Notify the Site Health and Safety Coordinator immediately. The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting a Near Miss Report or Incident Report to the Health and Safety Director within 24 hours. Near Miss Report or Incident Report forms are available in Appendix D for use in the field at the time of the near miss or incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.

9.2 Injury or Illness

If an injury or illness occurs, take the following action:

- Summon for help. If emergency personnel (fire/ambulance) are necessary, call 911. If it makes sense to take an individual to the hospital, see Figure 3 for route to nearest hospital.
- Begin first aid for the person immediately. Use and complete the First Aid Assessment Form in Appendix D.
- Notify the Site Health and Safety Coordinator. The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting an Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. Incident Report forms are available in Appendix D for use in the field at the time of the incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.
- If a subcontractor employee is injured, the Subcontractor Supervisor or Manager will also complete their own injury/illness investigation and submit a copy of their report to SGI's Health and Safety Director as well.
- The Site Health and Safety Coordinator will assume charge during a medical emergency until more qualified emergency response personnel arrive at the Site.

In the event of a medical situation, NOT requiring an ambulance (i.e., minor lacerations, minor sprains, etc.):

- If necessary, transport the individual to the hospital for treatment; see Figure 3 for route to nearest hospital.
- A representative of SGI should always drive the injured employee to the hospital and remain at the facility until the employee is ready to be released. For subcontractor employees, a representative of the subcontractor should accompany the injured subcontractor employee to the hospital.

In the event of a medical situation, requiring an ambulance (i.e., severe head injuries, amputations, heart attacks, etc.):

- Call 911.
- Administer first aid until an ambulance arrives. Use and complete the First Aid Assessment Form in Appendix D.
- A representative of SGI should always accompany the injured employee to the hospital and remain at the facility until final diagnosis and other relevant information is obtained. For subcontractor employees, a representative of the subcontractor should accompany the injured subcontractor employee to the hospital.

In either situation, if the Site Health and Safety Coordinator leaves the Site to accompany an injured employee, arrangements must be made to have another SGI employee to act as the temporary Site Health and Safety Coordinator.

9.3 Local Emergency and Project Telephone Numbers

See Project Telephone Numbers at the beginning of this HASP. These numbers also include emergency response numbers.

9.4 Emergency Medical Treatment and First Aid Procedures

Emergency medical treatment or First Aid may be administered at the Site by the Site Health and Safety Coordinator or other personnel who have been certified in first aid. Use and complete the First Aid Assessment Form in Appendix D.

General emergency medical and first aid procedures are as follows:

- Call for help.
- Remove the injured or exposed person(s) from immediate danger.
- Render first aid as needed; decontaminate affected personnel, if necessary.
- Call an ambulance for transport to local hospital immediately. This procedure should be followed even if there is no apparent serious injury.

- Evacuate other personnel at the Site to safe places until the Site Health and Safety Coordinator determines that it is safe for work to resume.
- The Site Health and Safety Coordinator is responsible for immediately notifying the Project Manager, and preparing and submitting an Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge. Incident Report forms are available in Appendix D for use in the field at the time of the incident, but it must also be completed online within 24 hours at http:/intranet.thesourcegroup.net.

9.5 Decontamination Procedures during an Emergency

Decontamination of an injured or exposed worker or during a Site emergency should be performed only if decontamination does not interfere with essential treatment or evacuation. If a worker has been injured or exposed and decontamination can be done, then wash, rinse, and/or cut off protective clothing and equipment.

If a worker has been injured or exposed and cannot be decontaminated, then perform the following tasks:

- Wrap the victim in blankets, plastic, or rubber to reduce contamination of other personnel;
- Alert emergency and offsite medical personnel to potential contamination; and
- Have the Site Health and Safety Coordinator or other personnel familiar with the incident and contaminants at the Site accompany the victim to the hospital. If possible, send a copy of the appropriate Material Safety Data Sheets (MSDSs) with the victim.

9.6 Directions to the Hospital from the Site

The route and directions to the nearest local hospital from the Site are illustrated in Figure 3.

9.7 Spill Control

To minimize the potential for spills, proper handling of chemicals is important. The primary risk for spills will come from investigative derived waste consisting of water generated from the decontamination of equipment, and purge water generated from well sampling and well development. Purge water and decontamination water will be stored onsite in 55-gallon drums, therefore proper drum handling practices is crucial in the prevention of accidental spills. To minimize the potential for spills to occur, workers will adhere to the hazard mitigator for drum handling and to the requirements of 8 CCR 5192(j). Drum hazard mitigators are as follows:

- Use only drums and containers that meet the appropriate DOT, OSHA, and EPA regulations;

- Be aware of the potential hazards of the contents of drums or containers before handling;
- Inspect the integrity of the drum or container before moving. Any drum or container lacking integrity shall be over-packed;
- Consider any unlabeled drum or container containing hazardous substance and leave alone until contents are properly identified and labeled;
- Organize site operations to minimize the amount of drum or container movement;
- Never stand on drums or containers;
- Know the bulging drums or containers are an indication of pressure build-up. Contact the Project Manager or Site Health and Safety Coordinator for guidance;
- Utilize drum/container handling equipment whenever possible. The equipment utilized should have a sufficiently rated load capacity, and should be able to operate smoothly on the available surface;
- Use proper lifting and moving techniques to prevent back injuries, if handling equipment is not available;
- Have a clear view of the available pathway when moving drums. If needed, an additional person should be available to provide guidance;
- Setup drum/container staging areas to safely identify and classify contents for proper shipment. Staging areas shall be provided with adequate ingress and egress routes; and
- Label and identify drums and containers as to their contents when moved to the staging area.
- At least one ABC-type dry-chemical fire extinguisher and a first aid kit will be available onsite.
- Designate at least one vehicle for emergency use.

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If a spill should occur, immediate measures will be taken to control spill runoff. Measures that may be taken include the use of absorbent pads or booms.

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"Threatened release" means a condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment.

"Hazardous material" means any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or threatened hazard to human health and safety or to the environment, if released into the workplace or the environment.

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- Identity of caller
- Location, date and time of spill, release, or threatened release
- Location of threatened or involved waterway or stormdrains
- Substance, quantity involved, and isotope if necessary.
- Chemical name (if known, it should be reported if the chemical if extremely hazardous)
- Description of what happened.

The Project Manager should call the following:

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  Outside California call 916-845-8911
- If appropriate, 911 or Fire Department in the event of real or perceived immediate danger to life or health or the environment.
- If appropriate, California Highway Patrol for spills occurring on highways in the State of California

Upon receiving a report concerning a spill, unauthorized release, or other accidental release involving hazardous materials, the OES will immediately inform appropriate agencies.

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http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/Spill%20Notification%20Guide/$file/SpillNotif06.pdf.

APPENDIX A

SUBCONTRACTOR TRAINING AND MEDICAL CLEARANCE RECORD

SGI SUBCONTRACTOR TRAINING AND MEDICAL CLEARANCE RECORD

SGI Subcontractor: _____

Address: _____

Employees Assigned to Project: _____

_____

I certify the above employees assigned to this project have received training, medical clearance, and respirator fit-testing according to the Health and Safety Plan and the Occupational Safety and Health Administration Standard on Hazardous Waste Operations and Emergency Response (29 CFR 1910.120). If any of these employees are injured, I will submit an incident report to the SGI Health and Safety Director within 24 hours.

Name: _____ Signature: _____

Title*: _____ Date: _____

*Subcontractor Supervisor or Manager only.

APPENDIX B

ACKNOWLEDGEMENT AND AGREEMENT FORM

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM
(SGI and SGI's subcontractor personnel must sign.)

I acknowledge I have reviewed a copy of the Site Health and Safety Plan for this project, understand it, and agree to comply with all of its provisions. I also understand I could be prohibited by the Site Health and Safety Coordinator or SGI personnel from working on this project for not complying with any aspect of this Site Health and Safety Plan:

Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date

APPENDIX C

TAILGATE SAFETY MEETING FORM

SGI environmental THE SOURCE GROUP, INC.

COMPLETE DAILY BEFORE FIELD OPERATIONS BEGIN

Date: _____ **Time:** _____ **Job Number:** _____
Client: _____ **Facility:** _____
Address: _____
Specific Location: _____
Type of Work: _____
Special Equipment: _____
Chemicals Used: _____

MANDATORY SAFETY TOPICS:

❑	Emergency exit route and protocol	❑	Eye wash station locations	❑	Fire extinguisher locations
❑	First Aid, MSDS and PPE location	❑	Site safety plan review and location	❑	Public safety and fences

Protective Clothing Equipment: _____

Chemical Hazards: _____

Physical Hazards: _____

Emergency Procedures: _____

Hospital / Clinic: _____ Phone: _____
Hospital Address _____
Paramedic Name and Phone _____

SITE SPECIFIC TOPICS:

❑	Manual lifting: strains / sprains	❑	Excavation / trenching	❑	Confined space entry
❑	Electrical hazards	❑	Noise Hazards	❑	Heat and cold stress
❑	Heavy Equipment / drill rigs	❑	Hot work permits	❑	Dust and vapor control
❑	Orderly site and housekeeping	❑	Portable tool safety and awareness	❑	Utility location
❑	Smoking in designated areas	❑	Decontamination procedures	❑	Stored energy

Discussion/Comments/Follow-up Actions: _____

NAME	SIGNATURE	COMPANY

APPENDIX D

NEAR MISS AND INCIDENT REPORT FORMS

- **NEAR MISS REPORT FORM**
- **INCIDENT REPORT FORM**
- **FIRST AID ASSESSMENT FORM**

SGI environmental THE SOURCE GROUP, INC.

NEAR MISS REPORT FORM

Date of Near Miss: _____

Employer (include SGI subcontractors)

Company Name: _____

Address: _____

City, State, Zip: _____

Project Name: _____

Project Number: _____

Employee (include SGI subcontractors)

First and Last Name: _____

Employment Status: _____

Near Miss Information

Where did near miss occur? (number, street, city, state, zip): _____

_____

Other people affected in this event?: _____

Description of Near Miss (Explain exactly how and what happened): _____

_____

_____

_____

Root Cause and Contributing Factors (Describe in Detail Why Near Miss Occurred)

1. _____

2. _____

Root Cause(s) Analysis (RCA) - Use proactively to avoid Near Misses.

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Uncontrollable.

SGI environmental THE SOURCE GROUP, INC.

INCIDENT REPORT FORM

Date of Incident: _____

Time employee began work: _____

Time of event or exposure: _____

Incident Type

❑	Fatality	❑	Industrial Non-Recordable	❑	Spill/Leak	❑	General Liability
❑	Lost Workday (LW)	❑	Non-Industrial	❑	Product Integrity	❑	Criminal Activity
❑	LW Restricted Duty	❑	Off-the-Job Injury	❑	Equipment	❑	Notice of Violation
❑	OSHA Illness w/o LW	❑	Motor Vehicle Accident (MVA)	❑	Business Interruption	❑	First Aid
❑	Fire	❑		❑		❑	
❑		❑		❑		❑	

The investigation of the incident by the employee's supervisor or Site Health and Safety Coordinator must begin immediately. Human Resources and Corporate Health & Safety must be informed immediately and in no case longer than 24 hours after the incident. This report must be completed as soon as possible. It must be reviewed and signed by the Principal and e-mailed or faxed to the Human Resources Manager, and Corporate Health and Safety (numbers below), even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report to Human Resources within 24 hours of the initial exam and any subsequent exams. Contact information at end of report.

Employer (include SGI subcontractors)

Company Name: _____

Address: _____

City, State, Zip: _____

Project Name: _____

Project Number: _____

Employee (include SGI subcontractors)

First and Last Name: _____

Home Address: _____

City, State, Zip: _____

Employment Status: _____

Date of Hire: _____

Injury or Illness Information

Where did incident occur? (number, street, city, state, zip): _____

_____

On Employer's premises: Yes or No: _____

Specific activity employee was engaged in when accident occurred: _____

_____

All equipment, materials or chemicals employee was using when incident occurred (e.g., the machine employee struck against, the vapor inhaled or material swallowed, what employee was lifting, pulling, etc.): _____

_____

Did employee lose at least one full shift's work?: _____

Has employee returned to work?: _____

Date employer notified of incident: _____

To whom reported: _____

Other workers injured/made ill in this event?: _____

Description of Incident: (Describe fully the incident events. Tell exactly what happened and how it happened so that someone could recreate the incident. Use extra paper if you need.):

_____

_____

_____

Does this Accident involve a Motor Vehicle and a Professional Driver?: _____

Does this incident involve a spill or a leak?: _____

If so, material spilled and quantity: _____

Does this incident involve a third party?: _____

If so, name, address and phone number of third party: _____

Investigation Team Member Names and Job Titles: _____

Reviewed by (Names and Job Titles): _____

SGI environmental THE SOURCE GROUP, INC.

FIRST AID ASSESSMENT FORM

Date: _____

Victim's Name: _____

Company Name: _____

First Aid Responder's Name: _____

Vitals

TIME			
PULSE Normal: 60-100			
BREATHING Listen – Look			
BLOOD Fingernail color return test			
SKIN Temperature / Color			

Interview "P-Q-R-S-T"

Provoke: _____

_____

Quality (sharp/dull/pressure): _____

Region / Radiates: _____

Severity (1 [low] to 10 [high]): _____ Allergies: _____

Time (how long?): _____ Medical History: _____

What did victim last eat and when: _____

Head to Toe Check

Head (Skull, Ears, Eyes, Mouth): _____

Neck (Hand squeeze test – Foot press test): Stabilize neck immediately if test fails.

Chest: _____

Arms/Legs: _____

APPENDIX E

JOB SAFETY ANALYSES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
Typical work	Steel toed and shank shoes, hardhat, safety glasses with side shields, hearing protection, reflective safety vest, and leather gloves for the non-chemical aspects of work as necessary. If you suspect that chemical exposure is possible, wear chemical resistant gloves, aprons, etc.	Weather related incidents. Automobile accidents. Slips, trips and falls.	● Check weather reports daily. Project visits will not be performed during inclement weather. Sampling may be performed during light rain mist. Wear raincoats. ● Drive at speed limit or less as needed to keep safe distance from vehicle in front, avoid short stops.
Typical work.		Cold Stress.	● For temperatures below 40 ^{0}F, adequate insulating clothing must be worn. If the temperature is below 20 ^{0}F, workers will be allowed to enter a heated shelter at regular intervals. Warm, sweet drinks should be available. Coffee intake should be limited. ● No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress, such as heavy shivering, pain in fingers or toes, drowsiness or irritability. Onset of any of these signs are indications for immediate return to a heated shelter.
Typical work.		Heat Stress	● Discuss health effects and symptoms during daily production meetings. ● Drink water regularly, i.e., at least one cup every 20-30 minutes depending upon level of effort and PPE worn. ● Breaks should be taken in an area cooler than the work area. ● Monitor temperature and relative humidity using WBGT meter.
Typical work	High-top steel toed and shank shoes or rubber boots, light colored long sleeved shirt, long pants, and leather gloves.	Insect bites, (to include black-legged or deer ticks)	● Tuck pants into socks or boot tops to reduce or prevent insect exposure to the skin, or wear high rubber boots. ● Apply DEET to the skin and clothing to serve as a repellant, (for ticks) and insect repellant for other insects. ● Use Permethrin on clothing (Note: Permethrin kills insects (ticks) on contact and must be applied in advance to permit drying). ● Daily check for the presence of insects (ticks) and their immediate removal. (Note: This is of obvious importance, and especially noteworthy since infection with Lyme disease requires at least 36 hours of tick attachment).
No eating, drinking, or smoking on-site.		Ingestion of contaminants.	● Use proper personal hygiene practices. ● Use proper decontamination practices.

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each workday. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Personal Protective Equipment	❸ Potential Hazard	❹ Critical Actions
No contact lenses on-site. No facial hair that would interfere with respirator fit.			● Exit Exclusion Zone and wash hands, face & neck before eating, drinking or smoking. ● Utilize appropriate spectacle kit with the respirator in use. ● Shave each morning before using respirator. Ensure that no facial hair interferes with respirator seal area.
A safety meeting shall be held each day, even if there is only one person working on the project on any given day.			● Topics will always include the work scheduled for the day and restatement of the hazards and means to avoid them. Other topics may be extricated from the list included in the HASP. ● Use Daily Tailgate Safety Meeting for logging the topics discussed.

APPENDIX F

GENERAL PHYSICAL HAZARD ANALYSIS

GENERAL PHYSICAL HAZARD ANALYSIS

The following general physical hazards are described in this Appendix.

- Machinery / Heavy Equipment
- Heat Stress (Summer Only)
- Cold Stress (Winter Only)
- Oxygen Hazards
- Flammable Atmosphere Hazards
- Hot Work in Hazardous Location
- Electrical Safety
- Utilities
- Noise
- Falls, Trips, Slipping
- Biological Hazards

Machinery / Heavy Equipment

The following general procedures should be followed when operating near heavy equipment (drill rig, backhoe, excavator, wheel loader, crane, etc.) and performing associated activities.

- Only staff necessary to operate the equipment shall remain in its proximity. Site workers shall not remain near working equipment longer than necessary.
- Hearing protection will be worn when noise levels are above 85 decibels, and in the absence of noise measurements, protection will be worn while operating or within a 10 foot vicinity of equipment, and when understanding speech is difficult at 5 feet.
- All site personnel will wear ANSI-approved hardhats, safety glasses or goggles, and steel-toed/steel-shank boots and traffic vests.
- Site workers shall be cognizant of equipment movement around them at all times.

Heat Stress (Summer Only)

Heat stress is the combination of both environmental and physical work factors that contribute to the total heat load imposed on the body. The Site Health and Safety Coordinator will observe field personnel for signs indicative of heat illness. Personnel experiencing heat strain symptoms will be required to immediately take action to reduce their stress.

The following measures will be used to help reduce the effects of heat stress or to prevent the heat stress from occurring:

- Acclimation to the heat through short work periods, followed by longer periods of work can reduce heat stress.

Limit the intake of diuretics (coffee, soda, etc.) and include electrolyte replacement drinks (Gatorade) if there is excessive sweating.

- Identify a shaded, cool rest area.
- Rotate personnel and alternate their job functions as needed.
- Ensure that personnel consume enough water to replace the amount of moisture lost through perspiration. Most workers exposed to hot conditions drink less fluid than they need. Workers should consume at least 50 ounces of fluid in small amounts at regular intervals during an 8-hour workday. This amount may be much larger depending upon the individual.
- Allow for frequent rest periods in the shade when temperatures exceed 80 degrees F. Each person will take their pulse at rest. At breaks, the pulse should be less than 110 beats per minute after one minute. Before returning to work, the pulse should be no more than 10 beats greater than the resting pulse. If necessary, a specific work/rest schedule will be established by the Site Health and Safety Coordinator.
- Work should stop if any of the following symptoms occur: muscle spasm and/or pain in the limbs or abdomen (heat cramps); weak pulse, heavy sweating, dizziness, and/or fatigue (heat exhaustion); or rapid pulse, no sweating, nausea, dizziness, and/or confusion (heat stroke). Provide First Aid immediately.
- Use sunscreen on unprotected skin to protect against ultraviolet exposure as necessary.
- Schedule the most strenuous activities during cooler periods, such as during the early morning hours or early evening hours.

Persons exhibiting symptoms of heat exhaustion (i.e., pale/clammy skin, dizziness, nausea, cramps) will be removed from the work area, given cool fluids to drink, and observed during the recovery period. Persons exhibiting symptoms of heat stroke (i.e. hot/dry skin, mental confusion, or unconsciousness) will be immediately cooled down and taken to the nearest hospital. Any of the following symptoms could indicate a serious heat stress problem: dizziness, rapid heart rate, nausea, cramps, breathing problems, weakness, or diarrhea.

Cold Stress (Winter Only)

The Site Health and Safety Coordinator will observe field personnel for signs indicative of cold illness. Personnel experiencing cold stress symptoms will be required to immediately take action

to reduce their stress. Workers should be aware of signs of cold stress such as heavy shivering, pain in the fingers or toes, drowsiness or irritability.

The following measures will be used to help reduce the effects of cold stress or to prevent the cold stress from occurring:

- For temperatures below 40°F, adequate insulating clothing must be worn. If the temperature is below 20°F, workers will be allowed to enter a heated shelter at regular intervals. Warm sweet drinks should be available. Coffee intake should be limited.
- No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress such as heavy shivering, pain in the fingers or toes, drowsiness, or irritability. Onsets of any of these signs are indications for immediate return to a heated shelter.

Oxygen Hazards

Oxygen deficiency is defined by O_2 levels below 19.5% by volume. Oxygen deficiency can be caused by combustion (cutting torches), decomposition of organic matter, oxidation of metals from rusting, inerting with nitrogen gas. This can also happen from oxygen or air displacement due to the presence of a different gas (CO2, CO, etc.).

Oxygen enrichment when O_2 levels exceed 23.5% creates an extreme fire hazard. Flammable materials such as clothing and hair will burn very rapidly in an oxygen-enriched atmosphere. High oxygen levels could occur from leaking or unattended oxygen lines or cylinders.

Flammable Atmosphere Hazards

For a fire or explosion to occur, fuel, oxygen, a source of ignition, and mixing must be present. The specific mixture of fuel and oxygen that will ignite or explode varies with the specific combustible gas. In all cases, this critical point is defined as the range between the lower explosive limit (LEL) and the upper explosive limit (UEL).

Lower explosive limit levels will be continuously monitored during operations involving all known combustible materials. A portable combustible gas LEL meter will be utilized with an audible alarm set to alert at 10% of the LEL. This 10% LEL level will allow workers adequate time to discontinue work, retreat and reevaluate the work hazard. Additional ventilation and/or purging with inert gas may be required. SGI policy is that no work is allowed whenever LEL levels are above 10%.

Hot Work in Hazardous Location

Potential ignition sources include electrical sparks, open flame. Work activities that necessitate the use of a flame, generate a spark or otherwise create an elevated temperature, which could ignite combustible or flammable materials or atmospheres, are considered hot work. Some of the

activities which could potentially create an ignition source include welding, metal cutting, grinding, or pneumatic chipping. Prior to hot work being performed, the location will be assessed for hazards by the subcontractor. SGIs Health and Safety Coordinator will be notified of all hot work activities. Areas where heat or spark may ignite the atmosphere or surrounding materials are considered a hazardous location, and a hot work permit will be required prior to performing the operation.

Electrical Safety

All electrical work will be performed in accordance with the National Fire Protection Association, National Electrical Safety Code, and OSHA Standards. Extension cords will be the three-wire type for grounded tools, and will be protected from damage. All extension cords will be protected by ground fault circuit interrupters. Only approved electrical cords will be utilized. Only receptacle and attachment plugs of the approved concealed-contact type are allowed.

Utilities

Prior to conducting any soil invasive site activities, SGI will make all attempts to identify existing underground utilities in the areas surrounding the activity. Appropriate local utility companies will be contacted to clear area of proposed excavation areas for potential underground utilities. To avoid any contact with aboveground utilities, site activities will be conducted at distances greater than 10 feet from aboveground utilities. The Utility Clearance Log and Utility Clearance Map are available in this Appendix G.

Noise

If noise levels exceed 85 decibels in an 8-hour work day, personal protective equipment (e.g., ear plugs) will be provided and used to reduce noise levels.

Falls, Trips, Slipping

The areas surrounding the remedial action activities may consist of uneven surfaces. All site personnel will wear skid-proof boots. Any known potential fall/trip/slip hazards will be discussed in the tailgate safety meetings. All field personnel will be equipped with approved skid-proof boots.

Traffic

All site personnel should be aware of surrounding traffic and always exercise caution with crossing roadways and driveways. If work is conducted in the roadway, always use caution cones or barriers to protect your work area.

Biological Hazards

All site personnel will wear long-sleeve shirts and pants, ANSI-approved hardhats, safety glasses or goggles, and steel-toed/steel-shank boots to avoid contact with biological hazards. Any person suffering from insect or animal bites should be treated immediately and taken to the nearest hospital, if necessary.

APPENDIX G

UTILITY CLEARANCE LOG/MAP

SGI environmental THE SOURCE GROUP, INC.

UTILITY CLEARANCE LOG

Date: _____

"One-call" confirmation number and date contacted: _____

"One-call" expiration date: _____

Subcontractor locating firm and invoice number: _____

Facility contact person & telephone number: _____

Facility drawings reviewed: _____

Verbal/written sign-off of clearance by facility contact: _____

Pressurized lines/shut-off valves identified*: _____

Underground utilities/lines identified*: _____

_____

Underground utilities/lines marked on-site by: _____

Overhead utilities/lines identified*: _____

Overhead utilities/marked on-site by: _____

Clearance Contact:

_____	_____	_____
Name (SGI employee only)	Signature	Date

Clearance Reviewed by:

_____	_____	_____
Name (SGI Project Manager)	Signature	Date

SGI environmental THE SOURCE GROUP, INC.

UTILITY CLEARANCE MAP

(As per the *Utility Clearance for Drilling Memorandum* completed before the event.)

APPENDIX H

AIR MONITORING TABLE/LOGS

- **MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE TABLE**
- **AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG**
- **AIR MONITORING LOG**

SGI environmental THE SOURCE GROUP, INC.

MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE TABLE

Equipment	Type/Model	Field Calibration Method	Field Calibration Frequency	Field Maintenance Method	Field Maintenance Frequency
Photoionization Detector (PID)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Flameionization Detector (FID)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Organic Vapor Meter (OVM)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Chemical Detector Tube (colorimetric)		___ Check expiration date ___ Other (please specify):	___ Before each use ___ Before day of sampling ___ Other (please specify):	___ All parts included and working ___ Other (please specify):	___ Before day of sampling ___ Other (please specify):
Combustible Gas Meter (LEL)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Multiparameter Meter		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):
Other (please specify)		___ Buffer solutions ___ Span gas ___ Zero gas ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):	___ Decon/Clean/Replace Filter ___ Batteries/Extra Set ___ All parts included and working ___ Other (please specify):	___ Before and after each use ___ Before day of sampling ___ Before and after day of sampling ___ Other (please specify):

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AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Date	Equipment Type/Model	Serial No.	Battery Check OK?	Zero Adjust OK?	Calibration Gas (PPM)	Reading (PPM)	Leak Check (Colorimetric Tube Pump)	Performed By	Comments

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AIR MONITORING LOG*

Date	Time	Location	Source/Area/ Breathing Zone	Equipment Type/Model	Concentration/Units	Sampled By

*Notify the Health & Safety Coordinator or Project Manager immediately if a PEL, TLV, or other limit is exceeded.

Geosyntec consultants

ATTACHMENT B

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

Former Anaconda Wire and Cable Company
Orange, CA

04-ANA-001

Prepared For:

Chapman University
1 University Drive
Orange, California 92866

Prepared By:

SGI environmental THE SOURCE GROUP, INC.
1962 Freeman Avenue
Signal Hill, CA

July 2013

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LIST OF ACRONYMS AND ABBREVIATIONS

C	Celsius
COC	Chain of Custody
CUR	Condition Upon Receipt
DI	Deionized
DO	Dissolved Oxygen
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
ERB	Equipment Rinseate Blank
ft/ft	Feet per foot
ft-bgs	Feet below ground surface
FTL	Field Task Leader
FS	Feasibility Study
FSP	Field Sampling Plan
GIS	Geographical Information System
HASP	Health and Safety Plan
IDL	Instrument detection limit
LCS	Laboratory Control Samples
LIMS	Laboratory Information Management System
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
ml	Milliliters
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	Mean Sea Level
NELAP	National Environmental Laboratory Accreditation Program
ORP	Oxidation Reduction Potential
OVM	Organic Vapor Meters
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness and Sensitivity
PHSO	Project Health and Safety Officer
PID	Photoionization Detector

LIST OF ACRONYMS AND ABBREVIATIONS

QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leaching Procedure
toc	Top of Casing
U.S. EPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared on behalf of Chapman University to describe the quality assurance/quality control (QA/QC) procedures to be followed during required assessment and remediation activities to be performed at the former Anaconda Wire and Cable Site located in the City of Orange, California (the Site; Figure 1).

This QAPP presents the organization, objectives, functional and planned activities, and specific QA and QC activities associated with Block Environmental's 2012 *Soil Contingency Plan*, Geosyntec's February 15, 2013, *Work Plan for Supplemental Source Area Investigation, Former Anaconda Wire & Cable Facility, Orange, California*, and Geosyntec's June 18, 2013, *Revised Supplemental Site Investigation Work Plan* (Work Plan). This QAPP may be modified or amended in the future to reflect changes in the project scope and/or requirements.

The QAPP describes specific protocols that will be followed for sampling, sample handling and storage, chain-of-custody, and laboratory analysis. All QA/QC procedures will be in accordance with applicable professional standards, U.S. Environmental Protection Agency (U.S. EPA) requirements, government regulations and guidelines, and specific project goals and requirements.

2.0 PROJECT MANAGEMENT

This section provides an overall approach to managing the work presented in the Work Plan and addresses:

- Project organization and roles and responsibilities;
- Problem definition;
- Project description;
- Project data quality objectives (DQOs) and criteria for measurement data;
- Special training requirements or certificates required for work performed; and
- Documentation and records management.

2.1 Project Organization and Roles and Responsibilities

The various responsibilities of key project roles are presented in this section.

2.1.1 Regulatory Oversight

The California Regional Water Quality Control Board (RWQCB), Santa Ana Region and the Orange County Health Care Agency are responsible for providing regulatory guidance and oversight during Site assessment and remediation activities.

2.1.2 Chapman University

The Chapman University is the property owner and project proponent.

2.1.3 Geosyntec

Geosyntec Consultants (Huntington Beach, CA) prepared the Work Plan and provides support to Chapman and coordinates the technical discussions with RWQCB.

2.1.4 The Source Group, Inc.

The Source Group, Inc. (SGI) is contracted to Chapman to implement the field implementation of the Work Plan. The following subsections describe the project organization and duties of the SGI personnel assigned to the project.

2.1.4.1 Project Director

The Project Director, Mr. Neil Irish (SGI), is responsible for reviewing all technical aspects of the project to ensure that all work elements meet the project objectives and technical standards, and are completed in accordance with the standards specified in the QAPP. The Project Director is provided technical

information by the Project Manager and the Task Leader(s) and quality assurance documentation by the Project QA Officer.

2.1.4.2 Project Manager

The Project Manager, Mr. Paul Parmentier (SGI), is responsible for the scope, cost, and technical considerations related to the project; staff and project coordination; and implementation of review of overall project quality related to the collection, completeness, and presentation of data. The Project Manager will report directly to Chapman and will provide the major point of contact and control for matters concerning the work. The Project Manager oversees the technical work conducted by the Task Leader(s) and the quality assurance efforts of the Project QA Officer.

2.1.4.3 Technical Project Manager

The Technical Project Manager, Mr. Daniel Swensson (SGI), is responsible for hydrogeologic and environmental engineering technical support for the project. The Technical Project Manager evaluates and develops the technical aspects of the project and works with the Project Director and Project Manager to meet the project objectives.

2.1.4.4 Project Quality Assurance Officer

The Project QA Officer, Ms. Eileen Bullen (SGI), is responsible for reviewing the project QA program as it relates to the collection and completeness of data from field and laboratory operations, including training personnel to follow established protocols.

2.1.4.5 Project Health and Safety Officer

The Project Health and Safety Officer (PHSO), Mr. Deryck Roberts is responsible for developing, implementing, and updating the Site-specific health and safety plan to be consistent with foreseeable conditions that may be encountered during field operations.

2.1.4.6 Task Leaders

Task Leaders are responsible for formulating a work plan and for executing work elements related to an assigned task. Each Task Leader will issue specific instructions for performing assigned work elements and will ensure that work is conducted in compliance with project-specific objectives and applicable QA procedures. Task Leaders will coordinate with the Project Manager and Project QA Officer to review general work plans and specific work elements. The Task Managers maintain all documentation and deliverables in the project files during the performance of the assigned tasks.

2.1.5 Analytical Laboratory

Calscience Laboratories (Calscience) of Garden Grove, California will provide analytical services for the project for groundwater and a State-certified mobile laboratory will provide soil gas sampling and analysis

services. Calscience has current certification for the State of California and is accredited by National Environmental Laboratory Accreditation Program (NELAP). A copy of Calscience's Quality Assurance Manual, showing personnel organization, responsibility, and training for the laboratory is provided in Appendix A. The soil gas sampling and analysis contractor will be experienced with the April 2012, Department of Toxic Substances Control and Regional Water Quality Control Board – Los Angeles Region *Advisory–Active Soil Gas Investigations (DTSC, 2012)* and will hold requisite State certification.

2.2 Problem Definition

The primary goals of the soil, soil gas, and groundwater sampling and analysis at the Site are to determine or further define:

- The lateral and vertical distribution of volatile organic compounds (VOCs), 1,4-dioxane, and selected metals in the vadose zone soil matrix and soil gas (VOCs only);
- The lateral distribution of VOCs, 1,4-dioxane and chromium VI in groundwater.

2.2.1 Site Location and Description

The Site is located on the Chapman University Campus in Orange, CA. A summary of the Site history and description are included in the Work Plan.

The region around the Site is used for educational, commercial, and residential purposes.

2.3 Project and Task Descriptions

Project tasks include soil boring and sampling, groundwater monitoring well and soil gas probe installation, and monitoring well sampling and soil gas sampling.

The organization, objectives, functional and planned activities, and specific quality assurance (QA) and quality control (QC) activities associated with the scope are specified in this QAPP.

2.3.1 Potential Measurements

A variety of measurements will be collected at the Site including:

- VOC concentrations in soil samples;
- Groundwater level elevations;
- Analytical chemical data for groundwater and soil gas, soil matrix; and
- Water quality parameters (such as temperature and pH).

2.3.2 Applicable Technical Quality Standards or Criteria

The applicable regulatory standards that potentially will be used include the following:

- **Soil Matrix Concentrations.** Concentrations of contaminants in soil matrix will be evaluated by comparison with soil gas VOCs concentrations and regulatory guidance reference levels such as USEPA's Environmental Screening Levels (ESLs).
- **Soil Gas Concentrations.** Concentrations of shallow soil gas VOCs will be compared to residential California Human Health Screening Levels (CHHSLs) and to VOC concentrations measured in other soil gas probes, and may be further evaluated using site-specific parameters and conditions.
- **Groundwater.** Criteria for contaminant concentrations in groundwater are maximum contaminant levels (MCLs).

2.3.3 Special Equipment and Personnel Requirements

Special equipment requirements for the anticipated work include, but are not limited to, use of groundwater sampling equipment, water quality meters and soil gas probes purging and sampling equipment. Personnel will be used who are trained to work and/or take measurements with the equipment. In accordance with the Site Health and Safety Plan (HASP) personnel performing environmental fieldwork at the Site must comply with training requirements specified in 29 CFR 1910.120. These include completion of a 40-hour health and safety-training course, an annual 8-hour refresher training, and participation in a medical surveillance program and respiratory protection program. In addition, personnel who are directly responsible for or who supervise employees performing fieldwork at the Site shall have received an additional 8 hours of specialized supervisor's training.

Field tasks and data interpretation will be conducted under the direction of a qualified California Professional Geologist.

2.3.4 Assessment Techniques

Assessments are conducted to ensure that the QAPP is implemented as prescribed (U.S. EPA, 2001). Specific details of assessment procedures can be found in Section 4.0. A summary of assessment activities that are required for the anticipated work is as follows:

- Assessment of field operations: To evaluate field operations performance, frequent review of sample collection documentation, chain-of-custody forms (COCs), field notes and measurements, and the performance of unannounced field operation audits may be conducted.
- Assessment of laboratory operations: The laboratory has a program of internal audits that are performed to assess the degree of adherence to their own policies and procedures. Additionally, the Project Manager and Task Leaders will be in frequent contact with the analytical laboratory to assess progress in meeting DQOs and to identify problems requiring corrective action.

2.3.5 Documents and Records

The Project Manager will be responsible for ensuring that the appropriate project personnel have the most current approved version of the QAPP. As needed, the QAPP may be updated in its entirety or by addenda. Critical task-related records include:

- Field activities records;
- Periodic progress reports;
- Periodic monitoring reports;
- Laboratory reports; and
- Summary reports of the results of the task-specific testing.

More details on project records and reports can be found in Section 2.6.

2.4 Data Quality Objectives and Criteria for Measurement Data

In this section, the DQOs for anticipated tasks and the performance criteria and measurement system that will be used will be discussed.

2.4.1 Data Quality Objectives

DQOs are both qualitative and quantitative statements that define the type, quality, and quantity of environmental data appropriate for the intended application. The DQOs applicable to the soil and soil gas sampling and the groundwater sampling and monitoring were developed as part of the Work Plan.

2.4.2 Method Performance Objectives

Analytical method performance requirements for work performed are expressed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). The following subsections present a summary of each PARCCS parameter and calculation equations, as appropriate.

2.4.2.1 Precision

Precision is a measurement of the degree of agreement of replicate data, which is quantitatively assessed based on the relative percent difference or standard deviation.

Field Precision

Field precision will be assessed through the collection and measurement of one field duplicate set of samples for every 10 or fewer groundwater samples only. Duplicate samples will be analyzed to check for overall variability introduced by sampling and analytical procedures. Field precision also will be assessed on the basis of reproducibility by multiple readings of a single sample. Duplicate field instrument readings will be made on one out of every 10 samples per matrix to determine field instrument reproducibility.

Laboratory Precision

Laboratory precision accuracy is assessed through the calculation of relative percent differences (RPDs) for two replicate samples. The precision of the analysis can be inferred through the use of one of the following: laboratory control duplicate samples; matrix spike and matrix spike duplicate (MS/MSD) samples, or unspiked duplicate samples. The laboratory analyzes one or more of these duplicate samples at a rate of one per batch of 20 or fewer investigative samples per matrix.

The MS/MSD samples provide information about the effect of the sample matrix on extraction and measurement methodology. An MS/MSD pair will be analyzed at a rate of one per batch of 20 or fewer investigative samples per matrix.

The precision of laboratory analyses will be assessed by calculating the RPD for each pair of duplicate samples (MS/MSD, laboratory control sample spike duplicates, unspiked duplicate samples) and field duplicate sets using the following equation:

$$\%\, RPD = \frac{S_1 - S_2}{S_{av}} \, x\, 100$$

where:

S_1 = first sample result (original or MS value)

S_2 = second sample result (duplicate or MSD value)

S_{av} = average of sample and duplicate = $(S_1 + S_2)/2$

2.4.2.2 Accuracy

Accuracy is the degree of agreement between a measurement or observation and an accepted value.

Field Accuracy

Field accuracy is assessed through the use of appropriate field equipment and trip blanks, and achieved through adherence to all sampling handling, preservation, and holding time requirements. Field blank samples are analyzed to check for procedural contamination that may cause sample contamination. Equipment rinse blanks are used to assess the adequacy of decontamination of sampling equipment between individual sample collections. Trip blanks are used to assess the potential for contamination of samples due to contaminant (i.e., volatile organic compounds) migration during sample shipment, handling, and storage. Accuracy of field instruments will be assessed by daily instrument calibration and calibration checks.

Laboratory Accuracy

Laboratory accuracy is assessed by the analysis of MS and laboratory control samples (LCS). The results are expressed as a percent recovery. Surrogate recoveries may also be used to assess accuracy. Method blanks are used to assess contamination resulting from laboratory procedures.

Laboratory control samples, method blanks, and preparation blanks will be analyzed at least once with each analytical batch, with a minimum of one for every 20 samples.

The percent recovery is calculated with the following equation:

$$\%R = \frac{A - B}{C} x\ 100$$

where:

A = The analyte concentration determined experimentally from the spiked sample.

B = The background level determined by a separate analysis of the unspiked sample.

C = The amount of the spike added.

2.4.2.3 Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficiency of the sampling plan design. Representativeness is demonstrated by providing full descriptions of the sampling techniques and the rationale used for selecting sampling locations in the project planning documents. The measure of representativeness is answered during the preparation of the sampling and analysis approach and rationale, and then reassessed during the data usability process. There are no numerical goals that can be used to evaluate this subjective measure.

2.4.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was planned to be obtained under normal conditions. Percent completeness is calculated with the following equation:

$$\%\ Completeness\ = \frac{Valid\ Data\ Obtained}{Total\ Data\ Planned} \text{ x } 100$$

Experience on similar projects has shown a reasonable goal considering combined historical field and laboratory performance is 90 percent completeness. If sufficient valid data are not obtained, corrective action will be initiated by the Project Manager.

2.4.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set obtained during parallel or previous investigations. Comparability can be related to precision and accuracy as these parameters are measures of data reliability.

Chemical samples from the same media are generally considered comparable if the same procedures for collecting and analyzing the samples are used, if the samples comply with the same QA/QC procedures, and if the units of measurement are the same. Soil gas sample results may be less comparable due to variations in vadose zone conditions.

2.4.2.6 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method is commonly referred to as the detection limit. Although there is no single definition of this term, the following terms (found in the laboratory reports) and definition of detection limits will be used:

- Instrument detection limit (IDL) is the minimum concentration that can be measured from instrument background noise under ideal conditions.
- Method detection limit (MDL) is a statistically determined concentration. It is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined in the same or a similar matrix. Because of the lack of analytical precision at this range, sample results (if reported by the laboratory) greater than the MDL but less than the reporting limit (RL) would be qualified as "estimated".
- The RL is the concentration of the target analyte that the laboratory has demonstrated the ability to measure within specified limits of precision and accuracy during routine laboratory operating conditions. This value is variable and highly matrix dependent. It is the minimum concentration that will be reported as unqualified by the laboratory.

For sensitivity, the quality objective is to analyze data with a method that achieves RLs that are below or equal to the task-specific target analysis goals or concentrations. Target reporting limits are summarized in Table 4 – Analytical Method Requirements.

2.5 Special Training, Requirements, and Certification

The Project Manager is responsible for assembling a project team with the necessary experience and technical skills. Part of the process is to identify special training requirements or certifications necessary to successfully execute the project. All contractors working at the Site should have the appropriate health and safety training. In accordance with the Site HASP, personnel performing environmental fieldwork at the Site must comply with training requirements specified in 29 CFR 1910.120. These include completion of a 40-hour health and safety-training course, an annual 8-hour refresher training, and participation in a medical surveillance program and respiratory protection program. In addition, personnel who are directly responsible for or who supervise employees performing fieldwork at the Site shall receive an additional eight hours of specialized supervisor's training. The analytical laboratory shall have current certification for the State of California and will be NELAP accredited. The investigation will be

conducted under the supervision of a California Professional Geologist. No other specialized training or certifications are anticipated for this work.

2.6 DOCUMENTATION, RECORDS AND REPORTS

This section identifies critical field and laboratory records required for the anticipated work, information to be included in technical reports, and the document control procedures to be used.

2.6.1 Field Records

The critical records required for this project include a daily field record or a field logbook along with task or measurement specific data forms. Examples of the anticipated field records are included in Appendix B. All original field records will be maintained in the project files.

2.6.2 Laboratory Records

All analytical results will be reported in Level II format. In addition to the analytical results, the laboratory data report will, at a minimum, include a narrative that will discuss any problems or discrepancies, and sufficient calibration and QC information to determine that the method was within control limits at the time that the samples were analyzed. The laboratory data report will include the following:

- Case narrative;
- COC documentation (external);
- Final analyte concentration including reporting limit, laboratory qualifiers, and re-analyses;
- Laboratory sample ID, field sample ID, matrix, and dilution factors;
- Sample collection receipt, extraction, and analysis dates for holding time verification;
- Percent recovery of each surrogate;
- Surrogate recovery control limits;
- Percent recovery of each compound in the MS sample;
- MS recovery control limits;
- RPD for all MS/MSD results;
- RPD control limits for MS/MSD reports;
- Percent recovery of each compound in the LCS;
- Recovery control limits for LCS;
- Condition and temperature of samples upon receipt;
- Results for method blanks, field blanks, equipment blanks, and trip blanks; and
- Method blank summary indicating associated samples.

In addition to the hard-copy report requirements, the laboratory will provide electronic data deliverables (EDDs) conforming to an ASCII comma-delimited or Microsoft Excel format as specified for all data reported, and in a format adequate for uploading onto the RWQCB's Geotracker database.

2.6.3 Technical Reports

In addition to the Workplan, the following technical plans are completed or anticipated for the Site:

- Well Installation Report
- Soil Gas Sampling Report
- Quarterly Groundwater Monitoring and Sampling Report
- Quality Assurance Project Plan;
- Field Sampling Plan; and
- Health and Safety Plan.

Information on routine technical reports anticipated for the Site, including frequency of reporting, anticipated report contents, and agencies to which reports will be submitted, is shown in Table 2. In general, final reports produced under an approved work plan will include the following information:

- A description of the scope of work and the field and analytical programs;
- A summary of field and analytical data, including a data quality assessment;
- Technical evaluations, recommendations or conclusions, when appropriate;
- Analytical data tables and/or figures to present results; and
- Appendices with supporting documents, such as field records, laboratory reports, and Data Validation Reports (Section 5.2).

2.6.4 Records Maintenance and Storage

All documents relating to the project will be controlled to assure proper distribution, filing, and retrieval, and to assure that revisions are properly recorded, distributed, and filed. Project records will be stored and maintained by the responsible staff. The Project Manager is responsible for organizing, storing, and cataloging all project information. He or she also is responsible for collecting records and supporting data from project team members. Once cataloged, project records are appropriately filed by category in the correct project file. Filed documents are available to staff through checkout procedures developed to assure the integrity of the project file. Individual project team members may maintain separate files or notebooks for individual tasks. Additional information on records management can be found in Section 3.10. The laboratory's internal records management protocols are described in the Quality Assurance Manual (Appendix A).

3.0 MEASUREMENT AND DATA ACQUISITION

This section describes all aspects of measurement design and implementation, and discusses the methods that will be used for sampling, analysis, data handling, and QC in support of the tasks performed as required by the DTSC. The information in this section is presented in a format that would be applicable to the anticipated tasks for Site sampling and monitoring. Should additional sampling or monitoring tasks be proposed, appropriate details, such as specific analytical methods not referenced in this QAPP, would be presented in task-specific work plans. The following specific aspects of measurement and data acquisition will be covered in this section:

- Sampling process design;
- Sampling methods requirements;
- Sample handling and custody requirements;
- Analytical methods requirements;
- QC requirements;
- Instrument/equipment testing, inspection, and maintenance requirements;
- Instrument calibration and frequency;
- Inspection and acceptance requirements for supplies and consumables;
- Data acquisition requirements; and
- Data management.

3.1 Sampling Process Design

A summary of the proposed sampling is presented in Table 1. The sampling program follows the Work Plan. Anticipated measurements to be taken and the media to be sampled may include, but are not limited to:

- Groundwater level elevations - groundwater;
- Analytical chemistry - groundwater and soil gas, soil matrix; and
- Water quality parameters – groundwater.

3.1.1 Field Sampling Documentation

The Field Task Leader (FTL) and other team members will maintain a daily field record form or field logbook to provide a daily record of significant events, observations, and measurements during sampling. All information pertinent to sampling will be recorded in the daily field record form or field logbook or on activity-specific data forms. Each day's entries will be signed and dated and will include:

- Date and time of entry, and weather and environmental conditions during the field activity;

- Project name and number;
- Location of sampling activity;
- Name of field crew;
- Name of site visitors;
- Sample media (e.g., groundwater);
- Sample collection method (e.g., bailer); and
- Number of samples taken.

When activity-specific data forms are used, they will also include:

- Investigation location;
- Sampler's initials;
- Sampling medium; and
- Sampling method.

The following information, as required, will be recorded either in the daily field record form or a field logbook or on the activity-specific data forms, as appropriate:

- Volume, media and number of samples taken;
- Date and time of collection;
- Sample depth;
- Sample identification number(s);
- Sample destination (for example, laboratory);
- Water-level measurement data;
- Field observations;
- Field equipment calibration and maintenance;
- Field measurements (for example, pH, temperature, and conductivity); and
- Sample handling (preservation).

Selected field data and sampling forms are provided in Appendix B of this QAPP.

All original data recorded in daily field records, field data forms, sample labels, and COC forms must be written with waterproof, indelible ink. None of these documents are to be destroyed or discarded, even if one is illegible or contains inaccuracies requiring document replacement. If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information will not be obliterated. Any subsequent error discovered on an accountable document will be corrected by the person who made the entry, if possible.

3.1.2 Sample Identification

The method of sample identification used depends on the type of sample collected and the sample container type. The field analysis data are recorded in the daily field record or on task-specific data sheets (e.g., Well Sampling Record) along with sample identity information while in the custody of the sampling team. A sample label will be completed and attached to each sample container for every sample collected. Labels consist of a waterproof material backed with a water-resistant adhesive. Labels are to be filled out using waterproof ink, and are to contain at least the following information:

- Project name and number;
- Sampling date and time;
- Sample identification number;
- Preservatives, if any;
- Sampler's initials; and
- Analyses to be conducted.

Each analytical sample will be assigned a unique number consisting of an alphanumeric code that identifies the specific sampling location and date. These numbers will be tracked from collection through laboratory analysis and into the final reports. The sample number will be cross-referenced with the site name and sample location on the COC. Additional sample volume will be collected for samples identified by the FTL for the laboratory QC (i.e., MS/MSD).

3.2 Sampling Method Requirements

Sampling procedures, methods, and equipment anticipated for this work are described in this section. Task-specific details for additional Site sampling or investigation activities will be presented in the required work plans. Decontamination procedures and corrective action procedures are also described. The laboratory support facilities for sample analysis are also identified here.

3.2.1 Sample Collection, Preparation, and Decontamination Procedures

Sampling tools and techniques that may be used to produce data during the implementation of the work include, but are not limited to:

- Soil sampling
- Water level measurements in groundwater wells;
- Groundwater sampling from monitoring wells;
- Soil gas sampling from vadose zone probes.

Protocols for sample collection, preparation, and decontamination procedures for the above sampling techniques are provided in the following subsections.

3.2.1.1 Soil Sampling

Soil samples will be collected during drilling operations. Soil samples from sonic stilling will be collected from the extracted soil core. Soil samples from the direct push drilling will be collected as a segment of the acetate sleeve. Samples collected by hollow stem auger will be collected from the steel rings inserted in the split-spoon samples.

The frequency of soil sample collection is listed in the Work Plan, and field indications of VOCs contamination by PID reading will also be used as a guide for soil matrix sample collection.

3.2.1.2 Water Level Measurements

Water level measurements will be taken in the monitoring wells for the purpose of obtaining current hydrogeological data for creating potentiometric maps. The frequency of collection of water levels is shown in Table 1. Water levels are also measured in monitoring wells during sampling events to ensure that drawdown remains within acceptable limits.

3.2.1.3 Groundwater Sampling from Monitoring Wells

Well sampling procedures are important for obtaining groundwater samples of good quality. Purging and sampling of monitoring wells will be conducted using modified U.S. EPA Region II Low-Flow Procedures (U.S. EPA, 1998b).

The samples will be placed in appropriate sample containers, capped, labeled as discussed in Section 3.1.1, and stored in an ice-filled sample cooler. The samples will be transported to the analytical laboratory following the protocol established in Section 3.3.2 and will be maintained under the sampling handling and custody requirements described in Section 3.3. Sample volumes will be determined by the analyses to be conducted (Table 3).

All samples will be labeled as described in Section 3.1.1. The samples will be transported to the analytical laboratory following the protocol established in Section 3.3.2 and will be maintained under the sampling handling and custody requirements described in Section 3.3.

3.2.1.4 Decontamination Procedures and Materials

All equipment used during sampling activities that could come into contact with potentially chemically-affected materials will be thoroughly cleaned, before and after each use, by washing with high pressure hot water and/or washing with Alconox (a laboratory-grade detergent) and deionized (DI) water and double rinsing with DI or distilled water. Decontamination procedures may be modified and/or revised based upon the data obtained.

3.2.2 Support Facility for Sampling Methods

The primary laboratory for analysis of samples collected by these sampling methods is:

Calscience Laboratory

7440 Lincoln Way

Garden Grove, CA 92841-1427

3.2.3 Sampling/Measurement System Failure Response and Corrective Action

If QC surveillance and/or field audits result in detection of unacceptable conditions or data, the Project Manager, in conjunction with the Project QA Officer, will be responsible for developing and directing implementation of corrective actions. Corrective actions will include one or more of the following:

- Identifying the source of the violation;
- Evaluating and amending sampling and analytical procedures; and
- Accepting data and flagging the data to indicate the level of uncertainty associated with failure to meet the specified QC performance criteria.

Any finding requiring corrective action must be documented to the Project Manager. The Project QA Officer will check to ensure that corrective actions have been implemented and that the problem has been resolved. More easily addressed problems may be encountered in the field or the laboratory. Such problems will be addressed and the corrective action noted in the appropriate lab or field data form.

If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information will not be obliterated. Any subsequent error discovered on an accountable document will be corrected by the person who made the entry, if possible.

3.2.4 Sample Equipment, Preservation, and Holding Time Requirements

The sample containers, preservative requirements, and maximum holding times for the routine analytical methods are provided in Tables 4 and 6.

3.3 Sample Handling and Custody Requirements

Proper sample handling, shipment, and maintenance of a COC are key components of building the documentation and support for data that can be used to make program decisions. It is essential that all sample handling and sample COC requirements be performed in a complete, accurate, and consistent manner. Sample handling and custody requirements must be followed for all samples taken as part of this project.

3.3.1 Sample Custody

Sample custody and documentation procedures described herein must be followed throughout all sample collection activities. Components of sample custody procedures include the use of field records, sample

labels, and COC forms. The COC form must accompany the samples during shipment from the field to the laboratory.

A sample is under custody under the following conditions:

- It is in one's actual possession;
- It is in one's view, after being in his or her physical possession;
- It was in one's physical possession and that person then locked it up to prevent tampering; and
- It is in a designated and identified secure area.

The following procedures must be used to document, establish, and maintain custody of field samples:

- A sample label will be completed and attached to each sample container for every sample collected. Labels consist of a waterproof material backed with a water-resistant adhesive. Labels are to be filled out using waterproof ink, making sure that the labels are legible and affixed firmly on the sample container. Sample labels are to contain at least the following information: project number; sampling date and time; sample identification number; investigation location; preservatives, if any; sampler's initials; and analyses to be conducted.
- All sample-related information must be recorded in the daily field record or on activity-specific data forms.
- The field sampler must retain custody of samples until they are transferred or properly dispatched.
- To simplify the COC record and minimize potential problems, as few people as possible should handle the samples or physical evidence. For this reason, one individual from the field sampling team should be designated as the responsible individual for all sample transfer activities. This responsible individual will be responsible for the care and custody of the samples until they are properly transferred to another person or facility.
- All samples will be accompanied by a COC record. This record documents the transfer of custody of samples from the field investigator to another person, to the laboratory, or other organizational entities, as each change of possession must be accompanied by a signature for relinquishment and receipt of the samples. Information entered on the chain-of-custody will consist of the following:
    - ~ project name and number;
    - ~ chain-of-custody serial number;
    - ~ number of containers/samples;
    - ~ sample numbers;
    - ~ sampler/recorder's signature;
    - ~ date and time of collection of each sample;

- ~ collection location;
- ~ sample type;
- ~ analyses requested;
- ~ inclusive dates of possession;
- ~ name of person receiving the sample;
- ~ laboratory sample number; and
- ~ date of receipt of sample.

Completed COC forms will be inserted into a plastic cover and placed inside of the shipping container used for sample transport from the field to the laboratory.

When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill or receipt will be recorded on the COC form or in the daily field record.

3.3.1.1 Laboratory Sample Handling and Custody

The Project Manager or FTL will notify the Laboratory Project Manager of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, analyses requested, and the expected date of arrival. The Laboratory Project Manager will notify appropriate laboratory personnel about the expected shipment including the sample custodian. Upon arrival at the laboratory, the samples will be received and logged in by a trained sample custodian in accordance with the laboratory's sample handling and internal sample custody program. A description of the laboratory's general program is provided in their Quality Assurance Manuals (Appendix A) and is summarized below.

Upon sample receipt, the sample custodian is responsible for performing the following activities during sample receipt where appropriate:

- Examining the shipping containers to verify custody tape is intact;
- Measuring and documenting the shipping container temperature on the COC record;
- Examining all sample containers for damage;
- Comparing samples received against those listed on the COC record;
- Verifying sample holding times have not been exceeded;
- Determining sample temperature (using an IR thermometer) and documenting variations from the acceptable range on the COC record;
- Determining sample pH as required and documenting on COC record;
- Immediately signing and dating COC record after shipment is accepted;
- Noting any sample receipt problems on the COC record, initiating a Condition Upon Receipt (CUR) report, and notifying the Laboratory Project Manager;

- Attaching laboratory sample container labels with laboratory identification number and test; and
- Placing the samples in proper laboratory storage.

The Laboratory Project Manager is responsible for contacting the Project Manager as soon as possible if any problems are identified during sample receipt. All identified sample-receiving problems will be resolved prior to sample preparation and analysis.

Following sample receipt, the sample custodian is responsible for logging the samples in the laboratory sample log-in book, and/or the Laboratory Information Management System (LIMS) with the following information:

- Laboratory project number;
- Sample numbers (laboratory and client);
- Type of samples;
- Required tests; and
- Date received.

The sample custodian is also responsible for notifying the Laboratory Project Manager and appropriate Group/Team Leader(s) of sample arrival and placing completed COCs records, waybills, and any additional documentation in the project file.

Samples will be stored appropriately within the laboratory to maintain any prescribed temperature, protect against contamination, and to maintain the security of the samples.

Sample custody procedures within the laboratory will be followed with appropriate documentation to trace the handling and possession of the sample from receipt until final analysis and disposal. If any samples are transferred to a different laboratory, the transfer will be done under chain-of-custody procedures and the original laboratory will maintain the appropriate documentation to preserve the traceability of the samples through final analysis and disposal.

3.3.2 Sample Packing and Shipping

Samples will be delivered to the designated laboratories by field personnel, laboratory courier, or by commercial shipping services (such as United Parcel Service or Federal Express). The method of sample shipment will be noted on the COC. During the field effort, the FTL or a designee will inform the laboratory daily of planned shipments. Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. The samples must be cushioned so as to prevent the least amount of damage if such a fall would occur.

All water VOC vials will be shipped in the same cooler. Each container will be clearly marked with a sticker containing the originator's address. A detailed SOP for sample packing and shipping is provided in Section 9 of the FSP.

The following procedures must be used when transferring samples for shipment:

- Samples must be accompanied by a COC record. When transferring possession of samples, the individuals relinquishing and receiving must sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person or to the laboratory. Overnight shipping companies will not be required to sign the COC record. A copy of the receipt of shipment will accompany the COC record.
- Samples must be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a signed COC record for each shipment.
- All shipments must be accompanied by a COC record identifying the contents. The original record must accompany the shipment, and the FTL must retain a copy.

3.4 Analytical Methods Requirements

This subsection presents the analytical methods requirements for analyses that may be performed, including preparation/extraction procedures where appropriate and method performance requirements.

Laboratory analyses will be conducted by Calscience Laboratory. The laboratory's Quality Assurance Manual is included in Appendix A and contains summary information from the analytical methods including the following:

- Sample containers, preservatives, and holding times;
- Calibration requirements including frequency and acceptance criteria;
- Laboratory quality control samples including frequency, acceptance criteria, and corrective action; and
- MDLs and RLs.

More detailed information on the laboratories analytical methods is presented in laboratory-specific SOP (Appendix A). Unless where otherwise specified, the information in the following subsections applies to Calscience.

3.4.1 Analytical Methods

All analyses will utilize EPA-approved methods or other recognized standard methods. Method references for laboratory analyses that may be performed for the anticipated work are provided in Table 3, including preparation/extraction methods where appropriate.

3.4.2 Reporting Limits

Laboratory-specific RLs for the analyses may be modified based upon the laboratory's current performance and/or changes to the methods.

The RLs should be evaluated in the DQO process for the planned tasks. The RLs should be below the appropriate targets defined in task-specific work plans. In general, the RLs for the various analytical methods reported by the laboratory should be sufficient for the anticipated use of data. In the event a task-specific target is less than the RLs reported by the laboratory, a discussion of the exception and any recommended solutions will be presented in the associated work plan(s). RLs for the expected analytical methods are shown in Table 4.

3.4.3 Laboratory Method Performance Requirements

A description of the method-specific QC samples that Calscience uses are provided in Appendix A, including the types of QC samples to be run, frequency, acceptance criteria, and corrective action to be taken when acceptance criteria are not met. Results of the QC samples are reviewed against the acceptance criteria by the laboratory analyst. Any identified discrepancies will trigger the laboratory's internal corrective action system as described below.

3.4.4 Laboratory Corrective Action

The laboratory has a formal corrective action system in place to assure that prompt action is taken when an unplanned deviation from a procedure or plan occurs and that whenever possible, corrective actions include measures to prevent the reoccurrence of deviations. Specific corrective actions to be taken when a QC sample does not meet acceptance criteria are presented in Appendix A. The following is a description of how information from the laboratory's corrective action system is communicated to the project team.

The laboratory's corrective action procedure includes prompt notification of the project contact for any significant problems or discrepancies. The Laboratory Project Manager is responsible for reporting any significant problems or discrepancies that occur as analyses are conducted to the Project Manager or other identified project contact. The Laboratory Project Manager is also responsible for assuring that corrective action is taken where appropriate to prevent the reoccurrence of similar problems or discrepancies. In addition, each analytical data report will include a case narrative that discusses any problems or discrepancies, and sufficient calibration and QC information to verify that the method was in control at the time that the samples were analyzed. The case narrative will also include a discussion of any corrective action taken by the laboratory to prevent the reoccurrence of similar problems or discrepancies.

3.5 Quality Control Requirements

This section presents the field QC checks that will be performed during field investigations, including a discussion of field QC samples with frequency and acceptance criteria and field corrective action procedures. A discussion of laboratory QC samples and laboratory corrective action was presented in the previous section (Section 3.4).

3.5.1 Field QC Samples

The type and frequency of field QC samples to be collected during field investigations are summarized in Table 5 and are described below. Definitions for the types of QC samples are provided in the following subsections.

3.5.1.1 Trip Blanks

Trip blanks are used to detect VOC contamination during sample shipping and handling. Trip blanks are 40 ml VOC analysis vials of water that are filled by the laboratory, transported to the sampling site, and returned to the laboratory with VOC samples. Trip blanks are not opened in the field. The planned frequency for trip blanks is one trip blank per cooler containing samples for VOC analysis.

3.5.1.2 Equipment Rinseate Blanks

Equipment rinseate blank (ERB) are samples of DI water passed through and over the surface of decontaminated sampling equipment. The rinse water is collected in sample bottles, preserved as necessary, and handled in the same manner as the samples. ERBs are used to monitor effectiveness of the decontamination process. The planned frequency for ERBs is one per day per equipment type. If more than one type of equipment is used to collect samples for a particular matrix, then an ERB is collected and submitted for each representative group of equipment. Typically, ERBs are analyzed for the same analytes as the corresponding samples collected that day.

3.5.1.3 Field or Decontamination Water Blanks

Field blanks are samples of the source water used for decontamination and steam cleaning. This blank is used to monitor for potential contaminants introduced from the water source during field decontamination procedures. Typically, at least one sample for each source of water or one field blank of analyte-free water for a specified event will be collected and analyzed for the same parameters as the corresponding field environmental samples. If more than one source of DI water is used, or if potable water from more than one location is used, additional field blanks are collected because these constitute different sources. The requirement for field blanks will be at the discretion of the Project Manager and presented in specific work plans.

3.5.1.4 Duplicate Field Samples

Duplicate field samples are collected to monitor the precision of the field sampling process. Duplicates will be collected for soil and groundwater samples and soil gas probes. The FTL will choose at least 10 percent of the total number of sample locations known or suspected to contain moderate contamination, and duplicate field samples are then collected at these locations. The source of the field duplicate sample will be listed as a field sample on the COC record sent to the laboratory.

MS/MSD samples provide information about the effect of the sample matrix on analytical methodology. An MS/MSD pair will be analyzed at a rate of one per batch of 20 or fewer investigative samples per matrix. At selected locations, an additional sample will be collected and submitted to the laboratory for MS/MSD analyses. The source of the MS/MSD sample will be identified on the COC record sent to the laboratory.

3.5.2 Field Corrective Action

Problems that require corrective action may be encountered in the field. Any finding requiring corrective action must be documented to the Project Manager. The Project QA Officer will check to ensure that corrective actions have been implemented and that the problem has been resolved. More easily addressed problems also may be encountered in the field. Such problems will be addressed and the corrective action noted in the appropriate field records. If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information will not be obliterated. Any subsequent error discovered on an accountable document will be corrected by the person who made the entry, if possible.

3.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Maintenance and inspection of both field and laboratory equipment are described in the following sections.

3.6.1 Field Instrument/Equipment

Preventative maintenance and trouble-shooting of field measurement instrumentation and equipment will be performed according to manufacturers' instructions. Equipment manufacturers manuals will be available for use on Site. The field staff is responsible for ensuring that all instrumentation is operating properly prior to use. If problems are encountered, they will be documented in the daily field record (included in Appendix B). The faulty instrumentation/equipment will be scheduled for repair at an appropriate facility. The malfunctioning equipment will be sequestered and tagged until repaired and qualified for re-use.

3.6.2 Laboratory Instrument/Equipment

Laboratory instrument/equipment testing, inspection, and maintenance will be conducted in accordance with the procedures specified in the laboratory's Quality Assurance Manuals (Appendix A). The manual discusses the schedule, procedures, criteria, and documentation in place at the laboratory to prevent instrument and equipment failure and to minimize downtime. For each instrument or piece of equipment the laboratory maintains the following:

- Instrument/equipment inventory list;
- Instrument/equipment major spare parts list or inventory;

- External vendor service agreements (if applicable); and
- Instrument-specific preventive maintenance logbook or file.

The laboratory documents all preventive maintenance piece of equipment in dedicated logbooks or files.

3.7 Instrument Calibration and Frequency

Calibration and frequency of calibration of both field and laboratory equipment are described in the following sections.

3.7.1 Field Instruments

The field equipment that may be used on a regular basis at the Site that will need calibration is listed below:

- pH meter;
- Conductivity meter;
- Dissolved oxygen meter;
- Multimeter with flow-through cell;
- Aquacheck pH and Conductivity meter;
- Chemetrics field test kits;
- Redox meter;
- Turbidity meter; and
- Photoionization detector;

Proper maintenance, calibration, and operation of each instrument will be the responsibility of field personnel assigned to a particular field activity. All instruments and equipment used during the field investigations will be maintained, calibrated, and operated according to the manufacturer's guidelines and recommendations. Field instrument calibration will be recorded in the daily field record or appropriate task-specific form (e.g., Well Sampling Record, Appendix B). Calibration procedures for field equipment are summarized below. All field equipment requiring regular calibration will be calibrated at least twice per day including once prior to daily use. Relevant manuals will be kept with field personnel during the performance of field activities. All equipment will receive routine maintenance checks to minimize equipment breakdown in the field. Any items found to be inoperable will be taken out of use and a note stating the time and date of this action will be made in the daily field records. A copy of the operating manuals for field equipment will be available at the Site.

3.7.1.1 Water Quality Parameters Measurement Equipment

During groundwater sampling at each well, indicator parameters of water quality will be measured. The instruments described below may be used for these measurements. All instrument probes will be properly cleaned and rinsed before each use.

- **Temperature**. Temperature will be measured with standard thermometers or temperature meters in degrees Celsius (°C).
- **pH**. The pH of groundwater will be measured with a conventional pH meter that consists of a pH electrode and a temperature electrode. The pH meter will be calibrated twice daily in the field using standard pH buffer solutions (pH 4.0, 7.00, and 10.00), or more frequently as necessary. A two-buffer calibration will be performed before measurements are taken, using the buffer solutions whose pH values bracket the anticipated values for the samples to be tested. Temperature corrections are made automatically by the pH meter.
- **Specific Conductance**. For specific conductance measurements, a conventional conductivity meter or equivalent combination instrument will be used. Digital conductivity meters will be calibrated twice daily in the field, or more frequently as necessary, using a reagent-grade sodium or potassium chloride standard (single point calibration), according to manufacturer's procedures. Calibration is performed via a temperature correction on the meter. The temperature of the standard solution at the time of calibration will be measured to 0.1 °C and recorded in the field records together with the certified and measured specific conductance values for the standard solution. The conductivity meters will be calibrated semiannually using different concentrations of reagent-grade potassium chloride standards (multipoint calibration). The certified and measured specific conductance values will be recorded and maintained in a log. The temperature of field samples will be recorded at the time of measurement.
- **Dissolved Oxygen**. Dissolved Oxygen (DO) measurements will be obtained using a conventional DO meter. Calibration procedures will be performed twice daily, according to the manufacturer's procedures.
- **Multimeter with Flow-Through Cell**. A multimeter with flow-through cell will be used to measure water quality parameters during low-flow purging and sampling procedures. The multimeter will be calibrated twice daily using a pH 4 solution. Calibration procedures are included in the operation manual, which will be available at the Site.
- **Aquacheck Meter**. An Aquacheck meter may be used to measure pH and conductivity in wells. The Aquacheck meter will be calibrated with a pH 4 solution as recommended by the manufacturer. Aquacheck manufacturer's manual will be available at the Site.
- **Redox**. Redox measurements will be taken with an oxidation reduction potential (ORP) meter. The meter will be checked against a standard solution twice daily in the field, according to the manufacturer's procedures.

- **Turbidity**. Turbidity will be measured in the field using a portable turbidity meter. The turbidity meter will be calibrated according to manufacturer's procedures before each measurement using a 10.0 NTU solution supplied in a bottle designed for that purpose by the manufacturer. The operation manual for the turbidity meter will be available at the Site.

3.7.1.2 Fluid-Level Measurement Equipment

- **Electric Well Sounder**. Water levels will be measured using a battery-powered sounder (Solinst brand or equivalent) that has regular 0.01-foot intervals permanently marked on the sounder line. The calibration of each electric sounder will be checked at least once every year. Markings will first be checked by physically comparing the spacings with a graduated steel tape. If the difference between the two measurements is not less than 0.05 feet per 100 feet per foot (ft/ft) depth to water, the measurement will be repeated, and repairs made, if necessary. Calibration checks records will be maintained in the instrument files. The sounder will also be checked for calibration after any incident that may alter the instrument's accuracy.

If more than one electric sounder is used during a single set of measurements, all sounders used will be checked against each other by measuring water depth for at least two measurement stations. The results of these measurements will be recorded in the field notes. If difference between measured values obtained at the same station exceeds 0.05 foot, the calibration of the sounders will be checked using a steel tape, as above, so that the difference may be resolved.

3.7.1.3 Organic Vapor Meter

Field measurements may be collected using portable organic vapor meters (OVMs) that feature hydrocarbon detection by Photoionization Detector (PID) (e.g., by HNU Model P1101). The OVM will be used to measure organic gases and vapors in soil vapor as well as in ambient air.

With the OVM, manufacturer-supplied calibration standard span gas will be used to calibrate the meter. Calibration of the OVM will be performed twice each day and more frequently as needed throughout the day if irregularities in the readings become apparent.

Field personnel will maintain a daily record containing calibration data for each OVM, including time and date of the previous calibration, who performed the calibration, and how it was performed. The instrument will be recharged when not in use.

3.7.1.4 Soil Gas Sampling Equipment

The soil gas sampling equipment calibration and maintenance will follow the 2012 CalEPA Advisory document on soil gas sampling and analyses procedures.

3.7.2 Laboratory Equipment and Instrumentation

All laboratory equipment and instruments specific to each analysis are included in method-specific SOPs, which are included in Appendix A.

Whenever possible, the laboratory uses recognized procedures for calibration, such as those published by U.S. EPA or ASTM. If established procedures are not available, the laboratory develops a calibration procedure based on the type of equipment, stability, characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured. Whenever possible, physical reference standards associated with periodic calibrations such as weights or certified thermometers with known relationships to nationally recognized standards are used. Where national reference standards are not available, the basis for the reference standard is documented.

Equipment or instruments that fail calibration or become inoperable during use are tagged to indicate they are out of calibration. Such instruments or equipment are repaired and successfully recalibrated prior to reuse.

3.8 Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables that may be used during field investigations include sample bottles, calibration gases, hoses, materials for decontamination activities, DI water, and potable water. Project team members obtaining supplies and consumables are responsible for assuring that the materials obtained meet the required specifications, are intact and in good condition, are available in adequate supply, and are stored appropriately until use. Project team members will direct any questions or identification of any problems regarding supplies and consumables to the Project Manager for resolution. Relevant specifications for anticipated supplies and consumables are shown in Table 6.

3.9 Secondary Data

According to the Uniform Federal Policy for Quality Assurance Project Plans (U.S. EPA, 2004a), “secondary data may include data generated for or by external, independent parties which are then transmitted to the current user” and “data collected in other investigations designed to answer different questions than those posed in the current investigation.” An example of secondary data, which will be used for this Site is precipitation data, which will be obtained from a regional weather station on a quarterly basis to coincide with water level measurements. Other types of secondary data which may be used include historical investigation reports from the Site or nearby sites, historical aerial photographs and maps, site plans, city files, and well abandonment records. Secondary data will be retained in the project files. The data may be of unknown quality. The accuracy of each document will be assessed individually based on the manner in which the source document was prepared.

3.10 Data Management

The objective of Data Management is to establish procedures to be used during the field investigations for documenting, tracking, and presenting investigative data. Data generated during the field tasks, as well as previously existing data, will be used to form the basis for conclusions and recommendations. Efficient utilization and comprehensive consideration of available data requires that the data be properly organized for review. Organization of the data shall be planned prior to actual collection to assure the generation of identifiable and useable data. This section contains procedures necessary to assure the collection of sufficient data for accurate validation of raw data and transfer of validated data to a data management system with which it can be evaluated with minimal effort. This section also describes the operating practices to be followed by personnel during the collecting and reporting of data.

3.10.1 Purpose and Background

Data collected during the routine field tasks will include lithology, water levels, analytical data from groundwater and soil gas, and current data on physical conditions present at the Site. These data will be integrated into technical analyses and may be represented by groundwater elevation contour maps, groundwater isoconcentration contour maps, soil gas concentrations maps or cross-sections and data summary tables. In particular, the data will be used for the following evaluations:

- Groundwater elevation data will be used to evaluate groundwater gradient.
- Chemical concentration data from groundwater wells will be used to evaluate the extent of dissolved contaminants.
- Chemical concentration data from Site soil gas and soil matrix will be used to evaluate the extent of contamination in the vadose zone.

To complete these evaluations, various computer programs will be utilized. The programs that are anticipated to be used are Microsoft Excel, Microsoft Access, Autodesk AutoCAD, and Geographic Information Systems (GIS).

3.10.2 Data Recording

Data used for analysis, presentation, and reporting will be stored in an electronic database using Microsoft Access. The database will be maintained and regularly updated by SGI and may be uploaded to the RWQCB Geotracker database. The SGI database will facilitate the following processes:

- Tracking chain-of-custody and sample identification data;
- Reviewing and evaluating analytical data against project-specific QAPP criteria; and
- Production of data tables.

Observations made and measurements taken in the field are recorded on appropriate data sheets (e.g., Water Level Monitoring Form, Well Sampling Records, Daily Field Record, or Field Logbook). Example field forms are included as Appendix B. Upon completion of tasks, applicable data will be entered into

spreadsheets and tabulated for evaluation and presentation in the related technical report. Copies of the selected original data records will be attached to the report as appendices. All original data records will be maintained in the project files.

Water level measurements collected from the monitoring wells will be entered into the project database. Groundwater elevations will be determined from the difference between water level measurements and the top of casing elevation, which is the reference point for water level measurements. Groundwater elevations will be tabulated for evaluation and presentation and will be used to construct groundwater contour maps. The tables and groundwater contour maps will be presented in the related technical report.

Calscience data management and reporting procedures are described in Appendix A. Analytical data from the Laboratory will be received in a hard copy report and an EDD. Each Sample Delivery Group from the Laboratory will be submitted as a complete and separate EDD. It is expected that the laboratory will perform a comparison of electronic data with the hard copy report prior to submittal to ensure that the EDD and hard copy data are identical. Project staff will check the EDD against the hard copy with 100 percent QA/QC for all detected analytes. The EDD should be submitted on a diskette or via email, with the disk label including the Sample Delivery Group, submittal date, laboratory name, and Site description. If the EDD is resubmitted, the EDD will be labeled as "Revised." The analytical data will be entered into the project database and will be tabulated for evaluation and presentation in the related technical report.

3.10.3 Data Validation

Data validation is an integral part of the QA program and consists of reviewing and assessing the quality of data. Data validation provides assurance that the data are of acceptable quality as reported. Analytical data submitted by the laboratory in EDD and hardcopy format will be validated as described in Section 5.0. If necessary, exception reports will be produced and qualified results will be entered into the project database.

3.10.4 Data Transformation

Transforming data by converting individual data point values into related values or symbols using conversion formulas or a system of replacement is not currently proposed for data evaluation for this project at this time. If data transformation is required at a later date, then conversion procedures will be described in detail in the associated work plan or technical report.

3.10.5 Data Transmittal

The integration of field data is completed by inputting the data from field forms into a spreadsheet format by data entry personnel. The spreadsheet is reviewed for completeness and accuracy by a staff geologist or engineer by comparing the electronic spreadsheet to the original field data. The reviewed spreadsheet is then uploaded into the project database.

Analytical laboratory data are provided in both a hard copy and in EDD format. The electronic data are provided in a specified format that will be uploaded to intermediate files, reviewed for completeness and accuracy by the Project Manager before uploading to the project database.

3.10.6 Data Analysis

Data analysis (e.g., computation of summary statistics, standard errors, confidence intervals, etc.) is not currently proposed for data evaluation for this project at this time. If data analysis is required at a later date, then the analysis procedures will be described in detail in the associated work plan or technical report.

3.10.7 Data Tracking

The Project Manager is ultimately responsible for all activities conducted in response to the 1992 ROD, including data management. The Project Manager has the authority to enforce proper procedures as outlined in this plan and to implement corrective procedures to assure the accurate and timely flow and transfer of data. The Project Manager will review the final data reports.

The generators of data (geologists, samplers, and chemical analysts) will be responsible for accurate and complete documentation of data required under the task, and for assuring that these data are presented to their supervisor in a timely manner.

The FTL will be responsible for the day-to-day monitoring of data collected in the field. He/she assures that data are collected in the format specified in the task's work plan, assigns sample designations, and routes data to the project files. At least one copy of all project documents will be retained by the FTL for project use during the investigation. Original documents will be maintained in the project file.

The Project Manager will be responsible for the day-to-day monitoring of activities related to the generation and reporting of chemical data. He/she ensures that samples are analyzed according to the specified procedures; that data are verified; and that the data are properly coded, checked for accuracy, and entered into the data management system. He/she assures the data are then routed to the project files.

3.10.8 Data Storage and Retrieval

A project file will be established for the storage of original data, historical data, written documents, and data collected or generated during this work. The format for the file will, at a minimum, include the following categories:

- Correspondence;
- Budgets;
- Contracts;
- Field Data;

- Figures and Maps;
- Permits;
- Laboratory Data and QA/QC Documents;
- Chains of Custody;
- Photographs;
- Reports; and
- Schedules.

All materials will be dated, carry the initials of the person responsible for the preparation of the document, and bear the project number. All documents relating to the project shall be controlled to assure proper distribution, filing and retrieval. The document control shall also assure that revisions are properly recorded, distributed, and filed. The Project Manager maintains overall responsibility for the project files and assures that appropriate documents are filed. Once filed, documents are available to project staff and may be removed from the file for use by signing out the material.

4.0 ASSESSMENT AND OVERSIGHT

This section presents the assessments that have been built into this project to assure that:

- Elements of this QAPP have been correctly implemented as prescribed for all proposed tasks;
- The quality of the data generated is adequate and satisfies the DQOs that have been identified in this QAPP; and
- Corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

Assessment activities may include surveillance, inspection, peer review, management systems review, readiness review, technical systems audit, performance evaluation, and data quality assessment.

4.1 Assessment Activities

The following subsections identify the planned assessment and oversight activities to assure the objectives identified above are attained for field and laboratory operations. The Project QA Officer and/or the Project Manager may also identify additional assessment activities to be performed during the course of the project based upon findings of the planned assessment activities described below.

4.1.1 Assessment of Field Operations

In general, internal assessments of field operations will be conducted by the Project QA Officer and/or other designated members of the project team where appropriate. Information contained in the QAPP will serve as a checklist to conduct these assessments. The assessment activities will evaluate field operations performance issues such as:

- Are sampling operations being conducted in accordance with the respective Work Plan and QAPP?
- Are the sample labels being filled out completely and accurately?
- Are the COC records complete and accurate?
- Are the daily field records or task-specific forms being filled out completely and accurately?
- Are the sampling activities being conducted in accordance with the approved work plan and SOPs?

Planned assessment activities to evaluate these and other field operations performance issues may include surveillance (frequent review) of sample collection documentation, sample handling records (COC forms), field records, and field measurements, and the performance of unannounced field operations audits. The Project Manager or Project QA officer will conduct periodic (biennially, at a minimum) audits of field activities to confirm that field operations are consistent with the respective work plans and QAPP. An audit report will be completed as described in Section 4.2.

4.1.2 Assessment of Laboratory Operations

The laboratory has an ongoing internal audit program that has been implemented to monitor the degree of adherence to their policies, procedures, and standards (Appendix A). The internal audit program is described in the laboratory's Quality Assurance Manual and includes systems audits, performance evaluations, data audits, and spot assessments. Internal audits are conducted by laboratory personnel who are independent of the area(s) being evaluated. The laboratory also participates in external audits conducted by regulatory agencies and other clients (Appendix A). Project-specific assessments of laboratory operations are described below.

Responsible task managers will be in contact with the analytical laboratory on a periodic basis while samples collected during this investigation are being analyzed. This will allow assessment of progress in meeting DQOs and the identification of any problems requiring corrective actions early in the investigative process. Responsible task managers will promptly report problems identified, corrective actions taken, and recommendations as appropriate for additional corrective action to the Project Manager. The Project Manager will review the problem and provide for the swift implementation of any outstanding corrective actions. The Project Manager or task managers will be responsible for working directly with the laboratory to assure the prompt resolution of any problems identified.

4.2 Assessment Reports

This subsection discusses internal reports within the project team. External reports are discussed in Section 2.6.

Reports to management may include project status reports, the results of surveillance evaluations, field and/or laboratory audits, and data quality assessments. These reports will be directed to the Project Manager who has ultimate responsibility for assuring that any corrective action response is completed, verified, and documented. The team member conducting the assessment activity will report the results of any assessment activities to the Project Manager and the Project QA Officer, if they were not directly involved in the assessment. Assessment activity reports will include the findings and identification of any corrective actions taken or planned.

Written communications between project team members, including reports to project management, will be maintained in the project files.

5.0 DATA VALIDATION AND USABILITY

This section of the QAPP provides a description of the QA activities that will occur after the data collection phase of the project is completed. Implementation of this section will determine whether or not the data conform to the specified criteria, thus satisfying the project objectives.

5.1 Field Data

All field data will be recorded on task-specific records (Appendix B). Daily field records and associated field data records will be reviewed by the Project Manager or designee. The review will include the following:

- Review of data completeness;
- Comparison of data to the task work plan to determine if the required methods, equipment, and/or protocols were used; and
- Comparison of data to historical measurements to identify potential anomalous results.

The results of the field data review will be summarized in a memorandum to the Project QA Officer.

5.2 Laboratory Data

Data validation is the process of reviewing data and accepting, qualifying, or rejecting data on the basis of sound criteria using established U.S. EPA guidelines. Laboratory data generated during field investigations will be reported by the laboratory in Level II format. The Level II data package includes, at a minimum, the analytical results, internal quality control results (laboratory control standards, surrogate and matrix spike recoveries, method blank results), and COC. All of this data will be subjected to the data validation performed according to the data quality control procedures as discussed below. A description of the laboratory's internal data review, verification and validation can be found in the laboratory Quality Assurance Manual included as Appendix A.

Data validation will be conducted by SGI's Eileen Bullen following methods for verification and validation of the laboratory data package consistent with Stage 2A of the USEPA Contract Laboratory Program (CLP) Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 2009). The data validation approach will consist of a systematic review of the analytical results, associated QC, methods and results. Best professional judgment in any area not specifically addressed by U.S. EPA guidelines will be utilized as necessary and described in the Usability Assessment portion of the data validation report.

Data will be validated according to applicable U. S. EPA data validation SOPs and guidelines set forth in the following sources as appropriate:

- "U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" ("National Functional Guidelines"), U.S. EPA, EPA540-R-04-004, October 2004;

- "U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", U.S. EPA, EPA540-R-99-008, October 1999;
- "U.S. EPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review", EPA 540-R-00-006, June 2001; and
- "U.S. EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use", EPA 540-R-08-005, OSWER 9200.1-85, January 2009.

Data validation will include a data completeness check of each data package, a transcription check for sample results, and a thorough review of all laboratory reporting forms. Specifically, this review will include:

- Review of data package completeness;
- Review of the required reporting summary forms to determine if the QC requirements were met and to determine the effect of exceeded QC requirements on the precision, accuracy, and sensitivity of the data;
- Review of the overall data package to determine if contractual requirements were met (based upon National Functional Guidelines);
- Review of additional QA/QC parameters, such as field duplicates and field blank contamination, to determine technical usability of the data; and
- Application of standard data quality qualifiers to the data.

In addition, each data validation will include a comprehensive review of the following QA/QC parameters as indicated in the National Functional Guidelines:

- Holding times (to assess potential for degradation that will affect accuracy);
- Blanks (to assess contamination for all compounds);
- System Monitoring Compounds (to assess method accuracy);
- Matrix Spikes/Matrix Spike Duplicates or Laboratory Fortified Blanks (to assess accuracy of the methods and precision of the method relative to the specific sample matrix);
- Compound Quantitation Limits and Method Detection Limits (to assess sensitivity as compared to project-specific requirements); and
- Field Duplicate Relative Percent Differences (or RPDs, to assess precision of the method relative to field sampling techniques, the specific sample matrix, and representativeness of the sample aliquot to the area sampled).

Samples that do not meet the acceptance limit criteria will be indicated with a qualifying flag, which is a one- or two-letter abbreviation that indicates a problem with the data (Table 7). During validation, the entire data set will be reviewed for overall trends in data quality and usability. Information summarized as part of the data quality validation will include frequencies of detection, dilution factors that might affect

data usability, and patterns of target compound distribution. The data set also will be evaluated to identify potential data limitations or uncertainties in the laboratory.

The results of the data validation and any corrective actions implemented are recorded on a QA/QC worksheet (example included in Appendix A). The data reviewer will initial and date the QA/QC worksheet. The Project QA Officer will provide secondary review of the QA/QC worksheet and will also initial and date the QA/QC worksheet. The initialed and dated QA/QC worksheet will be attached to the final analytical laboratory report that is retained in the project files.

All laboratory analytical data will be supported by a Data Validation Report. The Data Validation Report will be included as an appendix to the relevant technical report and will present the following information:

- A completed QA/QC worksheet (Appendix A);
- The laboratory analytical report, including supporting QC data for associated field samples;
- A comprehensive narrative detailing all QC exceedances, explaining qualifications of data results. In cases where data are qualified due to quantifiable QC exceedances, the bias (high or low) will be identified;
- Data summary tables in tabular format reporting all data results with the qualifiers that were added during the data validation review. These tables will include sample ID, laboratory ID, date sampled, sample type (e.g., field duplicate, field blank), units, concentration of analytes, and validation qualifiers. These tables may be modified to report other information as needed (such as depth of soil samples, date analyzed, dilution factor); and
- Resubmittal requests (if any) sent to the laboratory regarding missing information, validation of analytical information, etc.

Full data validation will be performed prior to finalization of Site closeout activities.

5.3 Reconciliation with User Requirements

The usability of the validated data will be assessed by comparing the data to the validation criteria and DQOs. The usability assessment will provide an overall summary of data quality; defining acceptability or problems with accuracy, precision, sensitivity, and representativeness of the results with clear guidance to the data users of the uncertainties in the data that have been qualified as estimated (J). Because of cumulative effects of QC exceedances, some specific results may be determined to be unusable. Alternatively, based upon the U.S. EPA guidelines and best professional judgment, specific results may be determined to be usable for DQOs when they are not significantly outside the QC criteria.

The data analysis process will be performed consistent with Guidance for Data Quality Assessment, Practical Methods for Data Analysis (U.S. EPA 2000a). The primary steps include the following:

- Review the DQOs and sampling design: Review the DQO outputs, the sampling design, and data collection documentation for consistency.

- Conduct preliminary data review: Review Data Validation Reports, tabulate analytical results or measured data and prepare graphical representations (potentiometric surface and isoconcentration maps).
- Select the statistical test: The environmental data will be evaluated against regulatory limits and historic Site trends. Groundwater concentrations of VOCs in Site wells will be compared to MCLs. If duplicate data are collected from a Site well, the average of the concentrations will be used in the comparison. Periodically, or when requested by DTSC or the U.S. EPA a statistical analysis of trends in the analytical data from each monitoring well will be conducted. This analysis may include an evaluation of concentration correlation with time, a linear regression of the data, or Mann-Kendall trend test. Additional investigations may be proposed if consistent increasing trends in concentrations are indicated by statistical analysis.
- Verify the assumptions of the statistical test: Examine the underlying assumptions of the statistical hypothesis test in light of the environmental data. Adjust for bias if warranted.
- Draw conclusions from the data: Interpret the results, document in the project files, and include in required project reports.

If the data quality is judged sufficient to achieve project objectives, the Project Manager will release the data and work can proceed. If there is a question on the validity of a sample result that cannot be resolved through the data validation process, the well will be re-sampled as soon as possible following the determination. Appropriate corrective action will be required if the data quality is determined to be insufficient to achieve project objectives. The Project Manager will evaluate potential corrective actions, including but not limited to confirmation sampling, modifications to the sampling and/or analytical program, and additional trend analyses.

6.0 REFERENCES

Department of Toxic Substances Control and Regional Water Quality Control Board – Los Angeles Region, 2012. Advisory–Active Soil Gas Investigations, April.

Geosyntec, 2013, Revised Supplemental Site Investigation Work Plan, Former Anaconda Wire and Cable Facility, Orange, California, June 18.

U.S. EPA, 1994, SW-846 Test Methods for Evaluating Soil Waste, Physical/Chemical Methods, Third Edition, Update II, September.

U.S. EPA, 1998a, EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, EPA/600/R-98/018, February.

U.S. EPA Region II, 1998b, Ground Water Sampling Procedure: Low Stress (Low Flow) Purging and Sampling, March.

U.S. EPA, 1999, Contract Laboratory Program National Functional Guidelines for Organic Data Review ("National Functional Guidelines"), U.S. EPA, EPA540-R-99-008, October.

U.S. EPA, 2000a, Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, EPA/600/R-96/084, July.

U.S. EPA, 2000b, Guidance for the Data Quality Objectives Process, EPA QA/G-4, EPA/600/R-96/055, August.

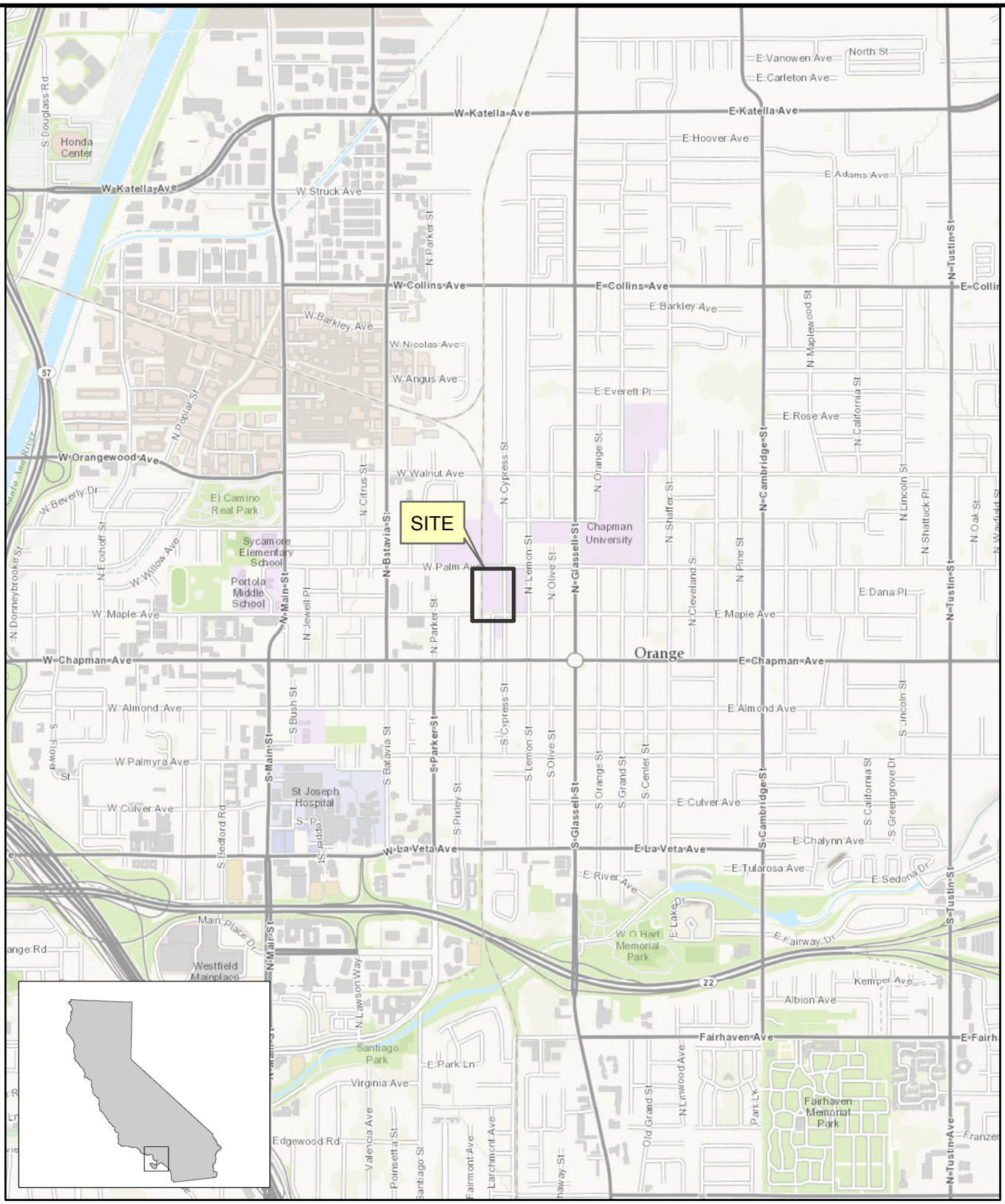
U.S. EPA, 2001a, EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, EPA/240/B-01/003, March.

U.S. EPA, 2001b, Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review, EPA 540-R-00-006, June.

U.S. EPA, 2004a, Uniform Federal Policy for Quality Assurance Project Plans, EPA505-B-04-900C, July.

U.S. EPA, 2004b, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review ("National Functional Guidelines"), U.S. EPA, EPA540-R-04-004, October.

FIGURES



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SGI environmental THE SOURCE GROUP, INC. 1962 FREEMAN AVE. SIGNAL HILL, CA 90755	**FORMER ANACONDA FACILITY** 220-296 NORTH CYPRESS STREET ORANGE, CALIFORNIA 92866				**SITE LOCATION MAP**	FIGURE **1**

TABLES

TABLE 1
SAMPLING MATRIX
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Sample	Location	Parameter(s)	Sample Type	Type of Containers[1]	Number of Containers	Methodology	Holding Time[2]	Preservation
Groundwater	Monitoring Wells	Water Level	N/A	N/A	N/A	Water Level Indicator	Immediate	N/A
		Dissolved Oxygen	N/A	N/A	N/A	Field meter w/ flow through cell	Immediate	N/A
		Eh (ORP)						
		Conductivity						
		Temperature						
		pH						
		Turbidity						
		VOCs	Grab	40 ml vial	3	SW-846 5030B/8260B	14 Days	1:1 HCl to pH<2; No Head Space, Cool 4°C
		1,4 Dioxane	Grab		1	SW-846-522		
		Chromium (VI)	Grab		1	SW-846-218-6		Unpreserved, filtered by laboratory
Soil Gas	Well annulus or boreholes	VOCs	Grab	Syringe	Per 2012 CalEPA Advisory on Soil Gas Investigations			
Soil Matrix	Boreholes	VOCs	Grab	Encore or Preservation VOAs	3	SW-846-8260B	7 Days	Encore or Methanol/Bisulfate
		1,4 Dioxane	Grab	40 ml vials or Acetate sleeves	1	SW-846-8270C		N/A
		Chromium (VI)	Grab	40 ml vials or Acetate sleeves	1	SW-846-7199		N/A
		Metals	Grab	40 ml vials or Acetate sleeves	1	SW-846-6010B/7471	14 Days	N/A
	Soil Bins	VOCs	Grab	Encore Samplers	3	Method 5035	7 Days	Encore
		TRPH	Composite	Vial	1	EPA 481-1	14 Days	N/A
		CAM Metals	Composite	Vial	1	EPA 6010/7471	14 Days	N/A

TABLE 2
ANTICIPATED TECHNICAL REPORTS
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Report Title	Frequency of Report	General Report Contents
Investigation Report	One-time	• Summary of groundwater monitoring well, soil and soil gas probe installation methodologies, observations and results. • Field forms (including boring logs, well gauging, development, and well survey data) • Hydrogeologic interpretation • Results of testing of soil gas monitoring probes • Field forms • Soil gas concentration summary tables, maps, and cross sections incorporating previous data and adjacent sites data. • Laboratory analytical reports for soil gas samples
Quarterly Groundwater Monitoring and Sampling Reports	Quarterly	• Quarterly water level data and potentiometric surface maps • Summary of analytical results of quarterly groundwater monitoring • Summary of QA/QC validation of analytical results • Evaluation of quarterly monitoring results against water quality objectives (MCLs) • Field forms (well gauging and purging records) • Laboratory analytical reports for samples

TABLE 3
ANALYSIS MATRIX
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Sample Media	Parameter(s)	Type of Bottles[1]	Number of Bottles	Preparatory Method	Analytical Method	SOP Reference[2]	Holding Time[3]	Preservation
Water	VOCs	VOAs	5	5030	8260B	8260B04	14 Days	1:1 HCL to pH<2; No Head Space, Cool 4°C
	1,4 Dioxane				522			
	Chromium (VI)				218.6			
	Water Level	N/A	N/A	N/A	Water Level Indicator	N/A	Immediate	N/A
	Dissolved Oxygen	N/A	N/A	N/A	Field meter w/ flow-through cell	N/A	Immediate	N/A
	ORP							
	Conductivity							
	Temperature							
	pH							
	Turbidity							
Soil Gas	VOCs	syringes	Per 2012 CalEPA Soil Gas Advisory					
Soil Matrix	VOCs	5035 Encore or Preservation VOAs	3	5035	8260B/5035		7 days	N/A
	1,4 Dioxane	Vials or Acetate sleeve	1	N/A	8270C			
	Metals	Vials or Acetate sleeve	1	N/A	6010B/7199			

Notes:

1. Bottle types – VOAs: Volatile Oganic Analysis vials (40mL)
2. SOP Reference - Reference for Standard Operating Procedure for analytical method in Calscience's Laboratory Quality Manual, Appendix A (extraction method SOP/analysis method SOP).
3. From verified time of sample collection.

TABLE 4
ANALYTICAL METHOD REQUIREMENTS
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Matrix	Analytes	Method	MDL	RL
Water	***Volatile Organic Compounds***		(µg/L)	(µg/L)
	1,1,1,2-Tetrachloroethane	8260B	0.4	1
	1,1,1-Trichloroethane		0.3	1
	1,1,2,2-Tetrachloroethane		0.41	1
	1,1,2-Trichloro-1,2,2-Trifluoroethane		0.78	10
	1,1,2-Trichloroethane		0.38	1
	1,1-Dichloroethane		0.28	1
	1,1-Dichloroethene		0.43	1
	1,1-Dichloropropene		0.46	1
	1,2,3-Trichlorobenzene		0.51	1
	1,2,3-Trichloropropane		0.64	5
	1,2,4-Trichlorobenzene		0.5	1
	1,2,4-Trimethylbenzene		0.36	1
	1,2-Dibromo-3-Chloropropane		1.2	5
	1,2-Dibromoethane		0.36	1
	1,2-Dichlorobenzene		0.46	1
	1,2-Dichloroethane		0.24	0.5
	1,2-Dichloropropane		0.42	1
	1,3,5-Trimethylbenzene		0.28	1
	1,3-Dichlorobenzene		0.4	1
	1,3-Dichloropropane		0.3	1
	1,4-Dichlorobenzene		0.43	1
	1,4 Dioxane			
	2,2-Dichloropropane		0.36	1
	2-Butanone		2.2	10
	2-Chlorotoluene		0.24	1
	2-Hexanone		2.1	10
	4-Chlorotoluene		0.13	1
	4-Methyl-2-Pentanone		4.4	10
	Acetone		10	20
	Benzene		0.14	0.5
	Bromobenzene		0.3	1
	Bromochloromethane		0.48	1
	Bromodichloromethane		0.21	1
	Bromoform		0.5	1
	Bromomethane		3.9	10
	c-1,2-Dichloroethene		0.48	1
	c-1,3-Dichloropropene		0.25	0.5
	Carbon Disulfide		0.41	10
	Carbon Tetrachloride		0.23	0.5
	Chlorobenzene		0.17	1
	Chloroethane		2.3	5
	Chloroform		0.46	1
	Chloromethane		1.8	10
	Dibromochloromethane		0.25	1
	Dibromomethane		0.46	1
	Dichlorodifluoromethane		0.46	1
	Diisopropyl Ether (DIPE)		0.33	2
	Ethanol		50	100
	Ethylbenzene		0.14	1
	Ethyl-t-Butyl Ether (ETBE)		0.44	2
	Isopropylbenzene		0.58	1
	Methylene Chloride		0.64	10
	Methyl-t-Butyl Ether (MTBE)		0.31	1
	Naphthalene		2.5	10
	n-Butylbenzene		0.23	1
	n-Propylbenzene		0.17	1
	o-Xylene		0.23	1
	p/m-Xylene		0.24	1
	p-Isopropyltoluene		0.16	1
	sec-Butylbenzene		0.25	1
	Styrene		0.17	1
	t-1,2-Dichloroethene		0.37	1
	t-1,3-Dichloropropene		0.25	0.5
	Tert-Amyl-Methyl Ether (TAME)		0.22	2
	Tert-Butyl Alcohol (TBA)		4.6	10
	tert-Butylbenzene		0.28	1
	Tetrachloroethene		0.39	1
	Toluene		0.24	1
	Trichloroethene		0.37	1
	Trichlorofluoromethane		1.7	10
	Vinyl Acetate		2.8	10
	Vinyl Chloride		0.3	0.5
	Antimony			
	Arsenic			
	Barium			
	Beryllium			
	Cadmium			
	Chromium			
	Chromium III			
	Chromium IV			
	Cobalt			
	Copper			

TABLE 4
ANALYTICAL METHOD REQUIREMENTS
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Matrix	Analytes	Method	MDL	RL
	Lead Mercury Molybdenum Nickel Selenium Silver Thallium Vanadium Zinc			

TABLE 4
ANALYTICAL METHOD REQUIREMENTS
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Matrix	Analytes	Method	MDL	RL
Soil	***Volatile Organic Compounds***		**(µg/kg)**	**(µg/kg)**
	1,1,1,2-Tetrachloroethane	8260B	0.24	1
	1,1,1-Trichloroethane		0.23	1
	1,1,2,2-Tetrachloroethane		0.35	2
	1,1,2-Trichloro-1,2,2-Trifluoroethane		0.35	10
	1,1,2-Trichloroethane		0.35	1
	1,1-Dichloroethane		0.21	1
	1,1-Dichloroethene		0.35	1
	1,1-Dichloropropene		0.33	2
	1,2,3-Trichlorobenzene		0.91	2
	1,2,3-Trichloropropane		0.83	2
	1,2,4-Trichlorobenzene		0.31	2
	1,2,4-Trimethylbenzene		0.59	2
	1,2-Dibromo-3-Chloropropane		1.7	5
	1,2-Dibromoethane		0.26	1
	1,2-Dichlorobenzene		0.23	1
	1,2-Dichloroethane		0.31	1
	1,2-Dichloropropane		0.44	1
	1,3,5-Trimethylbenzene		0.55	2
	1,3-Dichlorobenzene		0.18	1
	1,3-Dichloropropane		0.25	1
	1,4-Dichlorobenzene		0.22	1
	1,4 Dioxane			
	2,2-Dichloropropane		0.33	5
	2-Butanone		3.8	20
	2-Chlorotoluene		0.23	1
	2-Hexanone		1.8	20
	4-Chlorotoluene		0.21	1
	4-Methyl-2-Pentanone		4.3	20
	Acetone		6.2	50
	Benzene		0.13	1
	Bromobenzene		0.21	1
	Bromochloromethane		0.69	2
	Bromodichloromethane		0.23	1
	Bromoform		0.79	5
	Bromomethane		9.4	20
	c-1,2-Dichloroethene		0.28	1
	c-1,3-Dichloropropene		0.25	1
	Carbon Disulfide		0.31	10
	Carbon Tetrachloride		0.28	1
	Chlorobenzene		0.22	1
	Chloroethane		1.5	2
	Chloroform		0.24	1
	Chloromethane		0.3	20
	Dibromochloromethane		0.57	2
	Dibromomethane		0.77	1
	Dichlorodifluoromethane		0.44	2
	Diisopropyl Ether (DIPE)		0.48	1
	Ethanol		84	500
	Ethylbenzene		0.15	1
	Ethyl-t-Butyl Ether (ETBE)		0.51	1
	Isopropylbenzene		0.55	1
	Methylene Chloride		1.3	10
	Methyl-t-Butyl Ether (MTBE)		0.3	2
	Naphthalene		0.81	10
	n-Butylbenzene		0.16	1
	n-Propylbenzene		0.5	2
	o-Xylene		0.56	1
	p/m-Xylene		0.27	2
	p-Isopropyltoluene		0.63	1
	sec-Butylbenzene		0.58	1
	Styrene		0.6	1
	t-1,2-Dichloroethene		0.51	1
	t-1,3-Dichloropropene		0.61	2
	Tert-Amyl-Methyl Ether (TAME)		0.35	1
	Tert-Butyl Alcohol (TBA)		5.2	20
	tert-Butylbenzene		0.15	1
	Tetrachloroethene		0.21	1
	Toluene		0.52	1
	Trichloroethene		0.3	2
	Trichlorofluoromethane		0.38	10
	Vinyl Acetate		4.7	10
	Vinyl Chloride		0.5	1
	Antimony			
	Arsenic			
	Barium			
	Beryllium			
	Cadmium			
	Chromium			
	Chromium III			
	Chromium IV			
	Cobalt			
	Copper			

TABLE 4
ANALYTICAL METHOD REQUIREMENTS
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Matrix	Analytes	Method	MDL	RL
	Lead			
	Mercury			
	Molybdenum			
	Nickel			
	Selenium			
	Silver			
	Thallium			
	Vanadium			
	Zinc			

TABLE 4
ANALYTICAL METHOD REQUIREMENTS
Supplemental Site Investigation
Former Anaconda Wire and Cable Company
Orange, CA

Matrix	Analytes	Method	MDL	RL
			(µg/L)	(µg/L)
Soil Gas		8260B or TO-15	0.5	1.0
			0.01	0.1
			0.01	0.10
	Volatile Organic Compounds		0.5	1.0
	Acetone		1	2.0
	Bromoform		0.01	0.10
	Bromomethane		0.01	0.10
	2-Butanone (MEK)		0.01	0.10
	tert-Butyl alcohol (TBA)		0.01	0.10
	n-Butylbenzene		0.01	0.02
	sec-Butylbenzene		0.01	0.10
	tert-Butylbenzene		0.01	0.10
	Carbon Disulfide		0.01	0.10
	Carbon Tetrachloride		0.01	0.10
	Chlorobenzene		0.01	0.10
	Chloroethane		0.01	0.10
	Chloroform		0.01	0.10
	Chloromethane		0.01	0.10
	2-Chlorotoluene		0.01	0.10
	4-Chlorotoluene		0.01	0.10
	1,2-Dibromo-3-chloropropane		0.01	0.10
	Dibromochloromethane		0.01	0.10
	1,2-Dibromoethane (EDB)		0.01	0.10
	Dibromomethane		0.1	0.50
	1,3-Dichlorobenzene		0.01	0.10
	1,2-Dichlorobenzene		0.01	0.10
	1,4-Dichlorobenzene		0.01	0.04
	tert-Amyl Methyl Ether (TAME)		0.01	0.10
	Dichlorodifluoromethane (R12)		0.01	0.1
	1,1-Dichloroethane		0.01	0.1
	1,2-Dichloroethane (EDC)		0.01	0.10
	1,1-Dichloroethylene		0.01	0.10
	cis-1,2-Dichloroethylene		0.01	0.03
	trans-1,2-Dichloroethylene		0.01	0.10
	2,2-Dichloropropane		0.01	0.10
	1,2-Dichloropropane		0.01	0.10
	Benzene		0.01	0.10
	1,3-Dichloropropane		0.1	0.50
	trans-1,3-Dichloropropylene		0.01	0.1
	cis-1,3-Dichloropropylene		0.1	0.50
	1,1-Dichloropropylene		0.01	0.10
	Diisopropyl ether (DIPE)		0.01	0.10
	Ethylbenzene		0.5	1.0
	Ethyl-tert-Butyl Ether (ETBE)		0.01	0.10
	Bromobenzene		0.01	0.10
	Hexachlorobutadiene		0.01	0.10
	2-Hexanone (MBK)		0.1	0.5
	Isopropylbenzene		0.01	0.50
	4-Isopropyltoluene		0.5	1.0
	Bromochloromethane		0.01	0.03
	Methyl-tert-Butyl Ether (MTBE)		0.01	0.10
	Methylene Chloride		0.01	0.10
	4-Methyl-2-pentanone (MIBK)		0.01	0.10
	Naphthalene		0.01	0.10
	n-Propylbenzene		0.01	0.10
	Styrene		0.01	0.1
	1,1,2,2-Tetrachloroethane		0.01	0.1
	Bromodichloromethane		0.01	0.10
	1,1,1,2-Tetrachloroethane		0.01	0.10
	Tetrachloroethylene (PCE)		0.01	0.10
	Toluene		0.01	0.1
	1,2,4-Trichlorobenzene		0.01	0.1
	1,2,3-Trichlorobenzene		0.01	0.10
	1,1,2-Trichloroethane		0.01	0.10
	1,1,1-Trichloroethane		0.1	0.50
	Trichloroethylene (TCE)		0.01	0.10
	Trichlorofluoromethane (R11)		0.01	0.10
	1,2,3-Trichloropropane		0.01	0.01
	1,1,2-Trichloro-1,2,2-trifluoroethane (R113)		0.01	0.1
	1,3,5-Trimethylbenzene		0.01	0.1
	1,2,4-Trimethylbenzene			
	Vinyl chloride			
	o-Xylene			
	m,p-Xylenes			

Notes:
RL = Report
MDL = Meth
Soil gas levels are from Calscience reporting limits and correlate to CA Human Health Screening levels for indoor air residential setting.

[1] These numbers are subject to change

TABLE 5
FIELD QC SAMPLES
Quality Assurance Project Plan
Former Anaconda Wire and Cable Company
Orange, CA

Type of QC Sample	Frequency	Acceptance Criteria
Trip blanks	1 per cooler of aqueous samples for VOC analysis	EPA National Functional Guidelines Protocol
Equipment rinsate blank	1 per day per equipment type	EPA National Functional Guidelines Protocol
Field blank[1]	1 per water source per sampling event	EPA National Functional Guidelines Protocol
Duplicate	1 per 10 water samples	Relative percent difference, RPD < 30
Soil Gas Samples	Per 2012 CalEPA Advisory	Per 2012 CalEPA Advisory

1. The requirement for field blanks will be at the discretion of the Project Manager and presented in specific work plans.

TABLE 6
SPECIFICATIONS FOR ANTICIPATED SUPPLIES AND CONSUMABLES
Quality Assurance Project Plan
Former Anaconda Wire and Cable Company
Orange, CA

Consumable Item	Specification
Deionized Water	Supplied by the Analytical Laboratory and meets the requirements of ASTM Type II reagent water. ASTM D1193-99e1 Standard Specification for Reagent Water Reference: U.S. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). Chapter 1. Section 5.0
Sample Containers	Supplied by the Analytical Laboratory and meets the requirements of Section 9.2.2.4 of U.S. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)
PID Calibration Gas	Isobutylene in air gas cylinder (100ppm) or as described in Manufacturer's Operations Manual
Disposable Gloves	New nitrile gloves that meet ASTM D3578-01ae2 Standard Specification for Rubber Examination Gloves
Disposable Polyethylene Tubing	Meets ASTM D2737-03 Standard Specification for Polyethylene (PE) Plastic Tubing
Soil Gas Sampling Equipment and Tubing	Per 2012 CalEPA Advisory

Table 7
DATA QUALIFIER DEFINITIONS
Quality Assurance Project Plan
Former Anaconda Wire and Cable Co.
Orange, CA

Qualifier	Explanation of Qualifier
Organic Analysis[1]	
U	The coumpound was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicated the presence of an analyte for which there is presumtive evicence to make a "tenative identification".
NJ	The analysis indicates the presence of an analyte that has been "tenatively identified" and the associated numerical value represents its approximate concentration.
UJ	The analyte was nto detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and preciesly measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

1 U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, U.S. EPA 540-R-99-008, October 1999.

2 U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, U.S. EPA 540-R-04-004, October 2004.

3 U.S. EPA Contract Laboratory Program National Function Guidelines for Low Concentration Organic Data Review, U.S. EPA 540-R-00-006, June 2001.

APPENDIX A

CALSCIENCE LABORATORY QUALITY ASSURANCE MANUAL

UNCONTROLLED COPY

QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL ANALYTICAL SERVICES

Version 5.5
November 2012

Prepared By

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Based On

The NELAC Institute (TNI)
National Environmental Laboratory Accreditation Program (NELAP)
Management and Technical Requirements for Laboratories Performing Environmental Analysis
TNI Standard (EL-V1-2009) Effective September 09, 2009

Larry Lem
QUALITY ASSURANCE MANAGER

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Virginia Huang
OPERATIONS TECHNICAL DIRECTOR

Jill Henes
QUALITY ASSURANCE DIRECTOR

Steven L. Lane
VICE PRESIDENT, LABORATORY DIRECTOR

TABLE OF CONTENTS
QUALITY SYSTEMS MANUAL

PREFACE TO THE QUALITY SYSTEMS MANUAL

Purpose

The purpose of this document is to provide implementation guidance on the establishment and management of quality systems for Calscience Environmental Laboratories, Inc and is based on the National Environmental Laboratory Accreditation Conference's (NELAC) Quality System requirements, the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) and International Organization for Standardization / International Electrotechnical Commission (ISO/IEC) 17025:2005. These three programs are built upon one another and are mutually reinforcing in their Quality Assurance programs and protocols.

Background

To be accredited and in compliance under the following three programs:

The National Environmental Laboratory Accreditation Program (NELAP). Accredited laboratories shall have a comprehensive quality system in place, the requirements for which are outlined in The NELAC Institute (TNI) 2009 Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-2009). This manual was written with guidance primarily from Volume 1: Modules 2, 3, 4, 5, and 7.

Additional information may be found at:

- http://www.nelac-institute.org/
- http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx

The Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) will provide a means for laboratories to demonstrate conformance to the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM) as authorized by DoD Instruction 4715.15, The DoD QSM Revision 4.2 (October 25, 2010) is based on the National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems standard which provides guidelines for implementing the international standard, ISO/IEC 17025.

Additional information may be found at:

- http://www.denix.osd.mil/edqw/Accreditation/
- http://www.denix.osd.mil/edqw/upload/QSM-V4-2-Final-102510.pdf

ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories is for use by laboratories in developing their management system for quality, administrative and technical operations. Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories. ISO/IEC 17025:2005 is not intended to be used as the basis for certification of laboratories.

Additional information may be found at:

- http://www.iso.org/iso/home.html

Project Specific Requirements

Project-specific requirements or regulations may supersede requirements contained in this manual. The laboratory bears the responsibility for meeting all **State requirements**. Nothing in this document relieves the laboratory from complying with contract requirements, or with **Federal, State, and/or local regulations**.

Results and Benefits

- **Standardization of Processes** – Because this manual provides the laboratory with a comprehensive set of requirements that meet the needs of many clients, as well as the NELAP, the laboratory may use it to create a standardized quality system. Ultimately, this standardization saves laboratory resources by establishing one set of consistent requirements for all environmental work. Primarily, the laboratory bears the responsibility for meeting all State requirements as outlined in their respective certification programs.

- **Deterrence of Improper, Unethical, or Illegal Actions** – Improper, unethical, or illegal activities committed by only a few laboratories have implications throughout the industry, with negative impacts on all laboratories. This manual establishes a minimum threshold program for all laboratories to use to deter and detect improper, unethical, or illegal actions.

- **Foundations for the Future** – A standardized approach to quality systems, shared by laboratories and the NELAP, paves the way for the standardization of other processes. For example, this manual might serve as a platform for a standardized strategy for Performance Based Measurement System (PBMS) implementation.

Document Format

This Calscience Environmental Laboratories, Inc. (Calscience) *Quality Systems Manual* (QSM) is designed to implement the TNI 2009 (EL-V1-2009) standards along with the DOD QSM 4.2 and the ISO/IEC 17025:2005 standards

The section numbering has been changed from that of these standards as the manual is meant to be a stand-alone document. Thus the number in this document is not consistent with the numbering in the above-mentioned standards; however, all required elements are covered, herein.
.

ACROYNM LIST

°C: Degrees Celsius
ANSI/ASQC: American National Standards Institute/American Society for Quality Control
ASTM: American Society for Testing and Materials
CAS: Chemical Abstract Service
CCV: Continuing calibration verification
CFR: Code of Federal Regulations
CLP: Contract Laboratory Program
COC: Chain of custody
CV: Coefficient of variation
DO: Dissolved oxygen
DOC: Demonstration of capability
DoD: Department of Defense
DQOs: Data quality objectives
EPA: Environmental Protection Agency
g/L: Grams per liter
GC/MS: Gas chromatography/mass spectrometry
ICP-MS: Inductively coupled plasma-mass spectrometer
ICV: Initial calibration verification
ID: Identifier
ISO/IEC: International Standards Organization/International Electrotechnical Commission
LCS: Laboratory control sample
LCSD: Laboratory control sample duplicate
LOD: Limit of Detection
LOQ: Limit of Quantitation
LQMP: Laboratory Quality Management Plan
MDL: Method detection limit
ME: Marginal Exceedance
mg/kg: Milligrams per kilogram
MS: Matrix spike
MSD: Matrix spike duplicate
NELAC: National Environmental Laboratory Accreditation Conference
NELAP: National Environmental Laboratory Accreditation Program
NIST: National Institute of Standards and Technology
OSHA: Occupational Safety and Health Administration
PBMS: Performance Based Measurement System
PC: Personal computer
PCBs: Polychlorinated biphenyls
PT: Proficiency testing
QA: Quality assurance
QAD: Quality Assurance Division (EPA)
QAMS: Quality Assurance Management Section
QAPP: Quality Assurance Project Plan
QSM: Quality Systems Manual
QC: Quality control
RL: Reporting limit
RPD: Relative percent difference
RSD: Relative standard deviation
SD: Serial dilutions
SOP: Standard operating procedure
TNI: The NELAC Institute
TSS: Total suspended solids
UV: Ultraviolet
VOC: Volatile organic compound

QUALITY SYSTEMS

Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures that are delineated in a Quality Systems Manual (QSM) and followed to ensure and document the quality of the analytical data. Calscience, accredited under the National Environmental Laboratory Accreditation Program (NELAP), assures implementation of all QA policies and the applicable QC procedures specified in this Manual. The QA policies, which establish essential QC procedures, are applicable to all areas of Calscience, regardless of size and complexity.

The intent of this document is to provide sufficient detail about quality management requirements so that all accrediting authorities evaluate laboratories consistently and uniformly.

The National Environmental Laboratory Accreditation Institute (TNI) is committed to the use of Performance Based Measurement Systems (PBMS) in environmental testing and provides the foundation for PBMS implementation in these standards. While this standard may not currently satisfy all the anticipated needs of PBMS, NELAC will address future needs within the context of State statutory and regulatory requirements and the finalized EPA implementation plans for PBMS.

Chapter 5 is organized according to the structure of ISO/IEC 17025, 2005. Where deemed necessary, specific areas within this Chapter may contain more information than specified by ISO/IEC 17025.

All items identified in this QSM shall be available for on-site inspection or data audit.

1.0 SCOPE

a) This QSM sets the general requirements that Calscience must successfully demonstrate to be recognized as competent to perform specific environmental tests.

b) This QSM includes additional requirements and information for assessing competence or for determining compliance by the organization or accrediting authority that grants approval.

   If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates 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.

c) Calscience uses this QSM in the development and implementation of its quality systems. Accreditation authorities use this NELAC based standard to assess the competence of environmental laboratories.

2.0 REFERENCES

See Appendix A.

3.0 DEFINITIONS

The relevant definitions from ISO/IEC Guide 2, ANSI/ASQC E-4, 1994, the EPA “Glossary of Quality Assurance Terms and Acronyms,” and the *International vocabulary of basic and general terms in metrology (VIM*) are applicable. The most relevant is quoted in Appendix A, Glossary, of Chapter 1 of NELAC, together with further definitions applicable for the purposes of this Standard.

4.0 ORGANIZATION AND MANAGEMENT

4.1 Legal Definition of Laboratory

Calscience is legally definable as evidenced by its business license, and current California Department of Health Services Environmental Laboratory Accreditation Program (CADHS ELAP) certificate. It is organized and operates in such a way that its facilities meet the requirements of the Standard. See the graphical presentations of the Organization and QA responsibility in Figures 1 and 2, respectively.

4.2 Organization

Calscience:

a) Has a managerial staff with the authority and resources necessary to discharge their duties;

b) Has processes to ensure that its personnel are free from any commercial, financial and other undue pressure that adversely affect the quality of their work;

c) Is organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

d) Specifies and documents the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

   Such documentation includes:

   1) A clear description of the lines of responsibility in the laboratory, and is proportioned such that adequate supervision is ensured, and

   2) Job descriptions for all positions.

e) Provides supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results.

   The ratio of supervisory to non-supervisory personnel ensures adequate supervision and adherence to laboratory procedures and accepted techniques.

f) Has a technical director who has overall responsibility for the technical operation of Calscience.

   The technical director certifies that personnel who perform the tests for which the laboratory is accredited have the appropriate educational and/or technical background. Such certification is documented.

   The technical director meets the requirements specified in the Accreditation Process. (See NELAC Section 4.1.1.1.)

g) Has a quality assurance manager who has responsibility for the quality system and its implementation.

   The quality assurance officer has direct access to the technical director and to the highest level of management at which decisions are made regarding laboratory policy or resources.

   The quality assurance manager (and/or his/her designees):

   1) Serves as the focal point for QA/QC activities, and is responsible for the oversight and/or review of quality control data;

2) Has functions independent from laboratory operations for which she/he has quality assurance oversight;

3) Is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence;

4) Has documented training and/or experience in QA/QC procedures and is knowledgeable in the quality system, as defined under NELAC;

5) Has a general knowledge of the analytical test methods for which data review is performed;

6) Arranges for and conducts internal audits as per Calscience QSM section 5.3 annually; and

7) Notifies Calscience management of deficiencies in the quality system and monitors corrective action.

h) Nominates, by way of the "Alternates List," deputies in case of absence of the technical director and/or the quality assurance officer;

i) Calscience makes every effort to ensure the protection of its clients' information as confidential and proprietary.

ii) Calscience is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigatory processes. Calscience, therefore, holds all information in strict confidence with laboratory release only to the client.
iii) Information released to entities other than the client is performed only upon written request from the client.
iv) Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make every effort to maintain the confidence of client specific information.

j) For purposes of qualifying for and maintaining accreditation, participates in a proficiency test program as outlined in Chapter 2 of NELAC. Results of Calscience's performance in rounds of proficiency testing are available by request.

5.0 QUALITY SYSTEM – ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION

5.1 Establishment

Calscience establishes and maintains quality systems based on the required elements contained in this Manual and appropriate to the type, range and volume of environmental testing activities it undertakes.

a) The elements of this quality system are documented in this quality manual.

b) The quality documentation is available for use by all laboratory personnel.

c) The laboratory defines and documents its policies and objectives for, and its commitment to accepted laboratory practices and quality of testing services.

d) The laboratory management ensures that these policies and objectives are documented in the quality manual and are communicated to, understood and implemented by all laboratory personnel concerned.

i. All staff members are issued a copy of the quality manual at the commencement of work at Calscience. Employees read and endorse the following statement when they receive their quality manual: "By signature below, I acknowledge that I have received a copy of Revision [number] of Calscience's Quality Assurance Program Manual dated [effective date of the subject manual]. Furthermore, I agree to read and abide by the policies contained therein."

ii. A controlled copy of the quality manual is also available at the designated data reduction areas.

e) The quality manual is maintained current under the responsibility of the quality assurance officer. This manual is reviewed on an annual basis or more frequently, and revised as necessary. The review process begins in January of each year, and concludes on/before March of the same year. Where no revision is required, the manual is reissued in its entirety and review is scheduled for January of the following year.

5.2 Quality Systems Manual (QSM) Elements

This quality systems manual and related quality documentation state Calscience's policies and operational procedures established in order to meet the requirements of this Standard.

This Manual lists on the title page: a document title; the laboratory's full name and address; the name, address, and telephone number of individuals responsible for the laboratory; the name of the quality assurance manager; the identification of all major organizational units that are covered by this quality manual and the effective date of the version.

This quality manual and related quality documentation also contains:

a) A quality ***policy statement***, including objectives and commitments, by top management;

i. Calscience Environmental Laboratories, Inc. (Calscience) is committed to providing the highest quality environmental analytical services available. To ensure the production of scientifically sound, legally defensible data of known and proven quality, an extensive Quality Assurance program has been developed and implemented. This document, Calscience's Quality Systems Manual for Environmental Analytical Services, presents an overview of the essential elements of our Quality Assurance program. Calscience has modeled this systems manual after EPA guidelines as outlined in "Guidance for Quality Assurance Project Plans (EPA QA/G-5)", Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. EPA, EPA/240-R-02/009 December 2002. Calscience's QA Program is closely monitored at the Corporate, Divisional, and Group levels, and relies on clearly defined objectives, well-documented procedures, a comprehensive quality assurance/quality control system, and management support for its effectiveness.

ii. This QA Program Systems Manual is designed to control and monitor the quality of data generated at Calscience. The essential elements described herein are geared toward generating data that is in compliance with federal regulatory requirements specified under the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and applicable amendments, and state and DoD/DoE equivalents. Although the quality control requirements of these various programs are not completely consistent, each of the programs base data quality judgments on the following three types of information, the operational elements of each being described elsewhere in this manual.

⇨ Data which indicates the overall qualifications of the laboratory to perform environmental analyses;
⇨ Data which measures the laboratory's daily performance using a specific method; and
⇨ Data which measures the effect of a specific matrix on the performance of a method.

iii. It is important to note that the QA guidelines presented herein will always apply unless adherence to specific Quality Assurance Project Plans (QAPPs) or client and/or regulatory agency specific requirements are directed. In these cases, the elements contained within specified direction or documentation shall supersede that contained herein.

iv. This manual is a living document subject to periodic modifications to comply with regulatory changes and technological advancements. All previous versions of this document are obsolete. Users are urged to contact Calscience to verify the current revision of this document.

b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

See Figure 1 Organizational Chart, and Figure 2 QA Responsibility Chart.

c) The relationship between management, technical operations, support services and the quality system;

d) Procedures to ensure that all records required under the NELAP are retained, as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force;

i. Ensuring a high quality work product in the environmental laboratory not only requires adherence to the quality issues discussed in the previous sections, but also requires the ability to effectively archive, restore, and protect the records that are generated.

ii. Procedures are in place to ensure that all records are retained. In addition, a documentation control system is employed to clearly indicate the time period during which a standard operating procedure, manual, or document was in force. These procedures are outlined in the laboratory standard operating procedure SOP-T002.

iii. All laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and laboratory support documentation are stored for a minimum of five years. Project specific data are stored in sequentially numbered project files and include copies of the applicable laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and any other pertinent supporting documentation.

iv. When complete, the project specific data are high speed optically scanned and transformed into digital CD media. Additional copies of these records are created at the time of scanning and are stored off-site for protection of the data. These records are stored for a minimum of five years.

v. Access to all systems is limited by use of log-in and password protection and is maintained by the system administrator.

vi. There are four forms of electronic data that are generated in the laboratory. Refer to Table 1 – Data Archiving Schedule below for a synopsis of general data archiving schedules.

vii. All electronic records are stored for a minimum of five years.

FIGURE 1: ORGANIZATIONAL CHART

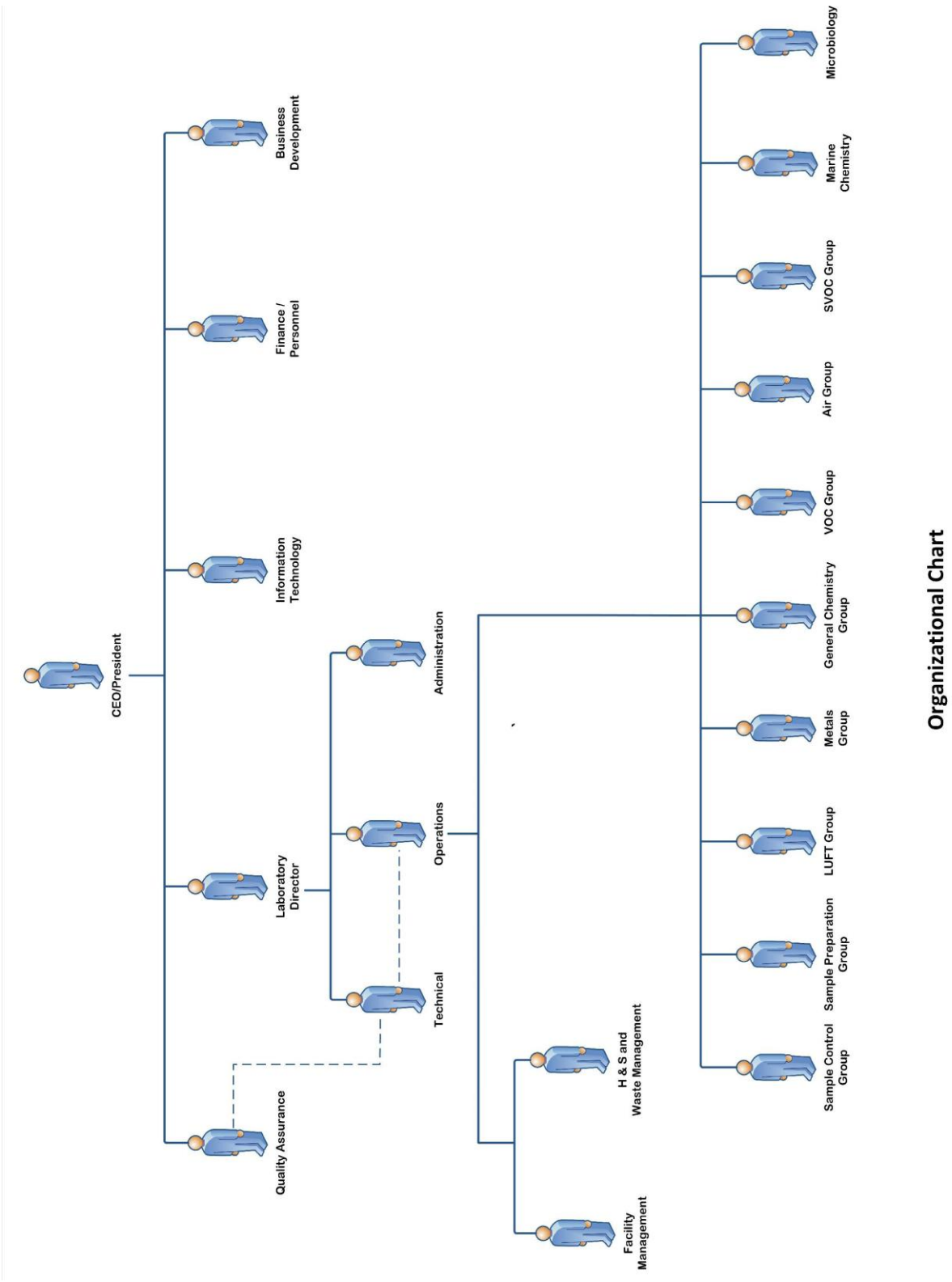

FIGURE 2: RESPONSIBILITY CHART

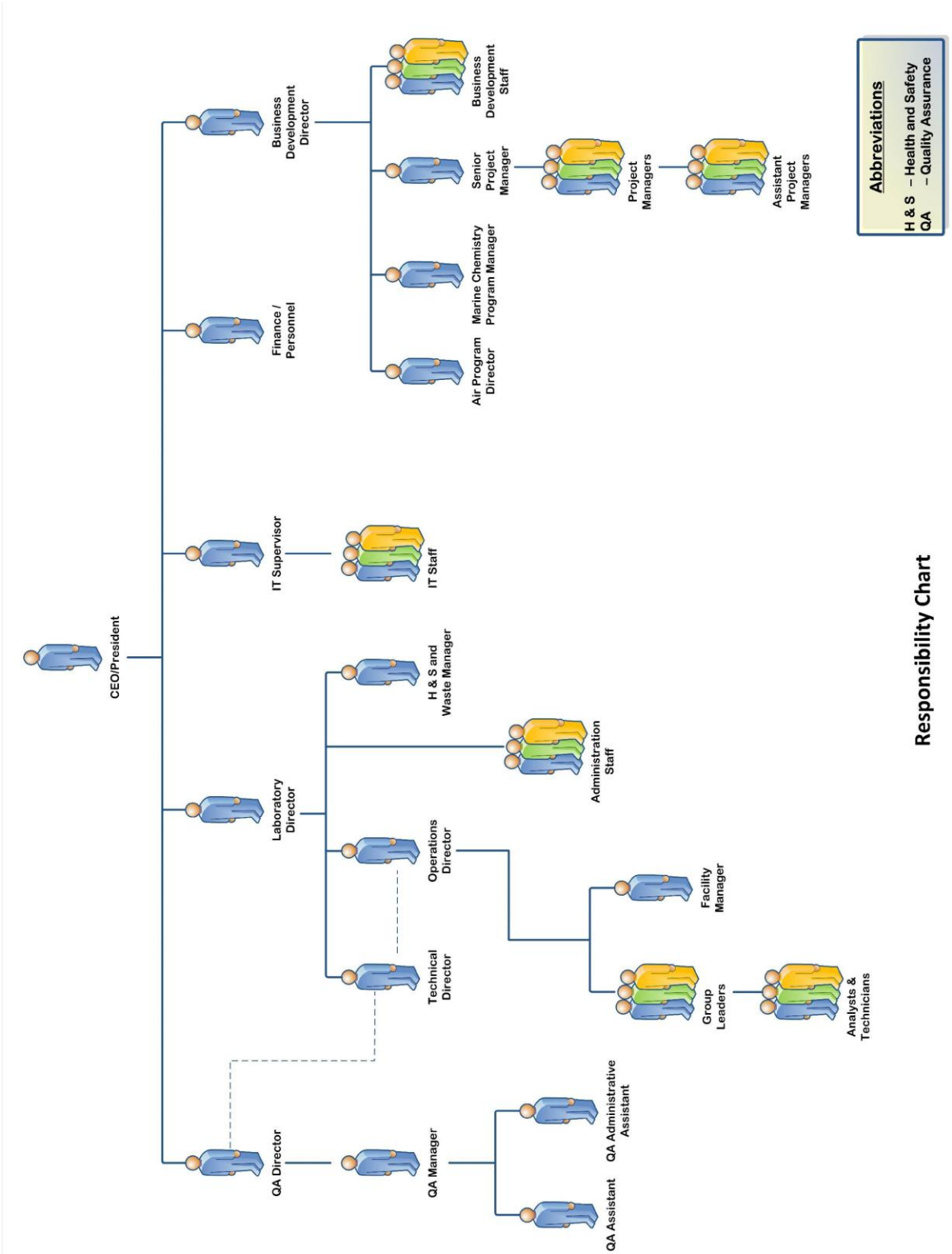

TABLE 1 – DATA ARCHIVING SCHEDULE

LIMS Database
Backup frequency: Daily
Backup media: Hard Disk
Backup software: MS SQL Server Backup
Backup versions kept: Ten previous versions
Onsite copy: Redundancy by using mirrored hard drive

Instrument Data
Backup frequency: Weekly
Backup media: Quantum 4000 DLT Raid Tape and DLT Tape
Backup software: Computer Associates ArcServIT
Backup versions kept: All versions
Offsite copy: One

Manual Data
Backup frequency: Weekly
Backup media: Quantum 4000 DLT Raid Tape and DLT Tape
Backup software: Computer Associates ArcServIT
Backup versions kept: All versions
Offsite copy: One

Hard Copy Data
Backup media: Digital CD
Backup software: Xerox Pagis
Backup versions kept: All versions
Offsite copy: One

e) Job Descriptions, 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 their job function and the quality program as a whole.

The responsibility for quality lies with every employee at Calscience. As such, all employees have access to the Quality Assurance Manual and are responsible for knowing the content of this manual and upholding the standards therein. Each employee is expected to conduct themselves in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs.

The following descriptions define the primary roles and their relationship to the Quality Assurance Program. Members of the key staff include the following:

- Management (e.g., President, Chief Executive Officer, Chief Operating Officer, Laboratory Director);
- Technical managers (e.g., Technical Director, Section Supervisors);
- Quality managers;
- Support systems and administrative managers (e.g., LIMS manager, purchasing manager, project managers); and
- Client services managers.

In these positions, members of the key staff are responsible for assuring compliance with the National Environmental Laboratory Accreditation Program (NELAP), California Environmental Laboratory Accreditation Program (ELAP), Department of Defense (DoD) ELAP, State and Federal Agencies, and ISO 17025:2005

Standard requirements. In these roles, key personnel may set or enforce quality policies, monitor compliance, initiate corrective actions, interface with laboratory, client, and regulatory personnel, and provide general program oversight.

Laboratory Director:

Calscience's Laboratory Director, through its President, is the final authority on all issues dealing with data quality and has the authority to require that procedures be amended or discontinued, or analytical results voided or repeated. He or she also has the authority to suspend or terminate employees on the grounds of non-compliance with QA/QC procedures. In addition, the Laboratory Director:

- ⇨ Ensures that Calscience remains current with all regulations which affect operations and disseminate all such changes in regulatory requirements to the QA Manager, Technical Director, and Group Leaders;

- ⇨ Provides one or more Technical Directors for the appropriate fields of testing. The name(s) of the Technical Director are included in the national database. (The Laboratory Director may also act in the Technical Director capacity.) If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director will designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 35 consecutive calendar days, the primary accrediting authority will 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;
- ⇨ Oversees the development and implementation of the QA Program which assures that all data generated will be scientifically sound, legally defensible, and of known quality;
- ⇨ In conjunction with the QA Manager, conducts annual reviews of the QA Program;
- ⇨ Oversees the implementation of new and revised QA procedures to improve data quality;
- ⇨ 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;
- ⇨ Oversees all laboratory accreditation efforts; and
- ⇨ Oversees in-house training on quality assurance and control.

Operations Director:

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

- ⇨ Evaluate the level of internal/external non-conformances for all departments;
- ⇨ Continuously evaluate production capacity and improves capacity utilization;
- ⇨ Continuously evaluate turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments;
- ⇨ Develop and improve the training of all analysts in cooperation with the Laboratory Director, QA Director, QA Manager and Group Leaders, and in compliance with regulatory requirements;
- ⇨ Ensure that scheduled instrument maintenance is completed;
- ⇨ Are responsible for efficient utilization of supplies;
- ⇨ Constantly monitor and modify the processing of samples through the departments; and

- ⇨ Maintain sufficient personnel, equipment and supplies to achieve production goals.

Quality Assurance Director:

The Quality Assurance (QA) Director has full authority through the President in all matters relating to quality assurance and quality control systems. The QA Director can make recommendations to the President and/or Laboratory Director regarding the suspension analytical activities or the suspension or termination of employees on the grounds of non-compliance with QA/QC systems or procedures. An alternate QA Director is always assigned. In the absence of the primary designate, the alternate will act in the QA Director's capacity with the full authority of the position as allowed by Calscience governing documents. In addition, the QA Director performs the following:

- ⇨ Oversight and monitoring of and compliance with Calscience's QA program;
- ⇨ Ensuring continuous improvement in all aspects of Calscience's QA program such as:
  - o accreditations/certifications;
  - o analytical method management;
  - o internal and external audits;
  - o documentation;
  - o training;
  - o proficiency evaluation studies;
- ⇨ Ensuring Calscience's QA program remains up-to-date consistent with current regulatory requirements and Calscience's QA policies;
- ⇨ Supervision and direction of all QA staff; and
- ⇨ Serving as a technical resource for analytical chemistry or QA matters

Quality Assurance Manager:

The Quality Assurance (QA) Manager has full authority through the Quality Assurance Director in matters dealing within the laboratory. The QA Manager can make recommendations to the Quality Assurance Director and/or Laboratory Director regarding the suspension or termination of employees on the grounds of non-compliance with QA/QC procedures. An alternate QA Manager is always assigned. In the absence of the primary designate, the alternate will act in the QA Manager's capacity with the full authority of the position as allowed by Calscience governing documents. In addition, the QA Manager performs the following:

- ⇨ Maintains and updates the QAM on an annual basis;
- ⇨ Implements Calscience's QA Program;
- ⇨ Monitors the QA Program within the laboratory to ensure complete compliance with its objectives, QC procedures, holding times, and compliance with client or project specific data quality objectives;
- ⇨ Distributes performance evaluation (PE) samples on a routine basis to ensure the production of data that meets the objectives of its QA Program;
- ⇨ Maintains all SOPs used at Calscience;
- ⇨ Maintains records and archives of all PE results, audit comments, and customer inquiries concerning the QA program;
- ⇨ Performs statistical analyses of QC data and establish controls that accurately reflect the performance of the laboratory;
- ⇨ Conducts periodic performance and system audits to ensure compliance with the elements of Calscience's QA Program;
- ⇨ Prescribes and monitors corrective action;
- ⇨ Serves as in-house client representative on all project inquiries involving data quality issues;
- ⇨ Coordinates data review process to ensure that thorough reviews are conducted on all project files;
- ⇨ Develops revisions to existing SOPs;

- ⇨ Reports the status of in-house QA/QC to the Laboratory Director;
- ⇨ Maintains records and archives of all QA/QC data including but not limited to method detection limit (MDL) studies, accuracy and precision control charts, and completed log books; and
- ⇨ Conducts and/or otherwise ensures that an adequate level of QA/QC training is conducted within the laboratory.

Quality Assurance Assistant:

The QA Assistant reports to the QA Manager and performs the following functions:

- ⇨ Assists the QA Manager and lab staff with internal audits, corrective action review and overall implementation of the QA program;
- ⇨ Generates and reviews, in conjunction with the QA Manager, Control Charts and Method Detection Limit (MDL) studies;
- ⇨ Reviews and revises SOPs as needed;
- ⇨ Distributes new SOPs to all applicable lab areas.

Technical Director

The Technical Director reports to the Laboratory Director and is responsible for all laboratory, client, and project technical issues. More specifically, he/she:

- ⇨ For major projects and/or clients, pre-bid, interface with Business Development to ensure Calscience possesses or can be made to possess the required technical qualifications. Post award, assist with QAPP development, kick-off meeting, training, and periodic data review;
- ⇨ Company wide, manage Calscience's training program and maintain all associated documentation. Develop training guides and other training documentation;
- ⇨ Interface directly with Project Management staff in response to questions pre-release or from the client post-release. Determine causation and interface with QA staff to prevent recurrences;
- ⇨ Interface with directly with clients, data validators, or other client representatives in matters related to data quality;
- ⇨ Provide support to QA staff for external audits responses. Provide input on, and define appropriate corrective actions, for the laboratory. Document corrective action responses, and monitor required audit response time frames as needed;
- ⇨ Attend client, Business Development, or industry meetings with or without management when a 'technical representative' is required or would be beneficial to Calscience. Provide support to Business Development through the review of DOD-related SAPs, QAPPs, and workplans. Provide comment and alternative solutions if unable to meet specific requirements. Populate DOD UFP QAPP tables for client SAPs/QAPPs when needed;
- ⇨ Support QA and Operations with SOP revisions, where needed;
- ⇨ Perform full QA reviews and/or data validation where required;
- ⇨ Provide technical solutions to QA with regard to laboratory procedures, data quality issues, possible solutions, and appropriate corrective actions;
- ⇨ Provide technical opinions and support to Operations with regard to current procedures or new method development;
- ⇨ Provide LIMS input; and
- ⇨ As may be necessary, act as Program Director for DOD or other high profile projects.
- ⇨ Interface with QA staff as necessary to ensure continuous improvement in all areas of Calscience's operations.

Marine Chemistry Program Manager:

The Marine Chemistry Program Manager manages and directs the analytical production and methods development activity of the Marine Laboratory. He/she is responsible for all operations in the Marine laboratory. This position reports directly to the Business Development Director. More specifically, he/she:

- ⇨ Monitors the validity of the analytical data generated in the Marine Laboratory. Reviews all data packages. Works with Project Managers concerning Marine Chemistry work;
- ⇨ Along with the Business Development Director, determines the need for new methods in the Marine Laboratory. Researches new methods. Determines the equipment and personnel needed to perform methods as requested by the Business Development Director;
- ⇨ Works with the Business Development Director to insure that the Marine Laboratory is capable of performing potential work prior to bid submittal. Ensure the laboratory has adequate manpower to insure that samples are analyzed as per the client's specifications;
- ⇨ Write and review SOPs for the methods and other operations in the Marine Laboratory. Modifies SOPs as needed when new procedures are developed and proven;
- ⇨ Ensure that the Chemists and technicians in the Marine Laboratory are properly trained, and that they understand the operations they perform. This included insuring that the SOPs are followed;
- ⇨ Interfaces with the Operations Director to insure proper staffing. Requests staffing or supplies from the Operations Director if needed. Provides assistance to the Operations Director when needed; and
- ⇨ Insures that the Marine Laboratory follows the requirements of the QA/QC and Ethics programs.

Air Program Director

The Air Program Director reports to the Business Development Director and serves as a technical resource for air testing both internally and externally with the current and future client base. With the goal of total client satisfaction, the responsibilities include:

- ⇨ Ensuring Calscience remains current with air testing regualations;
- ⇨ Providing technical training regarding air testing internally and to clients;
- ⇨ Prepares air testing guides for internal and client use;
- ⇨ Identifies new air testing opportunities;
- ⇨ Works with the Business Development Team; and
- ⇨ Provides input in the preparation of air proposals and quotes.

Business Development Director:

The Business Development Director reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team, Business Development team and satellite office Operations Managers. 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;
- ⇨ Business liaison for the Project Management team;
- ⇨ Human resource management of the Project Management team;
- ⇨ Responsible for the review and negotiation of client contracts and terms and conditions;
- ⇨ Responsible for establishing standard fee schedules for the laboratory;
- ⇨ Responsible for preparation of proposals and quotes for clients and client prospects;
- ⇨ Accountable for response to client inquiries concerning sample status;
- ⇨ Responsible for assistance to clients regarding the resolution of problems concerning Chains-of-Custody;

- ⇨ Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory;
- ⇨ Notifying the department managers 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 client 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; and
- ⇨ Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via the Corrective Action process.

Technical Directors (at Calscience known as Group Leaders):

The Group Leaders report directly to the Operations Director. They have the authority to accept or reject data based on pre-defined QC criteria. In addition, with the approval of the QA Manager, the Group Leaders may accept data that falls outside of normal QC limits if, in his or her professional judgment, there are technical justifications for the acceptance of such data. The circumstances must be well documented and any need for corrective action identified must be defined and initiated. The authority of the Group Leaders in QC related matters results directly from the QA Manager. The Group Leaders also

- ⇨ Coordinating, writing, and reviewing test methods and SOPs, with regard to quality, integrity, regulatory requirements and efficient production techniques;
- ⇨ 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 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; and
- ⇨ Coordinates audit responses with supervisors and QA Manager.
- ⇨ Actively support the implementation of Calscience's QA Program;
- ⇨ Ensure that their employees are in full compliance with Calscience's QA Program;
- ⇨ Maintain accurate SOPs (by reviewing and implementing updates) and enforce routine compliance with SOPs;
- ⇨ Conduct technical training of new staff and when modifications are made to existing procedures;
- ⇨ Maintain a work environment which emphasizes the importance of data quality;
- ⇨ Ensure all logbooks are current, reviewed and properly labeled or archived;
- ⇨ Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via Corrective Action reports;
- ⇨ Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, nonconformance issues, and the timely and accurate completion of performance evaluation samples and MDLs, for his/her department;.
- ⇨ Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and using appropriate documentation techniques;.
- ⇨ Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He or she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments;
- ⇨ Provide written responses to external and internal audit issues; and

- ⇨ Provide support to all levels of Calscience Management.

Technical Directors (Sample Control Group Leader):

The Sample Control Group Leader reports to the Operations Manager. The responsibilities are outlined below:

- ⇨ Direct the receipt, handling, labeling and proper storage of samples in compliance with laboratory procedures and policies;
- ⇨ Oversee the training of Sample Control Technicians regarding the above items;
- ⇨ Direct the logging of incoming samples into the LIMS and ensure the verification of data entry from login;
- ⇨ Oversee all sample courier operations;
- ⇨ Acts as a liaison between Project Managers and Analytical departments in respect to handling rush orders and resolving inconsistencies and problems with chain-of-custody forms, and routing of subcontracted analyses; and
- ⇨ Oversees the handling of samples in accordance with the Waste Disposal SOP, the Hazardous Waste Contingency Plan in the Chemical Hygiene/Safety Manual, and the U. S. Department of Agriculture requirements.

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, the Data Integrity Policy, and project-specific QA 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 work sheets, bench sheets, preparation logbook, and/or a Non-Conformance report;
- ⇨ Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to the Group Leader and/or the QA Manager;
- ⇨ Perform 100% review of the data generated prior to entering and submitting for secondary level review; and
- ⇨ 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.

Laboratory Technicians:

- ⇨ Prepare samples for analysis by weighing, extracting or digesting, filtering, or concentrating samples; and
- ⇨ Prepare method specific QC Samples with each preparation batch. All personnel must adhere to all QC procedures specified in the analytical method and in accordance to procedures or policies and are responsible for the full documentation of these procedures.

Project Managers:

The Project Manager normally reports to the Senior Project Manager and/or Business Development Director. Typical responsibilities include:

- ⇨ Serving as the laboratories' primary point of contact for assigned clients;
- ⇨ Working with laboratory chemists to resolve questions on data;
- ⇨ Scheduling of courier deliveries and pick-ups;
- ⇨ Tracking the progress of all laboratory production efforts;
- ⇨ Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- ⇨ Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- ⇨ Preparation of bottle kits for use by clients in their sampling efforts (as necessary);
- ⇨ Reviewing of reports/EDDs (Electronic Data Deliverables) as necessary prior to release;
- ⇨ Invoice preparation and review prior to release to client;
- ⇨ Serving as back-up contact person for other Project Managers in the event of his/her absence;
- ⇨ Coordination of all subcontracting efforts for projects assigned;
- ⇨ Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed;
- ⇨ Preparation of project Case Narratives, as needed; and
- ⇨ Assembly of full data packages in accordance with company or client protocol, as needed.

Project Management Assistant:

The Project Management Assistant normally receives direction from the Project Manager(s) for which he/she is assigned. Typical responsibilities include:

- ⇨ Working with laboratory chemists to resolve questions on data;
- ⇨ Scheduling of courier deliveries and pick-ups;
- ⇨ Tracking the progress of all laboratory production efforts;
- ⇨ Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- ⇨ Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- ⇨ Preparation of bottle kits for use by clients in their sampling efforts;
- ⇨ Reviewing of reports/EDDs (Electronic Data Deliverables) prior to release;
- ⇨ Invoice preparation and review prior to release to client;
- ⇨ Serving as back-up contact person for the project managers in the event of his/her absence;
- ⇨ Coordination of all subcontracting efforts for projects assigned; and
- ⇨ Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed.
- ⇨ As part of the administrative staff, this person may also be required to answer phones, do occasional filing, mailing, etc.

Health, Safety, and Respiration Protection Manager:

The Health and Safety Manager reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The EHS Manager is responsible for:

- ⇨ Conducting ongoing, necessary safety training and conducting new employee safety orientations;
- ⇨ Assisting in developing and maintaining the Chemical Hygiene/Safety Manual;
- ⇨ Oversees the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed; and
- ⇨ Completes accident reports, follows up on root causes and defines corrective actions.

Hazardous Waste Coordinator:

The Hazardous Waste Coordinator reports directly to the Environmental Health & Safety Manager. The duties of the HWC consist of:

- ⇨ Staying current with the hazardous waste regulations and continuing training on hazardous waste issues;
- ⇨ Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste;
- ⇨ Supervise the recording of the transfer of samples from refrigerated conditions to ambient conditions [in the sample disposal log sheets (SDLS)];
- ⇨ Check the records in SDLS against the logbook (LIMS) records;
- ⇨ Coordinate the collection of waste throughout the laboratory that will be disposed of through “Lab Packs”;
- ⇨ Coordinate and supervise Hazardous Waste Technician(s);
- ⇨ Dispose of solid waste to an assigned Tote;
- ⇨ Supervise the recording and disposal of acid and soil with methylene chloride extracts into appropriate drums;.
- ⇨ Prepare and discharge treated wastewater to the sewer system;
- ⇨ Maintain Uniform Hazardous Waste Manifest files;
- ⇨ Prepare weekly sample disposal schedules;
- ⇨ Coordinate and schedule waste pick-up;
- ⇨ Check all waste containers for appropriate labels; and
- ⇨ Maintain safe housekeeping and practices.

Education and Experience

Calscience makes every effort to hire analytical staff that posses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions are made based upon experience and an individual’s ability to learn as there are many in the industry that are more than competent, experts perhaps, who have not earned a college degree.

Selection of qualified individuals for employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Experience and specialized training may be accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc. are also considered).

Included in Section 5.2 (e) of this Quality Assurance Manual are the basic job titles and personnel responsibilities for anyone who manages, performs or verifies work affecting the quality of the environmental testing that the laboratory performs. Minimum education and training requirements are summarized in the following table:

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

f) Identification of the laboratory's approved signatories; at a minimum, the title page of the quality manual has the signed and dated concurrence (with appropriate titles) of all responsible parties including the QA manager, technical director, and the laboratory director;

g) The laboratory's procedures for achieving traceability of measurements;

Job Type	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), Titrimetric and Gravimetric Analyses,	H.S. Diploma or GED	On the job training
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college with at least 1 year of college chemistry, or	2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pest, PCB, Herb, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry, or	5 years of prior analytical experience is required
Spectra Interpretation	A college degree in an applied science or 2 years of college Chemistry, and	2 years relevant experience, or 5 years of prior analytical experience is required
Group Leaders – Advanced Instrumentation	Bachelors Degree in an applied science with 16 semester hours in chemistry. An advanced (MS, PhD.) degree may substitute for one year of experience, and	2 years experience in the analytical technique for environmental analysis of representative analytes for which they will oversee
Group Leaders – Wet Chemistry (Basic Skills)	Associates degree in an applied science or 2 years of college with 16 semester hours in Chemistry, and	2 years relevant experience

h) A list of all test methods under which the laboratory performs its accredited testing may be found in the Index of Standard Operating Procedures, a separate document.

i) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

j) Reference to the calibration and/or verification test procedures used;
Calibration procedures and verification of acceptability for each set of required calibrations are defined in Section 13 (Calibration) and Section 12 (Quality Control) of each standard operating procedure.

k) Procedures for handling samples received;

The generation of quality analytical data begins with the collection of the sample and, therefore, the integrity of the sample collection process is of importance to Calscience. Samples must be collected in such a way that foreign material is not introduced into the samples and that analytes of interest do not

escape from the samples or degrade prior to their analysis. To ensure sample integrity and representativeness, the following items must be considered:

- ⇨ Samples must be collected in appropriate containers. In general, glass containers are used for organic analytes and polyethylene for inorganic/metal analytes;
- ⇨ Only new sample containers which are certified and documented clean in accordance with U.S. EPA OSWER Directive No. 9240.0-0.05 specifications shall be provided by Calscience for sample collection;
- ⇨ Certain extremely hazardous samples or samples that have the potential to become extremely hazardous will not be accepted. These include (but are not limited to)

    1. Radioactive samples that exceed background levels
    2. Biohazardous samples (medical wastes, body fluids, etc.)
    3. Explosive samples (Flash or gunpowder, ammunition, flares, etc.)
    4. Neurological or other toxic agents (Sarin, Anthrax, Ricin, etc.)

Calscience's chain-of-custody document is used to forward samples from the client to the laboratory. As the basic elements of most all chain-of-custody (COC) documents are similar, clientele may choose to use their own chain-of-custody document to forward samples to Calscience.

Any discrepancies in the COC must be documented on the Sample Receipt Form and resolved prior to analysis of samples. Further guidance may be found in SOP T100 “Sample Receipt and Log-In Procedures”.

Upon receipt by Calscience, samples proceed through an orderly processing sequence designed to ensure continuous integrity of both the sample and its documentation from sample receipt through its analysis and beyond.

All coolers that are received by the Sample Control Group undergo a preliminary examination in accordance with Part A of the Sample Receipt Form. Specifically, each sample is carefully examined for label identification, proper container (type and volume), chemical preservation when applicable, container condition, and chain-of-custody documentation consistency with sample labels. Discrepancies are noted on the Sample Receipt Form, the chain-of-custody and, if possible, discussed with the client prior to his or her departure. If this is not possible, the discrepancies are communicated to the client for resolution prior to the completion of the log-in process. The temperature of the cooler is measured and, with other observations, is recorded in Part B of the Sample Receipt Form. Additional comments are recorded in Part C of the Sample Receipt Form.

During the log-in process each sample is assigned a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS), which stores all essential project information. Calscience maintains multiple security levels of access into LIMS to prevent unauthorized tampering/release of sample and project information.

Once all analyses for a sample have been completed and the sample container is returned to Sample Control, it shall remain in refrigerated storage for a period not less than 14 days following sample receipt unless the client requests return/forwarding of the sample. Following the 14-day refrigerated storage period, the samples are placed into ambient storage for another period not less than 14 days after which the samples are bulked into drums for later disposal.

Extended storage may be requested at prevailing per sample rates.

l) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests;

A list of major equipment is kept up-to-date on the List of Major Assets, reference APPENDIX G. This, as well as a list of reference measurement standards and their certificates of calibration, is maintained by the QA Manager or the respective departments. In general, all calibrations and references should be traceable to NIST

m) Reference to procedures for calibration, verification and maintenance of equipment; Laboratory SOPs (T043 and T066) are available to staff for calibration, verification and maintenance of equipment. In general,

n) Reference to verification practices which may include interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes;

Instrument calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity such that required reporting limits can be met. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The manufacturer's guidelines, the analytical method, and/or the requirements of special contracts determine the frequency of calibration and the concentration of calibration standards, whichever is most applicable. The following are very general guidelines and are not meant to be all-inclusive. Detailed calibration procedures are specified in the SOP for each method performed.

Gas Chromatography/Mass Spectroscopy (GC/MS): Each day prior to analysis of samples, all GC/MS instruments are tuned with 4-bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine (DFTPP) for SVOCs in accordance with the tuning criteria specified in the applicable methods. Samples are not analyzed until the method-specific tuning requirements have been met.

After the tuning criteria are met, the instrument is then calibrated for all target analytes and an initial multipoint calibration curve established. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Alternatively, the previous calibration curve may be used if validated by a continuing calibration verification (CCV) standard. All target analytes are represented in the calibration and certain key target analytes referred to as system performance calibration compounds (SPCCs) and calibration check compounds (CCCs) are used for curve acceptance determination. For the initial calibration to be deemed acceptable, the SPCCs and CCCs must meet established acceptance criteria and must be re-evaluated and meet the acceptance criteria, at a minimum, every twelve (12) hours thereafter.

Non-GC/MS Chromatography: The field of chromatography involves a variety of instrumentation and detectors. While calibration standards and control criteria vary depending upon the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply uniformly. Each chromatographic system is calibrated prior to sample analysis. An initial multipoint calibration curve is generated using all target analytes. All target analytes must meet the acceptance criteria for the calibration to be deemed acceptable. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). The continued validity of the initial multipoint calibration is verified every 12 hours using continuing calibration verification (CCV) standard containing all target analytes. If the CCV fails to meet the acceptance criteria, the system is re-calibrated and all samples analyzed since the last acceptable CCV must be re-analyzed.

Inductively Coupled Plasma Emission Spectroscopy: Initial calibration consists of a calibration blank (CB) plus one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standard. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

ICP/MS Spectroscopy: Each day prior to the analysis of samples, all ICP/MS instruments undergo mass calibration and resolution checks prior to initial calibration. Initial calibration consists of a calibration blank (CB) and at least one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standards. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

Cold Vapor Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a series of at least 5 standards. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

Flame and Graphite Furnace Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a low, medium, and high calibration standard. Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

General Inorganic Analyses: General inorganic (non-metal) analyses involve a variety of instrumental and wet chemistry techniques. While calibration procedures vary depending on the type of instrumentation and methodology, the general principles of calibration apply universally. Each system or method is initially calibrated using standards prior to analyses being conducted with continual verification that the calibration remains acceptable throughout analytical processing. If continual calibration verification fails to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV must be re-analyzed.

o) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur;

These procedures may be found in SOP-T015 (Correction/Prevention of Errors in Test Records) and SOP-T022 (Corrective/Preventive Actions).

p) The laboratory management arrangements for permitting exceptions and departures from documented policies and procedures or from standard specifications;

Calscience's SOPs are in substantial conformity with their corresponding published method references. Departure from approved SOPs shall be approved if necessary or appropriate due to the nature or composition of the sample or otherwise based on the reasonable judgment of Calscience's Laboratory Director, Technical Director, or QA Manager.
Departures shall be made on a case-by-case basis consistent with recognized standards of the industry. In no case shall departures be approved without written communication between Calscience and the affected client.

q) Procedures for dealing with complaints;

Procedures for dealing with complaints may be found in SOP-T018, Handling of Inquiries and Complaints.

r) Procedures for protecting confidentiality (including national security concerns) and proprietary rights;

Calscience is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigatory processes. Calscience, therefore, holds all information in strict confidence with laboratory release only to the client or designee. Information released to entities other than the client is performed only upon written, facsimile or e-mail request from the client.

Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make its best effort to maintain the confidence of client specific information.

s) Procedures for audits and data review;

Calscience participates in a wide variety of system and performance audits conducted by numerous federal and state agencies, as well as through its major clientele. These audits are conducted to verify that analytical data produced conforms to industry standards on a routine basis.

A System Audit is a qualitative evaluation of the measurement systems utilized at Calscience, specifically, that Calscience has, in place, the necessary facilities, staff, procedures, equipment, and instrumentation to generate acceptable data. This type of audit typically involves an on-site inspection of the laboratory facility, operations, and interview of personnel by the auditing agency.

A Performance Audit verifies the ability of Calscience to correctly identify and quantitate compounds in blind check samples. This type of audit normally is conducted by the auditing agency through laboratory participation in round robin Performance Evaluation (PE) programs. Examples of current PE program involvement include those offered by commercial suppliers like ERA (WS/WP/SOIL and DMR-QA), or other inter-laboratory studies not required for certification but done to ensure laboratory performance, as well as programs administered by major industry.

Outliers in required PE samples will be investigated and corrective actions documented using the Corrective/Preventive Action Record.

Should the result of any audit detect a significant error, which has been identified to adversely affect released data, the situation shall be thoroughly investigated. Corrective measures shall be enacted to include system re-evaluation, the determined affect on released data and client notification, as necessary. These measures shall be documented using the Corrective/Preventive Action Record.

t) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training;

Quality control begins prior to sample(s) receipt at the laboratory. The selection of well qualified personnel, based upon education and/or experience is the first step in successful laboratory management. A thorough screening of job applicants and selection of the best candidate to fulfill a well-defined need is as important an aspect of a successful QA/QC program as a careful review of analytical data.
Employee training and approval procedures used at Calscience are specified in SOP-T010, “Employee Training”, and includes but is not limited to the following:

⇨ A thorough understanding of the applicable regulatory method and Calscience SOP;

- ⇨ A review of Calscience's QA Program Manual and thorough understanding of the specifics contained therein that are directly related to the analysis to be performed;
- ⇨ Instruction by the applicable Group Leader on all aspects of the analytical procedure;
- ⇨ Performance of analyses under supervision of experienced laboratory personnel, which shall include analysis of blind QC check samples, when deemed appropriate;
- ⇨ Participation in in-house seminars on analytical methodologies and procedures;
- ⇨ Participation in job related seminars outside of the laboratory; and
- ⇨ Participation in conventions and meetings, i.e., ACS, etc.

u) Ethics policy statement developed by the laboratory and processes/procedures for educating and training personnel in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions;

A vital part of Calscience Environmental Laboratories' analytical laboratory services is their Laboratory Ethics Training Program. An effective program starts with an Ethics Policy Statement that is supported by all staff, and is reinforced with initial and ongoing ethics training.

"It shall be the policy of Calscience to conduct all business with integrity and in an ethical manner. It is a basic and expected responsibility of each staff member and manager to hold to the highest ethical standard of professional conduct in the performance of all duties."

A proactive ethics training program is the most effective means of deterring and detecting improper, unethical, or illegal actions in the laboratory. There are six facets to the program: (1) clearly define improper, unethical, and illegal actions; (2) outline elements of prevention and detection programs for improper, unethical, or illegal actions; and (3) identify examples of inappropriate (i.e., potentially fraudulent) laboratory practices; (4) Annual Ethics and Data Integrity Training to be documented and maintained in the personnel file of each employee., (5) Documented training on new revisions of the Quality Systems Manual (QSM) and for new employees as needed. (6) Signed Ethics and Data Integrity Agreement (to be completed for new employees and annually thereafter)

<u>Definition of Improper, Unethical, and Illegal Actions</u>

Improper actions are defined as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.

Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.

Prevention of laboratory improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by management. Improper, unethical, or illegal actions are detected through the implementation of oversight protocols.

<u>Prevention and Detection Program for Improper, Unethical, or Illegal Actions</u>

Calscience management has implemented a variety of proactive measures to promote prevention and detection of improper, unethical, or illegal activities. The following components constitute the basic program:

- ⇨ Data Integrity Standard Operating Procedure (SOP) T065
- ⇨ Data Integrity Documentation Procedures
- ⇨ An Ethics and Data Integrity Agreement that is read and signed by all personnel;
- ⇨ Initial and annual ethics training;
- ⇨ Internal audits;
- ⇨ Inclusion of anti-fraud language in subcontracts;
- ⇨ Analyst notation and sign-off on manual integration changes to data;

- ⇨ Active use of electronic audit functions when they are available in the instrument software; and
- ⇨ A "no-fault" policy that encourages laboratory personnel to come forward and report fraudulent activities.

A proactive, "beyond the basics" approach to the prevention of improper, unethical, or illegal actions are a necessary part of laboratory management. As such, in addition to the requirements above, Calscience has a designated ombudsman (data integrity officer) to whom laboratory personnel can report improper, unethical, or illegal practices, or provide routine communication of training, lectures, and changes in policy intended to reduce improper, unethical, or illegal actions.

Examples of Improper, Unethical, or Illegal Practices

Documentation that clearly shows how all analytical values were obtained are maintained by Calscience and supplied to the data user as needed. To avoid miscommunication, Calscience clearly documents all errors, mistakes, and basis for manual integrations within the project file and case narrative as applicable. Notification is also made to the appropriate supervisor so that appropriate corrective actions can be initiated. Gross deviations from specified procedures are investigated for potential improper, unethical, or illegal actions, and findings of fraud are fully investigated by senior management. Examples of improper, unethical, or illegal practices are identified below:

- ⇨ Improper use of manual integrations to meet calibration or method QC criteria (for example, peak shaving or peak enhancement are considered improper, unethical, or illegal actions if performed solely to meet QC requirements);
- ⇨ Intentional misrepresentation of the date or time of analysis (for example, intentionally resetting a computer system's or instrument's date and/or time to make it appear that a time/date requirement was met);
- ⇨ Falsification of results to meet method requirements;
- ⇨ Reporting of results without analyses to support (i.e., dry-labbing);
- ⇨ Selective exclusion of data to meet QC criteria (for example, initial calibration points dropped without technical or statistical justification);
- ⇨ Misrepresentation of laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported, or QC control limits presented within QAPP that are not indicative of historical laboratory performance or used for batch control;
- ⇨ Notation of matrix inference as basis for exceeding acceptance limits (typically without implementing corrective actions) in interference-free matrices (for example, method blanks or laboratory control samples);
- ⇨ Unwarranted manipulation of computer software (for example, improper background subtraction to meet ion abundance criteria for GC/MS tuning, chromatographic baseline manipulations);
- ⇨ Improper alteration of analytical conditions (for example, modifying EM voltage, changing GC temperature program to shorter analytical run time) from standard analysis to sample analysis;
- ⇨ Misrepresentation of QC samples (for example, adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over- or under-spiking); and
- ⇨ Reporting of results from the analysis of one sample for those of another.

v) Reference to procedures for reporting analytical results;

Standard operating procedures pertaining to the reporting of results are available to all laboratory personnel. They are: SOP-T009, Significant Figures, Rounding, and Reporting of Results; SOP-T025, Reporting of Tentatively Identified Compounds (TICs); and T-026, Reporting of Data Qualifiers.

All analytical data generated within Calscience is thoroughly checked for accuracy and completeness. The data validation process consists of data generation, reduction, and four levels of review as described below.

The analyst generating the analytical data has the primary responsibility for its correctness and completeness. All data is generated and reduced following protocols specified in the appropriate SOPs. Each analyst reviews the quality of his or her work based upon an established set of guidelines specified in the SOPs or as specified by project requirements. The analyst reviews the data package to ensure that:

- ⇨ Holding times have not been exceeded;
- ⇨ Sample preparation information is correct and complete;
- ⇨ Analysis information is correct and complete;
- ⇨ The appropriate procedures were employed;
- ⇨ Analytical results are correct and complete;
- ⇨ All associated QC is within established control limits and, if not, out-of-control forms are completed thoroughly explaining the cause and corrective action taken;
- ⇨ Any special sample preparation and analytical requirements have been met; and
- ⇨ Documentation is complete, i.e., all anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete, etc.

The data reduction and validation steps are documented, signed, and dated by the analyst on the QC Review coversheet accompanying each data package. This initial review step, performed by the analyst, is designated as primary review. The analyst then forwards the data package to his or her Group Leader, or designated data reviewer, who performs a secondary review. Secondary reviews consist of an independent check equivalent to that of the primary review and are designed to ensure that:

- ⇨ Calibration data is scientifically sound, appropriate to the method, and completely documented;
- ⇨ QC data is within established guidelines or reported with appropriate clarification/qualification;
- ⇨ Qualitative identification of sample components is correct;
- ⇨ Quantitative results are correct;
- ⇨ Documentation is complete and any anomalies properly addressed and documented;
- ⇨ The data is ready for incorporation into the final report package; and
- ⇨ The data package is complete and ready for archiving.

A significant component of the secondary review is the documentation of any errors that have been identified and corrected during the review process. Calscience believes that the data package that is submitted for a secondary review should be free from errors. Errors that are discovered are documented and formally transmitted to the appropriate Group Leader. The cause of the errors are then addressed by additional training or clarification of procedures (SOP revisions) to ensure that similar errors do not recur and high quality data will be generated.

Signature of Data Reviewer and the date of review document the completion of secondary reviews on the QC Review coversheet. These constitute approval for data release and generation of analytical report.

During both of the QC review processes, 100% of the raw data associated with the entire project is available to the reviewer. Data packages are checked back to the raw data as deemed necessary by the reviewer.

Following draft report generation, the report is reviewed by the Project Manager to ensure that the data set and quality control data is complete and meets the specific requirements of the project. When available, the data is also evaluated against historical site information. Once all requested analytical work has been verified as complete, a final report is generated and signed by the Project Manager.

Following approval for release by the Project Manager, the Quality Assurance Manager or Designee to ensure that the analytical and quality control data is correct performs a final review. The Quality Assurance Manager may review 10% of the project files back to the raw data as an additional check.

A variety of reporting formats, from Portable Document File (PDF), normal typed reports to computerized data tables to complex reports discussing regulatory issues are available. In general, Calscience reports contain the following information.

Analytical Data

Analytical data is reported by sample identification (both client and laboratory) and test. Pertinent information including date(s) sampled, received, prepared, and analyzed; any required data qualifiers are included on each results page. The reporting limit for each method analyte is also listed. Additional data may include Method Detection Limits (MDLs).

QC Data

A QC Summary is provided with each final report. Unless otherwise specified in a QAPP or requested by the client, QC Summaries include results for method blanks, matrix spikes, matrix spike duplicates, and surrogate spikes. Laboratory control sample and method blank surrogates are routinely included if matrix interference results in a QC outlier. The effective control limits for the reported QC values are also provided on the QC Summary as well as explanations for any QC outliers. Case Narratives may be included as appropriate.

As required for the project, data reports from “results only” through “full CLP-like” will be generated and provided. Included in this range are reports for the major DoD programs including NFESC, AFCEE, and USACE.

Methodology

References for the preparative and analytical methodology employed is included on all preliminary or final analytical reports.

Signatory

Final reports are ready for release to the client following review and approval by the Project Manager, as evidenced by his/her signature on the final report cover page.

Preliminary Data

Upon client request, preliminary data shall be released prior to completion of a full QC review. Preliminary data is subject to change pending QC review and, therefore, shall be clearly marked as “Preliminary”. This qualification is provided as notification to the client that the data review process has not been completed yet and that the data is subject to possible modification resulting therefrom.

Revised Data

Analytical reports that have been revised for any reason from the original sent report shall be noted as being revised with a report note, case narrative or indication as to the revision.

Formatting

At a minimum, an analytical report shall consist of the Report Cover Page, Analytical Results, QA/QC Data (Default), Footnotes/Comments Page, Sample Receipt Form and COC. Paginated reports shall be employed for all reports unless used for non-NELAP analysis.

w) A Table of Contents and applicable lists of references and glossaries, and appendices.

5.3 Audits

5.3.1 Internal Audits

The laboratory arranges streamlined quarterly and comprehensive annual internal audits to verify that its operations continue to comply with the requirements of the laboratory's said quality system. The quality assurance officer or the Quality Assurance Assistant plans and organizes audits as required by a predetermined schedule and requested by management. The Quality Assurance Assistant, independent of the activity to be audited, will carry out such audits following the procedures noted in SOP T028, Internal Audit Procedures. Personnel do not audit their own activities except when it can be demonstrated that an effective audit will be carried out. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory takes immediate corrective action and immediately notifies, in writing, any client whose work was involved.

Any outside audit findings will also be included in the Internal Audits.

5.3.2 Management Review

Calscience management conducts an annual review of its quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations. This review takes account of reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, corrective actions, and other relevant factors. The laboratory shall have a procedure for review by management, and maintain records of review findings and actions. Reference section 18.1 of this QSM and SOP T030 for more detailed descriptions.

5.3.3 Audit Review

All audit and review findings and any corrective actions that arise from them are documented. The laboratory management ensures that these actions are discharged within the agreed time frame as indicated in the quality manual and/or SOPs.

5.3.4 Performance Audits

In addition to periodic audits, the laboratory ensures the quality of results provided to clients by implementing checks to monitor the quality of the laboratory's analytical activities. Examples of such checks are:

a) Internal quality control procedures using statistical techniques (see Section 5.4 below);

b) Participation in proficiency testing or other interlaboratory comparisons;

c) Use of certified reference materials and/or in-house quality control using secondary reference materials as specified in Calscience QSM Section 5.4;

d) Replicate testing using the same or different test methods;

e) Re-testing of retained samples;

e) Correlation of results for different but related analysis of a sample (for example, total phosphorus should be greater than or equal to orthophosphate).

5.3.5 Corrective / Preventive Actions

a) In addition to providing acceptance criteria and specific protocols for corrective/preventive actions in SOP-T022, the laboratory implements general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include but are not limited to the following:

   1) Identify the individual(s) responsible for assessing each QC data type;

   2) Identify the individual(s) responsible for initiating and/or recommending corrective/preventive actions;

   3) Define how the analyst shall treat a data set if the associated QC measurements are unacceptable;

   4) Specify how out-of-control situations and subsequent corrective actions are to be documented; and

   5) Specify procedures for management (including the QA officer) to review corrective/preventive action reports.

b) To the extent possible, sample results are reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data are to be reported, all samples associated with the failed quality control measure are reported with the appropriate data qualifier(s).

5.4 Essential Quality Control Procedures

These general quality control principles apply, where applicable, to all testing at Calscience. The manner in which each is implemented is dependent on the types of tests performed by the laboratory and is further described in Appendix D and in SOP-T020, Internal Quality Control Checks. The standards for any given test type assures that the applicable principles are addressed:

a) All laboratories have detailed written protocols in place to monitor the following quality controls:

   1) Positive and negative controls (blanks, spikes, reference toxicants, etc.) to monitor tests;

   2) Tests to define the variability and/or repeatability of the laboratory results such as replicates;

   3) Measures to assure the accuracy of the test method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

   4) Measures to evaluate test method capability, such as detection limits and quantitation limits or range of applicability such as linearity;

   5) Selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;

   6) Selection and use of reagents and standards of appropriate quality;

   7) Measures to assure the selectivity of the test for its intended purpose; and

   8) Measures to assure constant and consistent test conditions (both instrumental and environmental) where required by the test method, such as temperature, humidity, light or specific instrument conditions.

b) All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance criteria are used to determine the usability of the data. (See Appendix D.)

c) The laboratory has procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exist. (See Calscience QSM Section 11.2, Sample Acceptance Policy.)

d) The quality control protocols specified in the method manual (Calscience QSM Section 10.1.2) is followed. Calscience ensures that the essential standards outlined in NELAC 5, Appendix D, or mandated methods or regulations (whichever are more stringent) are incorporated into the method manuals. When it is not apparent which is more stringent the QC in the mandated method or regulations is to be followed.

   The essential quality control measures for testing are found in Appendix D.

6.0 PERSONNEL

6.1 General Requirements for Laboratory Staff

Calscience's testing departments have a sufficient level of personnel with the necessary education, training, technical knowledge and experience to perform the assigned functions.

All personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

6.2 Laboratory Management Responsibilities

In addition to Calscience QSM Section 4.2.d, the laboratory management:

a) Defines the minimum level of qualification, experience and skills necessary for all positions in the laboratory. In addition to education and/or experience, basic laboratory skills such as using a balance and quantitative techniques, are considered.

b) Ensures that all technical laboratory staff members demonstrate capability in the activities for which they are responsible. Such demonstration is documented (See Appendix C). Note: In departments with specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the group as a unit meets the above criteria and this demonstration is fully documented.

c) Ensures that the training of each member of the technical staff is kept up-to-date (on-going) by the following:

   1) Keeping evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation that relates to his/her job responsibilities.

   2) Documenting training courses or workshops on specific equipment, analytical techniques, or laboratory procedures.

   3) Documenting employee attendance at training courses on ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions. Keeping on file evidence that demonstrates that each employee has read, acknowledges, and understands their personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions.

4) Maintains up-to-date analyst training records that contain a certification that technical personnel have read, understood and agreed to perform the most recent version of the test method (the approved method or SOP as defined by the laboratory document control system, Calscience QSM Section 5.2.d) and documentation of continued proficiency by at least one of the following once per year:

   i. Acceptable performance of a blind sample (single blind to the analyst);

   ii. Another demonstration of capability;

   iii. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624, or 5035/8260) would only require documentation for one of the test methods;

   iv. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy;

   v. If i-iv cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

d) Documents all analytical and operational activities of the laboratory;

e) Supervises all personnel employed by the laboratory;

f) Ensures that all sample acceptance criteria (Calscience QSM Section 11.0) are verified and that samples are logged into the sample tracking system and properly labeled and stored.

g) Documents the quality of all data reported by the laboratory.

h) Develops a proactive program for the prevention and detection of improper, unethical, or illegal actions. Components of this program could include: internal proficiency testing (single and double blind); post-analysis electronic and magnetic tape audits; effective reward program to improve employee vigilance and co-monitoring; and separate SOPs identifying appropriate and inappropriate laboratory and instrument manipulation practices.

6.2.1 Ownership Transfer / Out of Business

a) In the event that the laboratory transfers ownership or goes out of business, Calscience will ensure that the records are maintained or transferred according to client instruction.

b) Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives will be clearly established. In cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records will be followed.

c) In the event that the laboratory goes out of business, all records will revert to the control of the client or regulatory agency, as applicable. 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.

6.3 Records

Records on the relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory (see Calscience QSM Section 6.2.c), including records on demonstrated proficiency for each laboratory test method, such as the criteria outlined in Calscience QSM Section 10.5 for chemical testing.

7.0 PHYSICAL FACILITIES – ACCOMMODATION AND ENVIRONMENT

7.1 Environment

a) Laboratory accommodations, test areas, energy sources, lighting, heating and ventilation are such that they facilitate proper performance of tests.

b) The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of the measurements. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

c) The laboratory shall provide for the effective monitoring, control and recording of environmental conditions as appropriate. Such environmental conditions may include biological sterility, dust, electromagnetic interference, humidity, main voltage, temperature, and sound and vibration levels.

d) In instances where monitoring or control of any of the above-mentioned items is specified in a test method or by regulation, the laboratory meets and documents adherence to the laboratory facility requirements.

7.2 Work Areas

a) There is effective separation between neighboring areas when the activities therein are incompatible including volatile organic chemicals handling areas.

b) Access to and use of all areas affecting the quality of these activities are defined and controlled.

c) Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

d) Workspaces are available to ensure an unencumbered work area. Work areas include:

1) Access and entryways to the laboratory;

2) Sample receipt areas;

3) Sample storage areas;

4) Chemical and waste storage areas; and

5) Data handling and storage areas.

8.0 EQUIPMENT AND REFERENCE MATERIALS

a) Calscience is furnished with all items of equipment (including reference materials) required for the correct performance of tests for which accreditation is maintained. Note that Calscience does not use equipment outside its permanent control.

b) All equipment is properly maintained, inspected, and cleaned. Maintenance procedures are documented.

c) Any equipment item that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown by verification or otherwise to be defective, is taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

d) When appropriate, each item of equipment, including reference materials, is labeled, marked, or otherwise identified to indicate its calibration status.

e) Records are maintained of each major item of equipment and all reference materials significant to the tests performed. These records include documentation on all routine and non-routine maintenance activities in assigned log books and reference material verifications.

The records include:

1) The name of the item of equipment;

2) The manufacturer's name, type identification, and serial number or other unique identification;

3) Date received and date placed in service (if available);

4) Current location, where appropriate;

5) If available, condition when received (e.g., new, used, reconditioned);

6) Copy of the manufacturer's instructions, where available;

7) Dates and results of calibrations and/or verifications and date of the next calibration and/or verification;

8) Details of maintenance carried out to date and planned for the future; and

9) History of any damage, malfunction, modification or repair.

9.0 MEASUREMENT TRACEABILITY AND CALIBRATION

9.1 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.2 Traceability of Calibration

a) The overall program of calibration and/or verification and validation of equipment is designed and operated so as to ensure that measurements made by the laboratory are traceable to national standards of measurement.

b) Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification. The laboratory maintains records of all such certification in the QA office.

c) Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example, by participation in a suitable program of interlaboratory comparisons, proficiency testing, or independent analysis.

9.3 Reference Standards

a) Reference standards of measurement held by the laboratory (such as Class S or equivalent weights, or traceable thermometers) are used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated. A body that can provide traceability calibrates reference standards of measurement. Where possible, this traceability is to a national standard of measurement.

b) There is a program of calibration and verification for reference standards.

   i. Two weeks prior to their date of calibration expiration, individual thermometers are removed from service and replaced by newly calibrated units from the supplier.

   ii. Calscience keeps two sets of Class S weights on hand for use in the laboratory. One set is used for daily calibration checks, and the second set is kept for back up use should the first set be damaged, lost or otherwise compromised. The second set of weights is also place in service when the daily use set is shipped off site for recalibration.

   iii. Analytical balances are serviced and calibrated on a routine, annual schedule.

c) Where relevant, reference standards and measuring and testing equipment are subjected to in-service checks between calibrations and verifications. Reference materials are traceable. Where possible, traceability is to national or international standards of measurement, or to national or international standard reference materials.

d) NIST-Traceable Weights and Thermometers

   i. Reference standards of measurement shall be used for the purposes of calibration only. NIST-traceable thermometers and NIST-traceable weights shall not be used for routine testing. If NIST traceable reference sources are used for routine testing they shall not be used for calibration purposes unless it can be shown that their performance as reference standards would not be invalidated.

   ii. For NIST-traceable weights and thermometers, Calscience requires that all calibrations be conducted by a calibration laboratory accredited by A2LA or other recognized, ISO9001-compliant laboratory. The calibration certificate or report supplied by the calibration laboratory must contain a traceability statement, the conditions under which the calibrations were made, a compliance statement with an identified metrological specification and the pertinent clauses when applicable, and a clearly identified record of the quantities and functional test results before and after re-calibration. The certificate and scope of accreditation is kept on file at the laboratory.

   iii. If significant amendments are made to a calibration certificate, it must have its own unique report identifier and must reference the one it is replacing. The piece of equipment must be identified in the amended report using its unique serial number or other laboratory defined identifier. The amended report is maintained with the original calibration report.

   iv. Laboratory balances are recalibrated annually by an external, certified vendor. This service is documented on each balance with a signed and dated certification sticker. All mercury thermometers are calibrated annually against a NIST-traceable reference thermometer. Equipment that does not meet acceptance criteria is removed from service and repaired or replaced. Calibration reports are maintained by the Technical Manager or the QA Manager.

   v. Balance calibrations and temperature readings of ovens, refrigerators, and incubators are checked on each day of use. Min/Max thermometers are used for refrigerators and freezers to continually monitor temperature performance.

e) Traceable Reference Standards and Materials

i. Reference standards and materials are traceable to certified reference materials, where available. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP (National Voluntary Lab Accreditation Program) or other recognized vendor, and come with a Certificate of Analysis that documents the purity of the standard and expiration date, if assigned. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis against a known reference.

ii. Analytical reagents must be at a minimum the purity required by or stated in the test method. Commercial materials that are purchased for the preparation of calibration, verification or spiking solutions, are usually accompanied by an assay certificate or the purity is noted on the label. If the purity is ≥96%, the weight provided by the vendor may be used without correction. If the purity is <96%, a correction will be made to solution concentrations prepared from that material.

iii. The receipt of all reference standards and materials, including received date and expiration date, is documented by the laboratory at the time of receipt, in chemical receiving logbooks. All documentation received with the reference standard or material (Certificate of Analysis or Purity Certificates) is retained by the laboratory. To prevent contamination and/or deterioration in quality, all standards and materials are handled and stored according to the method or manufacturer's requirements.

iv. Preparation of standard or reference materials are documented in Standard Preparation Logbooks maintained in each department. These records show the traceability to the purchased standards or materials, and include the method of preparation, date of preparation, expiration date, and preparer's initials, at a minimum. Reference standards are assigned a unique identifier and are then labeled with the identifier and expiration date. Refer to Calscience SOP, T003, Standards and Reagents Login, Preparation, Storage and Disposal, for additional information.

v. All standards, reference, primary and working, whether purchased from a commercial vendor or prepared by the laboratory, must be checked regularly to ensure that the variability of the standard from the 'true' value does not exceed method requirements. Calibration standards are checked by comparison with a standard from a second source, usually another manufacturer and vendor. In cases where a second manufacturer is not available, a different lot, with vendor certification, may be used as a second source.

vi. Quality control (QC) criteria for primary and second source standards are defined in laboratory SOPs. The Reagent and Chemicals SOP, T107, gives a general overview of the requirements with the determinative SOPs for each process further defining the QC acceptance criteria. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS/LCSD (where there is no sample preparation) is used as the second source verification of a primary calibration source.

9.4 Calibration

Calibration requirements are divided into two parts: (1) requirements for analytical support equipment, and (2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial calibration and second source or initial calibration verification, and continuing calibration verification.

9.4.1 Support Equipment

These standards apply 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, thermometers, and volumetric dispensing devices (such as Eppendorf®, or automatic dilutor/dispensing devices) if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.

a) All support equipment is maintained in proper working order. The records of all repair and maintenance activities, including service calls is kept.

b) All support equipment is calibrated or verified at least annually, using NIST traceable references when available, over the entire range of use. The results of such calibration are within the specifications required of the application for which this equipment is used or:

   1) The item is removed from service until repaired; or

   2) The laboratory maintains records of established correction factors to correct all measurements.

c) Raw data records are retained to document equipment performance.

d) Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range, with NIST traceable calibrated references. The acceptability for use or continued use is according to the needs of the analysis or application for which the equipment is being used.

e) Mechanical volumetric dispensing devices including burettes (except Class A glassware) are checked for accuracy on at least a quarterly use basis. Glass microliter syringes are to be considered Class A glassware, and come with a certificate from the manufacturer attesting to established accuracy or the accuracy is initially demonstrated and documented by the laboratory.

9.4.2 Instrument Calibration

This manual specifies the essential elements that define the procedures and documentation for initial instrument calibration and continuing instrument calibration verification to ensure that the data are of known quality and be appropriate for a given regulation or decision. This manual does not specify detailed procedural steps ("how to") for calibration, but establishes the essential elements for selection of the appropriate technique(s). This approach allows flexibility and permits the employment of a wide variety of analytical procedures and statistical approaches currently applicable for calibration. If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not apparent which standard is more stringent, then the requirements of the regulation or mandated test method are to be followed.

Note: In the following sections, initial instrument calibration is directly used for quantitation and continuing instrument calibration verification is used to confirm the continued validity of the initial calibration.

9.4.2.1 Initial Instrument Calibrations

The following items are essential elements of initial instrument calibration:

a) The details of the initial instrument calibration procedures including calculations, integrations, acceptance criteria and associated statistics are included or referenced in the test method SOP. When initial instrument calibration procedures are referenced in the test method, the referenced material is retained by the laboratory and is available for review.

b) Sufficient raw data records are retained to permit reconstruction of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor; or unique equation or coefficient used to reduce instrument responses to concentration.

c) Sample results are quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification unless specifically stated in a mandated test method.

d) All initial instrument calibrations is verified with a standard obtained from a second manufacturer or lot. Traceability shall be to a national standard, when available.

e) Criteria for the acceptance of an initial instrument calibration is established, e.g., correlation coefficient or relative percent difference. The criteria used is appropriate to the calibration technique employed.

f) Results of samples not bracketed by initial calibration standards (within calibration range) are reported as having less certainty, e.g., defined qualifiers or flags or explained in the case narrative. As determined by the method, the lowest calibration standard is at or above the method detection limit and at or below the reporting limit.

g) If the initial instrument calibration results are outside established acceptance criteria, corrective actions are performed. Data associated with an unacceptable initial instrument calibration is not reported.

h) Calibration standards include concentrations at or below the regulatory limit/decision level, if the laboratory knows these limits/levels, unless these concentrations are below the laboratory's demonstrated detection limits (See Calscience QSM Section Appendix D.1.5 Detection Limits).

i) If a reference or mandated method does not specify the number of calibration standards, the minimum number is two, not including blanks or a zero standard. The laboratory's standard operating procedure defines the number of points for establishing the initial instrument calibration.

9.4.2.2 Continuing Instrument Calibration Verification

When an initial instrument calibration is not performed on the day of analysis, the validity of the initial calibration is verified prior to sample analyses by analyzing a continuing calibration verification standard with each analytical batch. The following items are essential elements of continuing calibration verification:

a) The details of the continuing calibration procedure, calculations and associated statistics must be included or referenced in the test method SOP.

b) A continuing calibration verification standard must be analyzed at the beginning and end of each analytical batch, and where required by method or project, at a specific frequency, every 10 or 20 samples or 12 hours, within the batch. The concentrations of the calibration verification shall be varied within the established calibration range. If an internal standard is used, only one continuing calibration verification standard must be analyzed, prior to sample or QC analysis, per analytical batch.

c) Sufficient raw data records must be retained to permit reconstruction of the continuing calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations. Continuing calibration verification records must explicitly connect the continuing calibration verification data to the initial calibration.

d) Criteria for the acceptance of a continuing calibration verification must be established, e.g., relative percent difference.

e) If the continuing calibration verification results obtained are outside established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second (consecutive and immediate) calibration verification within acceptance criteria, then the laboratory shall demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses shall not occur until a new initial calibration curve is established and verified.

As an exception, sample data associated with an unacceptable continuing calibration verification may be reported as qualified data under the following special conditions:

i. When the acceptance criteria for the continuing 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 are reanalyzed after a new calibration curve has been established, evaluated and accepted.

ii. When the acceptance criteria for the continuing 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 are reanalyzed after a new calibration curve has been established, evaluated and accepted.

10.0 TEST METHODS AND STANDARD OPERATING PROCEDURES

10.1 Methods Documentation

a) The laboratory has documented instructions on the use and operation of all relevant equipment, on the handling and preparation of samples and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests.

b) All instructions, standards, manuals, and reference data relevant to the work of the laboratory are maintained up-to-date and be readily available to the staff.

10.1.1 Standard Operating Procedures (SOPs) Administrative

Calscience maintains standard operating procedures that accurately reflect all phases of current laboratory activities such as instrument operation, assessing data integrity, corrective actions, handling customer complaints, reporting of test results, etc.

a) These documents, for example, may be equipment manuals provided by the manufacturer or internally written documents.

b) The test methods may be copies of published methods as long as any changes or selected options in the methods are documented and included in the SOP (See 10.1.2.)

c) Copies of all SOPs are accessible to all personnel.

d) The SOPs are organized.

e) Each SOP clearly indicates the effective date of the document, the revision number and the signatures of the approving authorities.

10.1.2 Standard Operating Procedures (SOPs) Analytical

a) The laboratory has and maintains SOPs for each accredited analyte or test method.

b) This SOP may consist of copies of published or referenced test methods or standard operating procedures that have been written by the laboratory. In cases where modifications to the published method have been made by the laboratory or where the referenced test method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described. Each test method includes or references where applicable:

1) Identification of the test method;
2) Applicable matrix or matrices;
3) Detection limit;
4) Scope and application, including components to be analyzed;
5) Summary of the test method;
6) Definitions;
7) Interferences;
8) Safety;
9) Equipment and supplies;
10) Reagents and standards;
11) Sample collection, preservation, shipment, and storage;
12) Quality control;
13) Calibration and standardization;
14) Procedure;
15) Calculations;
16) Method performance;
17) Pollution prevention;
18) Data assessment and acceptance criteria for quality control measures;
19) Corrective actions for out-of-control data;
20) Contingencies for handling out-of-control or unacceptable data;
21) Waste management;
22) References; and
23) Any tables, diagrams, flowcharts, and validation data.

Laboratory procedures other than preparative or analytical procedure may use a shortened format as outlined in SOP T001.

10.2 Exceptionally Permitting Departures from Documented Policies / Procedures

a) If it is necessary to depart from a documented procedure or policy due to circumstances outside of Calscience's control or due to conditions encountered while preparing or analyzing a sample, the following will be documented.

    1) The nature of the exception
    2) How the data or procedure may be impacted
    3) Any Corrective Action that may be needed.
    4) Any approval from a client that may be required.
    5) Approval by management to report or proceed with the exception.
    6) A Case Narrative with the Final Report explaining the exception.

10.3 Test Methods

The laboratory uses appropriate test methods and procedures for all tests and related activities within its responsibility (including, as applicable, sample collection, sample handling, transport and storage, sample preparation and sample analysis). The method and procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

a) When the use of specific test methods for a sample analysis is mandated or requested, only those methods are used.

b) Where test methods are employed that are not required, as in the Performance Based Measurement System approach, the methods are fully documented and validated (see Calscience QSM Section 10.1.2 and Appendix C), and are available to the client and other recipients of the relevant reports.

10.4 Test Method Assessment

The laboratory will periodically conduct a Test Method Assessment (TMA) on the analytical methods in use. These TMAs will be conducted under the guidance of SOP T029. The purpose is to evaluate the compliance between bench performances of the method versus the current Calscience Standard Operating Procedure versus the promulgated or published method. Discrepancies will need to be addressed and resolved. Note that some methods are totally prescriptive while others may contain prescriptive aspects, and still others are performance based. In many cases, modifications to the published method may be required due to circumstances outside the laboratories' control.

10.5 Demonstration of Capability

a) Prior to acceptance and institution of any test method, satisfactory demonstration of method capability is required. (See Calscience QSM Section Appendix C and 6.2.b.) This demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (sample of a matrix is which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. In addition, for analytes that do not lend themselves to spiking, the demonstration of capability may be performed using quality control samples.

b) Continuing demonstration of method performance, as per the quality control requirements in Appendix D (such as laboratory control samples) is required.

c) In cases where Calscience analyzes samples using a test method that has been in use by the laboratory before July 1999, and there have been no significant changes in instrument type, personnel or test method, the continuing demonstration of method performance and the analyst's documentation of continued proficiency shall be acceptable. The laboratory shall have records on file to demonstrate that an initial demonstration of capability is not required.

d) In all cases, the appropriate forms, such as the Certification Statement (Appendix C), is completed and retained by the laboratory to be made available upon request. The laboratory retains all associated supporting data necessary to reproduce the analytical results summarized in the Certification Statement. (See Appendix C for an example of a Certification Statement.)

e) Demonstration of capability is completed each time there is a significant change in instrument type, personnel, or test method.

f) In departments with specialized "work cell(s)" (a group consisting of analysts with specifically defined tasks that together perform the test method), the group as a unit must meet the above criteria and this demonstration of capability is fully documented.

g) When a work cell is employed, and the members of the cell change, the new employee(s) must work with an experienced analyst in that area of the work cell where they are employed. This new work cell must demonstrate acceptable performance through acceptable continuing performance checks (appropriate sections of Appendix D, such as laboratory control samples). Such performance is documented and the four preparation batches following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the new work cell must perform the demonstration of capability (Appendix C).

h) Performance of the work cell is linked to the training records of the individual members of the work cell (See Calscience QSM Section 6.2).

10.6 Sample Aliquots

Where sampling (as in obtaining sample aliquots from a submitted sample) is carried out as part of the test method, the laboratory shall use documented procedures and appropriate techniques to obtain representative subsamples. Reference SOP M230, Homogenization and Compositing of Solid, Soil and Sediment Samples for further guidance.

10.7 Data Verification

Calculations and data transfers are subject to appropriate checks.

a) The laboratory has Standard Operating Procedures that ensure that the reported data are free from transcription and calculation errors.

b) The laboratory has Standard Operating Procedures that ensure that all quality control measures are reviewed, and evaluated before data are reported. Refer to SOPs T020, internal Quality Control Checks and T062, Project Management and Analytical Report Review

c) The laboratory has Standard Operating Procedures that address manual calculations including manual integrations. Refer to SOPs T065, Data Integrity and T023, Peak Integration Procedures.

10.8 Documentation and Labeling of Standards and Reagents

Documented procedures exist for the purchase, receipt and storage of consumable materials used for the technical operations of the laboratory.

a) The laboratory retains records for all standards, reagents and media including the manufacturer/vendor, the manufacturer's Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material is not used, unless the laboratory verifies its suitability for testing use.

b) Original containers (such as those provided by the manufacturer or vendor) are labeled with an expiration date.

c) Records are maintained on reagent and standard preparation. These records indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials.

d) All containers of prepared reagents and standards bear a unique identifier and expiration date and are linked to the documentation requirements in Calscience QSM Section 10.8.c above.

10.9 Computers and Electronic Data Related Requirements

Where computers, automated equipment, or microprocessors are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data, Calscience ensures that:

a) All requirements of the NELAC Standard (i.e., Chapter 5 of NELAC) are met;

b) Computer software is tested and documented to be adequate for use, e.g., internal audits, personnel training, focus point of QA and QC;

c) Procedures are established and implemented for protecting the integrity of data. Such procedures include, but are not limited to, integrity of data entry or capture, data storage, data transmission and data processing;

d) Computer and automated equipment are maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data; and,

e) It establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

11.0 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT

While Calscience does not have control of field sampling activities, the following are essential to ensure the validity of the laboratory's data.

11.1 Sample Tracking

a) The laboratory has a documented system for uniquely identifying the items to be tested, to ensure that there can be no confusion regarding the identity of such items at any time. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates. The laboratory assigns a unique identification (ID) code to each sample container received in the laboratory. (The use of container shape, size, or other physical characteristic, such as amber glass, or purple top, is not an acceptable means of identifying the sample.)

b) This laboratory code is maintained as an unequivocal link with the unique field ID code assigned each container.

c) The laboratory ID code is placed on the sample container as a durable label.

d) The laboratory ID code is entered into the laboratory records (see Calscience QSM Section 11.3.d) and is the link that associates the sample with related laboratory activities such as sample preparation or calibration.

e) In cases where the sample collector and analyst are the same individual or the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be the same as the field ID code.

11.2 Sample Acceptance Policy

The laboratory has a written sample acceptance policy that clearly outlines the circumstances under which samples are accepted or rejected. Data from any samples that do not meet the following criteria are flagged in an unambiguous manner, and the nature of the variation is clearly defined. The sample acceptance policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) Proper, full, and complete documentation, that includes sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) Proper sample labeling that includes a unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink;

c) Use of appropriate sample containers;

d) Adherence to specified holding times;

e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests; and,

f) Procedures to be used when samples show signs of damage, contamination or inadequate preservation.

g) Samples are NOT accepted if classified as extremely hazardous, reference section 5.2 k for examples.

11.3 Sample Receipt Protocols

a) Upon receipt, the condition of the sample, including any abnormalities or departures from standard condition as prescribed in the relevant test method, is recorded**.** All items specified in Calscience QSM Section 11.2 above are checked.

   1) All samples that require cold temperature preservation are considered acceptable if the arrival temperature is within 2°C of the required temperature or the method-specified range. For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

   2) The laboratory shall implement procedures for checking chemical preservation using readily available techniques, such as pH or free chlorine, prior to or during sample preparation or analysis.

      With the exception of residual chlorine measurements in aquatic toxicity samples, certain measurements, such a pH, are performed and recorded just prior to analysis.

b) The results of all checks are recorded on Sample Receipt and, as needed, Sample Anomaly forms.

c) When there is any doubt as to the item's suitability for testing, when the sample does not conform to the description provided, and when the test required is not fully specified, the laboratory makes every attempt to consult the client for further instruction before proceeding. The laboratory establishes whether the sample has received all necessary preparation, or whether sample preparation has yet to be performed. If the sample does not meet the sample receipt acceptance criteria listed in this standard, the laboratory:

   1) Retains correspondence and/or records of conversations concerning the final disposition of rejected samples; or

   2) Fully documents any decision to commence with the analysis of samples not meeting acceptance criteria.

      i. The condition of these samples is, at a minimum, noted on the chain of custody record or transmittal form, and laboratory receipt documents.

      ii. The analysis data is/are appropriately "qualified" on the final report.

d) The laboratory utilizes a permanent chronological record such as a logbook or electronic database to document receipt of all sample containers.

   1) This sample receipt log records the following:

      i. Client/Project Name;

      ii. Date and time of laboratory receipt;

      iii. Unique laboratory ID code (see Calscience QSM Section 11.1); and

      iv. Signature or initials of the person making the entries.

2) During the login process, the following information is linked to the log record or included as a part of the log. If such information is recorded/documented elsewhere, that document becomes part of the laboratory's permanent records, easily retrievable upon request, and readily available to individuals who will process the sample. Note: The placement of the laboratory ID number on the sample container is not considered a permanent record.

   i. The field ID code that identifies each container is linked to the laboratory ID code in the sample receipt log.

   ii. The date and time of sample collection is linked to the sample container and to the date and time of receipt in the laboratory.

   iii. The requested analyses (including applicable approved test method numbers) are linked to the laboratory ID code.

   iv. Any comments resulting from inspection for sample rejection are linked to the laboratory ID code.

e) All documentation (i.e., memos or transmittal forms) that are conveyed to the laboratory by the sample submitter is retained.

f) A complete chain of custody record form is maintained.

11.4 Storage Conditions

The laboratory has documented procedures and appropriate facilities to avoid deterioration, contamination, and damage to the sample during storage, handling, preparation, and testing; any relevant instructions provided with the item are followed. Where items must be stored or conditioned under specific environmental conditions, these conditions are maintained, monitored, and recorded.

a) Samples are stored according to the conditions specified by preservation protocols:

   1) Samples that require thermal preservation are stored under refrigeration at +/-2° of the specified preservation temperature unless method-specified criteria exist. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

   2) Samples are stored away from all standards, reagents, food, and other potentially contaminating sources. Samples are stored in such a manner to prevent cross contamination.

b) Sample fractions, extracts, leachates, and other sample preparation products are stored according to Calscience QSM Section 11.4.a above or according to specifications in the test method.

c) When a sample or portion of a sample needs to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory has storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

11.5 Sample Disposal

The laboratory has standard operating procedures for the disposal of samples, digestates, leachates and extracts or other sample preparation products. Refer to SOP T005, Disposal of Laboratory Samples and Wastes.

12.0 RECORDS

The laboratory maintains a record system to suit its particular circumstances and comply with any applicable regulations. 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 test report for a minimum of five years.

There are two levels of sample handling: 1) sample tracking and 2) legal chain of custody protocols that are used for evidentiary or legal purposes. All essential requirements for sample tracking (e.g., chain of custody form) are outlined in Calscience QSM Sections 12.1, 12.2 and 12.3. Calscience details the Legal/Evidentiary and Internal Chain of Custody procedures in SOP T100, Sample Receipt and Log-In Procedures.

12.1 Record Keeping System and Design

The Calscience record keeping system allows historical reconstruction of all laboratory activities that produced the analytical data. The history of the sample is readily understood through the documentation. This includes inter-laboratory transfers of samples and/or extracts.

a) The records include the identity of personnel involved in sampling, sample receipt, preparation, calibration or testing.

b) 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.

c) 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.

d) All changes to records are signed or initialed by responsible staff. The reason for the signature or initials is clearly indicated in the records such as “sampled by,” “prepared by,” or “reviewed by.”

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

f) Entries in records are not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and dates the correction. These criteria also apply to electronically maintained records.

g) Refer to 10.9 for Computer and Electronic Data.

12.2 Records Management and Storage

a) All records (including those pertaining to calibration and test equipment), certificates and reports are safely stored, and held secure and in confidence to the client. NELAP-related records are available to the accrediting authority.

b) All records, including those specified in Calscience QSM Section 12.3, are retained for a minimum of five years from generation of the last entry in the records. The laboratory maintains all information necessary for the historical reconstruction of data. Records stored only on electronic media are supported by the hardware and software necessary for their retrieval.

c) Records that are stored or generated by computers or personal computers have hard copy or write-protected backup copies.

d) The laboratory has an established record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation storage and reporting.

e) Access to archived information is documented with an access log. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

f) The laboratory has a plan to ensure that the records are maintained or transferred according to the clients' instructions (see 4.1.8.e of NELAC) in the event of Laboratory Transfer of Ownership, Going out of Business or Bankruptcy. In all cases, appropriate regulatory and state legal requirements concerning laboratory records will be followed. Reference QSM Section 6.2.1 and SOP T-002, Document Control, for detailed policies and procedures for handling of client records and data in these situations.

12.3 Laboratory Sample Tracking

12.3.1 Sample Handling

A record of all procedures to which a sample is subjected while in Calscience's possession is maintained. These include but are not limited to all records pertaining to:

a) Sample preservation, including appropriateness of sample container and compliance with holding time requirement;

b) Sample identification, receipt, acceptance or rejection, and log-in;

c) Sample storage and tracking, including shipping receipts, sample transmittal forms (chain of custody form); and

d) Documentation procedures for the receipt and retention of test items, including all provisions necessary to protect the integrity of samples.

12.3.2 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following is retained:

a) 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);

b) 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;

c) Copies of final reports;

d) Archived standard operating procedures;

e) Correspondence relating to laboratory activities for a specific project;

f) All corrective/preventive action reports, audits and audit responses;

g) Proficiency test results and raw data; and,

h) Results of data review, verification, and cross-checking procedures.

12.3.3 Analytical Records

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

a) Laboratory sample ID code;

b) Date of analysis and time of analysis if the method-specified holding time is 72 hours or less, or when time critical steps are included in the analysis, e.g., extractions, and incubations;

c) Instrument identification and instrument operating conditions/parameters (or reference to such data);

d) Analysis type;

e) All manual calculations e.g., manual integrations;

f) Analyst's or operator's initials/signature or chemist ID number;

g) Sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

h) Sample analysis;

i) Standard and reagent origin, receipt, preparation, and use;

j) Calibration criteria, frequency and acceptance criteria;

k) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

l) Quality control protocols and assessment;

m) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and,

n) Method performance criteria including expected quality control requirements.

12.3.4 Administrative Records

The following are maintained:

a) Personnel qualifications, experience and training records;

b) Ethics Statements;

c) Records of demonstration of capability for each analyst; and

d) A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record.

13.0 LABORATORY REPORT FORMAT AND CONTENTS

The results of each test, or series of tests carried out by the laboratory must be reported accurately, clearly, unambiguously and objectively. The results normally reported in a test report and include all the information necessary for the interpretation of the test results and all information required by the method used. Some regulatory reporting requirements or formats, such as monthly operating reports may not require all items listed below, however, Calscience will provide all the required information to their client for use in preparing such regulatory reports.

a) Except as discussed in 13.b, each report to an outside client includes at least the following information (those prefaced with “where relevant” are not mandatory):

1) A title, e.g., "Analytical Report," or "Test Certificate," "Certificate of Results" or "Laboratory Results”;

2) Name and address of laboratory, and location where the test was carried out if different from the address of the laboratory and phone number with name of contact person for questions;

3) Unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

This requirement may be presented in several ways:

i. The total number of pages may be listed on the first page of the report as long as the subsequent pages are identified by the unique report identification and consecutive numbers, or

ii. Each page is identified with the unique report identification, the pages are identified as a number of the total report pages (example: 3 of 10, or 1 of 20).

Other methods of identifying the pages in the report may be acceptable as long as it is clear to the reader that discrete pages are associated with a specific report, and that the report contains a specified number of pages.

4) Name and address of client, where appropriate and project name if applicable;

5) Description and unambiguous identification of the tested sample including the client identification code;

6) Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

7) Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

8) Identification of the test method used, or unambiguous description of any nonstandard method used;

9) If the laboratory collected the sample, reference to sampling procedure;

10) Any deviations from (such as failed quality control), additions to or exclusions from the test method (such as environmental conditions), and any nonstandard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers.

11) Measurements, examinations and derived results, supported by tables, graphs, sketches, and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units such as µg/l or mg/kg;

12) When required, a statement of the estimated uncertainty of the test results;

13) A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue;

14) At the Calscience's discretion, a statement to the effect that the results relate only to the items tested or to the sample as received by the laboratory;

15) At the Calscience's discretion, a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

16) Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.; and

17) Clear identification of numerical results with values outside of quantitation limits.

b) Where the certificate or report contains results of tests performed by subcontractors, these results are clearly identified by subcontractor name or applicable accreditation number and the entirety of the subcontract report is included with the final Calscience report.

c) After issuance of the report, the laboratory report remains unchanged. Material amendments to a calibration certificate, test report or test certificate after issue may be made only in the form of a further document, or data transfer, including the statement "Supplement to Test Report or Test Certificate, serial number . . . [or as otherwise identified]", or equivalent form of wording. Such amendments meet all the relevant requirements of the NELAC Standard.

d) Calscience notifies clients 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 calibration certificate, test report or test certificate or amendment to a report or certificate.

e) The laboratory will, where clients require transmission of test results by telephone, telex, facsimile or other electronic or electromagnetic means, follow documented procedures that ensure that the requirements of this Standard are met and that confidentiality is preserved.

f) Calscience will certify that all its NELAC-certified test results reported meet all requirements of NELAC or provide reasons and/or justification if they do not.

14.0 SUBCONTRACTING ANALYTICAL SAMPLES

When Calscience subcontracts work whether because of unforeseen circumstances (e.g. workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g. through client direction, contractual arrangement or permanent subcontracting), this work shall be placed with a laboratory accredited under NELAP, or other appropriate certification, for the tests to be performed or with a laboratory that meets applicable statutory and requirements for performing the tests and submitting the results of tests performed. All subcontracted work shall be referenced and so noted in the final Calscience analytical report.

Subcontract laboratories will provide or make available, current copies of the following documents prior to Calscience submitting samples. This information will be updated annually or on an as needed basis.

a) Laboratory accreditations / certifications

b) Upon request, any Proficiency Testing (PT) or Performance Evaluation (PE) results relevant to the subcontracted samples.

c) Insurance Certificates

d) Quality Assurance Manual

e) Subcontract laboratories will also submit statements affirming that Calscience will be notified if any of the following occur.

- There is a change or loss in accreditation for the applicable analysis.
- Most recent PT or PE study results for the applicable analysis are unacceptable *AND* are not able to be addressed via Corrective Action.
- There is a need to subcontract Calscience project samples. Prior Calscience approval is required in writing for subcontracting samples.

f) The client project requirements will be used to evaluate the subcontract laboratories and to determine their acceptability. Approval by either: the QA Manager, Laboratory Director or Client Services Director (or designee) is required.

g) A master list of approved laboratories will be created and distributed to Sample Control and all Project Managers. All subcontracting must utilize a laboratory from this list.

The procedure for subcontracting samples will follow these guidelines:

a) Calscience will advise its client via written, facsimile or e-mail notification of its intention to subcontract any portion of the testing to another party in cases when unforeseen circumstances occur. Calscience shall gain approval by the client in writing, facsimile or via e-mail response.

b) Calscience may subcontract samples on a continuing basis without written, facsimile or e-mail notification under the following (but not limited to) cases:

- Standing Client direction or instruction
- Contractual specification or requirement
- Project historical precedent

c) A separate Chain of Custody will be created specifically for the subcontracted sample(s). This (or a copy) will be included with the full and complete subcontract report in the final Calscience analytical report.

d) Calscience shall retain records demonstrating that the above requirements have been met.

e) If the samples to be subcontracted are submitted to Calscience under special regulatory, agency or governmental accreditation, Example: Department of Defense, that have more comprehensive or differing quality criteria, Example: DoD QSM for Environmental Laboratories Version 4.2 October 2010, then the subcontract laboratory MUST have certification for the subcontracted analysis from the same entity and MUST have undergone similar assessment as the primary laboratory for the subcontracted component. Written authorization from the client or authorizing body must be obtained prior to usage of each subcontract laboratory.

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES

Calscience does not procure outside services and supplies, other than those referred to in this Manual.

16.0 INQUIRIES AND COMPLAINTS

Calscience SOP-T018 addresses the policies and procedures for the resolution of inquiries and complaints received from clients or other parties about the laboratory's activities. Where an inquiry or complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the requirements of this manual or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with NELAC Section 5.3.1. Records of the complaint and subsequent actions are maintained and are available for audits.

17.0 REVIEW OF WORK REQUESTS, CONTRACTS AND TENDERS

has established procedures for the review of work requests contracts and tenders. Projects, proposals and contracts are reviewed for adequately defined requirements and the ability of Calscience to meet those requirements. A thorough review of all technical and quality control requirements contained in these requests is performed to ensure a project's success. The appropriateness of requested methods, and the lab's capability to perform them must be established. A review of the laboratory's capability to analyze non-routine analytes is also part of this review process. Additionally, alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, detection and reporting levels, and quality control limits. During the review process, the laboratory determines whether it has the necessary physical, personnel and information resources to meet the project requirements, and if the personnel have the expertise needed to perform the required testing. Each proposal is also checked for its impact on the overall capacity of the laboratory. The proposed turnaround time will be checked for feasibility. Electronic or hard copy deliverable requirements are evaluated against the laboratory's ability to produce such documentation.

This review process ensures that the laboratory's test methods are suitable to achieve regulatory and/or client requirements and that the laboratory holds the appropriate certifications to perform the work. In the event that the use of a subcontract laboratory is needed, also confirming that they meet all project requirements and maintain the appropriate certifications for the proposed subcontract analyses. If the laboratory cannot provide all services and therefore intends to use the services of a subcontract laboratory, this will be documented and discussed with the client prior to project or contract approval.

Following the review process, the laboratory informs the client of the results of the review and notes any potential conflict, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the capability of the laboratory to meet those requirements is resolved in writing before acceptance of the project or contract. It is necessary that the project requirements or contract be acceptable to both the client and the laboratory prior to the start of the work. The review process is repeated when there are amendments to the original contract by the client.

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

Review Personnel

Depending upon the scope of a project or contract, one or more key persons may review and accept work on behalf of the laboratory. For routine projects, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has the necessary certifications, that it can meet the clients' data quality, reporting and turn-around time requirements.

For new, complex or large projects, the proposed project proposal or contract is given to the Business Development Director for an initial review that encompasses all facets of the operation. The scope of work is then distributed to the following personnel, as needed based on scope of contract, to evaluate all of the project related requirements:

- Laboratory Director
- Operations Manager
- Technical Services Manager
- Special Projects Manager
- Quality Assurance Manager
- Group Leaders
- Project Manager(s)

Appropriate records are maintained for every contract or work request. Copies of the agreed-upon contract will be distributed to key personnel as needed and the signed copies maintained by the Business Development Director and/or Laboratory Director.

Project Kick-off and Status Meetings

For routine project work, project managers ensure that specific technical and QC requirements are effectively evaluated and communicated to laboratory personnel through the use of the LIMS system: special requirements section of the chemist's worksheet.

Prior to work on a new or complex project, project managers or key personnel will hold meetings with operations personnel to discuss schedules and any unique aspects of the project. Items discussed include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, and any other special requirements.

Project requirements are given to the laboratory staff during project kick-off meetings or the daily status meetings. Information disseminated during these meetings provides direction to the laboratory staff in order to maximize production, maintain high quality and ensure client satisfaction.

During the project, changes to the scope of work may occur due to client, sampling or regulatory reasons. If these changes impact the laboratory's role in the project (use of a non-standard method or modification of a method to comply with revised requirements) then the changes need to be discussed with and agreed upon with the client prior to continuing with the work. These changes must be documented prior to implementation and communicated to the laboratory staff during a status or project specific meeting. Documentation of the modification is made in the analytical report narrative.

And at all times, records of all pertinent discussions with a client relating to the project or contract are documented and maintained as a part of the project record.

18.0 MANAGEMENT REVIEW, MANAGEMENT OF CHANGE AND CONTINUOUS IMPROVEMENT

18.1 Management Review

A comprehensive Management Review of the entire Calscience Quality System will be conducted by the Laboratory Director on an annual basis. The SOP T-030 may be consulted for detailed guidance. All major stakeholders will be given an opportunity to provide comment or input for the review. These will include:

- Laboratory Director
- Business Development Director
- Operations Manager
- Technical Manager
- Senior Client Manager
- Other Operational / Project Management personnel as appropriate.
- Clients

The purpose and goal of the Management Review will identify weaknesses, areas requiring more resources or oversight, opportunities for continuous improvement and follow up on previous recommendations.

The final completed review is part of the NELAP laboratory documentation requirements and may be submitted to Calscience authorized auditing agencies or clients upon request.

18.2 Management of Change

Whenever a change is made in a controlled environment (not just production) the laboratory is put at risk. However, one needs to constantly make changes to keep pace with business / regulatory requirements. The challenge to the laboratory is to minimize the risk and impact of that change.

An organization must have an operating process in place for which an evaluation has been conducted, and that allows proper lead times and approvals to ensure that the laboratory is unaffected when changes are made. But to successfully implement a change, one also needs to have a comprehensive understanding of the infrastructure that supports the services to determine the overall impact. The Management of Change process will facilitate, as referenced in SOP T030, this evaluation.

The Management of Change process will track and implement the following types of changes:

a) Permanent Change: – A change that is considered long term and durable. Any change which is not categorized as a Temporary Change.

b) Temporary Change: – A change which has a defined lifetime and which will be removed before a defined date (usually no more than six months). All temporary changes must have a specified removal date that is documented on the approved MOC form.

c) Emergency Change: – An emergency change path that allows the change to be implemented and commissioned immediately in order to address an immediate safety, operational, health, environmental, or product quality situations.

The functional categories that will be managed include:

a) Laboratory Facility Acquisition
b) Laboratory Instrument Acquisition
c) Analytical Method Development and Validation

d) Laboratory Operations Process Change
e) Department Relocation
f) Activation of Analytical Method
g) Waste Stabilization and Disposition
h) Human Resources
i) Information Technology
j) Safety and Security

18.3 Continuous Improvement

In order for Calscience to be proactive and a leader in the industry, the entire Calscience Quality system is designed to ensure the production of scientifically sound, legally defensible data of known and proven quality. The addition of the Management Review and Management of Change processes enhances Calscience's ability to foster continuous improvement.

Continuous improvement is an ongoing effort to improve data integrity, services or processes. These efforts can seek "incremental" improvement over time or "breakthrough" improvement all at once. All staff at Calscience participates in continuous improvement, from the Laboratory Director down to the beginning technician, as well as external stakeholders when applicable.

The following procedures / inputs have direct involvement in the continuous improvement process:

a) External Audits (Regulatory and Client Based)
b) Internal Audits
c) Corrective / Preventive Actions
d) Statistical Quality Control (SQC) Monitoring
e) Proficiency Testing Performance
f) Client Feedback – Complaints and Commendations
g) Management Review
h) Management of Change

The Management of Change process will guide and document the major improvements. The Corrective / Preventive Action procedure will enable and record the more incremental changes.

The principal elements are commitment to quality, focused effort, involvement of all employees, willingness to change, and communication.

NELAC APPENDICES

APPENDIX A - REFERENCES

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ISO Guide 8402: 1986. Quality – Vocabulary.

ISO Guide 9000: 1994. Quality management and quality assurance standards - Guidelines for selection and use.

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ISO Guide 9002: 1994. Quality systems - Model for quality assurance in production and installation.

ISO/IEC Guide 2: 1986. General terms and their definitions concerning standardization and related activities.

ISO/IEC 17025: 2005. General requirements for the competence of calibration and testing laboratories.

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Manual of Method for General Bacteriology, Philipp Gerhard et al., American Society for Microbiology, Washington, D.C. 1981.

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APPENDIX B - GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references was used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

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. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.5.2.3]

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)

Analysis Duplicate: The second measurement of the target analyte(s) performed on a single sample or sample preparation.

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. (NELAC)

Analytical Reagent (AR) Grade: Designation for the high purity of certain chemical reagents and solvents given by the American Chemical Society. (Quality Systems)

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 NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples, which 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 to 20 environmental samples of the same NELAC-defined 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 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 environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

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)

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: A 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; collector; time of collection; preservation; and requested analyses. (NELAC)

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 situations require analysis, the results must be appropriately qualified. (NELAC)

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. (NELAC)

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)

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). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Desorption Efficiency: The mass of target analyte recovered from sampling media, usually a sorbent tube, divided by the mass of target analyte spiked on to the sampling media expressed as a percentage. Sample target analyte masses are usually adjusted for the desorption efficiency. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

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)

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ ASQC E4-1994)

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 method. (NELAC)

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)

Laboratory: A body that calibrates and/or tests. (ISO 25)

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. 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. (NELAC)

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Limit of Detection (LOD): The lowest concentration level that can be determined by a single analysis and with a defined level of confidence to be statistically different from a blank. See also Method Detection Limit, Detection Limit, and Quantitation Limit. (Analytical Chemistry, 55, p. 2217, December 1983, modified)

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

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 matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

- Drinking Water: Any aqueous sample that has been designated 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: 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 sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate 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. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: Denotes permitted action, but not required action. (NELAC)

Media: Material that supports the growth of a microbiological culture.

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. (NELAC)

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)

Must: Denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference (NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Objective Evidence: Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measures, or tests that can be verified. (ASQC)

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. (NELAC)

Performance Based Measurement System (PBMS): A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

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. (NELAC)

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. (NELAC)

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

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. (NELAC) [2.1]

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. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, and analysis) which must be strictly followed. (EPA- QAD)

Pure Reagent Water: Shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)

Quality Assurance: An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

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. (EPA-QAD)

Quality Control: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample: An uncontaminated sample matrix with known amounts of analytes from a source independent from the calibration standards. 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. (EPA-QAD)

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. (NELAC)

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. (ANSI/ ASQC E-41994)

Quantitation Limits: Levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported at a specific degree of confidence. (NELAC)

Range: The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30- 2.1)

Reference Method: A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Chapter 5, Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sampling Media: Material used to collect and concentrate the target analytes(s) during air sampling such as solid sorbents, filters, or impinger solutions.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

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. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedure (SOP): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

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. (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 Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Testing Laboratory: Laboratory that performs tests. (ISO/ IEC Guide 2 - 12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Validation: The process of substantiating specified performance criteria. (EPA- QAD)

Verification: Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Sources:

American Society for Quality Control (ASQC), Definitions of Environmental Quality Assurance Terms, 1996

American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991

ANSI/ASQC E4, 1994

ANSI N42.23- 1995, Measurement and Associated Instrument Quality Assurance for Radiobioassay Laboratories

International Standards Organization (ISO) Guides 2, 30, 8402

International Vocabulary of Basic and General Terms in Metrology (VIM): 1984. Issued by BIPM, IEC, ISO and OIML

National Institute of Standards and Technology (NIST)

National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards

Random House College Dictionary

U.S. EPA Quality Assurance Management Section (QAMS), Glossary of Terms of Quality Assurance Terms, 8/31/92 and 12/6/95

U.S. EPA Quality Assurance Division (QAD)

40 CFR, Part 136

Webster's New World Dictionary of the American Language

APPENDIX C - DEMONSTRATION OF CAPABILITY

C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method. (See NELAC 10.2.1.)

Note: Where tests are performed by specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the work cell as a unit meets the above criteria and this demonstration is fully documented.

In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (a sample of a matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. However, before any results are reported using this method, actual sample spike results may be used to meet this standard, i.e., at least four consecutive matrix spikes within the last twelve months. In addition, for analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations shall be documented through the use of the form in this appendix.

The following steps, which are adapted from the EPA test methods published in 40 CFR Part 136, Appendix A, are performed if required by mandatory test method or regulation. Note: For analytes for which spiking is not an option and for which quality control samples are not readily available, the 40 CFR approach is one way to perform this demonstration. The laboratory documents that other approaches to DOC are adequate, and this is documented in the laboratory's Quality Manual.

a) A quality control sample is obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) is diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.

c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) Using all of the results, the mean recovery ($\overline{X}$) is calculated in the appropriate reporting units (such as µg/L) and the standard deviations of the population sample (n-1) (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory will assess performance against established and documented criteria.

e) Compare the information from (d) above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are no established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.

1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.

2) Beginning with c) 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 c).

C.2 CERTIFICATION STATEMENT

The following certification statement shall be used to document the completion of each demonstration of capability. A copy of the certification statement shall be retained in the personnel records of each affected employee (see Calscience QSM Section 6.3 and 12.3.4.b.).

Demonstration of Capability
Certification Statement

Date: Page __of __
Laboratory Name:
Laboratory Address:
Analyst(s) Name(s):

Matrix: _____
(examples: laboratory pure water, soil, air, solid, biological tissue)

Method number, SOP#, Rev #, and Analyte, or Class of Analytes or Measured Parameters:
_____ (examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2. The test method(s) was performed by the analyst(s) identified on this certification.

3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

_____	_____	_____
Technical Director's Name and Title	Signature	Date
_____	_____	_____
Quality Assurance Officer's Name	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

(Note: Form may be modified so long as the essential items are included in the updated form)

APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS

The quality control protocols specified by the laboratory's method manual (10.1.2) shall be followed. The laboratory shall ensure that the essential standards outlined in Appendix D are incorporated into their method manuals.

All quality control measures shall be assessed and evaluated on an ongoing basis and quality control acceptance criteria shall be used to determine the validity of the data. The laboratory shall have procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exists.

The requirements from the body of Chapter 5, e.g., Section 5.4, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the sections of this Appendix, i.e., chemical testing.

D.1 CHEMICAL TESTING

D.1.1 Positive and Negative Controls

a) Negative Controls

1) Method Blanks - Shall be performed at a frequency of one per preparation batch of samples per matrix type. The results of this analysis shall be one of the QC measures to be used to assess the batch. The source of contamination must be investigated and measures taken to correct, minimize or eliminate the problem if

i) the blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or

ii) the blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.

Any sample associated with the contaminated blank shall be reprocessed for analysis or the results reported with appropriate data qualifying codes.

b) Positive Controls

1) Laboratory Control Sample (LCS) - (QC Check Samples) Shall be analyzed at a minimum of 1 per preparation batch of 20 or less samples per matrix type, 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 assess the batch. NOTE: The matrix spike (see 2 below) may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS.

2) Matrix Spikes (MS) - Shall be performed at a frequency of one out of every 20 samples per matrix type prepared over time, 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 selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike.

3) Surrogates - 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 the sample composition and shall be reported to the client whose sample produced the poor recovery.

4) 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. 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 that are incompatible, a representative number (minimum of 10%) of the listed components may 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.

D.1.2 Analytical Variability/Reproducibility

Matrix Spike Duplicates (MSDs) or Laboratory Duplicates - Shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document its procedure to select the use of appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate.

D.1.3 Method Evaluation

In order to ensure the accuracy of the reported result, the following procedures shall be in place:

a) Demonstration of Analytical Capability - (Section 10.5) shall be performed initially (prior to the analysis of any samples) and with a significant change in instrument type, personnel, matrix or test method.

b) Calibration - Calibration protocols specified in Section 9.4 shall be followed.

c) Proficiency Test Samples - The results of such analyses (4.2.j or 5.3.4) shall be used by the laboratory to evaluate the ability of the laboratory to produce accurate data.

D.1.4 Analytical Measurement Uncertainty Estimation

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). Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. For 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 have a Gaussian distribution, and be reducible by increasing the total number of measurements.

Knowledge of the uncertainty of a measurement provides additional confidence in the validity of a result as its value accounts for all the factors which could possibly affect the result. Certain test methods will specify limits to the values of sources of uncertainty of measurement (EPA 500 series methods, etc.) and will specify the form of presentation of calculated results. When the method makes these stipulations, there is no need to provide a mechanism for calculating the uncertainty. Where this information is not provided within a method or other regulatory device, the uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte and is the Calscience standard for estimating analytical data uncertainty.

D.1.4.1 Using the Laboratory Control Sample (LCS) to Estimating Analytical Uncertainty

a) The LCS limits can be used to assess the performance of the measurement system since they take into consideration all of the laboratory-related variables associated with a given test over time. 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.

- To calculate the uncertainty of a result, multiply the analytical 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 analytical 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 a 99%-certain range for the reported result. Example: If the reported result is 1.0 mg/l, and the LCS percent recovery range is 75 to 125%. The uncertainty range would be 0.75 to 1.25 mg/l, which could also be written as 1.0 +/- 0.25 mg/l.

D.1.4.2 Additional Components to Estimating Analytical Uncertainty

When estimating analytical measurement uncertainty, all significant components of uncertainty must be identified and quantified. Components that affect analytical measurement uncertainty include sampling, handling, transport, storage, preparation and testing. A typical environmental laboratory will have the greatest contribution to uncertainty in the storage, preparation and testing portion of the analytical train, hence the estimation can be limited to those three areas, assuming all other factors are within recommended guidelines for sample size, container type, preservation (chemical, temperature, temporal) and handling/transport. If the latter are *NOT* within guidelines then these additional estimations of variability must be accounted for, and may supersede the laboratory contribution to uncertainty.

Definitive references and procedural manuals for calculating Analytical Measurement Uncertainty are listed below. Note that there are different theories on the “best” way to estimate uncertainty, it is up to the end user to determine that which best meets their project needs.

a) “Environmental Analytical Measurement Uncertainty Estimation – Nested Hierarchical Approach”, William Ingersoll, Defense Technical Information Center # ADA396946, 2001

b) “Quantifying Uncertainty in Analytical Measurement”, EuraChem / CITAC Guide CG 4, Second Edition, QUAM 2000.1

c) “Quantifying Measurement Uncertainty in Analytical Chemistry – A Simplified Practical Approach”, Thomas W. Vetter, National Institute of Standards and Technology

The process in general involves the following steps:

1. Specify the Measurand – Write down a clear statement of what is being measured, including the relationship between the measurand and the input quantities, i.e., measured quantities, constants, calibration standard values, etc.

2. Identify uncertainty sources – This will include sources that contribute to the uncertainty on the parameters in the relationships identified in step 1, but may include other sources and must include sources arising from chemical assumptions.

3. Quantify uncertainty components – Measure or estimate the size of the uncertainty component associated with each potential source of uncertainty identified. It is often possible to estimate or determine a single contribution to uncertainty from the aggregate of multiple sources.

4. Calculate combined uncertainty – The information obtained in step 3 will consist of a number of quantified contributions to overall uncertainty, whether associated with individual sources or with the combined effects of several sources.

The process outlined above relates to the measurement of uncertainty for the preparative / analytical laboratory procedure. However, there are uncertainty contributions from other factors outside the preparative / analytical procedure. These can be controlled to a great extent by specifying uniform and standardized training or conditions.

Examples:

Human Factors

a) All personnel at Calscience undergo documented training in the method and / or instrument used. Minimum levels of education or experience are required.

b) Initial and continuing Demonstrations of Capability (DOC) must be performed and documented prior to and in continuance of analytical work related to their areas of responsibilities.

c) Blind Proficiency Testing samples are analyzed twice a year to gauge each department, matrix and method.

d) Data Integrity and Ethics Training are provided to new employees and on an annual basis to all employees.

Accommodation and Environmental Conditions

a) Calscience has standardized operating procedures for transport, storage and tracking of samples, extracts and digests through out the laboratory. All incoming orders are logged into a Laboratory Information System that assigns a specific identifier code to each work order, sample container and analytical result.

b) The sample control areas are secured with restricted access using card key portals. Internal chain of custody is available if the project requires.
c) The laboratory has over 35,000 sq ft of laboratory space with temperature controlled and air positive or negative environmental controls.

d) Regular safety inspections are performed to identify potentially hazardous conditions and to ensure general cleanliness.

Environmental Test Methods and Method Validation

a) All methods in use have Standard Operating Procedures (SOPs) based upon published methods from the EPA, ASTM, Standard Methods or other established body. These are controlled documents assigned to each department. An annual review is performed.

b) Each method has internal and external quality control criteria for preparative efficiency, instrument performance, calibration, continuing method performance and possible matrix effects as appropriate.

c) Ongoing Proficiency Testing program.

Equipment and Instrumentation

a) Each instrument in use has performance parameters that must be evaluated to specific standards based on the established method prior to any analytical use.

b) Routine and preventative maintenance is performed to maintain optimum operational performance.

c) Complex instrument systems are covered under manufacturer service contracts as appropriate.

Measurement Traceability

a) Every reagent used must meet the indicated purity and fitness for usage as referenced in the method SOPs.

b) All calibration standards are certified by the manufacturer to meet or exceed purity levels as recorded in the accompanying Certificate of Traceability to NIST or other standards verification.

c) Each reagent, standard or working standard is recorded, assigned a tracking identifier. This is referenced in the analytical log book as needed to assure traceability to the original source.

d) All Balances, Dispensers, Pipettors, Refrigerators, Freezers and Thermometers are checked on a daily or other routine basis to specified tolerances.

D.1.5 Detection Limits

The laboratory shall utilize a test method that provides a detection limit that is appropriate and relevant for the intended use of the data. Detection limits shall be determined by the protocol in the mandated test method or applicable regulation, e.g., Method Detection Limit (MDL). If the protocol for determining detection limits is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method. Refer to SOP T006, Determination of Detection Limits.

a) A detection limit study is not required for any component for which spiking solutions or quality control samples are not available such as temperature.

b) The detection limit shall be initially determined for the compounds of interest in each test method in a matrix in which there are not target analytes nor interferences at a concentration that would impact the results or the detection limit must be determined in the matrix of interest (see definition of matrix).

c) Detection limits must be determined each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis.

d) All samples processing steps of the analytical method shall be included in the determination of the detection limit.

e) All procedures used must be documented. Documentation must include the matrix type. All supporting data must be retained.

f) The laboratory must have established procedures to relate detection limits with quantitation limits.

g) The test method's quantitation limits must be established and must be above the detection limits.

D.1.6 Data Reduction

The procedures for data reduction, such as use of linear regression, shall be documented.

D.1.7 Quality of Standards and Reagents

a) The source of standards shall comply with 9.3.

b) Reagent Quality, Water Quality and Checks:

    1) Reagents - In methods where the purity of reagents is not specified, analytical reagent grade shall be used. Reagents of lesser purity than those specified by the test method shall not be used. The

labels on the container should be checked to verify that the purity of the reagents meets the requirements of the particular test method. Such information shall be documented.

2) Water - The quality of water sources shall be monitored and documented and shall meet method specified requirements.

3) The laboratory will verify the concentration of titrants in accordance with written laboratory procedures.

D.1.8 Selectivity

a) Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. The laboratory shall develop and document acceptance criteria for retention time windows.

b) A confirmation shall be performed to verify the compound identification when positive results are detected on a sample from a location that has not been previously tested by the laboratory. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer. Confirmation is required unless stipulated in writing by the client. All confirmation shall be documented.

c) The laboratory shall document acceptance criteria for mass spectral tuning.

D.1.9 Constant and Consistent Test Conditions

a) The laboratory shall assure that the test instruments consistently operate within the specifications required of the application for which the equipment is used.

b) Glassware Cleaning - Glassware shall be cleaned to meet the sensitivity of the test method.

Any cleaning and storage procedures that are not specified by the test method shall be documented in laboratory records and SOPs.

D.1.10 Method Validation – Modified Procedures, Non-Standard Methods, Additional Analytes

Often times, modifications to published methods are promulgated to allow the laboratory flexibility, increased productivity and, in some cases, it allows for better hazardous waste management, all while maintaining the quality of the data generated. But, this cannot be done without following standard method validation procedures to guarantee that the results achieved from the modified version are equal to or greater than the actual published or routinely accepted method.

Validation procedures are done to make sure that the sensitivity and selectivity of the process is appropriate for the method or analytes chosen. Interference checks are performed to show that the changes or additions will not contribute interferences to previous analytes or on-going processes. Accuracy and precision requirements are established, or previously defined, and used to demonstrate the capability of an analyst to perform the method, initially and on-going.

In the event that a non-standard method (significantly modified or newly-developed) is needed to meet client requirements, the method specifications and how they impact the project requirements must be relayed to the client for approval prior to beginning work on project samples. The client must understand the limits of the method, why it was developed and when it will be used on their project samples, and they must agree to its use.

Any significantly modified or newly-developed method (including the addition of analytes to established procedures) must be fully defined in a Standard Operating Procedure. The validation must be performed by qualified personnel, using appropriate reagents, standards and equipment/instrumentation and that process must be documented. The following items must be performed (as applicable to the method) and the completed documentation with all raw data provided to the Operations Manager and QA Manager for review prior to granting approval for use. A new method cannot be put into production without Operations and QA approval. For situations where NELAP approval is being sought, the method cannot be used for client samples until the certification has been received from the State, unless approval is given by the client.

D.1.10.1 Significant Modification / New Method / Additional Analyte Documentation:

Prior to the acceptance of client samples for analysis, the following documentation, as applicable to the type of modification or method status, must be provided to both Operations and QA for review and approval.

1. Approved Standard Operating Procedure for Analytical or Preparation Processes. Include all related raw data for the SOP revision with the draft version.

    a) Modification of existing method: - Revised SOP with modifications clearly spelled out:

    b) New Method: - New SOP in NELAC format – QA will assign SOP number

    c) Additional Analytes: - Revised SOP with modifications clearly spelled out:

2. Method Detection Limit (MDL) Study: Compliant with 40CFR, Part 136.

    a) Include summary form and all raw data for the review

3. MDL Verification Standard spiked at 1-4x the MDL, or the level specified by the specific program or contract. Example: 1-2x the MDL, reference specific program requirements.

    b) Recovery within 30 -150%, or a minimum response distinguishable from the established instrument noise level.

4. Reporting Limit Verification (when an MDL verification is not performed)

    a) For analytical methods, reprocess the low calibration standard as percent recovery – recovery between 50% and 150% is acceptable.

    b) For extraction methods, or where required by project or program, spike a blank matrix at the reporting limit and process through all steps of the procedure. Note the spike level and percent recoveries. Method defined control limits are used for recovery evaluation, or default recoveries between 40% and 160% if method defined limits are not available.

5. Tuning Check (as applicable to the method)

6. Degradation Check (as applicable to the method)

7. A Valid Initial Calibration and Verification

    a) Minimum of 5 sequential points, unless otherwise stated in the method or in-house SOP.

    b) Low calibration standard at or below the Reporting/Quantitation Limit.

    c) Initial Calibration Verification Standard

8. Retention Time Window Study

9. Second Column Confirmation for all analytes (as applicable to the method)

10. Inter-element Correction (as applicable to the method)

11. Linear Range Study (as applicable to the method)

12. GCMS Spectral Profile(s) (as applicable to the method)

13. Interference Check – Method Blank

    a) Analysis of a blank matrix that has gone through all related steps, preparation and /or analysis, as applicable.

14. Acceptable PT Sample required for all new analytes where NELAP accreditation is being sought.

    a) At least one PT sample (preferably two) required for all new methods

    b) Where a PT sample is not available, or accreditation is not needed, accuracy can be measured through the use of a second source standard.

15. For California ELAP or NELAP, process a real world sample for MS and MSD. The sample does not have to contain any target analytes but recoveries for surrogates, internal standards and spikes must be within lab or method defined criteria.

    a) Use Tap Water for drinking water only methods, tap or other clean water source for ground, surface, etc. methods

    b) Local Soil sample for SW-846 methods (if applying for soil or soil/water)

16. Initial Demonstration of Capability (IDOC) per analyst

    a) 4 LCS for each matrix, spiked with all associated new analytes – most acceptance criteria are in the methods, if none, use an initial recovery range of 40-160% and an RPD of 30%.

    b) Non-Standard methods – Follow the procedure in the 2003 NELAC Standards, Chapter 5 appendix C.3.3 (b).

17. Certification / Approval from Regulatory Agency where available.

APPENDIX E – LIST OF ACCREDITED METHODS

E.1 California State Department of Health NELAP Certificate 03220CA

a) View at: http://www.calscience.com/PDF/NELAP1.pdf

California State Department of Health NELAP Fields of Accreditation

a) View at: http://www.calscience.com/PDF/NELAP2.pdf

E.2 New York State Department of Health NELAP Certificate 11896 and Fields of Accreditation

a) View at: http://www.calscience.com/PDF/New_York.pdf

E.3 United States Department of Defense ELAP Certificate L12-86-R1 and Fields of Accreditation

a) View at: http://www.calscience.com/PDF/DoD_ELAP.pdf

E.4 NELAP State Reciprocity Accreditations and other non-NELAP State Certifications/Permits

a) View at: http://www.calscience.com/QAQC/Certifications.aspx

APPENDIX F – LIST OF PHYSICAL LOCATIONS

F.1 Main Laboratory

- 7440 Lincoln Way, Garden Grove, CA 92841-1427
- 714-895-5494 Fax 714-894-7501

F.2 Satellite Laboratory 1

- 7445 Lampson Avenue, Garden Grove, CA 92841-2903
- Fax 714-898-2036

F.3 Satellite Laboratory 2

- 11380 Knott Street, Garden Grove, CA 92841-1400

F.4 Concord, CA Service Center

- 5063 Commercial Circle, Suite H, Concord, CA 94520-8577
- 925-689-9022 Fax 925-689-9023

F.5 Houston, TX Service Center

- 1300 Bay Area Boulevard, Suite B-122, Houston, TX 77058-2558
- 832-284-4566 Fax 832-284-4568

APPENDIX G – SPECIAL PROGRAM REQUIREMENTS

F.1 United States Department of Defense Environmental Laboratory Accreditation Program

1. Calscience participates and is accredited in the United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP).

2. The DoD ELAP will provide a means for laboratories to demonstrate conformance to the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM) as authorized by DoD Instruction 4715.15, Environmental Quality Systems, December 2006 and as required by the DoD Policy and Guidelines for Acquisitions Involving Environmental Sampling or Testing, December, 2007. The DoD QSM is based on the National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems standard (Chapter 5), which provides guidelines for implementing the international standard, ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.

3. The DoD ELAP will apply to environmental programs / projects at DoD operations, activities, and installations, including Government-owned, contractor-operated facilities and formerly used defense sites, where testing is being performed in support of environmental restoration programs. The program will apply to all laboratories, including permanent, temporary, or mobile facilities, that generate definitive data, regardless of their size, volume of business, or field of accreditation; the collection of screening data will be governed by project specific requirements.

4. The current DoD Quality Systems Manual for Environmental Laboratories is Version 4.2, dated October 25, 2010.

5. The Calscience Management will provide sufficient training, resources and other measures to ensure compliance with the DoD QSM as appropriate. (including but not limited to):

    a. Specific Standard Operating Procedures (SOPs) and / or Appendicles
    b. DoD compliant Laboratory Information Management System (LIMS) analytical test codes
    c. Specialized technician and chemist training
    d. Enhanced Quality Assurance (QA) oversight
    e. Project specific instruments
    f. Assigned Project Management personnel
    g. Quality Assurance Project Plans (QAPP)
    h. DoD analytical data reporting qualifiers
    i. Calibration and reference materials that meet DoD requirements.

APPENDIX H – LISTING OF MAJOR ANALYTICAL INSTRUMENTATION

Gas Chromatograph/Mass Spectrometers (GC/MS)

Designation	Manufacturer/Model No.	Acquired	Department
GC/MS-I	HP 6890/5973	1998	Summa Canister QC
GC/MS-J	HP 6890/5973	1998	Summa Canister QC
GC/MS-K	HP 6890/5973	1998	Air
GC/MS-L	HP 6890/5973	1998	Volatiles
GC/MS-M	HP 6890/5973	1999	Volatiles
GC/MS-O	HP 6890/5973	2000	Volatiles
GC/MS-P	HP 6890/5973	2000	Semivolatiles
GC/MS-Q	HP 6890/5973	2000	Volatiles
GC/MS-R	HP 6890/5973	2000	Volatiles
GC/MS-S	HP 6890/5973	2000	Volatiles
GC/MS-T	HP 6890/5973	2000	Volatiles
GC/MS-U	Agilent 6890/5973	2001	Volatiles
GC/MS-V	Agilent 6890/5973	2001	Air
GC/MS-W	Agilent 6890/5973	2001	Volatiles
GC/MS-X	Agilent 6890/5973	2002	Volatiles
GC/MS-Y	Agilent 6890/5973	2002	Semivolatiles
GC/MS-Z	Agilent 6890/5973	2002	Volatiles
GC/MS-AA	Agilent 6890/5973	2002	Air
GC/MS-BB	Agilent 6890/5973	2002	Volatiles
GC/MS-CC	Agilent 6890/5973	2002	Volatiles
GC/MS-DD	Agilent 6890/5973	2002	Air
GC/MS-EE	Agilent 6890/5973	2003	Volatiles
GC/MS-FF	Agilent 6890/5973	2003	Marine Lab
GC/MS-GG	Agilent 6890/5973	2003	Marine Lab (SPME)
GC/MS-HH	Agilent 6890/5973	2003	Air
GC/MS-II	Agilent 6890/5973	2005	Air
GC/MS-JJ	Agilent 6890/5973	2005	Volatiles
GC/MS-KK	Agilent 6890/5973	2005	Air
GC/MS-LL	Agilent 6890/5975	2007	Volatiles
GC/MS-MM	Agilent 6890/5975	2007	Semivolatiles
GC/MS-NN	Agilent 7890/5975	2007	Air
GC/MS-OO	Agilent 7890/5975	2007	Volatiles
GC/MS-PP	Agilent 7890/5975	2007	Volatiles
GC/MS-QQ	Agilent 7890/5975	2007	Volatiles
GC/MS-RR	Agilent 7890/5975	2007	Volatiles
GC/MS-SS	Agilent 7890/5975	2007	Semivolatiles
GC/MS-TT	Agilent 7890/5975	2007	Semivolatiles
GC/MS-UU	Agilent 7890/5975	2007	Volatiles
GC/MS-VV	Agilent 7890/5975	2007	Volatiles
GC/MS-WW	Agilent 7890/5975	2007	Volatiles
GC/MS-XX	Agilent 7890/5975	2008	Volatiles
GC/MS-YY	Agilent 7890/5975	2008	Air
GC/MS-ZZ	Agilent 7890/5975	2008	Air
GC/MS-AAA	Agilent 7890/5975	2008	Semivolatiles
GC/MS-BBB	Agilent 7890/5975	2009	Semivolatiles

GC/MS-CCC	Agilent 7890/5975	2009	Semivolatiles
GC/MS-DDD	Agilent 7890/5975	2010	Semivolatiles
GC/MS-EEE	Agilent 7890/5975	2010	Semivolatiles
GC/MS-FFF	Agilent 7890/5975	2010	Volatiles
GC/MS-GGG	Agilent 7890/5975	2010	Volatiles
GC/MS-HHH	Agilent 7890/5975	2011	Semivolatiles
GC/MS-III	Agilent 7890/5975	2011	Semivolatiles
GC/MS-JJJ	Agilent 7890/5975	2011	Semivolatiles
GC/MS-KKK	Agilent 7890/5975	2011	Air
GC/MS-LLL	Agilent 7890/5975	2012	Marine Lab
GC/MS-MMM	Agilent 7890/5975	2012	Air

Gas Chromatographs (GC)

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
GC-0	HP 5890 Series II	ECD-ECD	1990	Semivolatiles
GC-1	HP 5890	PID-PID-FID	1987	LUFT-GRO
GC-3	HP 5890	FID	1988	LUFT-DRO
GC-4	HP 5890	PID-PID-FID	1989	LUFT-GRO
GC-5	HP 5890	PID-PID-FID	1989	LUFT-GRO
GC-6	HP 5890 Series II	FID	1990	LUFT-DRO
GC-8	HP 5890 Series II	PID-PID-FID	1990	LUFT-GRO
GC-9	HP 5890 Series II	FID-FID	1991	Semivolatiles
GC-11	HP 5890 Series II	PID-PID-FID	1991	LUFT-GRO
GC-12	HP 5890 Series II	FID-TCD	1991	Semivolatiles
GC-13	HP 5890 Series II	FID-TCD	1990	Air
GC-14	HP 5890 Series II	FPD	1991	Air
GC-18	HP 5890 Series II	PID-PID-FID	1992	LUFT-GRO
GC-19	HP 5890A	FID	1988	Air
GC-21	HP 5890 Series II	PID-PID-FID	1994	LUFT-GRO
GC-22	HP 5890 Series II+	PID-PID-FID	1994	LUFT-GRO
GC-24	HP 5890 Series II+	PID-PID-FID	1994	LUFT-GRO
GC-25	HP 5890 Series II+	PID-PID-FID	1994	LUFT-GRO
GC-26	HP 6890	NPD-NPD	1995	Semivolatiles
GC-29	HP 5890 Series II	PID-PID-FID	2000	LUFT-GRO
GC-30	HP 5890 Series II	PID-PID-FID	2000	LUFT-GRO
GC-31	HP 6890	ECD-ECD	2000	Semivolatiles
GC-33	HP 5890	FID-FID	2000	Air
GC-34	HP 5890	FID-FID	2000	Air

GC-35	Agilent 6890N	NPD-NPD	2002	Semivolatiles
GC-36	Agilent 6890N	FID-TCD	2004	Air
GC-37	Agilent 6890N	ECD-ECD	2004	Marine Lab
GC-38	Agilent 5890N	FID	1995	Air
GC-39	Agilent 5890N	FID	1995	Air
GC-40	Agilent 7890N	ECD-ECD	2007	Semivolatiles
GC-41	Agilent 7890N	ECD-ECD	2007	Semivolatiles
GC-42	Agilent 6890N	PID-PID-FID	2007	LUFT-GRO
GC-43	Agilent 6890N	FID-FID	2007	LUFT-DRO
GC-44	Agilent 6890N	FID-FID	2007	Semivolatiles
GC-45	Agilent 7890A	FID-FID	2007	LUFT-DRO
GC-46	Agilent 7890A	FID-FID	2007	LUFT-DRO
GC-47	Agilent 7890A	FID-FID	2008	LUFT-DRO
GC-48	Agilent 7890A	FID-FID	2008	LUFT-DRO
GC-49	Agilent 7890A	FID-FID	2008	LUFT-DRO
GC-50	Agilent 7890A	FID-FID	2008	LUFT-DRO
GC-51	Agilent 7890A	ECD-ECD	2008	Semivolatiles
GC-52	Agilent 7890N	FID	2008	Air
GC-53	Agilent 6890N	FID	2000	Air
GC-54	Agilent 7890N	NPD	2008	Air
GC-55	Agilent 7890N	TCD	2008	Air
GC-56	Agilent 7890N	FID	2009	LUFT-GRO
GC-57	Agilent 7890N	FID	2009	LUFT-GRO
GC-58	Agilent 7890N	ECD-ECD	2009	Semivolatiles
GC-59	Agilent 7890N	FID	2009	Air
GC-60	Agilent 6890N	FID	1998	Air
GC-61	Agilent 6890N	FID	1998	Air
GC-63	Agilent 7890N	ECD/ECD	2012	Air Marine Lab
GC-64	Agilent 6890N	FID		Air
GC-65	Agilent 7890N	FID	2012	Air

Triple Quad GC/MS (GC/TQ)

Designation	Manufacturer/Model No.	Acquired	Department
GC/TQ-1	Agilent 7890/7000 QQQ	2011	Marine Lab
GC/TQ-2	Agilent 7890/7000 QQQ	2011	Marine Lab

Inductively Coupled Plasma Spectrophotometers (ICP)

Designation	Manufacturer/Model No.	Acquired	Department
ICP-6	PE Optima 5300 DV	2006	Metals
ICP-7	PE Optima 7300 DV	2008	Metals

Inductively Coupled Plasma/Mass Spectrometers (ICP/MS)

Designation	Manufacturer/Model No.	Acquired	Department
ICP/MS-3	PE ELAN DRC-e	2009	Metals
ICP/MS-4	PE ELAN DRC-e	2009	Metals
ICP/MS-5	PE NexIon 300D	2011	Metals

Flame Atomic Absorption Spectrometers (FAA)

Designation	Manufacturer/Model No.	Acquired	Department
FAA-3	PE PinAAcle 900F	2011	Metals

Mercury Analyzers

Designation	Manufacturer/Model No.	Acquired	Department
HG-4	PE FIMS-400	2005	Metals
HG-5	PE FIMS-400	2005	Metals
HG/AF-1	Teledyne / Hydra II	2011	Metals

High Performance Liquid Chromatographs (HPLC)

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
HPLC-5	Agilent 1100 HPLC	UV	2001	Semivolatiles
HPLC-6	Agilent 1100 HPLC	UV	2001	Semivolatiles
HPLC-7	Agilent 1100 HPLC	UV	2004	Semivolatiles
HPLC-8	Agilent 1100 HPLC	UV	2007	Marine Lab

Liquid Chromatography/Mass Spectrometry (LC/TQ)

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
LC/TQ-1	Varian 1200L Triple Quad	MS	2005	Inorganics

WET Chemistry Instrumentation

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
UV-2	HP 8453	Diode Array	1999	Inorganics
VIS-1	Milton Roy Spectronic 20	VIS	1992	Inorganics
TOC-2	OI Model 1010	IR	2000	Inorganics
TOC-3	OI Model 1020	IR	2003	Inorganics
TOC-4	OI Soil Module	IR	2003	Inorganics
TOC-5	OI Soil Module	IR	2007	Inorganics
IC-2	Dionex DX-100	Conductivity	1996	Inorganics (Anions)
IC-3	Dionex DX-500	Absorbance	2000	Inorganics (Cr(VI))
IC-5	Dionex DX-600	Absorbance	2001	Inorganics (Cr(VI))

IC-6	Dionex DX-320	Conductivity	2002	Inorganics (Perchlorate)
IC-7	Dionex ICS-1000	Conductivity	2003	Inorganics (Anions)
IC-8	Dionex ICS-2000	Conductivity	2004	Inorganics (Perchlorate)
IC-9	Dionex ICS-1000	Conductivity	2008	Inorganics (Anions)
IC-10	Dionex ICS-1000	Conductivity	2008	Inorganics (Anions)
IC-11	Dionex ICS-3000	Absorbance	2009	Inorganics (Cr(VI))
IC-12	Dionex ICS-3000	Absorbance	2009	Inorganics (Cr(VI))
FA1	OI 3360 Flow Analyzer	UV	2007	Inorganics
UV-2	HP 8453	Diode Array	1999	Inorganics
UV-3	Thermo	UV	2007	Inorganics
UV-4	Thermo	UV	2007	Inorganics
UV-5	Thermo	UV	2007	Inorganics
UV-7	Agilent 8453	Diode Array	2008	Inorganics

FTIR

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
IR-2	Perkin Elmer / Spectra Two	FTIR	2011	LUFT

Automated Extractors

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
ASE-1	Dionex ASE-200	None	1999	Extractions
ASE-2	Dionex ASE-200	None	1999	Extractions
ASE-3	Dionex ASE-300	None	2002	Extractions
ASE-4	Dionex ASE-300	None	2002	Extractions
ASE-5	Dionex ASE-200	None	2007	Extractions
ASE-6	Dionex ASE-200	None	2007	Extractions

Solid Phase Extraction

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
SPE-1	Horizon Tech./SPE-DEX 4790	None	2011	Extractions
SPE-2	Horizon Tech./SPE-DEX 4790	None	2011	Extractions
SPE-3	Horizon Tech./SPE-DEX 4790	None	2011	Extractions
SPE-4	Horizon Tech./SPE-DEX 4790	None	2011	Extractions
SPE-5	Horizon Tech./SPE-DEX 4790	None	2011	Extractions
SPE-6	Horizon Tech./SPE-DEX 4790	None	2011	Extractions
SPE-7	Horizon Tech./SPE-DEX 4790	None	2011	Extractions

SPE-8	Horizon Tech./SPE-DEX 4790	None	2011	Extractions

Particle Counter (Multi Wavelength)

Designation	Manufacturer/Model No.	Detector(s)	Acquired	Department
Part-1	Beckman Coulter / LS13-20	None	2011	Marine Lab

END OF DOCUMENT

APPENDIX B

EXAMPLE FIELD RECORD FORMS

DAILY FIELD RECORD

SGI environmental THE SOURCE GROUP, INC.

Project and Task Number:	Date:
Project Name:	Field Activity:
Location	Weather

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		½ Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD ***(Continued)***

SGI environmental THE SOURCE GROUP, INC.

Project and Task Number:	Date:

TIME	DESCRIPTION OF WORK PERFORMED

SGI environmental THE SOURCE GROUP, INC.

WATER LEVEL MONITORING FORM

Site: _____ Project Number: _____

Field Team: _____ Date: _____

Water-Level Measurements Method: _____

WELL NUMBER	PREVIOUS DEPTH TO WATER (Feet)	TIME OF MEASUREMENT	DEPTH TO WATER FROM MEASURING POINT	MEASURING POINT ELEVATION (Feet above NGVD 1929)	MEASURING POINT DESCRIPTION

SGI environmental THE SOURCE GROUP, INC.

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well I.D.: _____
Sample I.D.: _____ Duplicate I.D.: _____
Sample Depth: _____
Project and Task No.: _____
Project Name: _____
Date: _____
Sampled By: _____
Method of Purging: _____
Method of Sampling: _____

Initial Depth to Water: _____
Depth to Water after Sampling: _____
Total Depth to Well: _____
Well Diameter: _____
1 Casing/Borehole Volume: _____
(Circle one)
4 Casing/Borehole Volumes: _____
(Circle one)
Total Casing/Borehole Volume Removed: _____

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment)

pH CALIBRATION (Choose two)					Model or Unit No.:
Buffer Solution	pH 4.0	pH 7.0	pH 10.0		
Field Temperature					
Instrument Reading					

SPECIFIC ELECTRICAL CONDUCTANCE - CALIBRATION			Model or Unit No.:
KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

REDOC CALIBRATION		DISSOLVED OXYGEN CALIBRATION		Notes:
Standard Solution	468 V	Salinity %		
Field Temperature °C		Altitude		
Instrument Reading		Instrument Reading		
Model or Unit No.: Ag/AgCl Electrode (SSCE)		Model or Unit No.:		

SAMPLE CONTROL LOG

Project Name: _____

Project and Task No.: _____

Laboratory: _____

Page ___ of ___

Sample Date	Sampling Time	Sample Number (I.D.)	C.O.C. Number	Analyses Requested	Turnaround Time, Sample Location, Handling Notes, Chain-of-Custody Remarks, etc. (Duplicate, Blank info, etc.)	Date Sent to Lab	Date Results Due

DRUM INVENTORY

Project No.: _____

Site Location: _____

Drum Storage Location: _____

Page ___ of___

Drum Number	Contents (Volume)	Accumulation Date	Analyses Performed	Results	Haz (H) or Non-Haz (NH)	Labeled (Y or N)	Disposal Location	Disposal Date

FIELD NOTES - GROUNDWATER SAMPLING

Date: _____ Sample No.: _____

Time: _____

Project Name: _____ Project Number: _____

Sampler's Name: _____ Weather Conditions:: _____

Well Location: _____

Well Number: _____ Diameter: _____

Construction Material: _____ Total Depth: _____ Screened Interval: _____

Material Screened: _____ Water Depth: _____ Date: _____ Time: _____

Measurement Method: _____ Method of Obtaining Sample: ☐ Static ☐ Pumped

Volume to Purge: _____ Time Purged: _____ Pumping Rate: _____

Filed Parameters During Purging:

_____ Gallons SC-_____ pH-_____ Temp _____ Time _____

_____ Gallons SC-_____ pH-_____ Temp _____ Time _____

_____ Gallons SC-_____ pH-_____ Temp _____ Time _____

_____ Gallons SC-_____ pH-_____ Temp _____ Time _____

_____ Gallons SC-_____ pH-_____ Temp _____ Time _____

_____ Total Purged Depth From which Sample is Obtained: _____

Color: _____ Turbidity: _____ Odor: _____

pH: _____ Method: ☐ Meter ☐ Paper Temperature: _____ Method: ☐ Thermometer ☐ ThermoCouple

Conductivity: _____ Meter Type: _____ Conductivity Scale Used: _____

Corrected to Equivalent Value at 25 Deg. ^{o}C ☐ Yes ☐ No

ORP: _____ DO (mg/l): _____ Decontamination: _____

Vol.	Container	Filtered	Pres./Vol.	Analysis Requested
				Dissolved Metals
				Total Metals
				Alk/Ac/pH
				N/P
				Ions/TDS/TSS
				Ferrous Fe
				TOC
				TPH

Laboratory Name and Address: _____ Shipping Method: _____

Notes: _____

_____

FIELD EQUIPMENT QUALITY ASSURANCE CHECKLIST

pH Meter Buffer Check (At each Location): pH 4: _____ pH 7: _____ pH 10: _____

SP. Cond. Meter Standards Check (According to Instrument Manual): _____

ORP Probe: _____ DO: _____

SAMPLE LABELS

	DATE:	
	TIME:	
CLIENT/SITE NAME		
SAMPLE LOCATION	COMP	
SAMPLED BY	GRAB	

	DATE:	LAB USE ONLY
	TIME:	LOG DATE: _____
CLIENT/SITE NAME		☐ TR ☐ PC
SAMPLE LOCATION	COMP	☐ PD ☐ OG
SAMPLED BY	GRAB	☐ ST ☐ AN
		☐ RETURN TO SITE

CUSTODY SEAL

SECURITY SEAL DATE _____

DO NOT TAMPER INITIALS _____

SEND TO: _____

SGI environmental THE SOURCE GROUP, INC.

CHAIN-OF-CUSTODY RECORD

Project Name: _____ Samplers: _____ (Print)

Project Number: _____ _____ (Sign)

Recorder : _____ (Sign)

Sample Description Codes		Q.C. Codes	TAT Codes
A. 100 ml Glass	E. 250-ml Plastic	A. External Contamination Blank	1. Standard
B. Glass Liter	F. Other _____	B. Cross Contmination Blank	2. 48 Hour
C. Plastic 500-ml	_____	C. Field Blank	3. 24 Hour
D. Plastic Liter			4. Other _____

										Analysis Requested																Laboratory Use Only	
Date	Time	Sample Number	Sample Container (enter code)	Sample Description (enter code)	Number of Containers and Preservation: Not Preserved	HNO_3	HCl	H_2SO_4	Field Filtered (check)	VOCs	VOCs (low concentration)	SVOCs	Total TAL Metals	Dissolved TAL Metals	pH	Total Hardness	BOD_5, BOD_{20}, COD, TOC, TSS, TDS, TKN, Total-P (circle)	Alkalinity, Cond. NO_3-NO_2, SO_4, Cl, NH_3 PO_4, SI (circle)	Li, B, Be, Sr, F (circle)	Other	TAT Requested (enter code)	Maximum Holding Time for Method Requested	Sample Stopped at 4 °C (check)	No Headspace (check)	Notes	Sample Condition Upon Receipt	Notes

Notes/Miscellaneous:

Relinquished By: (Signature)	Received By: (Signature)	Date	Time
Relinquished By: (Signature)	Received By: (Signature)	Date	Time
Relinquished By: (Signature)	Received By: (Signature)	Date	Time

Method of Shipment	Description of Transport	Other Chains-of-Custody Transported with this Chain - (By Serial No.)	Dispatch By: (Signature)	Date	Time	Received By: (Signature)	Date	Time

Send Lab Results to (Name): Verbals Requested: ☐ Yes ☐ No

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GROUNDWATER SAMPLING

Field Data Sheet

Project: _____ Location: _____ Date: _____

Monitoring Well No._____ Sampling Zone No. _____ Start Time: _____ End Time: _____

Water Level in MP Casing: (start) _____ (end) _____ Technicians: _____

Sampler Probe Preparation - See Sampling Plan Collection Bottle Preparation - See Sampling Plan

Run No.	Surface Function Checks						Position Sampler	Sample Collection Checks									Comments
	Activate Shoe	Close Valve	Check Vacuum	Open Valve	Evacuate Container	Close Valve	Locate Port Release Arm Land Probe	Pressure In MP ( )	Activate Shoe	Pressure In Zone ( )	Open Valve	Final Zone Pressure ( )	Close Valve	Retract Shoe	Pressure In MP ( )	Volume Retrieved ( )	
																	Total Volume _____

Field Determinations (Appearance, pH, S.C., etc.)

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TEMPERATURE/Ph/CONDUCTIVITY
METER CALIBRATION AND MAINTENANCE LOG

Instrument Manufacturer: _____

Instrument Model: _____

Identification Number: _____

Date	Time	Initial	Standard Used/Esp. pH	Standard Used/Esp. Conduct.	Battery Check	Comments

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WATER LEVEL PROBE MAINTENANCE LOG

INSTRUMENT MODEL NUMBER: _____

INSTRUMENT SERIAL NUMBER: _____

Date/ Time	Initials	Battery Check	Sound Indicator Check	Light Indicator Check	Case	6-Foot Ruler	Comments

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MONITORING WELLS FIELD RECORD

Date: _____ Well Number: _____

Purge Volume: _____ Depth of Well: _____

Screen Depth: _____ Depth to Water: _____

Time	DO (mg/L0	Turbitity (ntu)	Eh (ORP) (Mv)	Conductivity (us/cm)	pH (units)	Temp (C)	Flow Rate (mL/min)	Water Level (ft)
(5 mins)	+-0.2	<50	-10	-+25	+-0.1	+-0.5C	100-250	<0.3

Samples Containers: VOC: 3 x 40 mL pre-preserved HCI

Comments:

Pump Deconed: Pump Broken Down (daily):