



Project No. S9850-03-21
September 30, 2016

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Subject: SAMPLING AND ANALYSIS PLAN
AIR MONITORING AT VARIOUS METAL SHREDDING
FACILITIES STATEWIDE:
SIMS METAL MANAGEMENT
699 SEAPORT BLVD, REDWOOD CITY CA, 94063-2712
SA RECYCLING - BAKERSFIELD
2000 E. BRUNDAGE LANE, BAKERSFIELD, CA 93307-2734
SA RECYCLING – TERMINAL ISLAND
901 NEW DOCK STREET, TERMINAL ISLAND, CA 90731

Dear Mr. Benelli:

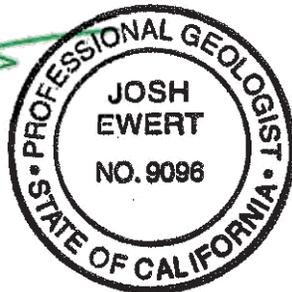
In accordance with the above-referenced contract, Geocon has prepared this Sampling and Analysis Plan (SAP) for air monitoring at the above-referenced metal shredding facilities. The California Department of Toxic Substances Control (DTSC) requested the preparation of this SAP as part of their investigation into the off-site migration of airborne particulates, toxic organic compounds, and asbestos from metal shredding facilities. The SAP summarizes the methodologies and rationale for proposed investigative activities and provides guidance for field activities, sample collection, laboratory analysis, data quality assurance and control, data management/review/analysis, and reporting to ensure that the results of the assessment satisfy predefined project objectives and performance criteria. The DTSC intends to use the results of the air monitoring to assess the potential impacts from air emissions from metal shredding and metal shredding waste management operations.

We appreciate the opportunity to work with the DTSC on this project. Please let us know if you have questions concerning the SAP or we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

Josh Ewert, PG
Project Geologist



Jim Brake, PG
Senior Geologist/Vice President



IDENTIFICATION FORM

Document Title: Sampling and Analysis Plan
Air Monitoring at Various Metal Shredding Facilities Statewide

Site Locations: Sims Metal Management
699 Seaport Blvd, Redwood City CA, 94063-2712
SA Recycling - Bakersfield
2000 E. Brundage Lane, Bakersfield, CA 93307-2734
SA Recycling – Terminal Island
901 New Dock Street, Terminal Island, CA 90731

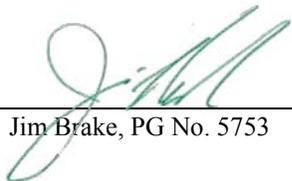
Contract No.: 15-T4124

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This document has been prepared for the California Environmental Protection Agency (CalEPA), DTSC. The material herein is not to be disclosed to, discussed with, or made available to any person(s) for any reason without prior express approval of the appropriate responsible DTSC officer.

APPROVAL FORM

Document Title: Sampling and Analysis Plan
Various Metal Shredding Facilities Statewide

Site Locations: Sims Metal Management
699 Seaport Blvd, Redwood City CA, 94063-2712
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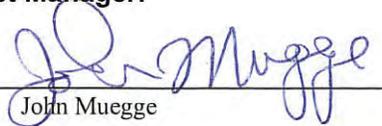
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California Environmental Protection Agency

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Hazardous Waste Management Program

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California Environmental Protection Agency

Department of Toxic Substances Control

Hazardous Waste Management Program

Josh Ewert, PG and Jim Brake, PG (project file)

Geocon Consultants, Inc.

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- B. EMSL Quality Assurance Management Plan and Example Chain-of-Custody Form
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- F. Copy of Tisch Environmental's *TE-Wilbur Operations Manual Rev 002.2, 01/07/2016*
- G. Copy of Tisch Environmental's *TE-1000 PUF Poly-Urethane Foam High Volume Air Sampler Operations Manual*
- H. Health and Safety Plan

ABBREVIATIONS AND ACRONYMS	
aka	Also known as
AHERA	Asbestos Hazard Emergency Response Act
AQMD	Air Quality Management District
ARB	Air Resources Board
CCV	Continuing calibration verification
CFR	Code of Federal Regulations
CLN	CHESTER LabNet
COC	Chain-of-custody
COPC	Chemical of potential concern
DQI	Data quality indicators
DQO	Data quality objectives
DTSC	Department of Toxic Substances Control
EAT	Eurofins Air Toxics
ECS	Eurofins Calscience
EMSL	EMSL Analytical, Inc.
HSP	Health and safety plan
ICAL	Initial calibration
L/min	Liters per minute
LCS/LCSD	Laboratory control sample/laboratory control sample duplicate
MCE	Mixed cellulose ester
MDL	Method detection limit
MS/MSD	Matrix spike/matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
ORELAP	Oregon Environmental Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PARCCS	Precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	Polychlorinated biphenyls
pdf	Portable document format
PM10	Particulate matter less than 10 μm
PM2.5	Particulate matter less than 2.5 μm
PPE	Personal protective equipment
PTFE	Polytetrafluoroethylene
PUF	Polyurethane foam
QAMP	Quality Assurance Management Plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference

ABBREVIATIONS AND ACRONYMS	
RSD	Relative standard deviation
SAP	Sampling and Analysis Plan
SARB	SA Recycling Bakersfield
SARTI	SA Recycling Terminal Island
SB	Senate Bill
SD	Standard deviation
SMM	Sims Metal Management
SOP	Standard operating procedures
TEM	Transmission electron microscopy
Tisch	Tisch Environmental
TOS	Toxic organic species
TSP	Total suspended particulates
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compounds
XRF	X-ray fluorescence
°C	Degrees Celsius

**SAMPLING AND ANALYSIS PLAN
AIR MONITORING AT VARIOUS METAL SHREDDING FACILITIES STATEWIDE
CONTRACT NO. 15-T4124**

1.0 INTRODUCTION

Geocon Consultants, Inc. prepared this Sampling and Analysis Plan (SAP) in compliance with California Department of Toxic Substances Control (DTSC) Contract Number 15-T4124, Start Work Order #1. This SAP summarizes air monitoring to be performed at the following facilities that generate metal shredding waste (collectively referred to as the Sites):

- Sims Metal Management (SMM) at 699 Seaport Blvd, Redwood City CA, 94063-2712,
- SA Recycling – Bakersfield (SARB) at 2000 E. Brundage Lane, Bakersfield, CA 93307-2734, and
- SA Recycling – Terminal Island (SARTI) at 901 New Dock Street, Terminal Island, CA 90731.

1.1 Background

Metal shredding facilities process end-of-life vehicles, appliances, and other forms of scrap metal to recover iron, steel, aluminum, and copper for re-use in new metal products. The metal shredding process generates large amounts of metal shredder waste, which consists of plastics, rubber, glass, foam, fabrics, automobile fluids, dirt, and residual metals. The metal shredding process can also potentially create significant amounts of environmental contamination in the forms of storm water runoff, contaminated soil, contaminated groundwater, and fugitive air emissions. The focus of the scope of services described in this SAP is on fugitive air emissions from facilities generating and/or receiving metal shredding waste.

Although metal shredding waste typically does not exceed the federal regulatory levels established by the Resource Conservation and Recovery Act (RCRA), metal shredder waste has been regulated as a California-only, non-RCRA hazardous waste since 1984 because residual levels of copper, lead, and zinc often exceed California's more stringent regulatory thresholds. Six large metal shredding facilities are currently authorized by DTSC to conduct metal shredding operations. Five of the facilities treat the metal shredding waste with a cement product which is intended to reduce the solubility of the metals and render the waste less hazardous. The sixth facility transfers their waste out of state for further processing. The treated waste is then disposed of in Class II or Class III landfills, where it is largely used as alternative daily cover.

Senate Bill (SB) 1249 (Hill, Chapter 756, Statutes of 2014) became law on January 1, 2015 and requires the DTSC to evaluate the risks and threats posed by the production and management of metal shredding waste. SB 1249 authorizes the DTSC to develop alternative management standards for metal shredding facilities. The DTSC has developed a 3-year plan to conduct the evaluation required by SB 1249, which includes an assessment of the potential impacts of off-site migration of air emissions.

1.2 Responsible Agency

DTSC is the lead regulatory agency overseeing this air monitoring program. DTSC regulates hazardous waste, and oversees clean-up of hazardous wastes on contaminated properties in California, primarily under the authority of the federal RCRA of 1976 and the California Health and Safety Code.

Geocon prepared and will implement the SAP for the DTSC. Geocon is a consulting firm that specializes in environmental and geotechnical engineering and materials testing services. Summary information about Geocon is available at <http://www.geoconinc.com>.

1.3 Project Contact Information

The title/responsibility, name, phone numbers, and email address of personnel associated with the air quality monitoring events are summarized in the following table:

Agency/Company	Name	Title/Responsibility	Phone Number	Email Address
DTSC	Ed Benelli	Project Manager	916.324.6564	Edward.Benelli@dtsc.ca.gov
Geocon	Jim Brake	Program/Quality Assurance Manager	916.852.9118	brake@geoconinc.com
Geocon	Josh Ewert	Project/Technical Manager	916.852.9118	ewert@geoconinc.com
CHESTER LabNet	Sheri Meldstab	Inorganic Lab Manager and QA/QC Coordinator	503.624.2183	sheldstab@chesterlab.net
EMSL	Michael Chapman	Industrial Hygiene Client Services Manager	800.755.1794	mchapman@EMSL.com
Eurofins Calscience	Alan Kemp	Northern California Operations Manager	925.786.8606	alankemp@eurofinsUS.com
Eurofins Air Toxics	Kelly Buettner	Air Toxics Project Manager	916.605.3378	kellybuettner@eurofinUS.com

2.0 SITE DESCRIPTIONS

Geocon staff will conduct air monitoring at the three Sites that represent examples of larger (SARTI, SMM) and smaller (SARB) operations. Each Site is in a different geographical region of the state (Figure 1) and operates under a different local Air Quality Management District (AQMD). Additional information about the Sites to be monitored is in the following sub-sections:

2.1 Description of Facilities

2.1.1 SMM

Site Name:	Sims Metal Management
Site Address:	699 Seaport Blvd, Redwood City, CA, 94063-2712 (Figures 2 and 3)
County:	San Mateo
Site Operator:	Sims Metal Management, Limited
Local AQMD:	Bay Area Air Quality Management District
Local AQMD Contact:	Eric Stevenson (415) 749-4695

SMM is located in the Port of Redwood City, on the eastern shore of Redwood Creek and approximately 1.1 miles southwest of San Francisco Bay. According to SMM's webpage, the recycling center "processes ferrous scrap metal and specializes in bus, railcars and aluminum trailer scrap recycling. The yard is equipped with a metal shredder and can process materials via ship, rail and truck" (SMM website, 2016).

Monthly average temperatures range from the high-30s degrees Fahrenheit (°F) in December to the low-80s °F in July. Annual average precipitation for Redwood City is 19.16 inches per year, with the lowest precipitation occurring between July and August (WRCC, 2016). Wind direction data is obtained from the San Carlos Airport, located approximately 2.3 miles west of SMM (<http://mesonet.agron.iastate.edu> , 2016). The average wind speed ranges from 4.6 miles per hour (mph) in January to 19.4 mph in May. Higher wind speeds typically occur from April to September. The most common wind directions throughout the year are from the north-northwest and northwest (Figure 4). During the month of October (the anticipated sampling month), the average wind speed is 5.8 mph with a predominant wind direction of northwest.

2.1.2 SARB

Site Name:	SA Recycling – Bakersfield
Site Address:	2000 E. Brundage Lane, Bakersfield, CA 93307-2734 (Figures 5 and 6)
County:	Kern
Site Operator:	SA Recycling, LLC
Local AQMD:	San Joaquin Valley Air Pollution Control District
Local AQMD Contact:	David Garner (559) 230-5938

SARB is located approximately 3 miles southeast of downtown Bakersfield, on the north side of Brundage Lane. According to SARB’s webpage, the recycling center services the entire San Joaquin Valley and accepts all scrap metal including steel, aluminum, copper, tin, appliance, junk cars, cans, and many other types of scrap metal (SARB website, 2016).

Monthly average temperatures range from the mid-30s °F in December to the low-100s °F in July. Annual average precipitation for the Bakersfield is 5.83 inches per year, with the lowest precipitation occurring from July through September (WRCC, 2016). Wind direction data is obtained from the Meadows Field Airport, located approximately 7.1 miles northwest of SARB (<http://mesonet.agron.iastate.edu> , 2016). The average wind speed ranges from 4.8 mph in January to 7.5 mph in June. Higher wind speeds typically occur from April to August. The most common wind direction throughout the year is northwest (Figure 7). During the month of October, the average wind speed is 4.8 mph with predominant wind directions of west-northwest, east, and east southeast.

2.1.3 SARTI

Site Name:	SA Recycling – Terminal Island
Site Address:	901 New Dock Street, Terminal Island, CA 90731 (Figures 8 and 9)
County:	Los Angeles
Site Operator:	SA Recycling LLC
Local AQMD:	South Coast Air Quality Management District
Local AQMD Contact:	Mohan Balagopalan (909) 396-2704

SARTI is in the Port of Long Beach, on the southern shore of Cerritos Channel and East Basin Channel on Terminal Island. According to SARTI's webpage, this Site is not open to the public (SARTI website, 2016).

Climate data for San Pedro, which is immediately west of Terminal Island, was used to represent conditions at Terminal Island. The monthly average temperatures range from the high-40s °F in January to the mid-70s °F in September. Annual average precipitation for the San Pedro is 10.69 inches per year, with the lowest precipitation occurring from June through August (WRCC, 2016). Wind direction data is obtained from the Long Beach Airport, located approximately 7.1 miles northeast of SARTI (<http://mesonet.agron.iastate.edu> , 2016). The average wind speed ranges from 4.3 mph in December to 6.4 mph in April. Higher wind speeds typically occur from March through July. The most common wind directions throughout the year are from the west-northwest and south (Figure 9). During the month of October, the average wind speed is 4.9 mph with a predominant wind directions of west-northwest and south.

3.0 PROJECT AND DATA QUALITY OBJECTIVES

This section describes the data quality objectives (DQO) for the air monitoring program. Laboratory sample handling and analysis methods and procedures are provided in the Quality Assurance Management Plans (QAMP) provided by CHESTER LabNet (CLN), EMSL Analytical, Inc. (EMSL), Eurofins Calscience (ECS), and Eurofins Air Toxics (EAT) and will be followed for all analytical testing. CLN is an Oregon Environmental Laboratory Accreditation Program (ORELAP) and National Environmental Laboratory Accreditation Program (NELAP) -certified laboratory in Tigard, Oregon, accredited for PM₁₀ and PM_{2.5} analyses. CLN's ORELAP certificate number is OR100051-008, which expires on June 22, 2017. EMSL is a National Voluntary Laboratory Accreditation Program (NVLAP) and NELAP-certified laboratory in Cinnaminson, New Jersey, accredited for asbestos and volatile organic compounds (VOCs). EMSL's NVLAP certificate number is 101048-0, which expires on June 30, 2017. EMSL's NELAP certificate number is 10872, which expires on April 1, 2017. ECS is a California ELAP and NELAP-certified laboratory in Garden Grove, California, accredited for polychlorinated biphenyls (PCB) analyses. ECS's ELAP certificate number is CA300001-010, which expires on January 29, 2017. EAT is a California ELAP and NELAP-certified laboratory in Folsom, California, accredited for formaldehyde analyses. EAT's ELAP certificate number is CA300005-007, which expires on October 17, 2016. EAT has stated that they will obtain a new ELAP certificate prior to their current certification's expiration.

3.1 Project Task and Problem Definition

The project task is to assess the concentrations of the following constituents of potential concern (COPCs) from the perimeters of a cross-section of metal shredding facilities in a variety of geographic conditions across the state of California:

- particulate matter (PM) in the form of total suspended particulates (TSP);
- PM less than 10 micrograms (μm) (PM₁₀);
- PM less than 2.5 μm (PM_{2.5});
- metals including aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc, (metals will be run for each TSP, PM₁₀, and PM_{2.5} sample);
- asbestos;
- PCBs;
- formaldehyde; and
- toxic organic species (TOS) including benzene, chloromethane, 1,1-dichloroethene, ethylbenzene, 4-ethyltoluene, dichlorodifluoromethane [also known as (aka) Freon 12], trichlorofluoromethane (aka Freon 11), 1,2,4-trimethylbenzene, toluene, 1,3,5-trimethylbenzene, xylenes, and vinyl chloride.

The DTSC intends to use the data generated from air monitoring to determine the potential for emissions from facilities generating and/or receiving metals shredding waste and evaluate the risk to sensitive populations using the criteria developed for the California Air Resources Board (ARB) Air Toxic Hot Spots Program Air Toxics “Hot Spot” Program [the Air Toxics Hot Spots Information and Assessment Act, Assembly Bill 288 (Connelly) as amended by SB 1731 (Calderon)].

3.2 Data Quality Objectives

DQOs for air monitoring, summarized in Table 1, represent the general and technical quality criteria that the analytical data should achieve to meet the objective of air monitoring. Rationale for proposed sampling locations and analytical suites are provided in Section 4 – Sampling Design and Rationale.

Physical and temporal study boundaries of the DQOs are based on the following assumptions:

- Air samples will be collected from four locations at each Site with approximately one upwind, one downwind, and two cross-wind samples. The samples will be representative of 24-hour duration and will be performed over three consecutive days at each Site.
- Additional spatial considerations will be in accordance with the sampling placement requirements listed in *40 CFR Appendix E to Part 58 - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring* and comments provided by the Bay Area Air Quality Management District. As such, requirements for sampler spacing are relative to the sampling unit inlet (edge) and must conform to the following criteria:

Parameter	Flow Rate	Inlet Above Ground Level Height Requirement	Horizontal Collocation Requirement	Vertical Collocation Requirement
TSP Metals	High-volume ^c (~ 1,100 L/min)	2-7 m	2-4 m	≤ 3 m
PM ₁₀ Metals	Low-volume (~16.7 L/min)	2-7 m	1-4 m	≤ 3 m
PM _{2.5} Metals	Low-volume (~16.7 L/min)	2-7 m	1-4 m	≤ 3 m
Asbestos	Low-volume (~2 L/min)	2-7 m	1-4 m	≤ 3 m
PCBs	High-volume (~ 226 L/min)	2-7 m	2-4 m	≤ 3 m
Formaldehyde	Low-volume (~ 1 L/min)	2-7 m	0-4 m	≤ 3 m
TOS	Low-volume (~ 0.004 L/min)	2-7 m	0-4 m	≤ 3 m

- As an example, per the table above, an inlet to a PM_{2.5} sampler must be no less than 2 m and no more than 7 m above the ground and it may be no closer than 2 m to any high-volume sampler. Moreover, the inlets of collocated samplers may be no less than 1 m and no more than 4 m in the horizontal direction, and no more than 3 m apart vertically.
- Additionally, inlets will be greater than 2 m away from supporting structures (like walls, parapets, or penthouses, greater than 10 m from trees, and between 2 and 10 m from roadways.
- Inlets will have unrestricted airflow and be located away from obstacles so that the distance from the obstacle to the inlet is at least twice the height that the obstacle protrudes above the inlet. For instance, if a corrugated steel perimeter fence is 4 m above the inlet of a PM₁₀ metals sampling unit, the inlet must be minimally 8 m from the fence. If obstacles are sufficiently large that identifying sample locations at least twice the height difference from the obstacle is impractical, then the inlet may be elevated above the maximum height requirement of 7 m.

Note: there is no minimum collocation distance for TOS as gases are much more heterogeneous in the ambient air than PM, and are not likely to influence one another, particularly at the low flow rates utilized.

Traditional ambient air quality studies have longer durations and include collecting samples in all types of weather. However, because of the timeframe of this project is very short, meteorological conditions like rain and gusty winds during our sampling events would have a greater impact on the overall representativeness of the data. Therefore, modifications to the proposed sampling schedule may be necessary to avoid inclement weather. The Project Manager will review forecasted meteorological conditions prior to and throughout the sampling events at each facility. If inclement weather is expected, the Project Manager will contact the DTSC and discuss the potential need to postpone sampling. Written approval for postponing the sampling due to inclement weather will be obtained from the DTSC prior to implementing the change in schedule.

Control of decision errors will be tracked using quality control (QC) samples collected during each monitoring round. Field-based QC parameters used for this study and associated frequency criteria are derived from USEPA guidance (USEPA, 2004) and are as follows:

- Collocated samples: analysis of collocated samples (sometimes referred to as duplicate samples for air sampling) is used to check for sampling and analysis error, reproducibility, and homogeneity. Collocated samples will be obtained from two identically configured samplers operating simultaneously in one sample location. One collocated sample per 10 primary samples for TSP, PM₁₀, PM_{2.5}, asbestos, PCBs, formaldehyde, and TOS will be collocated samples, as shown in Table 3.
- Filter blanks: analysis of filter blanks (sometimes referred to as trip blanks for air sampling) is used to assess the contamination of samples from the native presence of target analytes in the filters used for air sample collection. A filter blank consists of a clean filter that is transported with associated primary samples, but is never taken out of its protective sleeve. One filter

blank per facility will be collected and analyzed for TSP, PM₁₀, PM_{2.5}, asbestos, PCBs, and formaldehyde, as shown in Table 3.

- Field blanks: analysis of field blanks is used to assess the possible contamination of samples before, during, and after sample collection. A field blank consists of a clean filter that is placed onto the air sampler and then taken off without running the sampler. One field blank sample per 10 primary samples for TSP, PM₁₀, and PM_{2.5} will be collocated samples, as shown in Table 3.

Laboratory-based QC parameters to be used for this study are described in the selected laboratories' standard operating procedures (SOPs) and/or QAMPs (Appendices A through D) as follows:

- CLN
 - CLN QA/QC measures for gravimetric analysis include:
 - Reweighing 10% of the filters a minimum of 20 hours following the initial weighing. For tare weighing, the second weights must be within ± 0.01 mg for Teflon filters and ± 0.04 mg for quartz filters, of their initial weights. For 47 mm Teflon filters, the second gross weights must be within ± 10 ug or within $\pm 2\%$ of the net weight, whichever is greater.
 - Daily calibration of balance using National Institute of Standards and Technology (NIST) calibration verification weight. Control limits are ± 0.1 mg from the NIST certified mass weight.
 - Annual balance certification by a third party company.
 - Continuous monitoring of temperature and humidity readings of the weigh room.

If control limits are exceeded, the CLN Project Manager will notify Geocon that constant weight cannot be achieved using normal equilibrium methods. Corrective action can include scheduling a maintenance visit by the balance service technician.

- CLN QA/QC measures for the x-ray fluorescence (XRF) analysis include:
 - Performance of a quality assurance standard with control limits of 90-110%;
 - Performance of a laboratory replicate with control limits where the average analyte score for the sample must exceed 1.5. Calculations for the scoring of the replicate samples are provided in CLN's SOPs in Appendix A.;
 - Weekly NIST accuracy check using a thin film standard prepared and certified by NIST.

Corrective actions could include re-analysis of the samples, and recalibration of equipment

- CLN QA/QC measures for the metals analysis include:
 - Performance of triplicate readings for all standards and samples with control limits of $\pm 20\%$;
 - Performance of a calibration correlation coefficient once per run with control limits of greater than 0.995;

- Performance of an initial calibration verification standard once per run with control limits of 90-110%;
- Performance of an initial calibration blank once per run with control limits of no analyte result above detection limits;
- Performance of low-level calibration recovery ICP Standard, once per run with control limits of 70-130%;
- Performance of a preparation blank once per run with control limits where the analyte result is less than the method blank results, within \pm the detection limit for the method blank result, or less than the method blank result;
- Performance of a method blank once per run where analytes should be less than the lowest sample results, within either \pm 20% relative standard deviation (RSD) of the lowest sample result, or \pm detection limit of the lowest sample result;
- Performance of a laboratory control sample once per digestion batch of 20 samples with control limits of 80-120%;
- Performance of a continuing calibration verification standard (CCV) after every 10 analyses and at the end of the run with control limits of 90-110%;
- Performance of continuing calibration blank immediately after every CCV with control limits where no analytes are above the detection limit;
- Performance of supuplicate samples once per every 20 digestion samples with control limits of \pm 20%;
- Performance of a laboratory replicate once per every 20 digestion samples, with control limits of \pm 20% RPD;
- Performance of a matrix (pre-digestion) spike, once per every 20 digestion samples, with control limits of 75-125%;
- Performance of an analytical (post-digestion) spike, once per every 20 digestion samples, with control limits of 75-120%;

Corrective actions can include termination of analysis, recalibration of equipment using the same standards, review instrument operating parameters, recalibration using freshly prepared standards, and re-analysis of affecting samples.

- EMSL

- EMSL QA/QC measures for asbestos analysis include:
 - Performance of laboratory blank samples once per 10 samples with control limits where cumulative average is less than 5 structures per square millimeter (s/mm^2);
- EMSL QA/QC measures for TO-15 analysis include:
 - Performance of an initial calibration standard daily and following each corrective action with control limits of 30%RSD;
 - Performance of an initial calibration verification standard immediately following the initial calibration with control limits where a minimum of 90% of the target compounds have to be within the control limits;

- Performance of a CCV standard daily with control limits of 70-130%;
- Performance of a method blank after every initial calibration verification and CCV where the method blank should not contain any target analytes at concentrations at or above the 0.5 parts per billion reporting limit;
- Performance of reporting limit laboratory control sample once per run with control limits of 60-140%;
- Performance of an end calibration verification standard at the end of each run with control limits of 70-130%;

Corrective actions can include termination of analysis, cleaning of any contamination in the equipment, recalibration of equipment, review instrument operating parameters, re-analysis of affected samples, and flagging associated data.

- ECS

- ECS QA/QC measures for PCB analysis include:

- Performance of a degradation test prior to running the calibration standards and every 12 hours thereafter during analysis, where the degradation of 4,4'-DDT and endrin shall be less than 15%;
- Performance of an initial calibration where the RSD for each analyte is less than 20%;
- Performance of an initial calibration verification where the difference from the initial calibration is less than 20%;
- Performance of a CCV once per every 20 samples where the difference from the initial calibration is less than 20%;
- Establishment of a retention time window with a control limit of ± 3 seconds or ± 0.030 minute, whichever is greater;
- Performance of method blank samples once per every 20 samples with a control limit where the analyte result is less than the respective reporting limits;
- Performance of laboratory control samples and laboratory control sample duplicates once per every 20 samples with a control limit of 50 and 135% and a relative percent difference is less than 25%;
- Performance of a matrix spike and matrix spike duplicate samples, once per every 20 samples, with control limits of 50-135%;

Corrective actions can include termination of analysis, recalibration of equipment using the same standards, review instrument operating parameters, recalibration using freshly prepared standards, and re-analysis of affected samples.

- EAT

- EAT QA/QC measures for formaldehyde analysis include:

- Performance of a five-point initial calibration (ICAL) curve, analyzed in triplicate prior to sample analysis, where the RSD for each analyte is less than 10%;

- Performance of an initial calibration verification, following each ICAL where the difference from the initial calibration from 85 to 115%;
- Performance of a CCV once per every 10 samples and at the end of each batch, where the control limits are within $\pm 10\%$ of the expected value;
- Performance of an instrument (solvent) blank analysis, following the analysis of the standards, with control limits where no analytes are above the reporting limit;

Performance of laboratory control samples and laboratory control sample duplicates once per run, with a control limit where the RPD is less than 25%. Corrective actions can include recalibrating equipment, re-analysis of standards, re-inspection of the system and re-analysis of samples, and notate the problem in the case narrative.

3.3 Data Quality Indicators

Data quality indicators (DQI) are criteria established to assess the quality and therefore the usability of data. These are based on both field and laboratory protocols that examine whether the DQIs (i.e., precision, accuracy, representativeness, completeness, comparability, and sensitivity [PARCCS]) meet criteria established for various aspects of data gathering, sampling, or analysis activity. Quantitative DQIs include precision, accuracy, completeness, and sensitivity (Table 2). Qualitative DQIs include representativeness and comparability. Sections 3.3.1 through 3.3.6 summarize information regarding the DQIs associated with the air monitoring program. Sample analytical results and laboratory QC data from air monitoring will be assessed for compliance with the DQIs.

3.3.1 Precision

Precision is the degree of mutual agreement between or among independent measures of a similar property (usually reported as a standard deviation [SD] or RPD) and relates to the analysis of duplicate laboratory or field samples. Laboratory analysis precision is usually assessed using laboratory duplicates. Precision related to sample collection in the field is typically assessed by collection and analysis of field duplicate samples.

The precision of laboratory analysis will be assessed by comparing the analytical results with MS/MSD results and/or laboratory duplicate results. For laboratory precision, performance goals will be:

- RPD between duplicate blank spikes less than or equal to 20%.
- RPD between laboratory duplicate samples less than or equal to 30% for analyte concentrations greater than or equal to five times the method detection limit (MDL), and the absolute concentration difference less than or equal to the MDL for analyte concentrations less than five times the MDL.
- RPD between MSDs less than or equal to 40%.

If these criteria are exceeded, the laboratory will investigate why and will include a discussion of the impact on data usability in the case narrative. If the cause of the exceedance is determined to be laboratory error, the laboratory will reanalyze the sample, as appropriate.

Precision related to sample collection in the field will be monitored as the difference between field duplicates. The RPD between field duplicates for samples with analyte concentrations greater than the MDL should be less than or equal to 40 percent. The absolute concentration difference between duplicate samples with concentrations less than five times the MDL will be less than or equal to the corresponding MDL.

3.3.2 Accuracy

Accuracy is the degree of agreement with a measurement of a known or true value and is generally determined by QC indicators such as MS, surrogate spikes, LCS and performance samples. The accuracy of laboratory results will be assessed using method blank, reagent and preparation blank, and/or MS/MSD results.

3.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in parameters at a sampling point, or an environmental condition that they are intended to represent. Representativeness of data will be ensured through the consistent application of established field and laboratory procedures. To aid in the evaluation of the representativeness of the sample, field duplicate and laboratory blank samples will be evaluated for the presence of contaminants. Data determined by comparison with the existing data to be non-representative will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

3.3.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. The completeness objective for field and laboratory data is 90%. Field measurements are expected to provide 90% or more data that meet the QC acceptance criteria and the laboratories will provide 95% or more data that meet the QC acceptance criteria. If 95% of the laboratory data meet these criteria, the data sets are considered complete.

If completeness is less than 90%, an evaluation of potential causes of data failure will occur. These causes may include field issues (e.g., inadequate sample recovery due to electrical power problems, etc.), sample handling issues (broken or compromised sample containers, inadequately preserved samples, etc.), or laboratory issues (equipment failure, matrix interference, etc.). Geocon staff will determine whether the degree of data failure significantly compromises the DQOs for the project. Factors influencing this decision may include the number of samples, the size of the Sites,

the sampling objective, and the nature of potential contamination. If it is determined that corrective action is necessary, the laboratory may be requested to reanalyze samples and report both results. Re-collection of samples may also be appropriate in some cases.

3.3.5 Comparability

Comparability determines whether analytical conditions are sufficiently uniform for each analytical run to ensure that all reported data will be consistent. Comparability is ensured by using similar analytical methods from one Site to the next. Comparability will be maintained by adhering to consistent field sample collection and handling methods between sampling locations and using consistent laboratory procedures.

3.4 Data Review and Validation

Field and laboratory data will be reviewed to ensure that the type, quantity and quality of data used in decision-making are appropriate for intended applications. The Project/Technical Manager will be responsible for review of field data and final laboratory reports. Analytical laboratory department managers will be responsible for review of analytical activities and data.

Field data verification by the Project/Technical Manager may be based on, but not limited to, communication with field personnel and review of personnel timesheets, field notes, sample chain-of-custody (COC) forms, and other documentation associated with field activities. The field personnel will be responsible for implementing the sampling and documentation procedures summarized herein and for appropriately communicating information obtained in the field to the Project/Technical Manager. If possible, any inconsistencies with this SAP will be resolved immediately by the Project/Technical Manager based on consultation with field personnel.

Our Project/Technical Manager will be responsible for review, evaluation, and use of field and laboratory data with respect to qualitative and quantitative DQIs. Suspect data or data failing to meet acceptance criteria will be “flagged” with a qualifier identifying the associated problem. Based on their data review and evaluation results, the Project/Technical Manager will make judgments whether rejection of data, re-analysis of some samples, re-sampling, or other actions are appropriate to support project DQOs.

Our Project/Technical Manager will be responsible for review and approval of draft and final versions of investigative reports prepared by project staff. He will be responsible for ensuring that data presented in draft/final reports (e.g., in tables, on figures, and summarized in text) are compatible with accumulated field and laboratory data based on review of field documentation and laboratory reports. The Project/Technical Manager will be responsible for ensuring that the project findings reported are technically accurate.

Laboratory analysts will be responsible for preparation of data packages in accordance with laboratory SOPs that require the analyst to submit a data package to a department supervisor for review and verification of the analysis. A data package will be approved by a department supervisor prior to sending it to client services for reporting. If there are problems or questions, the supervisor will send the entire data package back to the analyst for review.

3.5 Data Management

Our Project/Technical Manager will be responsible for the collection, storage, review, and use of field and laboratory data. Field personnel will be responsible for field data accumulation and documentation (e.g., in field logbooks) as summarized in this SAP and for appropriately transmitting data obtained in the field to the Project/Technical Manager.

Analytical laboratory department managers will be responsible for management of analytical data as specified in their document control and data storage procedures. The analytical laboratory's Project Manager will be responsible for transmittal of laboratory reports to the Project/Technical Manager.

Field and laboratory data will be archived in Geocon's files in hard-copy form and/or electronically as portable document format or another appropriate format. Files and individual documents will be designated and dated according to a consistent convention to facilitate retrieval and review. Analytical data may be transferred to a spreadsheet or word processing program for analysis and/or presentation. Activities and responsibilities associated with data use and review are summarized in Section 3.4.

3.6 Assessment Oversight

Our field personnel will be responsible for completion of field sampling activities under the assessment oversight of the Project/Technical Manager as indicated in Section 3.4. To ensure rapid identification of potential problems or inconsistencies associated with this SAP or anomalous findings that could require revision of project objectives or activities, assessment oversight will be conducted as soon as possible after data become available and information will be transmitted from one level of oversight responsibility to another (e.g., from field technician to Project/Technical Manager and vice-versa) as soon as possible. Inconsistencies with this SAP or anomalous findings will be evaluated and addressed immediately by the Project/Technical Manager based on consultation with field personnel. With regard to their respective responsibilities, the field technicians and Project/Technical Manager will have authority to ensure that judgments regarding rejection of data, re-analysis of some samples, re-sampling, or other corrective actions appropriate to support project DQOs are implemented.

Analytical laboratory department managers will be responsible for oversight of analysts, analytical data management, and QA processes. The Laboratory Director and the Laboratory QA Director, with concurrence of the laboratory department managers, will direct corrective actions when problems that affect product or service quality are identified.

Our Project/Technical Manager will be responsible for assessment oversight of draft and final versions of air monitoring reports. He will be responsible for ensuring that the data presented in draft/final reports are compatible with accumulated field and laboratory data based on review of field documentation and laboratory reports. The Project/Technical Manager will be responsible for ensuring that the air monitoring findings reported are technically accurate and that the associated conclusions and recommendations are technically justifiable.

4.0 SAMPLING DESIGN AND RATIONALE

The objective of the work described in this SAP is to assess concentrations of COPCs including various PM populations, metals, asbestos, and TOS, from a cross-section of metal shredding facilities in a variety of geographic conditions across the state of California. The DTSC intends to use the data generated during the air quality monitoring to determine the potential for emissions from facilities generating and/or receiving metals shredding waste and evaluate the risk to sensitive populations using the criteria developed for the California ARB Air Toxic Hot Spots Program Air Toxics “Hot Spot” Program [the Air Toxics Hot Spots Information and Assessment Act, Assembly Bill 288 (Connelly) as amended by SB 1731 (Calderon)].

Geocon staff will perform three consecutive 24-hour air monitoring events at each of the three metal shredding facilities. At each Site, samples will be collected from four locations including upwind, cross-wind and downwind. Upwind samples will indicate the conditions of the air coming onto the facilities and serve as ambient or background levels. Downwind samples will indicate the conditions of the air leaving the facilities and are anticipated to contain the highest concentrations of COPCs. Cross-wind samples will serve to assess potential lateral dispersion of COPCs or may also serve as downwind locations as wind directions change. The proposed sample locations for the SMM, SARB, and SARTI facilities are shown on Figure 3, 6, and 9, respectively.

5.0 LABORATORY ANALYSIS

This section summarizes the laboratory analytical plans for air samples collected during implementation of this SAP. Specifically described are analytical parameters and methods, laboratory reporting limits, and sample hold times.

5.1 Analyses Narrative

The COCs will be analyzed by the following methods:

- TSP - 40 CFR Part 50, Appendix B to Part 50 *Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere* (USEPA, 1998);
- PM₁₀ - 40 CFR Part 50, Appendix J to Part 50 *Reference Method for the Determination of Particulate Matter as PM₁₀ in the Atmosphere* (USEPA, 1998), 40 CFR Part 50, Appendix L to Part 50 *Reference Method for the Determination of Particulate Matter as PM_{2.5} in the Atmosphere* (USEPA, 1998) and *Quality Assurance Guidance Document 2.12 – Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods* (USEPA, 2016);
- PM_{2.5} - 40 CFR Part 50, Appendix L to Part 50 *Reference Method for the Determination of Particulate Matter as PM_{2.5} in the Atmosphere* (USEPA, 1998) and *Quality Assurance Guidance Document 2.12 – Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods* (USEPA, 2016);
- Asbestos – Asbestos Hazard Emergency Response Act (AHERA)-modified transmission electron microscopy (TEM) as found in 40 CFR part 763 Appendix A Subpart E (USEPA, 1987);
- PCBs – USEPA method TO-4A (USEPA, 1999a);
- Formaldehyde - USEPA method TO-11A (USEPA, 1999b); and
- VOCs - USEPA method TO-15 (USEPA, 1999c).

Sample container, preservation, and holding time requirements associated with the COCs are summarized in Table 4. The laboratory reporting limits for the analyses planned for each air monitoring event are summarized in Table 5.

At each location a sufficient volume of sample will be collected for analysis and laboratory QC as specified in Section 10 – Quality Control.

PM₁₀ and PM_{2.5} filters and formaldehyde sample cartridges will be placed in sample coolers, preserved at approximately 4 degrees Celsius (°C) with ice and shipped by courier to the laboratory under standard COC protocol. Unless the observations, experience, and judgment of supervisory field personnel in concurrence with the Project/Technical Manager determine otherwise based on

unanticipated field conditions (i.e., emergency conditions that potentially threaten human health or the environment), samples will be analyzed on a standard 2-week turnaround time.

5.2 Analytical Laboratories

Samples to be analyzed for TSP, PM₁₀, PM_{2.5} and metals will be submitted to CLN of Tigard, Oregon. CLN's QAMP and SOPs are in Appendix A and summarize the policies, practices, and procedures for ensuring that the quality of laboratory measurement data generated by CLN meets requirements of the NELAP.

Samples to be analyzed for asbestos and TOS will be submitted to EMSL of San Leandro, California. The EMSL QAMP is in Appendix B.

Samples to be analyzed for PCBs will be submitted to ECS of Garden Grove, California. ECS's SOP is in Appendix C.

Samples to be analyzed for formaldehyde will be submitted to EAT of Folsom, California. EAT's SOP is in Appendix D.

CLN, EMSL, ECS, and EAT will document laboratory data in written reports that will include sample results and copies of COCs. In addition, they will provide laboratory QC reports for surrogate recoveries, MS/MSD samples, and laboratory control sample/laboratory control sample duplicate LCS/LCSD samples as applicable. Activities and responsibilities associated with laboratory data review, data management, and assessment oversight processes are summarized in Section 3.4 (Data Review and Validation) and Section 3.5 (Data Management), as well as in their SOPs and QAMPs in Appendices A through D.

6.0 FIELD METHODS AND PROCEDURES

This section describes the air monitoring design and describes the rationale for the sampling locations and approach.

6.1 TSP

6.1.1 TSP Sampling Equipment

Tisch Environmental Inc.'s (Tisch) TE-5170V high-volume air sampler will be used to collect TSP samples. The TE-5170V is a volume flow-controlled, high-volume air sampler for TSP. The system components are housed in an anodized aluminum shelter that supports the vertically symmetrical TSP inlet. A blower assembly draws air through a quartz fiber filter which is held in place by a filter paper cartridge. According to CLN, quartz fiber filters typically have less background metal contamination and generate more representative data compared to the standard glass fiber filters. A continuous flow/pressure recorder verifies the sample duration and ensures the target volume is achieved. Additional specifications for the TE-5170V are summarized in the following table:

High-Volume TSP Sampler Specifications	
Manufacturer	Tisch Environmental, Inc.
Model	TE-5170V
Construction	Anodized aluminum
Filter Media	8"x10" Quartz fiber filter
Flow Rate	0 - 44 cubic feet per minute (1,245 liters per minute)
Motor Blower	Brush-style motor assembly
Flow Indicator	Continuous flow/pressure recorder
Timer	10-day mechanical timer/elapsed time indicator
Electrical Supply	110/220VAC, 50/60 Hz, 8/4 Amps

6.1.2 TSP Sampling Method

TSP sampling will be conducted in accordance with *40 CFR Part 50, Appendix B to Part 50 Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere* (USEPA, 1998). The sampling will involve collecting an integrated (i.e., continuous) 24-hour air sample on the specified sampling days.

Although the sampling equipment has a digital timer and mass flow controller, actual sample durations and flow rates may differ from targeted values. The actual laboratory detection limits achieved are dependent upon the laboratory instrument detection limit and sample volume obtained in the field. Note that sample volumes less than targeted values may result in higher than targeted detection limits.

The following sub-sections describe methods for: pre-sampling activities; calibration; and operation of the sampling equipment.

6.1.2.1 TSP Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure equipment from manufacturer or supplier which is anticipated to take up to 5 business days;
- Assemble the high-volume air sampler and become familiar with its operation;
- Calibrate the high-volume air sampler and enter calibration data into Sample Volume Calculation Sheet;
- Establish monitoring locations (e.g., upwind, cross-wind, and downwind) by reviewing data from the nearest meteorological station or by using dispersion modeling;
- Procure electrical generators and scissor lifts, as necessary; and
- Procure pre-weighted sample filters from laboratory.

6.1.2.1 TSP Calibration Activities

Each high-volume TSP air sampler will be calibrated upon installation and prior to first use at each facility, in accordance with the calibration and sampling schedule in Table 3. The TE-5170V will be calibrated using the following step-by-step calibration procedures from the *Operations Manual TE-5170V Volumetric Flow Controlled Total Suspended Particulate High Volume Air Sampler* (Appendix E).

1. Mount the calibrator orifice and top loading adapter plate to the sampler. A sampling filter is generally not used during this procedure. Tighten the top loading adapter hold-down nuts securely for this procedure to assure that no air leaks are present.
2. Turn on the sampler and allow it to warm up to its normal operating temperature.
3. Conduct a leak test by covering the holes on top of the orifice and pressure tap on the orifice with your hands. Listen for a high-pitched squealing sound made by escaping air. If this sound is heard, a leak is present and the top loading adapter hold-down nuts need to be re-tightened.

Avoid running the sampler for longer than 30 seconds at a time with the orifice blocked. This will reduce the chance of the motor overheating. Also, never try this leak test procedure with a manometer connected to the pressure tap on the calibration orifice or the pressure tap on the side of the sampler. Liquid from either manometer could be drawn into the system and cause motor damage.

4. Connect one side of a water manometer or other type of flow measurement device to the pressure tap on the side of the orifice with a rubber vacuum tube. Leave the opposite side of the manometer open to the atmosphere.
5. Connect a water manometer to the quick disconnect located on the side of the aluminum outdoor shelter (this quick disconnect is connected to the pressure tap on the side of the filter holder).

6. Make sure the TE-5028A orifice is all the way open (turn the black knob counter clockwise). Record both manometer readings, the one from the orifice and the other from the side of the sampler. To read a manometer one side goes up and the other side goes down, you add both sides, this is your inches of water. Repeat this process for the other four points by adjusting the knob on the variable orifice (just a slight turn) to four different positions and taking four different readings. You should have five sets of numbers, ten numbers in all.
7. Remove the variable orifice and the top loading adapter and install a clean filter. Set your timer.
8. Record the ambient air temperature, the ambient barometric pressure, the sampler serial number, the orifice serial number, the orifice Qactual slope and intercept with date last certified, today's date, site location and the operator's initials."

An example of the calibration sheet to be used is included in the Appendix E.

6.1.2.1 TSP Sampling Activities

TSP samples will be collected using the following step-by-step sampling procedures from the *Operations Manual TE-5170V Volumetric Flow Controlled Total Suspended Particulate High Volume Air Sampler* (Appendix F)

1. After performing calibration procedure, remove filter holder frame by loosening the four wing nuts allowing the brass bolts and washers to swing down out of the way. Shift frame to one side and remove.
2. Don clean gloves and carefully center a new filter, rougher side up, on the supporting screen. Properly align the filter on the screen so that when the frame is in position the gasket will form an airtight seal on the outer edges of the filter. Note: Any filter that is noticeably torn or has a hole in it should immediately be invalidated and investigated on what caused the problem.
3. Secure the filter with the frame, brass bolts, and washers with sufficient pressure to avoid air leakage at the edges (make sure that the plastic washers are on top of the frame). IMPORTANT: make sure the filter cassette cover is removed.
4. Wipe any dirt accumulation from around the filter holder with a clean cloth.
5. Close shelter lid carefully and secure with the "S" hook.
6. Make sure all cords are plugged into their appropriate receptacles and the rubber tubing between the blower motor pressure tap and the TE-5009 continuous flow recorder is connected (be careful not to pinch tubing when closing door).
7. Prepare TE-5009 continuous flow recorder as follows:
 - a. Clean any excess ink and moisture on the inside of recorder by wiping with a clean cloth.
 - b. Depress pen arm lifter to raise pen point and carefully insert a fresh chart.
 - c. Carefully align the tab of the chart to the drive hub of the recorder and press gently with thumb to lower chart center onto hub. Make sure chart is placed under the chart guide clip and the time index clip so it will rotate freely without binding. Set time by rotating the drive hub clockwise until the correct time on chart is aligned with time index pointer.
 - d. Make sure the TE-160 pen point rests on the chart with sufficient pressure to make a visible trace.

8. Prepare the 7-Day Timer as instructed below.
 - a. To set the "START" time, attach a (bright) "ON" tripper to the dial face on the desired "START" time. Tighten tripper screw securely.
 - b. To set the "STOP" time, attach a (dark) "OFF" tripper to the dial face on the desired "STOP" time. Tighten tripper screw securely.
 - c. To set current time and day, grasp dial and rotate **clockwise only** until correct time and day appear at time pointer.
9. At the end of the sampling period, remove the frame to expose the filter. Don new gloves and carefully remove the exposed filter from the supporting screen by holding it gently at the ends (not at the corners). Fold the filter lengthwise so that sample touches sample.
10. Place the folded filter in the protective manila folder. Apply a sample label to the manila folder. CAUTION: do not write on the filter or attach a sample label.
11. Place the filter/manila folder in a large Zip-lock bag. Keep filters out of sunlight and maintain at room temperature. CAUTION: do not chill samples.
12. Fill out the COC and place in a small FedEx box with the samples. Include any field QC samples as necessary. It is critical to ship the samples in a rigid container such as a cardboard FedEx box for protection. The box should not be so large that the samples move around. Add padding as necessary.
13. Typical sample hold times prior to laboratory analysis are 6 months for gravimetric TSP and most metals (mercury analysis is 28 days). However, for the sake of consistency, the more conservative hold times from the PM_{2.5} guidance will be applied to the TSP samples. Therefore, the TSP samples will be analyzed within a 30 day hold time.

6.2 PM₁₀

6.2.1 PM₁₀ Sampling Equipment

Tisch's TE-Wilbur10 low-volume air samplers will be used to collect the PM₁₀ samples. The TE-Wilbur10 sampler is housed in an anodized aluminum shelter that supports the vertically symmetric PM₁₀ inlet. A blower assembly draws air through the 46.2-millimeter-diameter polytetrafluoroethylene (PTFE) Teflon™ filter. The system monitors and records all system sensors such as flow, temperatures and barometric pressure, and also records the system pressure, filter temperature variation, and flow total which provides the operator or laboratory technician additional information on the sample if warnings or alarms occurred during the sample run. Additional specifications for the TE-Wilbur10 sampler are summarized in the following table:

Low-Volume PM₁₀ Sampler Specifications	
Manufacturer	Tisch Environmental, Inc.
Model	TE-Wilbur10
Construction	Anodized aluminum
Filter Media	46.2 mm-diameter PTFE Teflon™ with integral support ring with a pore size of 10 μm
Inlet	10-micron particulate fractionator (TE-PM ₁₀)

Flow Rate	0 – 25 liters per minute
Low-Volume PM₁₀ Sampler Specifications	
Motor Blower	Brushless 24 VDC motor with a diaphragm-type pump
Flow Indicator	Thermal mass-type ranged from 0-25 liters per minute (TE-W-150)
Timer	Digital timer/elapsed time indicator
Electrical Supply	120/240 VAC, 50/60 Hz, 5 Amps

6.2.2 PM₁₀ Sampling Method

PM₁₀ sampling will be conducted in accordance with *40 CFR Part 50, Appendix J to Part 50 Reference Method for the Determination of Particulate Matter as PM₁₀ in the Atmosphere* (USEPA, 1998). The sampling will involve collecting an integrated (i.e., continuous) 24-hour air sample from on the specified sampling days.

Although the sampling equipment has a digital timer and mass flow controller, actual sample durations and flow rates may differ from targeted values. The actual laboratory detection limits achieved are dependent upon the laboratory instrument detection limit and sample volume obtained in the field. Note that sample volumes less than targeted values may result in higher than targeted detection limits.

The following sub-sections describe methods for: pre-sampling activities; calibration, and operation of the sampling equipment.

6.2.2.1 PM₁₀ Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure equipment from manufacturer or supplier which is anticipates to take up to 5 business days;
- Assemble the air sampler and become familiar with its operation;
- Calibrate the air sampler and enter calibration data into Sample Volume Calculation Sheet;
- Establish monitoring locations (e.g., upwind, cross-wind, and downwind) by reviewing data from the nearest meteorological station or by using dispersion modeling;
- Procure electrical generators and scissor lifts, as necessary; and
- Procure pre-weighted sample filters from laboratory.

6.2.2.2 PM₁₀ Calibration Activities

Each low-volume PM₁₀ air sampler will be calibrated upon installation and prior to first use at each facility, in accordance with the calibration and sampling schedule in Table 3. Calibration activities will follow the procedures from the *TE-Wilbur Operations Manual Rev 002.2, 01/07/2016* (Appendix G).

Ambient Temperature Calibration

1. Obtain a Tisch FRM-CAL low-volume calibration system, which includes a calibrated temperature device.
2. Allow the calibrated temperature device to reach equilibrium with the ambient air and take a reading on the calibrated temperature device.
3. The temperature calibration can be performed by following these keystrokes:
Main Menu → Calibration → Ambient Temperature Calibration
4. Press the box and enter the temperature reading from the calibrator.
5. Press **Update** to update the temperature.

Filter Temperature Calibration

1. Obtain a Tisch FRM-CAL low-volume calibration system, which includes a calibrated temperature device.
2. Allow the calibrated temperature device to reach equilibrium with the ambient air.
3. Place the temperature device into the filter holder holding it at the tip of the filter temperature RTD.
4. The temperature calibration can be performed by following these keystrokes:
Main Menu → Calibration → Filter Temperature Calibration
5. Press the box and enter the temperature reading from the calibrator.
6. Press **Update** to update the temperature.

Barometric Pressure Calibration

1. Obtain a Tisch FRM-CAL low-volume calibrator, which includes a calibrated barometric device.
2. Allow the calibrated barometric pressure device to reach equilibrium with the ambient air.
3. The barometric calibration can be performed by following these keystrokes:
Main Menu → Calibration → Barometric Press Calibration
4. Press the box and enter the pressure reading from the calibrator.
5. Press **Update** to update the barometric pressure.

Flow Calibration

1. Flow calibration can be performed by following these keystrokes:
Main Menu → Calibration → Flow Calibration
2. Place the Tisch FRM-CAL low-volume calibrator, a known, calibrated flow standard, onto the downtube of the TE-Wilbur unit. This calibrator should be within its certification period.
3. Place a filter cassette with a screen and filter into the filter holder and close the filter holder.
NOTE: this filter cannot be used for subsequent sampling per USEPA Quality Assurance Guidance Document 2.12.

4. Proceed to the setpoint screen where the user can change the setpoint of the flow calibration. 16.67 Liters per minute (L/min) is the default setpoint and should only be changed under abnormal operations.
5. Press **Start** and the Calibration Point 1 screen will be displayed and the flow system will start and will achieve the first setpoint. The setpoint and flow is shown on the left.
6. After the flow stabilizes, take a reading from the calibrator and press the blue box to enter the calibrator's reading.
7. Press the green **Accept** box to accept that reading and continue to setpoint number two.
8. Perform setpoints two, three and four. After the fourth setpoint the final flow calibration screen will appear.
9. The user is presented with the slope, intercept and R coefficient of the four-point linear regression formula. If the R coefficient is less than 0.98 the user is notified that the calibration needs attention.
10. If the R coefficient is greater than 0.98 and the user feels that the calibration was successful they can save the calibration values by pressing the **Yes Save** button. If the user does not want to save the calibration settings, they can press **No Quit** and the last calibration values will be used for flow adjustment.

Flow Calibration Audit / Verification

1. Each flow setpoint has a corresponding START button below it. Press each start button to have the flow system reach that flow setpoint.
2. Let the flow stabilize at that setpoint and compare the reading with a calibrated flow device such as a Tisch FRM-CAL low-volume calibrator.
3. Press the STOP button or press the Calibration Main Menu return button to stop the flow verification.

External Leak Check

1. Insert a clean filter (designated the "leak check filter") into a filter cassette with a screen and insert the cassette into the sampler filter holder.
2. **NOTE:** Leak check filters will not be used for subsequent sampling. The same filter may be used for the leak check that was used for the flow rate verification check.
3. Close the filter holder
4. Remove the PM₁₀ inlet and install the TE-L30 flow rate adapter on the top of the downtube.
5. Close the valve on the flow rate adapter to plug the air flow.
6. Press the Select External Leak Check button on the Leak check selection screen.
7. At the Perform External Leak Check Next Steps screen, the screen will show the TE-L30 adapter closed and the filter holder closed. Press next step and then press the Final Step button.
8. You will now be at the Leak Check Control Screen. Press the **Start Leak Check** button.

9. The system will start the pump and pull a vacuum on the system. **NOTE:** if the TE-L30 adapter is not closed and the vacuum does not reach 50" H₂O, after 60 seconds the system will stop and fail.
10. Once the system pulls a vacuum of 50" H₂O, the solenoid will close, isolating the system from the solenoid to the TE-L30 adapter. The final ending pressure will be much greater than 50" H₂O since the system will stabilize to a final ending pressure.
11. After 20 seconds to allow the system to stabilize, the leak check timer of 60 seconds will start and the system will calculate the final ending pressure in order to pass an external leak check of less than 80mL/min.
12. If the external leak check passes, a green box will appear after the leak check timer expires indicating the external leak check has passed.
13. If the external leak check fails, meaning the vacuum pressure has dropped below the final ending pressure, meaning a leak of more than 80mL/min is present, a red box will appear after the leak check timer expires indicating the external leak check has failed.
14. To cancel the external leak check, press the **Cancel Leak Check** button at any point or press the return to main menu button.
15. After the external leak check is completed, open the TE-L30 adapter slowly to prevent any damage from the inrush of air into the system.

Internal Leak Check

1. Place the TE-W-004 Solid internal leak check disk into the filter holder.
2. Close the filter holder.
3. Press the **Perform Internal Leak Check** at the leak check select screen.
4. At the step 1 screen press next step to go to the step 2 screen.
5. At the step 2 screen press Final Step to go to the leak check control screen.
6. Press the **Start Leak Check** button.
7. The system will start the pump and pull a vacuum on the system. Note: if the system vacuum does not reach 50" H₂O, after 60 seconds the system will stop and fail.
8. Once the system pulls a vacuum of 50" H₂O, the solenoid will close, isolating the system from the solenoid to the bottom half of the filter cassette. The final ending pressure will be greater than 50" H₂O since the system will stabilize to a final ending pressure.
9. After 20 seconds to allow the system to stabilize, the leak check timer of 60 seconds will start and the system will calculate the final ending pressure in order to pass an internal leak check of less than 80mL/min.
9. If the internal leak check passes, a green box will appear after the leak check timer expires indicating the leak check has passed.
10. If the internal leak check fails, meaning the vacuum pressure has dropped below the final ending pressure, a red box will appear after the leak check timer expires indicating the internal leak check has failed.
11. To cancel the internal leak check, press the **Cancel Leak Check** button at any point or press the return to main menu button.

12. After the internal leak check is completed, remove the internal leak check disk and return unit back to normal operation.

6.2.2.3 PM₁₀ Sampling Activities

The following procedures will be used to operate the TE-Wilbur10 air sampler:

1. Annotate the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and time of sampler setup visit,
 - b. Site identification and location,
 - c. Sampler model, unique sample ID number (this may be the cassette and/or filter ID number, or some other tracking number),
 - d. Scheduled sample start date and time, unusual conditions that may affect samples (e.g., subjective evaluation of pollution on that day, construction activity, weather conditions), and
 - e. Setup operator's signature or initials.

An example of the data sheet to be used is in Appendix F. Because sampler data are electronically downloaded and archived, table entry of data relative to the run start and end operating conditions may not need to be made, so long as the information is properly documented in electronic format and appropriately stored.

2. Ensure the sampler is not operating. If the sampler is set to automatically begin operation, ensure that enough time is available to complete these setup procedures before it starts.
3. Open the filter holder assembly according to the manufacturer's instructions. Visually inspect the O-rings inside the filter holder to ascertain that they are present, secure and not cracked. Do not sample without these O-rings installed because the system will no longer be leak-free. Install the uniquely identified filter cassette containing the pre-weighed filter. Never remove the filter from the cassette. This is done only at the filter weighing facility. Reinstall the filter cassette holder and ensure that the fittings around the impactor housing and the filter assembly are secure.

4. Set up the TE-Wilbur10 for a custom sample by following these keystrokes

Main Menu → Sample Setup → Set Custom Sample

5. Enter a start month /day / year / hour / minute and duration of 24 hours. The sampler will then start on the date entered and run for the duration of the runtime entered. When multiple TE-Wilbur10 are sampling at a Site, the samplers will be coordinated so that they each start and the same time. All alarms associated with shutting down a sample, data logging and all features of the USEPA standard samples are associated with the custom sample.
6. When a custom sample is engaged, all screens will show a blue box indicating that a custom sample has been setup and engaged. When a custom sample is running a green box will show on all screens that a sample is running.
7. The sampler is now ready to sample. If the sampler is not already set to turn on automatically for the next sampling period, program the controls to do so. Check clock on sampler to make certain it is accurate to within 1 minute of an atomic clock and set to local standard time.

8. Visually inspect the monitoring site and its equipment to ensure that all sampling components are ready for the next run day(s). Note any changes in the site surroundings, especially dust-producing activities.
9. Visually inspect the records of the sampler. If it is time for the monthly/every 4 weeks' check, measure and record independent measurements of ambient temperature and pressure, and ensure that the ambient temperature (i.e., inlet temperature) and pressure readings taken by the sampler are within 2.0 °C and 10 mmHg of the independent readings, respectively. Be certain that the independent temperature sensor (thermometer or thermistor probe) is located side-by-side with the sampler's ambient temperature sensor. This will require that the sensor be placed in the louvers of the sampler's radiation shield and kept out of direct sunlight. Also check the sampler's display for the filter temperature and ensure this value is reasonable compared to the ambient temperature display.
10. At the end of the sampling run, visually inspect the sampler readouts to ensure that the sampler is operating properly. Sequential samplers require manipulation of a number of display screens to retrieve all data. Consult the operating manual. Also check the sampler for any other obvious problems, such as a full water collection jar. If problems are identified, describe them on the sample run data sheet and take corrective actions before starting another run. If the weather is bad, provide a temporary shelter to facilitate data transfer and to protect exposed parts of the sampler. A small work table may be useful.
11. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and sample pick-up time,
 - b. Stop time and total elapsed time of the sample run,
 - c. Average flow rate, coefficient of variation of the flow rate, and total volume sampled,
 - d. Average temperature and pressure measured by the sampler during the sampling event,
 - e. Conditions at the site or of the collector that may have affected the sample,
 - f. Any flags triggered by the sampler (e.g., power outage, flow rate variation),
 - g. Explanations for questionable or voided samples,
 - h. Collecting operator's signature or initials.
12. Download the runtime data (e.g., sampler filter, interval, and input data files) for the completed run using a laptop computer or another data transfer device.
13. Carefully open the sampler's filter holder assembly according to the manufacturer's instructions. If the filter cassette comes apart or sticks to the upper housing during this process, close and gently reopen the assembly. Do not allow the filter to be shaken, dropped, or touched by any foreign object (fingers, rain, and so on). Visually examine the filter and cassette for damage or unusual appearance. Make notes and then immediately place the filter cassette inside an appropriately marked protective container (see Figure 4.2) for storage and later transport to the weighing laboratory.
14. Inspect the interior of the filter housing and the sampler itself. Note any abnormalities on the sampler run data sheet.
15. Conduct any scheduled maintenance activities.

16. If another sampling run will be performed, install a filter cassette according to the aforementioned instructions.
17. Observe conditions around the monitoring site; note any activities that may affect filter particle loading (e.g., paving, mowing, fire) and record this information on the run data sheet. Retrieve equipment and applicable documentation. Secure the site.

6.3 PM_{2.5}

6.3.1 PM_{2.5} Sampling Equipment

Tisch’s TE-Wilbur2.5 low-volume air samplers will be used to collect the PM_{2.5} samples. The TE-Wilbur2.5 is the same sampling equipment as the TE-Wilbur10 with the exception that the TW-Wilbur2.5 has a TE-PM2.5C cyclone or WINS impactor installed downstream of the PM₁₀ size inlet. Additional specifications for the TE-Wilbur2.5 samplers are summarized in the following table:

Low-Volume PM_{2.5} Sampler Specifications	
Manufacturer	Tisch Environmental, Inc.
Model	TE-Wilbur2.5
Construction	Anodized aluminum
Filter Media	46.2 mm-diameter PTFE Teflon with integral support ring with a pore size of 10 µm
Inlet	10-micron particulate fractionator with a PM2.5 Cyclone (TE-PM _{2.5} C)
Flow Rate	0 – 25 liters per minute
Motor Blower	Brushless 24 VDC motor with a diaphragm-type pump
Flow Indicator	Thermal mass-type ranged from 0-25 liters per minute (TE-W-150)
Timer	Timer Digital timer/elapsed time indicator
Electrical Supply	120/240 VAC, 50/60 Hz, 5 Amps

6.3.2 PM_{2.5} Sampling Method

PM_{2.5} sampling will be conducted in accordance with *40 CFR Part 50, Appendix L to Part 50 Reference Method for the Determination of Particulate Matter as PM_{2.5} in the Atmosphere*. (USEPA, 1998) and *Quality Assurance Guidance Document 2.12 – Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods* (USEPA, 2016). The sampling will involve collecting an integrated (i.e., continuous) 24-hour air sample on the specified sampling days.

The same pre-sampling activities, calibration, and operations steps used for the PM₁₀ sampling, as described in Section 4.2.2., will be used for the PM_{2.5} sampling.

6.4 Asbestos

6.4.1 Asbestos Sampling Equipment

Gillian GilAir 3 sampling pumps equipped with a 25-mm-diameter mixed cellulose ester (MCE) fiber filter will be used to collect the asbestos samples. The GilAir 3 sampling pumps will be set to operate at a flowrate of approximately 2 liters per minute (L/min).

6.4.2 Asbestos Sampling Methods

Asbestos sampling will be conducted in accordance with AHERA-modified TEM methods as found in 40 CFR part 763 Appendix A Subpart E (USEPA, 1987).

The AHERA-modified method recommends sampling rates from 1 to 10 L/min. The anticipated flow rate for the samplers will be 2 L/min over a sampling duration of 24-hours. The anticipated total volume sampled will be approximately 2,880 L, which is greater than the recommended minimum volume for 25-mm filters of 560 L.

6.4.2.1 Asbestos Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure equipment from manufacturer or supplier;
- Assemble the pump and become familiar with its operation;
- Calibrate the pump to the desired flow rate of 2 L/min;
- Charge the GilAir 3 pumps and additional batteries to be used during the sampling; and
- Procure sample filters from laboratory.

6.4.2.2 Asbestos Calibration Activities

Each low-volume GilAir-3 sampler will be calibrated upon installation and prior to first use at each facility, in accordance with the calibration and sampling schedule in Table 3 and using the following calibration procedures:

1. Use a GilAir-3 pump with a fully charged battery pack.
2. Attach tubing to the pump.
3. Connect an MCE filter to the tubing. Note: Calibration filters will not be used for subsequent sampling.
4. Connect the tubing from the collection media to an external calibrated flow meter.
5. Use a small Phillips screwdriver to loosen the side anti-tamper plate screw.
6. Rotate the side cover plate 180°.

7. Use a pointed instrument such as a ball-point pen or paper clip bent 90° to press the MODE/HOLD button twice. CAL should appear on the display. CAL allows you to run the pump without actually collecting run data.
8. Use a small Phillips screwdriver to loosen the front anti-tamper plate screw.
9. Rotate the front cover plate 180°.
10. Move On/Off switch to the On position.
11. Make sure the calibrated external flow meter is working.
12. Set the pump flow rate by turning the flow adjust screw. (Clockwise for increased flow and counterclockwise for decreased flow.) Use built-in rotameter only as a flow indicator.
13. When desired flow rate has been reached, turn off pump. The pump is now ready for sampling.

6.4.2.3 Asbestos Sampling Activities

Asbestos samples will be collected using the following sampling procedures:

1. Following calibration activities, attach an MCE filter to the pump via tubing.
2. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and time of sampler setup visit,
 - b. Site identification and location,
 - c. Sampler model, unique sample ID number (this may be the cassette and/or filter ID number, or some other tracking number),
 - d. Scheduled sample start date and time, unusual conditions that may affect samples (e.g., subjective evaluation of pollution on that day, construction activity, weather conditions), and
 - e. Setup operator's signature or initials.
3. Move the On/Off switch to the On position.
4. Place the pump, tubing and cassette in the desired sampling location.
5. When sampling is completed, move the On/Off switch to the Off position. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and sample pick-up time,
 - b. Stop time and total elapsed time of the sample run,
 - c. Average flow rate, coefficient of variation of the flow rate, and total volume sampled,
 - d. Conditions at the site or of the collector that may have affected the sample,
 - e. Any flags triggered by the sampler (e.g., power outage, flow rate variation),
 - f. Explanations for questionable or voided samples, and
 - g. Collecting operator's signature or initials.

6.5 PCBs

6.5.1 PCB Sampling Equipment

Tisch's TE-1000PUF high-volume air samplers will be used to collect the PCB samples. The TE-1000 PUF is a volume flow-controlled, high-volume air sampler for TSP. TE-1000PUF polyurethane foam (PUF) sampler is a complete system designed to simultaneously collect suspended airborne particulates as well as trap airborne pesticide vapors at flow rates up to 280 liters per minute. The TE-1000PUF features the latest in technological advances for accurately measuring airborne particulates and vapors. A dual chambered aluminum sampling module contains both filtering systems. The upper chamber supports the airborne particulate filter media in a circular filter holder. The lower chamber encapsulates a glass cartridge which contains the PUF for vapor entrapment. Additional specifications for the TE-1000PUF are summarized in the following table:

High-Volume PCB Sampler Specifications	
Manufacturer	Tisch Environmental, Inc.
Model	TE-1000 PUF
Construction	Anodized aluminum
Filter Media	3-inch thick polyurethane foam (PUF) plugs
Flow Rate	125 to 250 liters per minute
Motor Blower	Brush motor assembly
Flow Indicator	0-100" Magnehelic gauge
Timer	7-day mechanical timer/elapsed time indicator
Electrical Supply	110 Volt, 60 Hz, 15 amps

6.5.2 PCB Sampling Methods

PCB sampling will be conducted in accordance with USEPA method TO-4A (USEPA, 1994).

The USEPA method states that ambient air should be pulled through the filter/adsorbent cartridge at a flow rate of approximately 8 standard cubic feet per minute (approximately 226 L/min), to obtain a total sample volume of over 300 standard cubic meters (approximately 8,500 L) over a 24-hour period.

6.5.2.1 PCB Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure equipment from manufacturer or supplier;
- Assemble the pump and become familiar with its operation;
- Calibrate the pump to the desired flow rate of 226 L/min;
- Establish monitoring locations (e.g., upwind, cross-wind, and downwind) by reviewing data from the nearest meteorological station;

- Procure electrical generators and scissor lifts, as necessary; and
- Procure sample filters from laboratory.

6.5.2.2 PCB Calibration Activities

Each high-volume PCB air sampler will be calibrated upon installation and prior to first use at each facility, in accordance with the calibration and sampling schedule in Table 3. Calibration activities will follow the procedures from the *TE-1000 PUF Poly-Urethane Foam High Volume Air Sampler Operations Manual* (Appendix D).

1. Calibration of the PUF Sampler is performed without a foam plug (TE-1010) or filter paper in the sampling module. However, the empty glass cartridge must remain in the module to insure a good seal through the module.
2. Install the TE-5040A Calibrator (orifice) on top of the 4" Filter Holder. Tighten and make sure of no leaks.
3. Open both ports on top of manometer and connect tubing from manometer port to the pressure tap on the TE-5040A Calibrator. Leave the opposite side of manometer port open to the atmosphere.
4. Open ball valve fully (handle should be straight up), this is located inside of shelter directly above the blower motor.
5. Turn the system on by tripping the manual switch on the timer. Allow a few minutes for motor to warm up.
6. Adjust and tighten the voltage control screw (variac) on the TE-5010 to obtain a reading of 70 inches on the dial of the Magnehelic Gauge (or 80 whatever is desired). Do not change until completion of calibration.
7. With 70 inches on the gauge as your first calibration point, record this figure and the orifice manometer reading on your data sheet. To read a manometer, one side goes up and one goes down, add both sides together, this is your inches of water.
8. Close the ball valve slightly to readjust the dial gauge down to 60 inches. Record this figure and the orifice manometer reading on your data sheet.
9. Using the above procedure, adjust the ball valve for readings at 50, 40, and 30 inches and record on data sheet. You should have 5 sets of numbers 10 numbers in all.
10. Manually turn sampler off.
11. Record the information of TE-1000 PUF Sampler Calibration Data Sheet (Appendix D) and use the worksheet to calculate flow.

6.5.2.3 PCB Sampling Activities

PCB samples will be collected using the following sampling procedures:

1. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and time of sampler setup visit,

- b. Site identification and location,
 - c. Sampler model, unique sample ID number (this may be the cassette and/or filter ID number, or some other tracking number),
 - d. Scheduled sample start date and time, unusual conditions that may affect samples (e.g., subjective evaluation of pollution on that day, construction activity, weather conditions), and
 - e. Setup operator's signature or initials.
2. Release the three (3) swing bolts on the 4" filter holder (FH-2104) and remove the triangle cover (cover must be off when sampler is "ON") and hold-down ring.
 3. Install a clean 102-mm-diameter (4") quartz fiber filter (TE-QMA4) on the support screen in between the Teflon gaskets and secure it with the hold-down ring and swing bolts.
 4. Unscrew together the 4" filter holder and the sampling module cap leaving the module tube in place with the glass cartridge exposed.
 5. Load the glass cartridge with foam and or foam/granular solids and replace in the module tube. Fasten the glass cartridge with the module cap and 4" filter holder assembly while making sure that the module assembly, 4" filter holder and all fittings are snug.
 6. Move the On/Off switch to the On position.
 7. When sampling is completed, move the On/Off switch to the Off position. Then remove the glass cartridge and quartz fiber filter from the sampler with forceps and clean gloved hands and immediately placed in a sealed container for transport to the laboratory. Similar care should be taken to prevent contamination of the filter paper and vapor trap (foam) when loading the sampler.
 8. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and sample pick-up time,
 - b. Stop time and total elapsed time of the sample run,
 - c. Average flow rate, coefficient of variation of the flow rate, and total volume sampled,
 - d. Conditions at the site or of the collector that may have affected the sample,
 - e. Any flags triggered by the sampler (e.g., power outage, flow rate variation),
 - f. Explanations for questionable or voided samples,
 - g. Collecting operator's signature or initials.

6.6 Formaldehyde

6.6.1 Formaldehyde Sampling Equipment

Gillian GilAir 3 sampling pumps equipped with a plastic holder containing 0.35 g of 150-250 µm (60-100 mesh) silica gel coated with 1.0 mg of acidified 2,4-dinitrophenylhydrazine will be used to collect the formaldehyde samples. The GilAir 3 sampling pumps will be set to operate at a flowrate of 1 L/min.

6.6.2 Formaldehyde Sampling Methods

Formaldehyde sampling will be conducted in accordance with USEPA method TO-11A (USEPA, 1994).

The USEPA method states that ambient air should be pulled through the filter/adsorbent cartridge at a flow rate of approximately from 0.1 to 2 L/min. The anticipated flow rate will be approximately 1 L/min with a total volume sampled will be approximately 1,440 L.

6.6.2.1 Formaldehyde Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure equipment from manufacturer or supplier;
- Assemble the pump and become familiar with its operation;
- Calibrate the pump to the desired flow rate of 1 L/min;
- Charge the GilAir 3 pumps and additional batteries to be used during the sampling; and
- Procure sample filters from laboratory.

6.6.2.2 Formaldehyde Calibration Activities

Each GilAir 3 pump will be calibrated upon installation or first use at each Site using the same calibration procedures described in Section 6.4.2.2.

6.6.2.3 Formaldehyde Sampling Activities

Formaldehyde samples will be collected using the following sampling procedures:

1. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and time of sampler setup visit,
 - b. Site identification and location,
 - c. Sampler model, unique sample ID number (this may be the cassette and/or filter ID number, or some other tracking number),
 - d. Scheduled sample start date and time, unusual conditions that may affect samples (e.g., subjective evaluation of pollution on that day, construction activity, weather conditions), and
 - e. Setup operator's signature or initials.
2. Open sampler by removing end caps and attach sampler to GilAir 3 pump with flexible tubing. To protect from intense light, such as bright sunlight, the sampler will be wrapped with aluminum foil or electrical tape.
3. Move the On/Off switch to the On position.
4. Place the pump, tubing and cassette in the desired sampling location.

5. When sampling is completed, move the On/Off switch to the Off position. Place end caps on the sampler and seal sampler in an envelope. Place the samplers on ice and pack securely for shipment to the laboratory.
6. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and sample pick-up time,
 - b. Stop time and total elapsed time of the sample run,
 - c. Average flow rate, coefficient of variation of the flow rate, and total volume sampled,
 - d. Conditions at the site or of the collector that may have affected the sample,
 - e. Any flags triggered by the sampler (e.g., power outage, flow rate variation),
 - f. Explanations for questionable or voided samples,
 - g. Collecting operator's signature or initials.

6.7 VOC

6.7.1 VOC Sampling Equipment

6-L Summa canisters equipped with 24-hour flow regulators will be used to collect VOC samples. The flow regulators will be set to operate at a flowrate of 3.8 mL/min.

6.7.2 VOC Sampling Methods

VOC sampling will be conducted in accordance with USEPA method TO-15 (USEPA, 1999).

6.7.2.1 VOC Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure sampling equipment from laboratory;
- Assemble the samplers and become familiar with its operation;
- Verify the vacuum levels in the canisters.

6.7.2.2 VOC Certification

EMSL will individually certify each 6-L Summa canister.

6.7.2.3 VOC Sampling Activities

VOC samples will be collected using the following sampling procedures:

1. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and time of sampler setup visit,

- b. Site identification and location,
 - c. Sampler model, unique sample ID number (this may be the Summa canister and/or flow restrictor ID number, or some other tracking number),
 - d. Scheduled sample start date and time, unusual conditions that may affect samples (e.g., subjective evaluation of pollution on that day, construction activity, weather conditions), and
 - e. Setup operator's signature or initials.
2. Vacuum test the connections between the Summa canister and flow restrictor for 5 minutes by placing an end cap on the sampling inlet and opening and closing the canister to place a test vacuum on the assembly.
 3. If gauge vacuum was maintained for 5 minutes, then remove the end cap and begin sampling by opening the Summa canister valve.
 4. Close the sample canister valve when the sample canister gauge indicates approximately 5 inches Hg of vacuum remain in the canister (this typically takes approximately 24 hours for a 6L Summa canister connected to a 3.8 milliliters/minute flow regulator).
 5. Record the following information on the sampler run data sheet, in the sampler logbook, and/or on the sample COC making note of the following:
 - a. Date and sample pick-up time,
 - b. Stop time and total elapsed time of the sample run,
 - c. Total volume sampled,
 - d. Conditions at the site or of the collector that may have affected the sample,
 - e. Explanations for questionable or voided samples,
 - f. Collecting operator's signature or initials.
 6. Seal the samples and prepare them for transport to EMSL following standard COC protocol.

6.8 Meteorological Data

6.8.1 Meteorological Monitoring Equipment

Meteorological data will be collected from the Sites using a Davis Vantage Pro2 weather monitoring station. Site-specific data for wind direction, speed, temperature, relative humidity, and pressure will be recorded by the Vantage Pro2. Weatherlink® software and a data logger will allow continuous monitoring and downloading of the site-specific data.

6.8.2 Meteorological Monitoring Procedures

Meteorological data will be collected by reading the screen of the Davis Vantage Pro2 at the beginning and the end of each 24-hour sampling period. Also, at the end of each 24-hour sampling period, the highs and lows for the preceding 24 hours will be recorded in the field log book. The Davis Vantage Pro2 will collect wind direction and wind speed readings once every 2.5 to 3 seconds, and collect temperature, relative humidity, and barometric pressure readings once every minute. The readings collected

by the Davis Vantage Pro 2 will be downloaded to a computer at the completion of sampling at each facility. A copy of each Site's weather station data will also be requested, as each Site operates their own onsite weather station.

7.0 SAMPLE CONTAINERS, PRESERVATION AND STORAGE

Information regarding sample container, preservation, and storage requirements for these air monitoring events is addressed in the laboratories QAMPs, which are in Appendices A through D. Table 3, Sampling Frequency and Analysis, lists the analyses that are planned to assess the presence and concentration of the COCs in air onsite. Sample container, preservation, and holding time requirements associated with the COCs are summarized in Table 4.

8.0 DISPOSAL OF RESIDUAL MATERIALS

Based on the proposed scope of services, very minimal residual materials are anticipated to be generated. Used sampling materials and disposable personal protective equipment, such as filters and gloves, will be placed in garbage bags and disposed of as municipal refuse.

9.0 SAMPLE DOCUMENTATION

This section summarizes the procedures regarding sample documentation. Geocon Field Supervisors will be responsible for implementing the documentation procedures summarized in this SAP and for appropriately communicating information obtained in the field to Geocon's Project Manager. If possible, any problems or inconsistencies regarding sample documentation procedures will be resolved immediately by the Project/Technical Manager based on consultation with Field Supervisors.

9.1 Field Notes

Record-keeping procedures for field activities are summarized in the following sub-sections.

9.1.1 Field Logbook

A field logbook will be maintained to document where, when, how, and from whom pertinent project information was obtained. The field logbook will be a bound notebook with a sufficient number of divided sections and pages for anticipated daily entries so that all field notes associated with the proposed investigation are maintained together in one volume. For appropriate data management, separate sections of the logbook will be maintained for record of daily activities/observations, sample dates/times, equipment maintenance and calibration activities, and other information deemed appropriate by field personnel and the Project Manager. Logbook sections will be appropriately titled and each page within sections will be consecutively numbered (e.g., "page 15/30").

Entries will be made in the logbook each day of field work for the duration of the project. Logbook entries will be made with factual, objective language and will be legible, written in black ink, and signed or initialed by field personnel making the entries. To preserve information in case of logbook loss or damage, backup copies of logbook pages will be made daily or as practical and deemed appropriate by supervisory field personnel and the Project Manager.

At a minimum, the following information will be recorded in the field logbook:

- Field technician and project management/supervisory personnel names, responsibilities, and cell phone numbers;
- Names, responsibilities, and phone numbers for DTSC and laboratory representatives;
- Name and affiliation of site visitors (if any) and the purpose for their visit;
- Times that the personnel and site visitors (if any) arrive and depart;
- Summary of conversations with DTSC and laboratory representatives, site visitors, and others;
- General morning/afternoon weather conditions during daily field activities and as conditions significantly change;

- Summary of daily activities and significant events;
- Problems encountered, deviations from this workplan, and the reason/rationale for workplan modifications;
- General descriptions of field conditions;
- GPS coordinates of sampling locations;
- Photograph dates/times;
- Equipment types and model numbers, as appropriate; and
- Sample packaging and shipping information.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description;
- Site plan or sampling area sketch showing sample locations;
- Sample location GPS coordinates;
- Sampler's name(s);
- Date and time of sample collection;
- Designation of the sample as composite or discrete;
- Type of sampling equipment used;
- Sample preservation;
- Average flow rate, coefficient of variation of the flow rate, and total volume sampled;
- Average temperature and pressure measured by the sampler during the sampling event;
- Conditions at the site or of the collector that may have affected the sample;
- Any flags triggered by the sampler (e.g., power outage, flow rate variation); and
- Shipping arrangements and recipient laboratory.

9.1.2 Photographs

Color photographs will be taken with a digital camera during field activities at the discretion of field personnel. Photographs will serve to verify information entered in logbooks. Photographs will be uploaded to and saved in the computer file for the project on a daily basis or as soon as practical and deemed appropriate by field personnel and the Project Manager. A separate section of the field logbook will include a photographic log that will include the camera model, photographer name, photograph date/time, and brief photographic description. At a minimum, photographs will be taken to be representative of and document the following:

- Equipment used and field conditions at each sample location;
- Each sample location and its location relative to surrounding facilities and structures;
- Evidence of conditions at the site or of the collector that may have affected the sample; and
- Sampling equipment, sample containers, and the sampling process.

9.2 Labeling

An appropriate self-adhesive sample label will be affixed to each sample container. Sample container labels will indicate the unique sample number, sample date and time, sample location, sampler name or initials, requested analysis, and preservation used.

Information recorded on labels will be written legibly with permanent black ink in a clear and precise manner for proper identification in the field and subsequent tracking in the laboratory and at the disposal facility.

9.3 Sample COC Forms

Sample COC forms will be completed as sampling activities progress to record unique sample numbers, sample collection dates and times, and requested analyses and to provide sample tracking documentation in the field and laboratory. Each sample shipment cooler sent to the laboratory for analyses will be accompanied by an original COC specific for the shipment contents that bears the original signatures of sample custodians. Sample COC forms are in Appendices A through D, respectively.

Information recorded on COC forms will be written legibly with permanent black ink in a clear and precise manner for proper identification in the field and subsequent tracking in the laboratory and/or at the disposal facility. The Field Supervisors will be responsible for completing/maintaining chain-of-custodies until samples are shipped to the laboratory. Laboratory procedures and personnel responsibilities with respect to sample receipt, log-in, storage, and tracking in the laboratory are summarized in SOPs and QAMPs (Appendices A through D).

9.4 Packaging and Shipping

Sample containers will be transported by courier (e.g., Golden State Overnight, FedEx, etc.) in sturdy hard-sided ice chests for overnight delivery to the laboratory. Samples will be shipped the day of or the day after the last 24-hour sampling event at each facility, whichever is most practical based on workday limitations. The following summarizes the sample packaging procedures for the proposed investigation:

- Blue ice used to chill sample coolers will be double-bagged in re-useable plastic bags that will be securely sealed. Cooler drain plugs will be sealed with tape.

- Sample coolers will be lined with a large plastic bag and shipping material (e.g., bubble wrap) will be placed in the interior of the bottom of the coolers as necessary to prevent movement and damage to the sample containers during transportation.
- Screw caps on sample containers and temperature blank containers will be checked for tightness. If a sample container is not full, the volume level of the sample will be marked on the outside of the container with permanent black ink.
- Sample and QA/QC containers will be placed into re-sealable plastic storage bags that will be put into the sample coolers. Blue ice bags will be packed on top and around the samples to maintain an appropriate temperature in the cooler.
- Empty space in sample coolers will be filled with bubble wrap or other appropriate cushioning material to prevent sample container shifting during transportation to the laboratory.
- The appropriate COC(s) associated with the sample cooler will be double-bagged in re-sealable plastic bags and placed inside the cooler.
- Sample cooler lids will be securely sealed shut with clear packing tape and custody seals will be affixed to the front, right, and back of the cooler lids.

10.0 QUALITY CONTROL

This section summarizes the QC procedures for each monitoring event to ensure that the type, quantity, and quality of data used in decision-making are useful for intended applications and will support project objectives. The Project/Technical Manager will be responsible for overall QC for all monitoring events. Analytical laboratory department managers will be responsible for laboratory QC as specified in the laboratory-specific QAMPs.

The following sections summarize QC procedures with respect to field QC samples, background samples, field screening and confirmation samples, and laboratory QC samples.

10.1 Field QC Samples

Field sampling and laboratory precision will be assessed through the collection and analysis of field duplicates, which provide an assessment of the impact on sample integrity posed by collection, shipment, preparation, and analysis. Field duplicates will be collected at a rate of 1 for every 10 normal samples (10%). A summary of the proposed locations for the duplicate samples and their sampling frequency is presented in Table 3.

Variability will be assessed through the collection and analysis of field duplicate sample pairs. The two samples will be analyzed for identical contaminants, and will be submitted to the laboratory "blind." The sample locations of the field duplicates for each sampling event will be adjacent to the anticipated downwind locations, where concentrations are expected to be greatest. An assessment of the RPD between the results of each COC will be made to check if variability is within limits set by the DQIs.

10.2 Laboratory QC Samples

LCSs will be generated, analyzed, and reported in accordance with the requirements specified in the laboratory-specific QAMPs. MS/MSDs are scheduled for collection for each monitoring event at the rates specified in Section 3.2. MS/MSD samples may require double the normal sample volume. All air samples will be associated with the applicable MS pair for each analytical batch of 20 samples. Batch QC samples will also include method blanks, control samples, and calibration samples for each analytical method.

11.0 FIELD VARIANCES

Based on the knowledge of the Sites, it is unlikely that field conditions will be significantly different than anticipated. However, it may be necessary to implement some minor modifications to the sampling activities described in this SAP such as utilizing different sampling methods (disposable bailers versus peristaltic pumps).

Recommendations for significant SAP modifications (if any) will be based on the observations, judgment, and experience of the Field Supervisors, Project Manager, and Technical Manager following consultation with the DTSC, analytical laboratory, and others, as appropriate.

Our Project Manager will contact the DTSC as soon as practical to communicate significant unanticipated field conditions and significant problems or inconsistencies with this SAP that would potentially require modification of the proposed activities. Written approval of significant SAP modifications will be obtained from the DTSC prior to implementing changes. The summary report following monitoring events will document SAP modifications and the factors/rationale that made them necessary.

12.0 HEALTH AND SAFETY PROCEDURES

Our field personnel have completed Occupational Safety and Health Administration (OSHA) –approved 40-hour health and safety (Hazardous Waste Operations and Emergency Response) training course and appropriate 8-hour annual refresher courses. Field supervisory and sampling personnel will read and understand the air monitoring program and sampling procedures described in this SAP and the health/safety requirements and procedures for this project that are documented in the site-specific HSP in Appendix H.

Our field personnel will acknowledge familiarity with, and understanding of, the elements of the HSP by signing the final page of the HSP prior to site work. The Project Manager and Field Supervisors will conduct an onsite meeting prior to the start of field activities to communicate project roles and responsibilities, discuss key elements of the HSP, and coordinate activities. A copy of the HSP will be maintained at the Sites by supervisory field personnel for the duration of the field operations and will be available to affected personnel.

The risk of significant exposure to contaminants is considered to be low to moderate while performing tasks required during air monitoring. Sampling methods and work practices to be employed will reduce the potential for significant exposure to potential contaminants. On that basis, it is anticipated that Level D protection will be appropriate for field activities. Level D PPE includes hard hats, safety boots, and safety glasses as appropriate. Samplers will wear appropriate disposable gloves. If field conditions warrant upgrading to a higher protection level, all work will cease and the health and safety officer will be notified.

13.0 REPORT PREPARATION

Following receipt and review of laboratory analytical reports, a summary report will be prepared documenting the results of air monitoring. At a minimum, the report will include:

- Meteorological conditions.
- Site and adjacent property descriptions.
- Site location map and a site plan that depicts sample locations.
- Summary of the field investigation and sampling procedures implemented. A copy of the field logbook will be included in an appendix.
- A summary table for Field Equipment/Instrument Calibration, Maintenance, Testing, and Inspection showing when the calibrations were completed and the results of the tests.
- Qualitative summary of conditions observed.
- Summary of and rationale for variances to this SAP, if any.
- Tabulated analytical results. Laboratory reports will be included in an appendix.
- QA/QC procedures that were implemented for field and laboratory work and an evaluation whether project DQOs were satisfied.

14.0 ANTICIPATED SCHEDULE

The anticipated schedule for the SAP is summarized below:

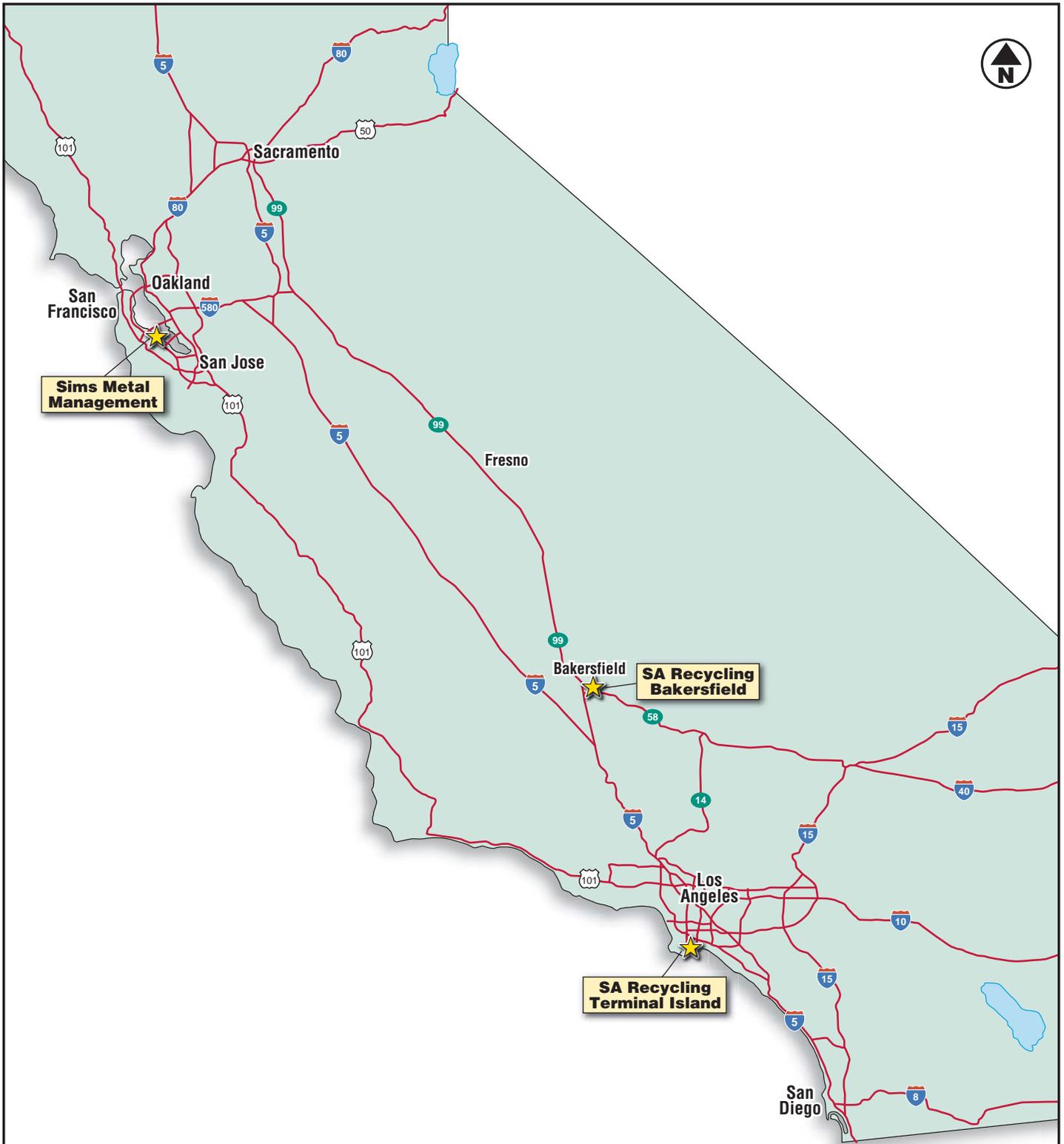
- Geocon submits Draft SAP to DTSC: September 1, 2016
- DTSC review of Draft SAP: September 12, 2016
- Geocon submits Final SAP to DTSC: September 29, 2016
- DTSC approval of Final SAP: September 30, 2016
- Geocon conducts SAP field work at SARB: October 3-7, 2016
- Geocon conducts SAP field work at SARTI: October 10-15, 2016
- Geocon conducts SAP field work at SARB: October 17-21, 2016
- Geocon submits Draft Summary Report for SARB: October 31, 2016
- DTSC review of Draft Summary Report for SARB: November 8, 2016
- Geocon submits Draft Summary Report for SARTI: November 8, 2016
- DTSC review of Draft Summary Report for SARTI: November 15, 2016
- Geocon submits Draft Summary Report for SMM: November 15, 2016
- DTSC review of Draft Summary Report for SMM: November 22, 2016
- Geocon submits revised Summary Reports for SARB, SARTI, and SMM to DTSC: November 31, 2016
- DTSC determination on Summary Report: November 31, 2016

15.0 REFERENCES

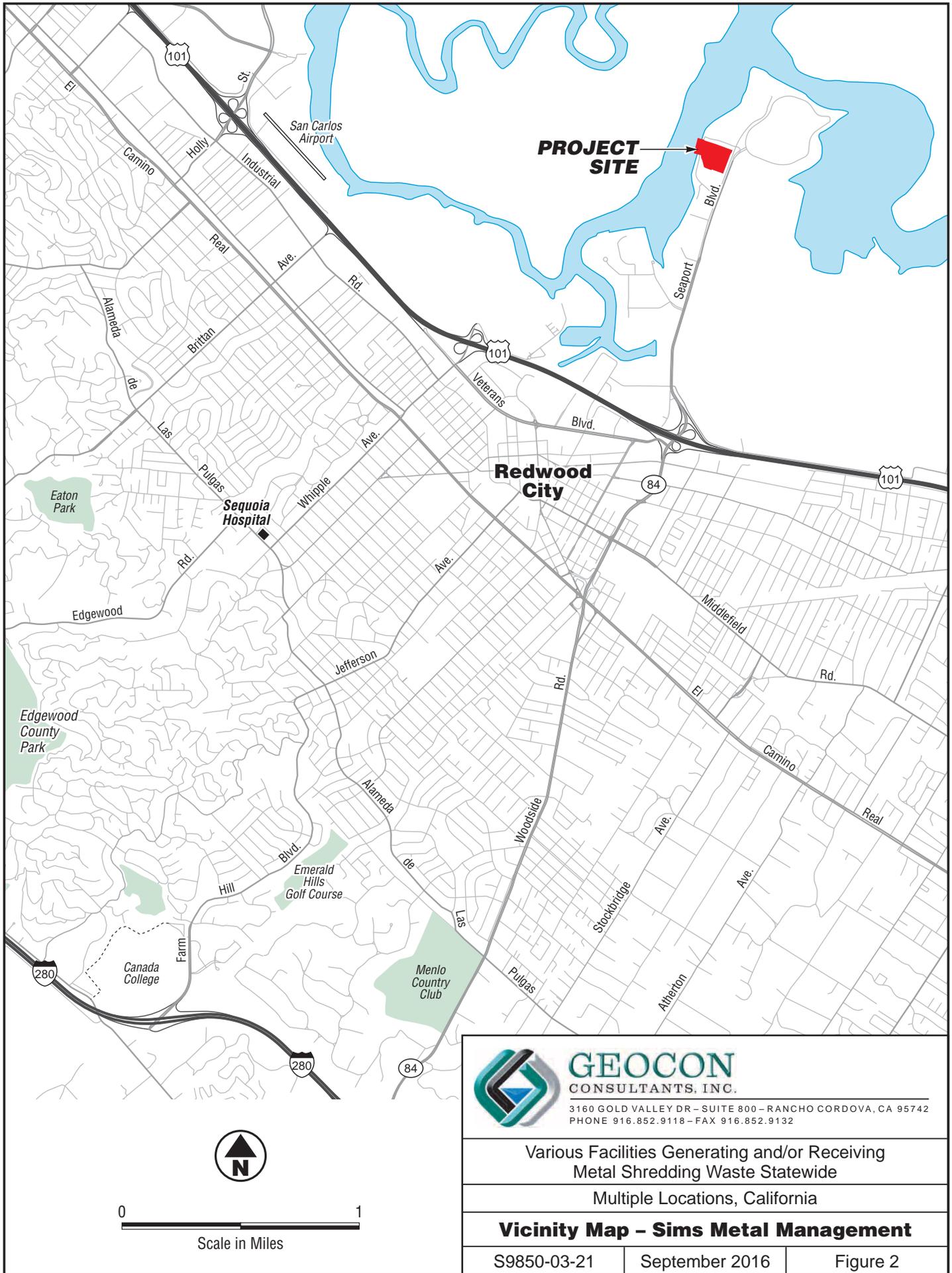
- Iowa Environmental Mesonet Database, <http://mesonet.agron.iastate.edu/>
- SA Recycling Bakersfield webpage, <http://www.sarecycling.com/yard/CA-Bakersfield-2000-E-Brundage-Lane/>
- SA Recycling Terminal Island webpage, <http://www.sarecycling.com/yard/CA-Los-Angeles-901-New-Dock-Street/>
- Sims Metal Management Redwood City webpage, <http://www.simsmm.com/Local-Solutions/North-America/California/Redwood-City>
- Tisch Environmental, *Operations Manual TE-5170V Volumetric Flow Controlled Total Suspended Particulate High Volume Air Sampler*,
- Tisch Environmental, *TE-Wilbur Operations Manual*, Revised January 2016
- Tisch Environmental, *TE-1000 PUF Poly-Urethane Foam High Volume Air Sampler Operations Manual*
- United States Environmental Protection Agency, *40 CFR Part 50, Appendix B to Part 50 Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere*, 1998.
- United States Environmental Protection Agency, *40 CFR Appendix E to Part 58 - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring*, 2015.
- United States Environmental Protection Agency, *40 CFR Part 50, Appendix J to Part 50 Reference Method for the Determination of Particulate Matter as PM₁₀ in the Atmosphere*, 1998.
- United States Environmental Protection Agency, *40 CFR Part 50, Appendix L to Part 50 Reference Method for the Determination of Particulate Matter as PM_{2.5} in the Atmosphere*, 1998.
- United States Environmental Protection Agency, *Quality Assurance Guidance Document 2.12 – Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods*, 2016.
- United States Environmental Protection Agency, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition: Compendium Method TO-15 - Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed By Gas Chromatography/Mass Spectrometry*, January, 1999.
- United States Environmental Protection Agency, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition: Compendium Method TO-11A - Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC) [Active Sampling Methodology]*, January, 1999.

United States Environmental Protection Agency, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition: Compendium Method TO-4A - Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using High Volume Polyurethane Foam (PUF) Sampling Followed by Gas Chromatographic/Multi-Detector Detection*, January, 1999.

Western Regional Climate Center webpage, <http://www.wrcc.dri.edu/>.



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Various Facilities Generating and/or Receiving Metal Shredding Waste Statewide		
Multiple Locations, California		
Project Location Map		
S9850-03-21	September 2016	Figure 1



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Various Facilities Generating and/or Receiving
Metal Shredding Waste Statewide

Multiple Locations, California

Vicinity Map - Sims Metal Management

S9850-03-21

September 2016

Figure 2



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Various Facilities Generating and/or Receiving Metal Shredding Waste Statewide	
Multiple Locations, California	
Site Plan - Sims Metal Management	
S9850-03-21	September 2016
	Figure 3

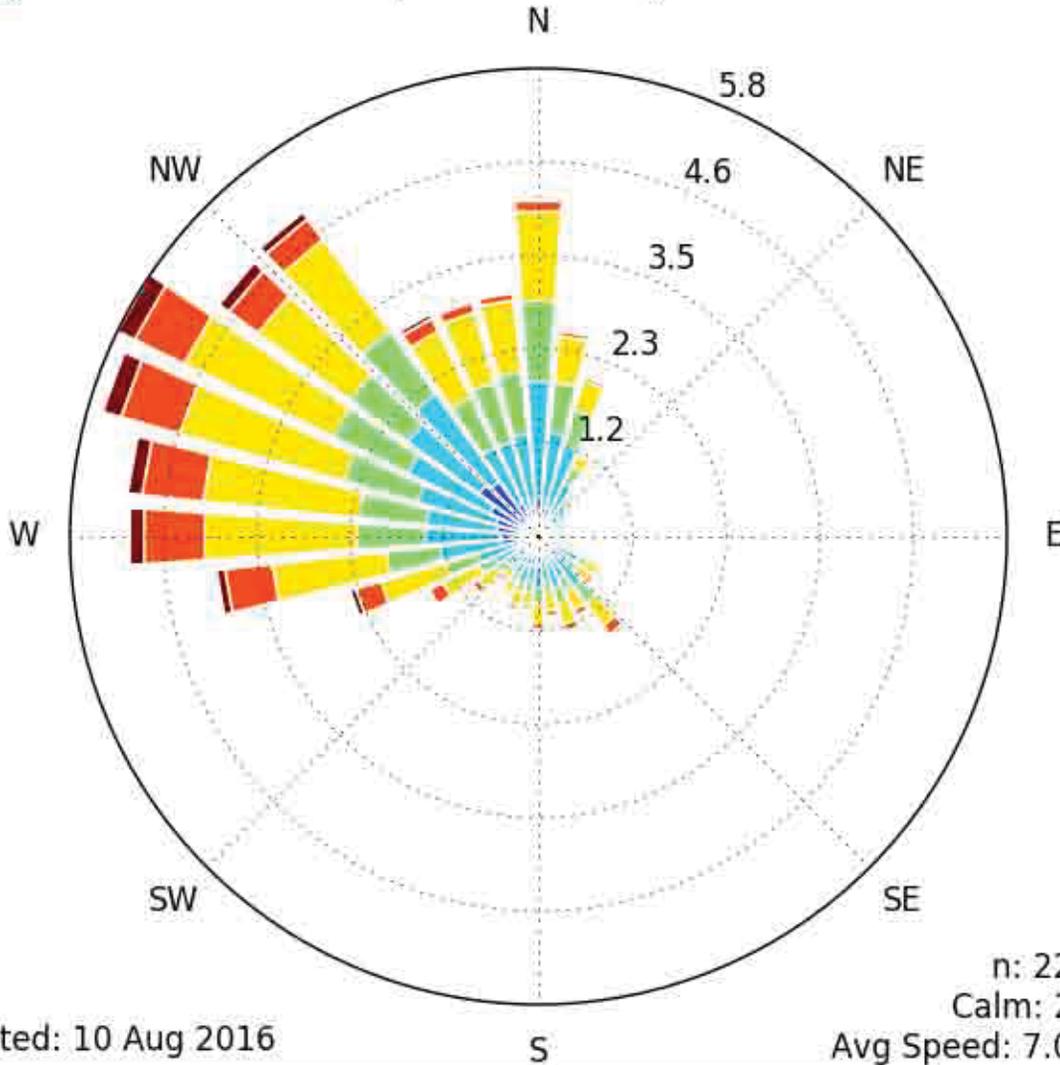
LEGEND:

- - - Approximate Site Boundary
- Proposed Air Sampling Location

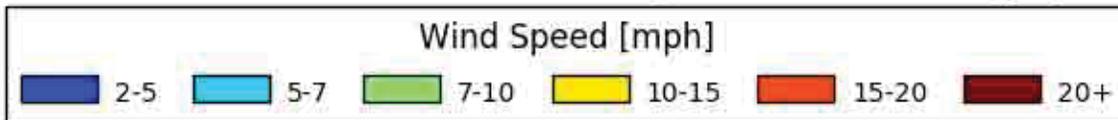
0 200
 Scale in Feet



[SQL] SAN CARLOS AIRPORT
Windrose Plot [All Year]
Period of Record: 01 Jul 1983 - 09 Aug 2016



Generated: 10 Aug 2016



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Metal Shredding Waste Statewide

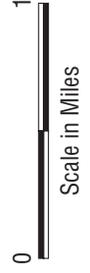
Multiple Locations, California

Rose Diagram - Sims Metal Management

S9850-03-21

September 2016

Figure 4





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Various Facilities Generating and/or Receiving
Metal Shredding Waste Statewide

Multiple Locations, California

Vicinity Map - SA Recycling Bakersfield

S9850-03-21 September 2016 Figure 5



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Various Facilities Generating and/or Receiving
 Metal Shredding Waste Statewide
 Multiple Locations, California

Site Plan - SA Recycling Bakersfield

S9850-03-21 September 2016 Figure 6

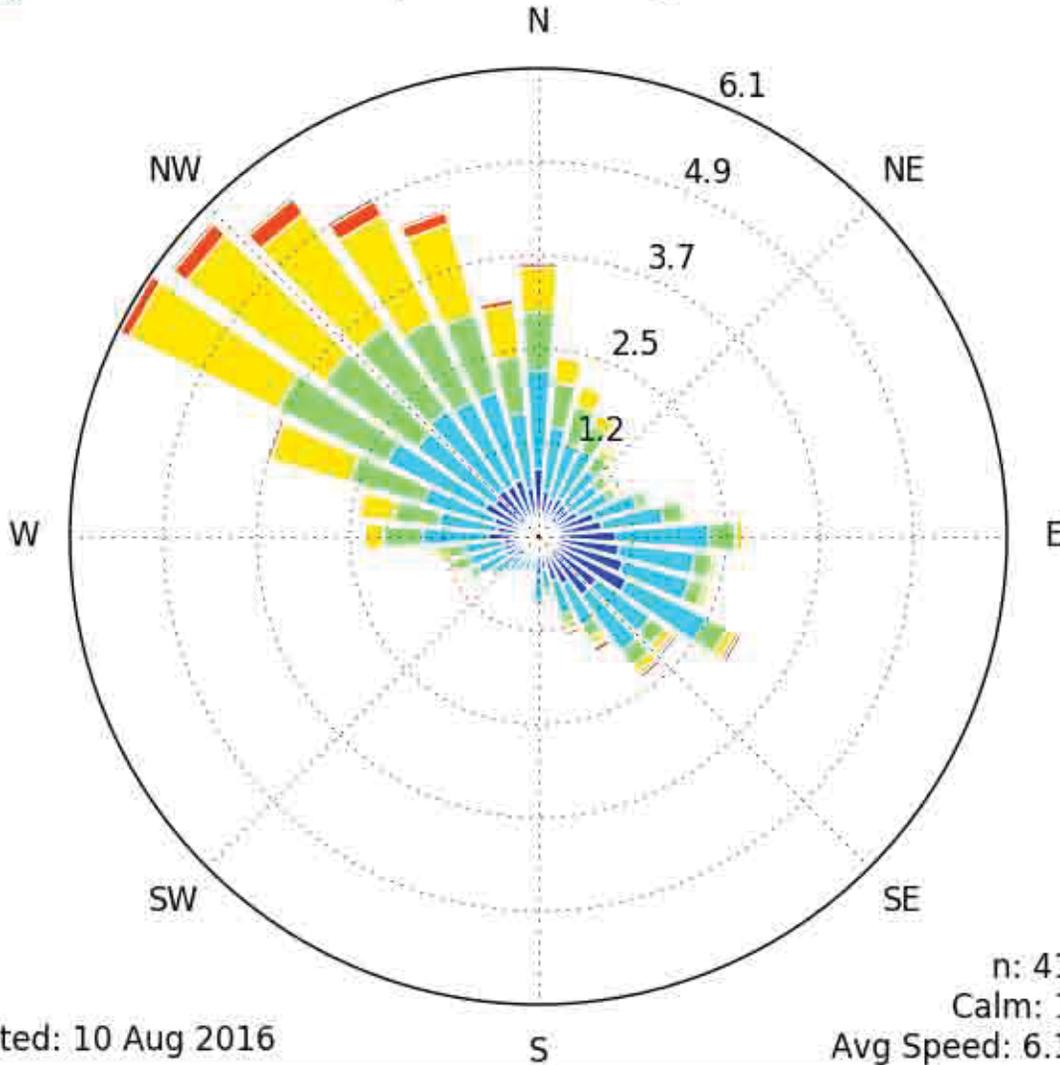
LEGEND:

- Approximate Site Boundary
- SARBB1 Proposed Air Sampling Location

0 250
 Scale in Feet

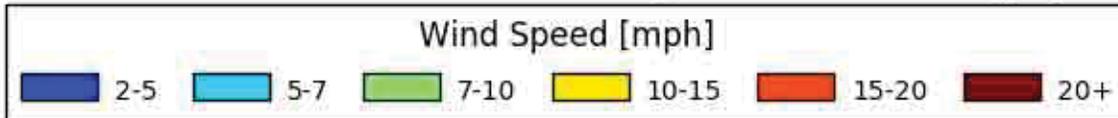


[BFL] BAKERSFIELD/MEADOWS
 Windrose Plot [All Year]
 Period of Record: 01 Jan 1970 - 09 Aug 2016



Stats
 n: 411062
 Calm: 17.8%
 Avg Speed: 6.1 mph

Generated: 10 Aug 2016



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Various Facilities Generating and/or Receiving
 Metal Shredding Waste Statewide

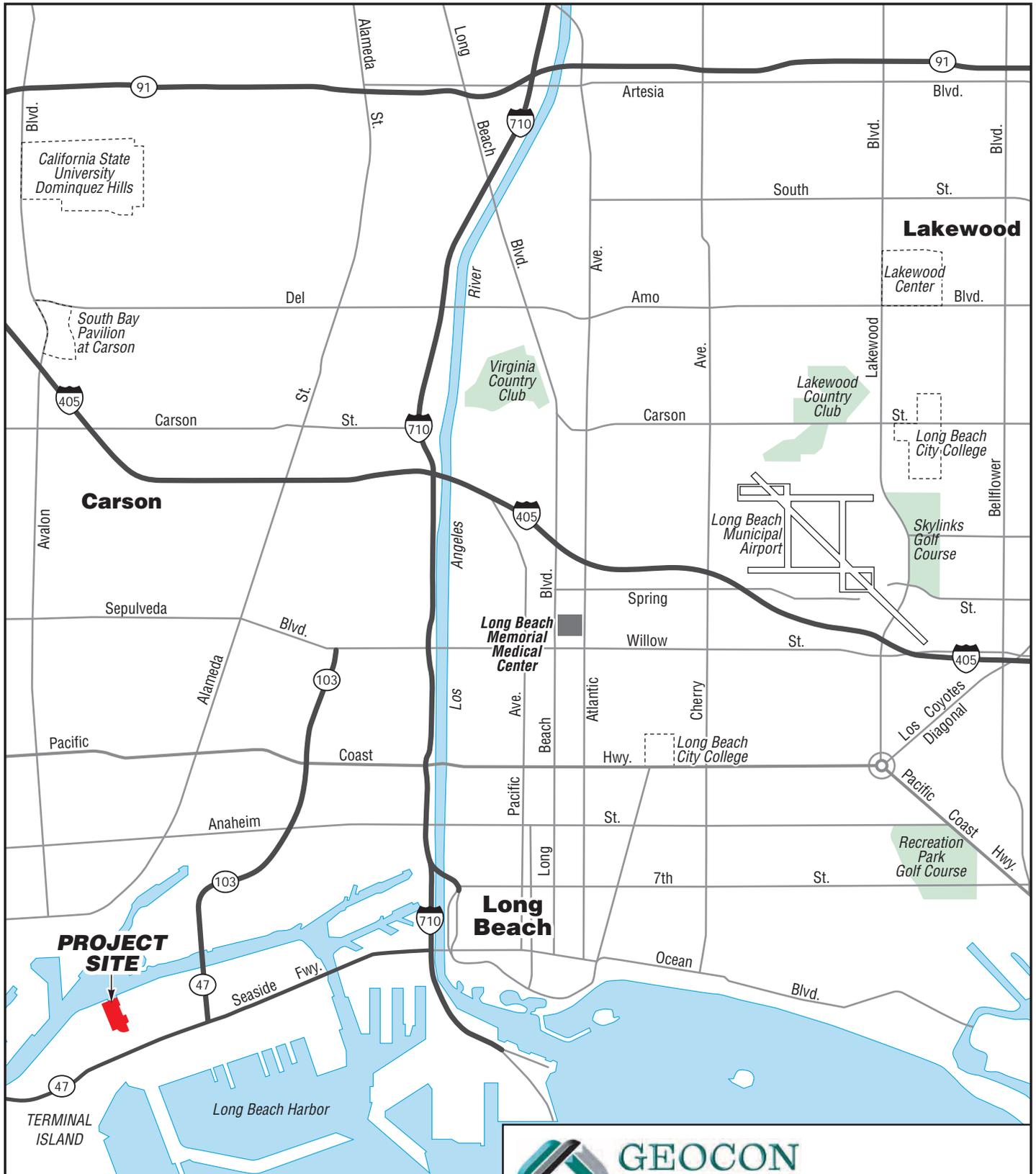
Multiple Locations, California

Rose Diagram - SA Recycling Bakersfield

S9850-03-21

September 2016

Figure 7



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Various Facilities Generating and/or Receiving
Metal Shredding Waste Statewide

Multiple Locations, California

Vicinity Map - SA Recycling Terminal Island

S9850-03-21

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Figure 8



EAST BASIN



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Various Facilities Generating and/or Receiving
Metal Shredding Waste Statewide

Multiple Locations, California

Site Plan - SA Recycling Terminal Island

S9850-03-21

September 2016

Figure 9

LEGEND:

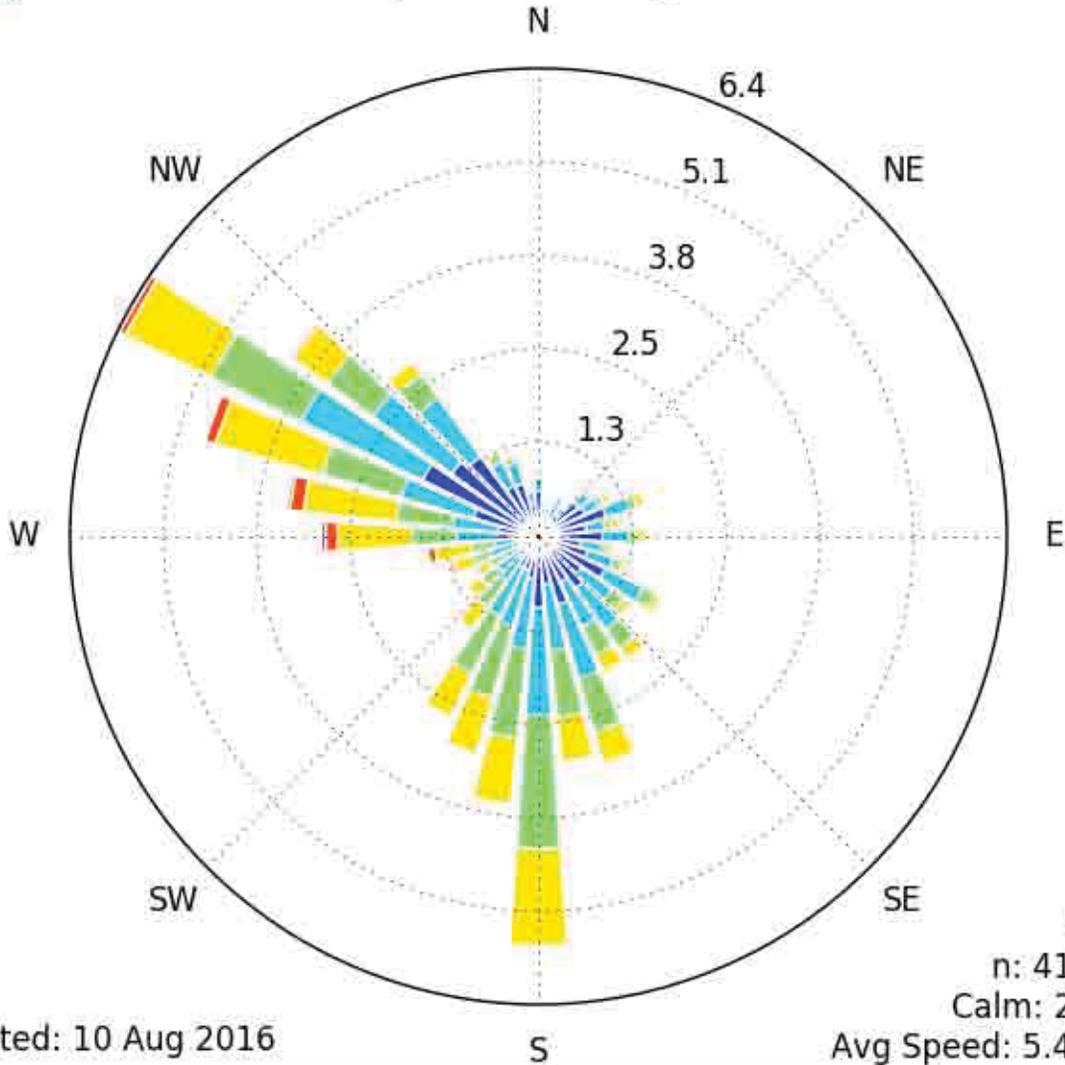
--- Approximate Site Boundary

SART11 Proposed Air Sampling Location

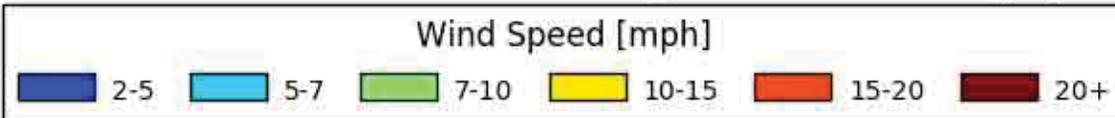




[LGB] LONG BEACH AIRPORT
Windrose Plot [All Year]
Period of Record: 01 Jan 1970 - 09 Aug 2016



Generated: 10 Aug 2016



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Various Facilities Generating and/or Receiving
Metal Shredding Waste Statewide

Multiple Locations, California

Rose Diagram - SA Recycling Terminal Island

S9850-03-21

September 2016

Figure 10

TABLE 1
 SUMMARY OF DATA QUALITY OBJECTIVES
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

<p>Step 1 State the Problem and Project Tasks</p>	<p>Stakeholders: The DTSC.</p> <p>Problem: To provide credible data that can be used to characterize the risks and hazards associated with off-site migration of air emissions impacted by metals, asbestos, and toxic organic compounds (i.e., the COPCs) resulting from metal shredding and/or the handling of metal shredding waste.</p> <p>Tasks: Collect TSP, PM10, PM2.5, metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc;) , asbestos, and toxic organic species (including benzene, chloromethane, 1,1-dichloroethene, ethylbenzene, 4-ethyltoluene, dichlorodifluoromethane (aka Freon 12), trichlorofluoromethane, (aka Freon 11), 1,2,4-trimethylbenzene, toluene, 1,3,5-trimethylbenzene, xylenes, vinyl chloride, poly chlorinated biphenyls (PCB), and formaldehyde) from preselected upwind, downwind, and cross wind locations samples at pre-selected locations (Figures 3, 4, and 5) at three selected metal shredding facilities, analyze the samples for the COPCs, and report the results.</p>
<p>Step 2 Identify the Goal of the Study</p>	<p>Questions to Resolve and Potential Actions to Take:</p> <p>Is air at the metal shredding facilities impacted by COPCs at concentrations that could potentially be detrimental to human health and/or the environment?</p> <p>If so, recommendations for additional investigation and/or remediation will be made, as appropriate.</p>
<p>Step 3 Identify Information Inputs</p>	<p>Information Inputs:</p> <ol style="list-style-type: none"> 1. Goals and plans for the Facilities 2. Operational history of the Facilities 3. Findings of previous investigations associated with the Facilities (if any) 4. Regulatory agency decisions regarding the Facilities (if any) 5. Potential environmental and/or human impacts of the Site 6. Observations and monitoring/screening results during field activities 7. Analytical results of air samples 8. Potential exposure scenarios and pathways for receptors of concern 9. Laboratory QC results and overall project QC evaluations.

TABLE 1
 SUMMARY OF DATA QUALITY OBJECTIVES
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

<p>Step 4 Define Boundaries of the Study</p>	<p>Spatial Boundaries: Each facility's property boundaries will define the maximum lateral extent of investigation activities with a focus on collecting samples from the perimeter of the facilities. To assess if activities occurring at the metal shredding facilities are contributing to the COPC impacted air, we will collect samples from upwind, downwind, and cross wind locations at each facility. Additional spatial considerations will be needed to be in compliance with the sampling placement requirements listed in 40 CFR Appendix E to Part 58 - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring. As such, sampler inlets are required to be between 2 and 7 meters above ground level, greater than 2 meters away from supporting structures (like walls, parapets, or penthouses, greater than 10 meters from trees, and between 2 and 10 meters from roadways. Furthermore, because each of these sampling locations will have multiple collocated sampling devices present, the sampler inlets for any high volume samples (>200 liters per minute) must be at least 2 meters apart and the sampling inlets for low volume samplers (<200 L/min) will be spaced at least 1 meter apart, they must be spaced no greater than 4 meters apart, and the inlets should be within 1 meter of each of the vertically.</p> <p>Temporal Boundaries: The temporal limits of the field activities are defined by contractual budgeted resources for the proposed investigation, which includes up to three separate 24-hour sampling durations at each of the three metals shredding facilities.</p>
<p>Step 5 Develop the Analytic Approach</p>	<p>High volume TSP equipment will sample an 8-in by 10-in quartz fiber filter which will be analyzed off-site for TSP and selected metals. Low volume PM10 equipment will sample 47-mm Teflon filter which will be analyzed off-site for PM10 and selected metals. Low volume PM2.5 equipment will sample 47-mm Teflon filter which will be analyzed off-site for PM2.5 and selected metals. Low volume air sampling equipment will be used to sample onto 25-mm diameter mixed cellulose ester fiber filters which will be analyzed offsite for asbestos. High volume air sampling equipment will be used to sample onto 3-inch thick polyurethane foam (PUF) plugs which will be analyzed offsite for PCBs. Low volume air sampling equipment will be used to sample onto a cartridge containing silica gel coated with 2-4-dinitrophenylhydrazine which will be analyzed offsite for formaldehyde. 6-Liter Summa canisters will be used to sample ambient air and will be analyzed offsite for selected toxics organic species.</p>
<p>Step 6 Specify Performance or Acceptance Criteria</p>	<p>Acceptance of the chemical analytical results will be based on verification and validation criteria specified in the data quality indicators in Table 2.</p>

TABLE 1
 SUMMARY OF DATA QUALITY OBJECTIVES
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Step 7 Develop the Detailed Plan for Obtaining Data	<p>Basic Data Collection Design: Collection and analysis of air quality samples at the facilities is in accordance with USEPA’s <i>40 CFR Part 50, Appendix B to Part 50 Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere</i>, <i>40 CFR Part 50, Appendix J to Part 50 Reference Method for the Determination of Particulate Matter as PM₁₀ in the Atmosphere</i>, and <i>40 CFR Part 50, Appendix L to Part 50 Reference Method for the Determination of Particulate Matter as PM_{2.5} in the Atmosphere</i> and will evaluate the air along the perimeter of the facilities for potential impact by the COPCs. Data collection is designed to characterize air upwind, crosswind and downwind of the current metal shredding facilities to provide data useful to evaluate potential impacts and manage risk associated with the Site (if any).</p> <p>Design Flexibility: If concentrations of COPCs reported in soil, sediment, groundwater and soil vapor samples exceed respective screening levels, then additional investigation or appropriate remediation measures may be recommended DTSC to characterize the distribution and/or limits of potentially hazardous substances so that appropriate mitigation measures can be developed (if any).</p>
---	--

Notes:

- COPCs = Chemicals of potential concern
- DTSC = Department of Toxic Substances Control
- USEPA = U.S. Environmental Protection Agency
- TSP = Total suspended particulates
- PM10 = Particulate matter > 10 µg
- PM2.5 = Particulate matter > 2.5 µg
- µg = micrograms
- TOS = Toxic organic species

TABLE 2
 DATA QUALITY INDICATORS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

INDICATOR	MEANS OF ASSESSMENT	QUALITY CONTROL ELEMENT(S) ASSESSED	ACCEPTANCE CRITERIA
Precision	RPD	Field and lab duplicate samples; LCS/LCSD and MS/MSD samples; laboratory control samples	CLN: Field duplicates: 20% RPD Lab duplicates: 20% RPD; LCS/LCSD : 25% RPD; Lab replicate: ±20% RPD; Reweighing filters: ±0.01 mg (Teflon) and ±0.04 mg (quartz); EMSL: IC : 30%RSD; ECS: LCS/LCSD : 25% RPD; EAT: ICAL: <10%
Accuracy	%R	Field; LCS and MS/MSD samples; laboratory control samples	CLN: CCC : 0.995; ICV: 90-110%; LCR: 70-130% LCS: 80-120%; CCV: 90-110% MS: 75-125%; AS: 75-125% EMSL: ICV: 90%; RLLC: 60-140% CCV: 70-130% ECV: 70-130%; ECS: IC/ICV: >20% MS/MSD: 50-135%; EAT: ICV: 85-115% CCV: ±10%

TABLE 2
 DATA QUALITY INDICATORS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

INDICATOR	MEANS OF ASSESSMENT	QUALITY CONTROL ELEMENT(S) ASSESSED	ACCEPTANCE CRITERIA
Accuracy	Blanks	Laboratory control samples	CLN: ICB: < detection limits; CCB: < detection limits EMSL: Method blank : < or less than 5 ppb above reporting limit ECS: Method blank: <reporting limit EAT: Solvent blank: < reporting limit
Completeness	Percent of complete data	Analytical data reports by method and event	> 95%
Representativeness	Overview of investigation data	Analytical data reports; all applicable elements	Lateral and vertical extent of COCs defined by data gathered
Comparability			Trend analysis

Notes:

- RPD - relative percent difference
- MS/MSD - matrix spike/matrix spike duplicate
- LCS/LCSD - laboratory control sample/laboratory control sample duplicate
- CCC - calibration correlation coefficient
- IC/ICV - initial calibration/ initial calibration verification
- ICAL - initial calibration curve
- LCR - low-level calibration recovery
- AS - analytical spike
- CCV - continuing calibration verification
- RLLC - report limit laboratory control
- ECV - end calibration verification
- %R - percent recovery
- COCs - contaminants of concern
- CLN - CHESTER LabNet
- EMSL - EMSL Analytical Inc.
- ECS - Eurofins Calscience
- EAT - Eurofins Air Toxics

TABLE 3
 CALIBRATION AND SAMPLING FREQUENCY AND ANALYSIS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Sample ID	Number of Filters/Samplers Needed							QA/QC Sample ID
	TSP/Metals	PM10/ Metals	PM2.5/ Metals	Asbestos	TOS	Formal- dehyde	PCBs	
SMM4-T2-TSP	1							
SMM4-T2-PM10		1						
SMM4-T2-PM2.5			1					
SMM4-T2-ASBESTOS				1				
SMM4-T2-TOS					1			
SMM4-T2-FORM						1		
SMM4-T2-PCB							1	
SMM4-T3-TSP	1							
SMM4-T3-PM10		1						
SMM4-T3-PM2.5			1					
SMM4-T3-ASBESTOS				1				
SMM4-T3-TOS					1			
SMM4-T3-FORM						1		
SMM4-T3-PCB							1	
Trip Blank Samples								
	1							SMM-TB-TSP
		1						SMM-TB-PM10
			1					SMM-TB-PM2.5
				1				SMM-TB-ASBESTOS
					0			
						1		SMM-TB-FORM
							1	SMM-TB-PCB
Lab Blank Samples								
	2							Held by lab, not shipped to Site.
		2						
			2					
Sampling Breakdown for SMM								
Primary Samples	12	12	12	12	12	12	12	
Duplicate Samples	2	2	2	2	2	2	2	
Trip Blank Samples	1	1	1	1	0	1	1	
Field Blank Samples	2	2	2	0	0	0	0	
Lab Blank Samples	2	2	2	0	0	0	0	
Total Number of Samples at SMM	19	19	19	15	14	15	15	

TABLE 3
 CALIBRATION AND SAMPLING FREQUENCY AND ANALYSIS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Sample ID	Number of Filters/Samplers Needed							QA/QC Sample ID
	TSP/Metals	PM10/ Metals	PM2.5/ Metals	Asbestos	TOS	Formal- dehyde	PCBs	
Calibrate Equipment Prior to First Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
SARB1-T1-TSP	1							
SARB1-T1-PM10		1						
SARB1-T1-PM2.5			1					
SARB1-T1-ASBESTOS				1				
SARB1-T1-TOS					1			
SARB1-T1-FORM						1		
SARB1-T1-PCB							1	
Calibrate Equipment Prior to First Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
SARB1-T2-TSP	1							
SARB1-T2-PM10		1						
SARB1-T2-PM2.5			1					
SARB1-T2-ASBESTOS				1				
SARB1-T2-TOS					1			
SARB1-T2-FORM						1		
SARB1-T2-PCB							1	
SARB1-T3-TSP	1							
SARB1-T3-PM10		1						
SARB1-T3-PM2.5			1					
SARB1-T3-ASBESTOS				1				
SARB1-T3-TOS					1			
SARB1-T3-FORM						1		
SARB1-T3-PCB							1	
Calibrate Equipment Prior to First Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
SARB2-T1-TSP	1 + DUP							SARB5-T1-TSP
SARB2-T1-PM10		1 + DUP						SARB5-T1-PM10
SARB2-T1-PM2.5			1 + DUP					SARB5-T1-PM2.5
SARB2-T1-ASBESTOS				1 + DUP				SARB5-T1-ASBESTOS
SARB2-T1-TOS					1 + DUP			SARB5-T1-TOS
SARB2-T1-FORM						1 + DUP		SARB5-T1-FORM
SARB2-T1-PCB							1 + DUP	SARB5-T1-PCB
SARB2-T2-TSP	1 + DUP							SARB5-T2-TSP
SARB2-T2-PM10		1 + DUP						SARB5-T2-PM10
SARB2-T2-PM2.5			1 + DUP					SARB5-T2-PM2.5
SARB2-T2-ASBESTOS				1 + DUP				SARB5-T2-ASBESTOS
SARB2-T2-TOS					1 + DUP			SARB5-T2-TOS
SARB2-T2-FORM						1 + DUP		SARB5-T2-FORM
SARB2-T2-PCB							1 + DUP	SARB5-T2-PCB

TABLE 3
 CALIBRATION AND SAMPLING FREQUENCY AND ANALYSIS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Sample ID	Number of Filters/Samplers Needed							QA/QC Sample ID
	TSP/Metals	PM10/ Metals	PM2.5/ Metals	Asbestos	TOS	Formal- dehyde	PCBs	
SARB4-T2-TSP	1							
SARB4-T2-PM10		1						
SARB4-T2-PM2.5			1					
SARB4-T2-ASBESTOS				1				
SARB4-T2-TOS					1			
SARB4-T2-FORM						1		
SARB4-T2-PCB							1	
SARB4-T3-TSP	1							
SARB4-T3-PM10		1						
SARB4-T3-PM2.5			1					
SARB4-T3-ASBESTOS				1				
SARB4-T3-TOS					1			
SARB4-T3-FORM						1		
SARB4-T3-PCB							1	
Trip Blank Samples								
	1							SARB-TB-TSP
		1						SARB-TB-PM10
			1					SARB-TB-PM2.5
				1				SARB-TB-ASBESTOS
					0			
						1		SARB-TB-FORM
							1	SARB-TB-PCB
Lab Blank Samples								
	2							Held by lab, not shipped to Site.
		2						
			2					
Sampling Breakdown for SARB								
Primary Samples	12	12	12	12	12	12	12	
Duplicate Samples	2	2	2	2	2	2	2	
Trip Blank Samples	1	1	1	1	0	1	1	
Field Blank Samples	2	2	2	0	0	0	0	
Lab Blank Samples	2	2	2	0	0	0	0	
Total Number of Samples at SARB	19	19	19	15	14	15	15	

TABLE 3
 CALIBRATION AND SAMPLING FREQUENCY AND ANALYSIS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Sample ID	Number of Filters/Samplers Needed							QA/QC Sample ID
	TSP/Metals	PM10/ Metals	PM2.5/ Metals	Asbestos	TOS	Formal- dehyde	PCBs	
Calibrate Equipment Prior to First Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
SARTI1-T1-TSP	1							
SARTI1-T1-PM10		1						
SARTI1-T1-PM2.5			1					
SARTI1-T1-ASBESTOS				1				
SARTI1-T1-TOS					1			
SARTI1-T1-FORM						1		
SARTI1-T1-PCB							1	
SARTI1-T2-TSP	1							
SARTI1-T2-PM10		1						
SARTI1-T2-PM2.5			1					
SARTI1-T2-ASBESTOS				1				
SARTI1-T2-TOS					1			
SARTI1-T2-FORM						1		
SARTI1-T2-PCB							1	
SARTI1-T3-TSP	1							
SARTI1-T3-PM10		1						
SARTI1-T3-PM2.5			1					
SARTI1-T3-ASBESTOS				1				
SARTI1-T3-TOS					1			
SARTI1-T3-FORM						1		
SARTI1-T3-PCB							1	
Calibrate Equipment Prior to First Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
SARTI2-T1-TSP	1							
SARTI2-T1-PM10		1						
SARTI2-T1-PM2.5			1					
SARTI2-T1-ASBESTOS				1				
SARTI2-T1-TOS					1			
SARTI2-T1-FORM						1		
SARTI2-T1-PCB							1	
SARTI2-T2-TSP	1 + DUP							SARTI2-T2-TSP
SARTI2-T2-PM10		1 + DUP						SARTI2-T2-PM10
SARTI2-T2-PM2.5			1 + DUP					SARTI2-T2-PM2.5
SARTI2-T2-ASBESTOS				1 + DUP				SARTI2-T2-ASBESTOS
SARTI2-T2-TOS					1 + DUP			SARTI2-T2-TOS
SARTI2-T2-FORM						1 + DUP		SARTI2-T2-FORM
SARTI2-T2-PCB							1 + DUP	SARTI2-T2-PCB

TABLE 3
 CALIBRATION AND SAMPLING FREQUENCY AND ANALYSIS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Sample ID	Number of Filters/Samplers Needed							QA/QC Sample ID
	TSP/Metals	PM10/ Metals	PM2.5/ Metals	Asbestos	TOS	Formal- dehyde	PCBs	
SARTI4-T2-TSP	1 + FB							SARTI4-T2-TSP-FB
SARTI4-T2-PM10		1 + FB						SARTI4-T2-PM10-FB
SARTI4-T2-PM2.5			1 + FB					SARTI4-T2-PM2.5-FB
SARTI4-T2-ASBESTOS				1				
SARTI4-T2-TOS					1			
SARTI4-T2-FORM						1		
SARTI4-T2-PCB							1	
SARTI4-T3-TSP	1							
SARTI4-T3-PM10		1						
SARTI4-T3-PM2.5			1					
SARTI4-T3-ASBESTOS				1				
SARTI4-T3-TOS					1			
SARTI4-T3-FORM						1		
SARTI4-T3-PCB							1	
Trip Blank Samples								
	1							SARTI-TB-TSP
		1						SARTI-TB-PM10
			1					SARTI-TB-PM2.5
				1				SARTI-TB-ASBESTOS
					0			
						1		SARTI-TB-FORM
							1	SARTI-TB-PCB
Lab Blank Samples								
	2							Held by lab, not shipped to Site.
		2						
			2					
Sampling Breakdown for SARTI								
Primary Samples	12	12	12	12	12	12	12	
Duplicate Samples	2	2	2	2	2	2	2	
Trip Blank Samples	1	1	1	1	0	1	1	
Field Blank Samples	2	2	2	0	0	0	0	
Lab Blank Samples	2	2	2	0	0	0	0	
Total Number of Samples at SARTI	19	19	19	15	14	15	15	

Notes:

- TSP = Total suspended particulates
- PM10 = Particulate matter > 10 µg
- PM2.5 = Particulate matter > 2.5 µg
- µg = micrograms
- TOS = Toxic organic species
- SMM = Sims Metal Management - Redwood City
- SARB = SA Recycling - Bakersfield
- SARTI = SA Recycling Terminal Island
- FB = Field blank. Filter is loaded into sampling equipment but not run.
- DUP = Duplicate sample. Samples collected from identically configured sampler located adjacent to the primary sample location.

TABLE 4
 SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

ANALYTES	ANALYTICAL METHOD	SAMPLE CONTAINERS	PRESERVATION	HOLDING TIME
TSP	Gravimetric methods listed in Title 40 CFR Part 50 Appendix B	One 8-inch by 10-inch quartz filter	None	30 Days ¹
PM10	Gravimetric methods listed in Title 40 CFR Part 50 Appendix J	One 47-millimeter PTFE Teflon filter with support ring	Cool 4°C (+/- 2°C)	30 Days
PM2.5	Gravimetric methods listed in Title 40 CFR Part 50 Appendix L	One 47-millimeter PTFE Teflon filter with support ring	Cool 4°C (+/- 2°C)	30 Days
Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc	USEPA IO3.3	One 8-inch by 10-inch quartz filter	None	30 Days ¹
Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc	USEPA IO3.3	One 47-millimeter PTFE Teflon filter with support ring	Cool 4°C (+/- 2°C)	30 Days
Beryllium	Title 40 CFR Part 50 Appendix G	One 8-inch by 10-inch quartz filter	None	6 Months
Beryllium	Title 40 CFR Part 50 Appendix G	One 47-millimeter PTFE Teflon filter with support ring	Cool 4°C (+/- 2°C)	30 Days

TABLE 4
 SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

ANALYTES	ANALYTICAL METHOD	SAMPLE CONTAINERS	PRESERVATION	HOLDING TIME
Asbestos	AEHRA-modified TEM as found in 40 CFR part 763 Appendix A Subpart E	25-millimeter mixed cellulose ester fiber filter	Cool 4°C (+/- 2°C)	None
Benzene, chloromethane, 1,1-dichloroethene, ethylbenzene, 4-ethyltoluene, dichlorodifluoromethane, trichlorofluoromethane, 1,2,4-trimethylbenzene, toluene, 1,3,5-trimethylbenzene, xylenes, vinyl chloride	EPA Method TO-15	One 6-Liter Summa canister	None	30 Days
PCBs	USEPA Method TO-4A	3-inch thick polyurethane foam (PUF) plugs	Cool 4°C (+/- 2°C)	30 Days
Formaldehyde	USEPA Method TO-11A	Cartridge containing silica gel coated with 2,4-dinitrophenylhydrazine fitted with an ozone scrubber	Cool 4°C (+/- 2°C)	14 Days

Notes:

PCBs = polychlorinated biphenyls

°C = degrees Celsius

USEPA = United States Environmental Protection Agency

CFR = Code of Federal Regulations

AHERA = asbestos Hazard Emergency Response Act

TEM = transmission electron microscopy

1 = For sake of consistency, we are applying the more conservative hold times for PM2.5 to the TSP analysis.

TABLE 5
 SUMMARY OF LABORATORY REPORTING LIMITS
 VARIOUS METAL SHREDDING FACILITIES STATEWIDE
 MULTIPLE LOCATIONS, CALIFORNIA
 CONTRACT NO. 15-T4124

Chemical of Concern	Reporting Limits (mass per filter in µg)	Reporting Limits (concentration in µg/m ³)*	Reporting Limits (concentration in µg/tube)
USEPA Method IO 3.3			
Aluminum	0.09	0.00376506	N/A
Antimony	0.123	0.005145582	N/A
Arsenic	0.019	0.000794846	N/A
Barium	0.949	0.039700469	N/A
Cadmium	0.088	0.003681392	N/A
Calcium	0.022	0.000920348	N/A
Chromium	0.011	0.000460174	N/A
Cobalt	0.01	0.00041834	N/A
Copper	0.01	0.00041834	N/A
Iron	0.014	0.000585676	N/A
Lead	0.045	0.00188253	N/A
Manganese	0.018	0.000753012	N/A
Molybdenum	0.04	0.00167336	N/A
Nickel	0.01	0.00041834	N/A
Selenium	0.016	0.000669344	N/A
Silver	0.086	0.003597724	N/A
Tin	0.154	0.006442436	N/A
Vanadium	0.011	0.000460174	N/A
Zinc	0.011	0.000460174	N/A
Title 40 CFR Part 50 Appendix G			
Beryllium	0.5	0.020917001	N/A
AEHRA-modified TEM as found in 40 CFR part 763 Appendix A Subpart E			
Asbestos	N/A	none	N/A
USEPA TO-15			
Benzene	N/A	0.5	N/A
Chloromethane	N/A	0.5	N/A
1,1-Dichloroethene	N/A	0.5	N/A
Ethylbenzene	N/A	0.5	N/A
4-Ethyltoluene	N/A	0.5	N/A
Dichlorodifluoromethane	N/A	0.5	N/A
Trichlorofluoromethane	N/A	0.5	N/A
1,2,4-Trimethylbenzene	N/A	0.5	N/A
Toluene	N/A	0.5	N/A
1,3,5-Trimethylbenzene	N/A	0.5	N/A
Xylenes	N/A	0.5	N/A
Vinyl Chloride	N/A	0.5	N/A
USEPA Method TO-4A			
PCBs	N/A	0.12	N/A
USEPA Method TO-11A			
Formaldehyde	N/A	N/A	0.5

Notes:

PCBs = poly chlorinated biphenyls
 N/A = Not applicable
 µg = micrograms
 µg/m³ = micrograms per cubic meter
 µg/tube = micrograms per tube
 USEPA = United States Environmental Protection Agency

APPENDIX

A

CHESTER LabNet

12242 SW Garden Place ❖ Tigard, OR 97223-8246 ❖ USA
Telephone 503-624-2183 ❖ Fax 503-624-2653 ❖ www.chesterlab.net

Standard Operating Procedure AD-004.03

GLASSWARE CLEANING FOR INORGANICS LABORATORY CHESTER LABNET PROPRIETARY METHOD

Approvals:

 _____ Author	<u>8.29.13</u> Date
 _____ Lead Analyst	<u>9.3.13 AT</u> Date
 _____ QA/QC	<u>8.29.13</u> Date

Effective from: 8-9-3-13
Effective until: present

GLASSWARE CLEANING FOR INORGANICS LABORATORY CHESTER LABNET PROPRIETARY METHOD

1.0 Introduction

1.1 Test Method Reference ID: Chester LabNet Proprietary Method

1.2 Applicability: This method is applicable to the cleaning of all laboratory glassware.

1.3 Detection Limit: Not Applicable

1.4 Method Performance: Not Applicable

2.0 Summary

2.1 Scope and Application: This intended use of this method is for the cleaning of glassware for general use in inorganic analytical procedures.

2.2 Summary of Method:

2.2.1 Glassware is washed using Citranox® detergent with a mild abrasive technique. Glassware for use in metals analysis is further cleaned using nitric and hydrochloric acid. Labels written directly onto glassware with marker pens are wiped clean with a paper towel wetted with acetone.

2.2.2 Glass volumetric pipets are cleaned with a series of acid washes, DI rinses and an acetone rinse.

2.3 Interferences: Not Applicable

2.4 Sample collection/preservation/shipment/storage: Not applicable

3.0 Safety

- 3.1 Follow the Chester LabNet Chemical Hygiene plan.
- 3.2 This method presents no safety risk beyond typical laboratory safety hazards. Use caution when handling any broken glassware.
- 3.3 No carcinogenic reagents are used in this method.

4.0 Pollution Prevention and Waste Management

- 4.1 The smallest quantity of chemical feasible is removed from its primary container for use.
- 4.2 Chemicals are used in amounts needed by the method, and excess reagents are not made.
- 4.3 Chester LabNet is a conditionally exempt small quantity generator and as such does not require formal chemical waste processing.
 - 4.3.1 Acidic and Basic wastes are neutralized prior to disposing of them in the sanitary sewer system.
 - 4.3.2 Organic liquids are usually primarily used for cleaning purposes. Organic wastes are generated in very small quantities, and evaporate off with no need for more formal disposal.
- 4.4 Larger quantities of known hazards are returned to the client for disposal.
- 4.5 Expired Chemicals:
 - 4.5.1 Dry chemicals beyond their ^{SA 10-4-15} ~~real or arbitrary~~ expiration date are lab packed and disposed of by a qualified chemical disposal company.
 - 4.5.2 Acids and Bases beyond their ^{SA 10-4-15} ~~real or arbitrary~~ expiration date are neutralized prior to being disposed of via the sanitary sewer system.

- 4.5.3 Organic liquids beyond their ^{8/10-4-15} real or arbitrary expiration date are disposed of by a qualified chemical disposal company if the volume or type of liquid warrants such disposal. Disposal of organic liquids is rare.

5.0 Apparati, Equipment and Supplies

- 5.1 Various sized bottle brushes and glassware brushes.
- 5.2 Green abrasive ("scrubie") pads
- 5.3 17.5"x23.5"x6" linear polyethylene (LPE) tray
- 5.4 Nalgene® pipet soaking cylinder
- 5.5 500 mL LPE wash bottle
- 5.6 500 mL or 1L plastic or glass beakers

6.0 Reagents and Standards

6.1 For all dishes

- 6.1.1 Citranox® brand acidic, metals-free glassware detergent
- 6.1.2 DI water

6.2 For metals glassware

- 6.2.1 Reagents contained in section 6.1
- 6.2.2 Concentrated nitric acid
- 6.2.3 Concentrated hydrochloric acid

6.3 For glass volumetric pipets

- 6.3.1 1:1 hydrochloric acid
- 6.3.2 1:1 sulfuric acid
- 6.3.3 1:1 nitric acid
- 6.3.4 DI water
- 6.3.5 Acetone

7.0 Preparation, Calibration and Standardization

- 7.1 Wear gloves at all times while washing dishes. Citranox® is an acidic detergent, and can cause irritation to the skin. Broken glass from dropped or shattered glassware also presents a hazard which gloves help to mitigate.
- 7.2 A rubber coated apron is stored on a hook near the sink for the purposes of dishwashing. It is recommended that any personnel washing dishes wear this apron to avoid getting drenched from spraying water.

8.0 Procedure

8.1 General Glassware:

- 8.1.1 Place dirty glassware in the LPE tray until enough dishes are present to justify washing dishes.
- 8.1.2 If glassware has been labeled by writing directly on the glass, wipe away all pen marks with a paper towel wetted with acetone
- 8.1.3 Remove glassware from tray, place in sink, and add a drop of Citranox® to each dish. Fill with warm tap water.
- 8.1.4 Using an appropriate abrasive device (brush or "scrubbie"), wash all surfaces of the item (inside and out) thoroughly.
- 8.1.5 Rinse with hot tap water until all soap residue is visibly rinsed away, then rinse three times, inside and out, with DI water.
- 8.1.6 [^] Return item to its appropriate cabinet when dry.

Place on drying racks until fully dry. SH 10.9-15

8.2 Metals Glassware:

8.2.1 Wash glassware as detailed in Section 8.1

8.2.2 For dedicated metals Erlenmeyer flasks and watch glasses:

8.2.2.1 Add 2.5 mL concentrated nitric acid and 2.5 mL concentrated hydrochloric acid to each flask

8.2.2.2 Place watch glasses over the top of each Erlenmeyer and heat on a hot plate until the acid has refluxed strongly for a minimum of 15 minutes (~30 min total with time for hotplate to heat up).

8.2.2.3 Remove watchglasses such that the drop of refluxing acid gets sandwiched between the upper and lower surfaces of the watchglasses. Place watchglasses in glass specimen dish.

8.2.2.4 Pour acid into the acid neutralizing bath.

8.2.2.5 Remove any pen markings from the Erlenmeyers with an acetone wetted paper towel.

8.2.2.6 Rinse Erlenmeyers three times with DI water.

8.2.2.7 Rinse watch glasses, top and bottom, three times with DI water.

8.2.2.8 Store Erlenmeyers by covering with clean watch glasses.

8.3 Graduated and volumetric glass pipets

8.3.1 Store dirty glass pipettes upside down in the pipette cylinder next to the dirty dish tray (tip up so as not to damage delivery tip).

8.3.2 Assemble a series of 5 large beakers in front of an aspirator, containing (in order) 1:1 sulfuric acid, 1:1 hydrochloric acid, 1:1 nitric acid, DI water and acetone.

- 8.3.3 Ensure the aspirator water drains into the neutralizing bath.
- 8.3.4 Attach a piece of rubber tubing to the aspirator.
- 8.3.5 Treat each pipet as follows:
 - 8.3.5.1 Attach the top of the pipet to the rubber tubing.
 - 8.3.5.2 With the aspirator on, aspirate 1:1 sulfuric, 1:1 hydrochloric, 1:1 nitric acid in that order through the pipet.
 - 8.3.5.3 Next aspirate 3 aliquots of DI water through the pipet.
 - 8.3.5.4 Finally aspirate acetone through the pipet and invert the pipet such that all liquid is pulled out of the tip and it is thoroughly dry.
- 8.3.6 Wipe the outside of the pipet with a Kimwipe and place in the appropriate drawer.

9.0 QA/QC

9.1 Not Applicable

10.0 Calculations

10.1 Not Applicable

11.0 References

- 11.1 APHA. 1992. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington, D.C.
- 11.2 U.S. EPA. 1997. Manual for the Certification of Laboratories Analyzing Drinking Water: Criteria and Procedures, Quality Assurance. Fourth Edition. EPA 815-B-97-001. United States Environmental Protection Agency, Office of Ground Water and Drinking Water, Cincinnati, OH.

12.0 Definitions

- 12.1 Analyst: the designated individual who performs the "hands-on" method and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.
- 12.2 Analysts' Notes: Non-essential aspects of a method, which may help the analyst during some phase of the method. Notes may include, but not be limited to, historical aspects of the method, "tricks" of the method, unexpected issues to be aware of, or other facts or opinions related to the method, but not directly part of the procedure.
- 12.3 Reagent: a single chemical or combination of chemicals or a chemical solution used in the preparation or analysis of samples.

13.0 Analysts' Notes

- 13.1 For glassware with hard to remove organic deposits (grease/oil etc), a variety of organic solvents may be used to remove the contamination, including: acetone, Isopropanol, Ethanol, Dichloromethane and Hexane.
- 13.2 For non-volumetric glassware with hard to remove inorganic deposits (plating etc.), a small amount of concentrated hydrofluoric may be used to rinse the deposit out. **Hydrofluoric acid is an extreme safety hazard** and should only be used by analysts having proper training in its safe handling and usage.

APPENDIX A: Differences from Promulgated methods

There is no promulgated method for dishwashing. This method is a *CHESTER LabNet* proprietary method for internal use.

CHESTER LabNet

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Standard Operating Procedure
AD-008.06

SAMPLE RECEIPT AND LOG IN
CHESTER LABNET PROPRIETARY METHOD

Approvals:

<u><i>Shirley Huddleston</i></u> Author	<u>3-12-14</u> Date
<u><i>Paul D.</i></u> Lead Project Manager	<u>1/21/14</u> Date
<u><i>Shirley Huddleston</i></u> QA/QC	<u>3-12-14</u> Date

Effective from: 3-12-14
Effective until: ~~present~~ OK
Present at 3-12-14

SAMPLE RECEIPT AND LOG IN CHESTER LABNET PROPRIETARY METHOD

1.0 Introduction

- 1.1 This method is a Chester LabNet proprietary method.
- 1.2 This method is applicable to all matrices of samples received by Chester LabNet.
- 1.3 Detection Limits: Not applicable.
- 1.4 Method Performance: Not applicable.

2.0 Summary

- 2.1 Scope and Application: The intended use of this method is for receipt and log-in of all samples received by Chester LabNet. *This method meets its intended use. SA 3.14.16*
- 2.2 Summary of Method: Samples are received and the sample container and sample integrity are inspected. If requested by the client, the temperature of the container and/or samples are taken and recorded on the Chain of Custody. Chain of Custody forms are checked against shipment contents and signed with the date and time of receipt noted on the form. Anomalies are communicated to the client and corrective actions carried out. An analysis request form is filled out and unique laboratory identification numbers are assigned to each sample by the laboratory information management system (LIMS). For all projects except gravimetry-only projects, a worklist for the analysts is prepared and a project file is created which contains all pertinent documents relating to the sample batch. Samples are transferred to the appropriate analyst for preparation or appropriate storage location until analysis can begin.
- 2.3 Interferences: N/A

2.4 Sample collection/preservation/shipment/storage: Collection, field preservation and shipment of samples is performed by the client. Chester LabNet has no control over the actions of the client in the field. Upon receipt, samples shall be stored appropriately, based upon analytical method requirements.

3.0 Safety

3.1 Follow the Chester LabNet Chemical Hygiene plan. Always treat samples of unknown origin and/or constitution as hazardous.

3.2 This method presents no safety risk beyond typical laboratory safety hazards.

3.3 No carcinogenic reagents are used in this method.

4.0 Pollution Prevention and Waste Management

4.1 No chemicals are used in this administrative Standard Operating Procedure.

4.2 Coolers and blue ice received from clients are returned to clients upon request. Dry ice is allowed to sublimate off. "Wet" ice (solid water) is disposed of in the sanitary sewer system.

4.3 Paper waste generated during the log-in process is recycled. "Scratch" paper is utilized for printing where the printout is not considered critical.

5.0 Apparati, Equipment and Supplies

5.1 Laboratory Information Management System (LIMS)

5.2 Analysis request forms

5.3 Sample log in forms

5.4 NELAC Sample Log-in checklist

5.5 Job file folders (manila folders)

5.6 Non-contact infra-red NIST traceable Thermometer

5.7 (For source samples only) Source Sample Log-in Checklist

6.0 Reagents and Standards

6.1 N/A

7.0 Preparation, Calibration and Standardization

7.1 N/A

8.0 Procedure

8.1 Determine if samples are to be accepted or rejected:

8.1.1 All samples are to be accepted unless they are rejected per the following section of this SOP.

8.1.2 Samples are to be rejected, and the client immediately notified by phone if:

8.1.2.1 The samples are obviously not intended for Chester LabNet (e.g. PUFs, Tedlar bags, summa canisters, etc.)

8.1.2.2 The laboratory is incapable of performing the analysis due to the condition of the sample (broken sample container, inappropriate sample matrix such as glass fiber filters for OC/EC analysis, XRF samples with large holes in them, etc.)

8.1.2.3 The client asks the laboratory to not analyze the sample (e.g. "void" samples)

8.1.2.4 Note that for internal documentation reasons, the sample may be logged into the LIMS, however, no analysis will be requested.

8.2 Examine the sampling dates for readability and hold times.

8.3 Examine the shipping container for the presence of custody seals. If custody seals are present, examine the integrity of each seal. Note the presence/absence of custody seals and seal condition on the CoC provided with the samples.

8.4 If requested by the client, retain the bill of lading (air bill) if attached to the exterior of the shipping container, or a photocopy if retaining the original is not possible.

8.5 Open the shipping container and note the presence/absence of the following items:

- 8.5.1 Samples in appropriate containers
- 8.5.2 Bottle for monitoring transit temperature, if required
- 8.5.3 Chain of custody (CoC) form
- 8.5.4 Client sample analysis request (often part of the CoC form)
- 8.5.5 Field data sheets, if client elects to include them
- 8.5.6 Ice (Blue ice, dry ice or "wet" ice)

8.6 Sample receipt temperature:

8.6.1 If requested by the client, immediately take the temperature of the fluid in the transit temperature bottle, or measure the temperature of the samples using the non-contact IR thermometer. Do not remove the bottle and/or sample from the shipping container when taking the temperature.

If a temperature bottle is supposed to be present, but is not in the shipping container, use the non-contact IR thermometer to measure the temperature of one of the samples.

8.6.2 For samples received with dry ice present, the temperature is recorded as $<-60^{\circ}\text{C}$, the lowest the IR thermometer can read. □

temperature that GHS.14.16

8.6.3 Note the temperature on the CoC form provided with the samples.

- 8.7 Remove the sample containers and examine for breakage or leakage. Note any problems on the CoC or sample receipt checklist. Compare the sample ID number and tag number (if present) with those listed on the CoC form. Note any discrepancies on the CoC form. In case of discrepancies, notify the client contact and proceed with any agreed upon corrective actions.
- 8.8 For all samples, complete a NELAC sample log-in checklist.
- 8.9 For source emission testing methods only, complete the Source Sample Receipt Checklist
- 8.10 For projects requiring a written record that the pertinent steps in the sample receipt process have been followed, a preprinted checklist will be filled out during the sample receipt.
 - 8.10.1 Each step in the procedure will be checked off on the list immediately after that particular step has been accomplished.
 - 8.10.2 Included on the checklist will be the client and project names, date and time of sample receipt, chain of custody form ID number, number and type of samples, and the name and signature of the person receiving the samples.
 - 8.10.3 The signed original checklist is placed in the job file folder and included in the data package sent to the client.
- 8.11 Sign and date the CoC form with the date/time of receipt. If the samples are from an existing client, proceed to section 8.13
- 8.12 If the samples are from a new client, initiate the job in the accounting software:
 - 8.12.1 Assign a new client/job identification number in the format X000, where X is the first letter of the client's business name (e.g., C for Chester LabNet), and 000 are ascending numbers to differentiate clients with the same letter (e.g., if Chester LabNet were C001, Crucial Analytical Services would be C002 if it was the next client to be assigned a "C" ID).

8.12.2 Enter the client name, invoicing address, ship to address, contact name and appropriate phone numbers into the accounting software.

8.13 Create report number and file folder:

8.13.1 For all samples requiring **chemical analyses**, retrieve next report number from the Report Log ^{POP client} ~~clipboard~~. Record the client name and number, and brief description of analysis requested on the Report Log next to the first available report number on the Report Log.

Google Documents Set 2.15.15

Prepare a job file folder where appropriate, labeling the folder with the report number and client name. Place the completed chain of custody form and all other pertinent documents (e.g., air bills, telephone contact sheets, checklists, etc.) in the folder. Place the folder in the work-in-progress queue.

8.13.2 For samples requiring **gravimetric analysis only**, record the client name and number, date received and quantity of samples received on the gravimetry sample log ~~located in the gravimetry work in progress folder.~~ ^{AMB 2/13/15}

Paperclip the the completed chain of custody form and all other pertinent documents (e.g., air bills, telephone contact sheets, checklists, etc.) together and place in the gravimetry work in progress folder.

8.14 Log samples into the LIMS as described in Standard Operating Procedure AD-007, Laboratory Informational Management System (LIMS). Write the LIMS ID's next to the client ID's on the Chain of Custody. Note: samples only requiring gravimetric analysis usually have had LIMS ID's created at the time of Tare weighing, thus logging these samples in does not require the generation of a LIMS ID.

8.15 Fill out an Analysis Request form, including the following:

- 8.15.1 Client name and client/job ID number
- 8.15.2 Date samples received
- 8.15.3 Date results are due to the client, if different from standard turn around time
- 8.15.4 Report number
- 8.15.5 Number of samples
- 8.15.6 Analytes and costs
- 8.15.7 Purchase order or Project Number
- 8.15.8 LIMS generated laboratory ID numbers

8.16 Place the completed Analysis Request form in the analysis request form logbook.

8.17 Using the LIMS, print out sample labels and affix to their corresponding samples. For all samples except filters tare weighed by Chester LabNet, each label will contain the following information:

- 8.17.1 Client sample number
- 8.17.2 LIMS generated laboratory sample ID
- 8.17.3 Client/job ID number
- 8.17.4 Report number

(Filters tare weighed by Chester LabNet ^{may 2/13/15 JMB} will have been labeled prior to being shipped to the client, ^{those SH 2-15-15} and are not relabeled after receipt back from the field.)

8.18 Using the LIMS, print out any applicable Analyst Worklist(s), and place with the samples.

8.18.1 Note that for XRF, analysis run sheets are used in lieu of worklists. The XRF run sheets contain 15 sample IDs or less (usually 10) and the corresponding deposit mass and area.

8.18.2 Note that for OC/EC, analysis run sheets are used in lieu of worklists.

8.19 Transfer the samples to the appropriate area (e.g., weighroom for equilibration, refrigerator/freezer or sample staging area in the lab).

Samples that require gravimetry prior to other analyses will have all worklists and run sheets retained with the filters until the gravimetric process is complete. Only after confirmation that all samples were weighed and passed QC will the worklists and samples be delivered to the appropriate sample staging area for further analysis.

9.0 QA/QC

9.1 Sample Receipt Checklist.

- 9.1.1 Frequency: once per sample receipt batch requiring a checklist (upon request)
- 9.1.2 QC statistic: completed checklist
- 9.1.3 Corrective action: contact client for any discrepancies or errors. Note corrective actions at the bottom of the checklist.

9.2 NELAC Sample Receipt Checklist.

- 9.2.1 Frequency: once per sample receipt batch
- 9.2.2 QC statistic: completed checklist
- 9.2.3 Corrective action: none. The 2009 TNI sample acceptance criteria do not fit well with many/most air quality methods. This checklist is completed to maintain the laboratory's compliance with the 2009 TNI standard, however, it is not included in the final report to the client.

9.3 Source Sample Receipt Checklist.

- 9.3.1 Frequency: once per sample receipt batch
- 9.3.2 QC statistic: completed checklist
- 9.3.3 Corrective action: contact client for any discrepancies or errors. Note corrective actions at the bottom of the checklist.

10.0 Calculations

10.1 N/A

11.0 References

- 11.1 U.S. EPA. 1978 (revised 1983). National Enforcement Investigation Center (NEIC) Policies and Procedures. U.S. Environmental Protection Agency, Office of Legal and Enforcement Counsel, Denver, CO.
- 11.2 U.S. EPA. 1979. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

12.0 Definitions

- 12.1 Corrective Action: the action taken to address and/or eliminate where possible the causes of a nonconformity, such as exceeding a control limit. Actions may include reanalyzing a sample, or noting the non-conformance in the data report.
- 12.2 Frequency: The number of occurrences of a specified event within a given interval. The number of samples or analytical runs with which a given QC sample or metric must be analyzed or verified.
- 12.3 Holding Time: the maximum times that samples may be held prior to analysis while still being considered valid or non-compromised.
- 12.4 Laboratory Information Management System (LIMS): a comprehensive computerized database system that a laboratory uses for sample tracking and data management, from sample receipt to reporting and archiving.
- 12.5 QC Statistic: any of a number of statistical permutations performed on raw data to generate a metric capable of being subjected to control limits and corrective actions.
- 12.6 Reagent: a single chemical or combination of chemicals or a chemical solution used in the preparation or analysis of samples.

13.0 Analysts' Notes

- 13.1 N/A

Laboratory Analysis Request Form

Client: _____
 Number of samples: _____
 Date Received: _____
 Sample Type: _____

Project Number: _____
 Report Number: _____
 Date Due: _____

LabNet ID's:

Gravimetry

#	Test	Price
	Gross Weight	

XRF

#	Protocol	Price

Carbon Analysis

#	Test	Price	Worklist #
	OC/EC		

Specialty Tests

#	Test	Price
	Resuspension	
	HF Digestion	
	Extraction	

Conventional Analysis

#	Test	Price	Worklist #	Analytes
	GFAA			
	ICP			
	IC Anions			
	IC Cations			
	CVAA			Hg
	UV-VIS			Cr VI

Notes: _____

Total Price per Sample: \$ _____
 Purchase Order No: _____

Invoice Date: _____
 Invoice # _____

Figure 1. Example Analysis Request Form

ICP Worklist Number: 9749 Date Requested: 11/ 6/02
 Client: A005 (Client Name)
 Report #: 02-270

Lab ID	Analyte	Results in ug/L		
1. kv:ICV			Expected	% Recovery
	Pb	_____	_____	_____
2. bl:ICB				
	Pb	_____		
3. bl:Prep_Blk				
	Pb	_____		
4. bl:Meth_Blk				
	Pb	_____		
5. Spike of _____			Spk Amount	Spike Rec.
	Pb	_____	_____	_____
6. 02-T11920 0211055A/B-01	Pb	_____		
7. Dup of _____			Difference	RPD
	Pb	_____	_____	_____
8. 02-T11932 0211055A/B-03	Pb	_____		
9. Spike of _____			Spk Amount	Spike Rec.
	Pb	_____	_____	_____
10. 02-T11935 0211010-07A	Pb	_____		
11. 02-T11936 0211055A/B-05	Pb	_____		
12. 02-T11942 0211010-05A	Pb	_____		
13. 02-T11943 0210726-05A	Pb	_____		
14. kv:CCV			Expected	% Recovery
	Pb	_____	_____	_____
15. bl:CCB				
	Pb	_____		

Figure 2. Example Analyst Worklist

CHESTER LABNET SAMPLE RECEIPT CHECKLIST

Client _____ Date _____
SDG _____ Time _____
Samples _____ Matrix _____
Chain of Custody Form Number(s) _____

- Custody Seals Inspected, If Present
- Transit Temperature Bottle Inspected, If Present
Temperature Taken
- Chain-of-Custody Form Inspected
 - Has Form Been Signed?
 - Have Date and Time Custody Released Been Noted on Form?
 - Condition of Custody Seals Noted
 - Transit Temperature Noted
- All Sample Containers Inspected
 - Does Number of Samples Match Number on COC Form?
 - Do All Sample ID Numbers Match Those on the COC Form?
 - Are the Sample Containers Intact?
- Chain-of-Custody Form Signed and Dated
- Corrective Actions
 - Client Contacted Due to Mismatching Sample ID Numbers
 - Client Contacted Due to Broken Sample Container(s)
 - Client Contacted Due to Leaking Sample Container(s)
 - Corrective Actions Documented on Phone Contact Sheet
 - Corrective Actions Accomplished
 - Phone Contact Sheet Placed in Job File Folder

Signed _____

Notes _____

Figure 3. Example Sample Receipt Checklist (optional, per client request)

CHESTER LABNET SOURCE SAMPLE RECEIPT CHECKLIST

Client _____ Date _____
 # Runs _____ Time _____

Custody Seals Inspected, If Present		<input type="checkbox"/>
Chain-of-Custody Form Inspected		<input type="checkbox"/>
CoC present with samples?		<input type="checkbox"/> *
CoC indicate analytical methodology to be used? (eg M29 etc)		<input type="checkbox"/> !!
CoC indicate if compliance testing? (esp. M26)		<input type="checkbox"/> !!
M26 samples have Thiosulfate added in field?		<input type="checkbox"/> !!
M29 indicate FH/BH separate or combined?		<input type="checkbox"/> !!
Has Form Been Signed?		<input type="checkbox"/>
Have Date and Time Custody Released Been Noted on Form?		<input type="checkbox"/>
All Sample Containers Inspected		<input type="checkbox"/>
Does Number of Samples Match Number on CoC Form?		<input type="checkbox"/> !!
Do All Sample ID Numbers Match Those on the CoC Form?		<input type="checkbox"/> !!
Did client mark sample volumes prior to shipment?		<input type="checkbox"/> *
If required by method, did client vent samples prior to shipment?		<input type="checkbox"/>
Are the Sample Containers Intact?		<input type="checkbox"/> !!
Are signs of leakage present?		<input type="checkbox"/> *
Chain-of-Custody Form Signed and Dated by CLN		<input type="checkbox"/>
Corrective Actions		
Client Contacted Due to Mismatching Sample ID Numbers		<input type="checkbox"/>
Client Contacted Due to Broken Sample Container(s)		<input type="checkbox"/>
Client Contacted Due to Leaking Sample Container(s)		<input type="checkbox"/>
Client contacted for verification of methodology?		<input type="checkbox"/>
Corrective Actions Documented?		<input type="checkbox"/>
Corrective Actions Accomplished?		<input type="checkbox"/>

Items marked !! shall be addressed prior to any analytical work being started.
*Items marked * shall be noted in case narrative upon reporting of results to client.*

Signed _____
 Notes _____

Figure 4. Example Source Sample Receipt Checklist

CHESTER LABNET
SAMPLE RECEIPT CHECKLIST FOR NELAC REQUIREMENTS

Client _____ Method _____ Date _____

Archaic methods or methods that can't be analyzed as written: M26/26A; M202; M12; M101/101A/102 (This is not a complete listing)

NELAC Required Sample Condition	(circle one)	Chain of Custody	(circle one)
Received in condition required by method? ¹	Y N N/A	Chain of Custody present?	Y N N/A !!
Samples in appropriate containers? ¹	Y N N/A	Client contact information present on CoC? ¹	Y N N/A
Correct temperature?	Y N N/A *	All requested analyses definitively identified? ²	Y N N/A !!
Within hold time?	Y N N/A *	If no, is this a long-standing project	
Broken/damaged?	Y N N/A !!	with understood analyses?	Y N N/A
Sufficient sample present to perform analysis? ¹	Y N N/A !!		
Preserved appropriately? ¹	Y N N/A		

Additional NELAC Requirements		NELAC required Method information	
All samples identified uniquely? ¹	Y N N/A !!	Method requested the latest valid edition? ³	Y N N/A
Labels water resistant? ¹	Y N N/A	Method appropriate for the analyses requested? ³	Y N N/A
Indelible ink used on labels? ¹	Y N N/A	Is it possible to use the method requested? ³	Y N N/A
Location of Sample collection listed? ¹	Y N N/A	Method out of date (wrong revision number)? ³	Y N N/A
Sample collector's name listed? ¹	Y N N/A	Is the method archaic? ³	Y N N/A
Preservation type listed? ¹	Y N N/A	Can the method be performed as written? ³	Y N N/A
Sample type listed? ¹	Y N N/A		

¹ CHESTER LabNet will not notify clients of these "deficiencies" to avoid alienating clients by perpetual contact.
² may be identified by Method number if method contains no room for doubt as to analytes of interest.
³ Many Air Quality/Soure Emission methods are archaic, contradict themselves or are inappropriate. Some regulators require the use of older versions of a method. CHESTER will follow, to the best of their ability, the method requested by the client.
 !! address prior to any analytical work being started. * note in case narrative upon reporting of results to client.

Signed _____

Notes _____

Note: NELAC requirements are designed for Water/Soils, and are often incompatible with Ambient or Source Air Promulgated Methods.

Figure 5. Example NELAC Sample Receipt Checklist

XRF Analysis Request Form

Date of Request: _____
 Date Results Required: _____
 Client Name: _____
 Run Number: _____
 Protocol: _____
 Sample Description: _____
 Total # of Samples: _____
 Report Number: _____
 Date Data Processed: _____
 Date Worklist Released: _____
 Comments: _____

Initial/Date: _____
 Load: _____
 Ag Collimator: _____
 Ta collimator: _____
 Resume: _____
 QA: _____
 Unload: _____

	a	b
Cond	Date/Time	Date/Time

Pos.	LIMS ID	S	Deposit Area	Mass	Client ID	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16	<i>QS001</i>					

Figure 6. Example XRF Run Sheet

Worklist # _____

OC/EC - IMPROVE_A

Client:

Report #

	Sample ID	Client ID	Sample Date	Received Date	Analyzed	Analyst	Comments
1	13-U1459		10/30/13	12/6/13			
2	13-U1460		11/5/13	12/6/13			
3	13-U1461		11/11/13	12/6/13			
4	13-U1462		11/3/13	12/6/13			
5	13-U1463		11/9/13	12/6/13			
6	13-U1464		11/15/13	12/6/13			
7	13-U1465		11/2/13	12/6/13			
8	13-U1466		11/8/13	12/6/13			
9	13-U1467		11/4/13	12/6/13			
10	13-U1468		11/10/13	12/6/13			
11	13-U1469		11/11/13	12/6/13			
12	13-U1470		11/2/13	12/6/13			
13	13-U1471		11/8/13	12/6/13			
14	13-U1472		10/31/13	12/6/13			
15	13-U1473		11/6/13	12/6/13			
16	13-U1474		11/12/13	12/6/13			
17	13-U1475		11/1/13	12/6/13			
18	13-U1476		11/7/13	12/6/13			
19	13-U1477		11/13/13	12/6/13			
20							

Figure 7. Example OC/EC Run Sheet

APPENDIX A: Differences from Promulgated methods

There is no promulgated method for sample receipt and log-in. This method was developed in-house.

Quality Assurance Management Plan

CHESTER LabNet

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This document supplants any previous versions.

Revision Number:	February, 2016	Effective Date:	February 1, 2016
Document Number:	QAMP February 2016		

Review History

Review Date	Changes	Author
1/25/16	Updated changes in staffing, equipment, and SOP lists. Typographical and grammatical errors corrected.	S. Heldstab
1/28/15	Updated changes in staffing, equipment, floorplan and SOP lists. Typographical and grammatical errors corrected.	S. Heldstab
1/15/14	Updated changes in accredited methods, staffing, equipment, SOP lists. Typographical and grammatical errors corrected.	S. Heldstab
2/21/13	Updated changes in accredited methods, staffing, equipment, SOP lists. Typographical and grammatical errors corrected.	S. Heldstab
1/8/12	Updated to NELAC template. Updated Personnel and Organizational Structure to reflect current staffing, capital equipment and manuals lists. Updated floor plan to reflect current floor plan; build-out is on-going.	S. Heldstab
6/14/11	Updated to NELAC template. Updated Personnel and Organizational Structure to reflect current staffing, capital equipment and manuals lists. (Revision incomplete)	S. Heldstab
2/17/11	Updated equipment and manuals lists. Changed client surveys section.	S. Heldstab
2/26/10	Changed Personnel and Organizational Structure to reflect current staffing. Minor clarifications to text.	S. Heldstab
2/12/09	Minor changes to text.	S. Heldstab
12/16/08	Changed Personnel and Organizational Structure to reflect current staffing. Minor clarifications to text.	S. Heldstab
2/19/08	Changed Personnel Organizational Structure to reflect staffing, incorporated new equipment to Capital Equipment Inventory, added section to 'Backup of LIMS System' to include other computers containing essential information, updated final data report page, minor changes to text for clarification.	J. Schleis
2/15/07	Changed Corrective Action Report documentation system, minor change to quality policy statement to include metric reviewable goals, moved 'Traceability of Measurements' section to section 7, added section on client surveys, merged client complaints & corrective action documentation into a single system, added appendices "Listing of Document Locations" and "Glossary & Definitions of Terminology"	S. Heldstab
2/5/07	Changed references to staffing where staffing has changed, added text on handling of PE samples to section 10.6, added section on detection limits (7.8), added details for clarification throughout.	S. Heldstab
2/7/06	Definition of "basic laboratory skills" added to Personnel qualifications, SOP formatting elements changed to reflect new NELAC-compliant format, acceptance/rejection criteria for non-standard methods added, section added on documentation of customer inquiries/complaints, updated staff resumes, updated SOP listing, added 'failure to report' to the list of breaches of ethical behavior in Appendix D.	S. Heldstab

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or the title page is clearly stamped "copy" in red ink.*

Quality Assurance Management Plan

Review Date	Changes	Author
7/8/05	Expanded section 7.7, revised section 10.4 and 10.5 to reflect new internal audit process, updated staff references.	S. Heldstab
1/5/05	Added Appendix D (Ethics training).	S. Heldstab
10/21/04	Major updating to incorporate elements of NELAC/ORLAP requirements. Sections 3.3.2.1, 7.3–7.7, 8.2.4-8.2.7, 8.3, 8.3.1–8.3.5, 8.4, 9.4, 10.6–10.8, 11.8–11.10 added.	S. Heldstab
1/23/04	Updated floor plan and Capital inventory table. Minor grammatical changes.	S. Heldstab
3/10/03	Changes in organization of Section 3. No changes to content, only to formatting.	S. Heldstab
12/10/02	Minor changes to text, some text rearranged for clarity and conciseness.	S. Heldstab
11/8/01	This document has been in existence since at least 1988. The number and types of revisions are unknown. As of this date, the document is being revised to standardize the formatting of <i>CHESTER LabNet</i> documents.	S. Heldstab
Unknown	No Changes - date of origination.	C.R. Lytle

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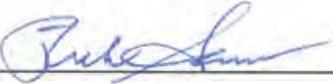
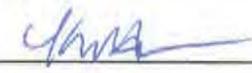
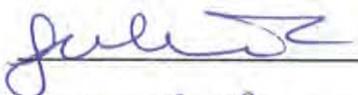
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Quality Assurance Management Plan

Concurrences

The following approved signatories, by their signature, attest to having read and understood the most current version of the Quality Assurance Management Plan for CHESTER LabNet:

<u>Name</u>	<u>Title(s)/Responsibility(ies)</u>	<u>Initials</u>	<u>Signature</u>	<u>Date</u>
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Sheri Heldstab	QA Officer Conventional Chemistry Laboratory Technical Director Senior Chemist Health & Safety Officer	<u>SH</u>	<u></u>	<u>2-1-16</u>
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Jennifer (Jen) Schleis	Gravimetry Laboratory Technical Director Senior Gravimetry Laboratory Technician XRF Technician Chemist	<u>JS</u>	<u></u>	<u>2-08-16</u>
Katie Hawks	Chemist Gravimetry Laboratory Technician	<u>KH</u>	<u></u>	<u>2-5-16</u>
Julie Delarue	Chemist Gravimetry Laboratory Technician XRF Technician	<u>JD</u>	<u></u>	<u>2-09-16</u>
Theodore (Ted) Perry	Chemist Gravimetry Laboratory Technician	<u>TP</u>	<u></u>	<u>2-4-16</u>

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Disclaimer

In 2011, ORELAP, the accrediting body for the state of Oregon, requested that the laboratory use the 2009 TNI Standard QAMP template in creating its QAMP to make it easier for auditors to find information. The 2009 TNI Standard and its associated QAMP template are designed for water/soil analysis.

CHESTER LabNet specializes in inorganic air quality analyses, both ambient and source emissions. Volume 1, Module 1, Section 1.3.2 of the 2009 TNI Standard states *“This Standard does not apply to fields of accreditation that are not designated as Field of Proficiency Testing (FoPT) by the TNI Proficiency Testing (PT) Board.”* As of this writing, only a few source sampling methods and no ambient air methods have FoPT’s; thus, according to the 2009 TNI Standard, **CHESTER LabNet** is not eligible for accreditation for any ambient air methods and many source sampling methods. However, ORELAP has accredited the laboratory for some ambient methods since 2005, despite their ineligibility for accreditation.

The state of Texas has listed SW-846 Method 6010 as an accreditable method for the determination of metals in source emissions even though the quality matrix defined in 6010 is waters/solids not air source emissions. Texas also lists Method 202 as an accreditable method, despite the utter lack of availability of PEs, the impossibility of utilizing the method as written, the impossibility of performing an LOD, LOQ, DoC or Precision and Bias study for that method – all requirements for accreditation of a method. Many states are doing similar things.

Due to the significant differences between sampling gaseous samples and sampling water/soil samples, there are some requirements of the 2009 TNI Standard which are unachievable based on the nature of the methods utilized. Throughout this document, the original requirements as set forth in the 2009 TNI QAMP template have been included. Also included are the reasons those requirements are not applicable to our field of work as well as explanations of how the laboratory attempts to meet the intent, if not the letter, of the requirement.

Below is a short list of issues which may be found throughout various sections of the document:

1. “Media”: This term is used throughout the 2009 TNI QAMP template in reference to microbiological testing. For the purposes of air quality testing, media is generally comprised of either filters (various sizes/compositions) or sorbent tubes. Most media used by the laboratory has some form of contamination present from the manufacturing process and is considered a routine part of analysis.
2. Sampling: The laboratory performs no sampling. Most air quality methods, source or ambient, involve quite complex sampling equipment and procedures. The laboratory’s clients perform the sampling, from collection to shipment. The laboratory has no control over the actions or inactions of the clients in the field. Many requirements of the 2009 TNI standard make reference to sampling, sample containers and sample rejection. These requirements are not well suited to the nature of air quality sampling or analysis.
3. Sample containers: To capture a gaseous sample, either a filter, an absorbing solution or a sorbent material of some sort must be used. Thus, the primary

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container for the sample is either “filter,” “solution,” or “sorberent.” Secondary containers are then used for containing the sample containers. Filters may or may not be provided by the laboratory in a variety of secondary containers. Containers for liquids are nearly always provided by the client as the laboratory has no idea how much liquid will be collected. The absorbing solution acts as a preservative by its nature, thus, no preservatives are added to any secondary container.

4. Method selection: Air Quality methods, particularly the Code of Federal Regulations (CFR) methods, tend to not be regularly updated to incorporate technological improvements. 40 CFR 60 Method 12 requires hand-plotting a calibration curve from a Flame AA. 40 CFR 60 Method 26/26A requires the use of a manual integrator (as opposed to computer software). 40 CFR 61 Method 101 requires the use of a PerkinElmer 300 model AA, an instrument that was last supported in 1972.

CHESTER LabNet has no control over the selection of methods used during analysis. Frequently, our clients have no control over method selection either. The client is responsible to their client (the “ultimate” client), who, in turn, is usually responsible to a regulator at some governmental level (e.g., federal, state, county, city). The regulator for the particular facility or project being monitored is the body responsible for method selection. The laboratory and the laboratory’s clients have little sway over the decisions of these regulators.

In addition, some methods are in conflict with the laws of physics and are, therefore, not possible to perform as written. 40 CFR 51 Method 202 was updated in 2010, becoming effective on 1 January, 2011. This method requires the analyst, during a biphasic separatory funnel extraction, to “drain the bottom organic fraction” from the separatory funnel. The solvent required by the method was changed from Dichloromethane to Hexane. Hexane has a lower density than water and consequently floats, making draining this layer first impossible. In January of 2012, a “suggested update” was published in the CFR, changing the method to “pour off the top organic fraction,” a technique not ideally suited to separatory funnels.

The 2009 TNI Standard has many requirements pertaining to the selection of methods to be used by the laboratory. These sections cannot be applied to the type of work performed at *CHESTER LabNet*.

5. Rejection of Samples: The 2009 TNI Standard has many requirements pertaining to the rejection of samples. Due to the highly complex nature of air sampling, the laboratory does not reject any sample unless requested to do so by the client, or the sample is suspected of being fraudulent. Many air quality samples are time sensitive, and thus re-sampling is often impossible. Hence, these requirements are not well suited to the nature of work performed by *CHESTER LabNet* or its clients.

CHESTER LabNet will make every effort to meet the intent of the requirements as given in the 2009 TNI Standard, just as it makes every effort to meet the intent and chemistry of archaic or contradictory methods.

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Section 3

INTRODUCTION AND SCOPE

(TNI V1:M2 – Sections 1, 2, 3)

The purpose of this Quality Assurance Management Plan is to outline the management system for *CHESTER LabNet*. The Quality Assurance Management Plan defines the policies, procedures and documentation that assure analytical services continuously meet a defined standard of quality. That standard is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

CHESTER LabNet is proud of having specialized in the inorganic analysis of ambient particulates and source emission samples since its inception as NEA, Inc. in the late 1970's. The laboratory as an organization, its management, and its personnel are committed to the production of the highest quality data achievable with current methodologies and instrumentation; and to compliance with contractual, regulatory and accreditation standards and requirements.

This QAMP is written using the template produced by TNI. The Oregon accrediting body for NELAP is ORELAP, who has requested that laboratories use this template. The template is designed for water, wastewater and soil/sludge samples, and does not work well for air quality samples. As a result, many sections have been significantly modified in an effort to meet accrediting requirements. In addition, many of the requirements of the 2009 TNI Standard also do not apply to air quality sampling (ambient or source) and have been significantly modified.

The Quality Assurance Management Plan sets the standard under which all laboratory operations are performed, including the laboratory's organization, objectives and operating philosophy. The Quality Assurance Management Plan has been prepared to assure compliance with the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-M1 through M7-ISO-2009). This Standard is consistent with ISO/IEC 17025:2005 requirements that are relevant to the scope of environmental testing services and thus, the laboratory operates a quality system in conformance with ISO/IEC 17025:2005(E). In addition, the policies and procedures outlined are compliant with the various accreditation and certification programs listed in Appendix E.

For any activity involving a service or the creation of an analytical result, quality may be defined as conformity to a given set of requirements. To ensure acceptable quality, three conditions must be met: (1) requirements and objectives must be clearly delineated before work begins; (2) the major steps in the production of the service or analytical result must have a component that allows for the control of quality, based on the end-result objectives; (3) the components of quality control must include control limits and corrective actions designed to both effectively monitor quality and modify procedures if quality is compromised.

Quality Assurance (QA) comprises the overall program elements designed to maintain any activity within the stated objectives. Examples of such program elements are: clearly stated precision and accuracy targets; written standard operating procedures for all laboratory and instrumental protocols; the selection of sample preparation and analytical methods that are most appropriate for the matrices and analytes to be encountered; etc.

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Quality Control (QC) comprises the individual checks used to monitor laboratory procedures, the precision and accuracy statistical control limits for each individual check, and the specific corrective actions to be followed when QC results are outside control limits. An example of a QC element is the matrix spike. Good quality control would set the frequency of analysis, the particular QC statistic to be used (e.g., percent recovery), the control limit (based on published statistics for the particular analysis or on QC charts developed in house), and the corrective action for QC results that are out of control.

3.1 Scope of Testing

CHESTER LabNet specializes in Inorganic Air Quality Analysis of ambient air and source emissions, including analysis of PM₁₀ and PM_{2.5} samples. The laboratory's scope of analytical testing services includes those listed in Appendix D.

At present, the six methods accredited are:

- Hexavalent Chromium in ambient air (modified CARB SOP MLD039 and modified ASTM D7614-12);
- 40CFR60 Method 202, "Condensable Particulate Matter, Rev. 12/1/2010";
- NIOSH 5040 "ELEMENTAL CARBON (DIESEL PART.)"; DRI SOP#2-216r2 (not a promulgated method, Organic & Elemental Carbon by Improve_A parameters);
- PM₁₀ 40CFR50 Appendix J,
- PM_{2.5} 40CFR50 Appendix L, and
- 40CFR60 Method 26A, "Hydrogen Halides and Halides in Stationary Sources".

Note that the 2009 NELAC standard, Volume 1, Module 1, Section 1.3.2 states "This Standard does not apply to fields of accreditation that are not designated as fields of proficiency testing (FoPT) by the TNI Proficiency Testing (PT) Board." At present, only Method 26 is contained within any field of proficiency testing.

3.2 Table of Contents, References and Appendices

The Table of Contents is in Section 2 and Appendices are at the end of this document.

This Quality Assurance Management Plan uses the references included in the 2009 TNI Environmental Laboratory Sector Standard, Volume 1: Modules 1,2 and 4, "Management and Technical Requirements for Laboratories Performing Environmental Analysis," where applicable to air quality analyses.

Unlike Water and Soils methods, promulgated Air Quality methods can be difficult to locate and, in some cases, a promulgated method may not exist for the analysis requested by the client. The majority of methods utilized at *CHESTER LabNet* are promulgated in 40 CFR 50, 40 CFR 60, 40 CFR 61, NIOSH Methods Compendium, OSHA Methods Compendium, US EPA IO Methods Compendium, US EPA "Other Test Methods," US EPA "Conditional Test Methods," published peer-reviewed papers, and a variety of methods developed in-house to satisfy the needs of our clients. See

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Appendix D for a listing of promulgated methods commonly used at *CHESTER LabNet* and Appendix B for a listing of all *CHESTER LabNet* SOPs.

3.3 Glossary and Acronyms Used

Quality control terms are generally defined within the Section that describes the activity.

3.3.1 Glossary

Accreditation: The process by which an agency evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value.

Analyst: The designated individual who performs the “hands-on” method and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Archaic: A method that requires the use of equipment that is no longer available, no longer in use, or that has become obsolete by virtue of technological advancements (e.g., requiring the use of instrumentation that has not been supported since 1972, requiring hand-injection where autosamplers are commonly available).

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operation, function, or activity.

Batch:

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents.

Analytical Batch: a group of prepared samples (extracts, digests, etc.) that are analyzed together as a group, although they may have been prepared separately.

Preparation Batch: a group of one to 20 samples of the same matrix which are prepared together as a group, and which share common QC samples.

Blank: (note: “clean” for most Air Quality matrices is defined as a matrix that has had no sampling performed on it. Many sampling matrices, including filters, sorbents materials, and some impinger solutions, are not “analyte free”)

Blank: a clean aliquot of the same or similar matrix as the samples. A blank is subjected to the usual analytical and measurement processes.

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Calibration Blank: An unspiked clean matrix of similar constitution as the sample extracts or digests (e.g., DI Water, 5% HNO₃, etc.) used to establish the zero intercept of the calibration curve.

Instrument Blank: a clean sample (e.g., deionized water) processed through the instrumental steps of a method, used to determine instrument contamination.

Laboratory Blank: (Gravimetric analysis) A clean non-sampled filter or container that has been subjected to the same physical handling in the laboratory as the samples.

Method Blank ("MB"): An unspiked clean sampling media aliquot, taken through the entire preparation and analytical processes associated with a method. This blank determines if the sampling media may be contributing any analyte of interest to the samples.

Preparation Blank ("PB"): All reagents involved in the preparation, without sampling media (if any), taken through the entire preparation and analytical processes associated with a method. This blank demonstrates cleanliness of reagents and of the preparation process itself.

Reagent Blank ("RB"): All reagents, mixed in correct proportion, used in the preparation of samples, however, not taken through the preparation process. In the laboratory, this blank is rarely used, and usually only used when some question arises as to the source of contamination (reagents vs. process). Clients submit reagents blanks routinely, and these reagent blanks are treated as a sample.

Field Blank ("FB"): A blank prepared by the client in the field. This blank is treated as a sample by the laboratory.

Train Blank ("FTRB"): A blank prepared by the client in the field. This blank is treated as a sample by the laboratory.

Proof Blank ("FTPB"): A blank prepared by the client in the field. This blank is treated as a sample by the laboratory.

Trip Blank ("TB"): A container with necessary clean media that is shipped from the lab to the field and back again, or from the field to the lab, without ever having been opened. This blank is treated as a sample by the laboratory.

Calculation: The mathematical process of transforming raw data into a more useable form.

Calibrate: To determine, by measurement or comparison with a standard, the correct value of each reading of the instrument.

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

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The levels of the applied calibration standard should bracket the range of planned or expected sample measurements *where possible*.

Calibration Standard: A substance or reference material used to calibrate an instrument.

Chain of Custody (CoC): A record that documents the possession and identification of the samples from the time of collection to receipt by the laboratory.

Continuing Calibration Blank (CCB): A blank “standard” analyzed at the end of an analytical batch and at least every 10 samples during an analytical batch to verify that the lower end of the calibration curve remains valid during the course of the analytical run. See ICB.

Continuing Calibration Verification Standard (CCV): A second source standard, of a different lot or manufacturer from the calibration standards, analyzed at the end of an analytical batch and at least every 10 samples during an analytical batch to verify that the calibration curve remains valid during the course of the analytical run. See ICV.

Control Limit: A mathematical representation of acceptable limits for a given Quality Control Metric such as percent recovery or percent difference. Limits may be in the form of an absolute number or represented as a percentage.

Corrective Action: The action taken to address and/or eliminate, where possible, the causes of a non-conformity, such as exceeding a control limit.

Corrective Action Report (CAR): A document, filled in by the person or persons finding a non-conformity, which documents the non-conformity and actions taken to correct it.

Correlation Coefficient: The statistical representation of how closely a set of x, y coordinates approaches the line of best fit. A correlation coefficient of 1.000 is considered a perfectly straight line of data points. Correlation coefficients above 0.995 are usually attainable by most instruments.

Demonstration of Capability (DoC): A procedure to establish the ability of an analyst to generate acceptable accuracy and precision.

Detection Limit: The lowest concentration of an analyte of interest that can be identified, measured and reported with confidence that the analyte concentration is not a false positive value.

Instrument Detection Limit (IDL): The detection limit statistically determined at the instrument using a clean matrix and no preparation.

Limit of Detection (LOD) or Method Detection Limit (MDL): The detection limit determined by processing clean matrix through the entire method, including all preparatory steps. Note: not all matrices are amenable to MDL's due to contamination from manufacturing (e.g., Mg levels above the calibration standard in glass fiber filters). Sampling is a key component of

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the method, over which the laboratory has no control. For most air quality methods, IDLs are used in lieu of MDLs.

Limit of Quantitation (LOQ) or Practical Quantitation Limit (PQL): The limit at which, not only is the laboratory confident that the concentration is not a false positive, but that the concentration reported is within acceptable limits from the true value. Commonly set at five times the LOD/IDL.

Duplicate: A second aliquot of a sample, taken through all steps of the method, including digestion/preparatory stages.

Frequency: The number of occurrences of a specified event within a given interval. The number of samples or analytical runs with which a given QC sample or metric must be analyzed or verified.

Holding Time: The maximum time that samples may be held prior to analysis while still being considered valid or non-compromised.

Initial Calibration Blank (ICB): A blank “standard” analyzed at the beginning of an analytical batch immediately after calibration to verify that the calibration curve is valid at the beginning of the analytical run.

Initial Calibration Verification Standard (ICV): A second source standard analyzed at the beginning of an analytical batch immediately after calibration that verifies that the calibration curve is valid at the beginning of the analytical run. This standard must be of a different source than the standards used to calibrate the instrument.

Laboratory Control Standard (LCS): Unsampled sample matrix (e.g., filter, sorbent, solution), spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes; generally used to establish analyst specific precision and bias, or to assess the performance of the method.

Laboratory Control Standard Duplicate (LCS-D): A duplicate unsampled sample matrix, (e.g., filter, sorbent, solution), spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes; generally used to establish analyst specific precision and bias or to assess the performance of the method.

Laboratory Information Management System (LIMS): A comprehensive computerized database system that the laboratory uses for sample tracking and data management, from sample receipt to reporting and disposal.

Matrix/Matrices: The component or substrate that contains the analyte of interest. For the purposes of NELAP, this is comprised of “aqueous,” “solid,” or “air” matrices.

For the purposes of *CHESTER LabNet*, the matrix is more specifically designated as size/type of filter, chemical composition of impinger solution, type of sorbent tube or other descriptor of the substance used to capture the analyte of interest.

Proficiency Testing (or Proficiency Evaluation or Audit) sample (PT or PE): a blind sample used to evaluate a method’s capability to meet accuracy control limits,

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or the analysis used in determining the result for the sample. Not all air methods have PT/PE/audit samples commercially available. It is not possible to create PT/PE/audit samples for some air methods.

In June, 2013, the EPA required all source emission samples for which a NELAC approved audit sample was available to be analyzed in tandem with an audit if the testing was for compliance or regulatory purposes. As of this writing, the methods performed by the laboratory for which PE samples are available are: Method 26/26A, Method 29, Method 6 & 8, and Method 13B. In 2015, the laboratory analyzed 96 PE samples for Method 26/26A alone.

Quality Assurance/Quality Control (QA/QC): A series of samples or metrics designed to show precision, accuracy and bias of the procedure are within acceptable limits.

QC Statistic: Any of a number of statistical permutations performed on raw data to generate a metric capable of being subjected to control limits and corrective actions.

Reagent: A single chemical, combination of chemicals, or a chemical solution used in the preparation or analysis of samples.

Replicate: A second aliquot of a single preparation (digest, extract, etc.) analyzed in tandem with the primary aliquot. Usually a replicate is analyzed only when a true duplicate is not possible, which normally occurs with very small sample quantities, or when the entirety of the sample is reduced to a single digestate.

Spike: To add verified known amounts of analytes or a material containing known and verified amounts of analytes to a sample or matrix prior to analysis.

Analytical (Post-Digestion) Spike: an aliquot of prepared sample to which verified known amounts of analytes or a material containing known and verified amounts of analytes are added to a sample prior to analysis. Usually analyzed only when a true spike is not possible which normally occurs with very small sample quantities, or when the entirety of the sample is reduced to a single digestate.

Matrix Spike: a sample prepared by adding verified known amounts of analytes or a material containing known and verified amounts of analytes to a second aliquot of sample or matrix prior to preparation for analysis.

Standard (analytical): A solution or matrix (solid or liquid, prepared in the laboratory or purchased from a vendor such as a standard weight for balances) of a known amount of analyte(s).

Stock standard: a standard received from a vendor with NIST or equivalent traceability.

Working standard: any standard created when mixing, diluting or otherwise manipulating aliquots of primary standards; may be called "working standards" or "intermediate standards."

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Primary Standard: A standard typically used for calibration and no other purpose, received from a vendor with NIST or equivalent traceability.

Secondary Standard: A standard typically used to verify calibration of a different lot or manufacturer from the primary standard, received from a vendor with NIST or equivalent traceability.

Standard (NELAP): A set of requirements and recommendations which must be met to be accredited by NELAP.

Standard (adjective): usual or typical; as in "The *standard* way to extract a solid for metals is with a hot acid digestion."

Standard (ambiguous): use of the word "standard" more than once in a sentence without enough context to make the meaning comprehensible, as in "The standard must be in keeping with the standard standard."

Standard Operating Procedure (SOP): A written document detailing the method of an operation, analysis or action, in which techniques and procedures are thoroughly prescribed, that is the accepted method for performing certain routine or repetitive tasks. SOPs are not training manuals and thus may not contain all of the fine details a trained analyst should know.

For further definitions, please refer to The Terms and Definitions Section of Modules 1, 2 and 4 in the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis.

3.3.2 Acronyms

A list of acronyms used in this document and their definitions are:

AB	-	Accrediting Body
ANSI	-	American National Standards Institute
ASQC	-	American Society for Quality Control
ASTM	-	American Society for Testing and Materials
Blk	-	Blank
°C	-	degrees Celsius
cal	-	calibration
CARB	-	California Air Resources Board
CAR	-	Corrective Action Report
CAS	-	Chemical Abstract Service
CFR	-	Code of Federal Regulations
CCV	-	Continuing calibration verification
CLP	-	Contract Laboratory Program (US EPA)
CoA	-	Certificate of Analysis
CoC	-	Chain of custody
CVAA	-	Cold Vapor Atomic Absorption Spectrophotometer
DI	-	De-ionized water
dscf	-	dry standard cubic feet
dscm	-	dry standard cubic meters
DoC	-	Demonstration of Capability

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DQO	-	Data Quality Objective
EPA	-	Environmental Protection Agency
FoPT	-	Field of Proficiency Table
g/L	-	grams per liter
IC	-	Ion Chromatograph
ICP	-	Inductively Coupled Plasma (Atomic Emission Spectrophotometer)
ICV	-	Initial calibration verification
IDL	-	Instrument Detection Limit (see LOD)
IO	-	Inorganics Air Compendium
ISO/IEC	-	International Organization for Standardization/International Electrochemical Commission
LCS	-	Laboratory control sample
LOD	-	Limit of Detection (formerly "detection limit", see "IDL")
LOQ	-	Limit of Quantitation (formerly "Quantitation limit" or "Practical Quantitation Limit)
MDL	-	method detection limit (See "LOD")
mg/Kg	-	milligrams per kilogram
mg/L	-	milligrams per liter
mg/Sx	-	milligrams per sample
MS	-	matrix spike
MSD	-	matrix spike duplicate
NELAC	-	National Environmental Laboratory Accreditation Conference
NELAP	-	National Environmental Laboratory Accreditation Program
NIOSH	-	National Institute of Safety and Health
NIST	-	National Institute of Standards and Technology
OC/EC	-	Organic Carbon/Elemental Carbon
OSHA	-	Occupational Safety and Health Administration
PM	-	Particulate Matter
PM2.5	-	Particulate Matter 2.5µm or smaller
PM10	-	Particulate Matter 10µm or smaller
PQL	-	Practical Quantitation Limit (see "LOQ")
PT (or PE)	-	Proficiency Test(ing) (or Proficiency Evaluation or Audit) sample
PTP	-	Proficiency Testing Provider
PTPA	-	Proficiency Testing Provider Accreditor
QA	-	Quality Assurance
QAO	-	Quality Assurance Officer
QC	-	Quality Control
QAMP	-	Quality Assurance Management Plan
RL	-	Reporting level (See "LOQ")
RO	-	Reverse Osmosis
RPD	-	Relative percent difference
RSD	-	Relative standard deviation
SOPs	-	Standard operating procedures
spk	-	spike
std	-	standard
TNI	-	The NELAC Institute
TSP	-	Total Suspended Particulate
µg/L	-	micrograms per liter (air or liquid volume, context matters)
µg/m ³	-	micrograms per cubic meter
µg/Sx	-	micrograms per sample
UV	-	Ultraviolet
XRF	-	X-ray Fluorescence spectrophotometer

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3.4 Management of the Quality Assurance Management Plan

The Quality Assurance Officer (QA Officer) or their designated alternate is responsible for maintaining the currency of the Quality Assurance Management Plan (QAMP).

The Quality Assurance Management Plan is reviewed annually by the QA Officer and laboratory personnel to ensure that it reflects current practices and meets the requirements of any applicable regulations or client specifications. The manual is updated and the revision number is changed to the month and calendar year of the revision. If more than one revision in a given month/year is required, a letter is added after the year to indicate the new revision (e.g., "February, 2012B"). The cover sheet of the Quality Assurance Management Plan is then signed and the Table of Contents is updated.

The Quality Assurance Management Plan is considered confidential and proprietary, and may not be altered in any way except by approval of the QA Officer. If it is distributed to external users, it is for the purpose of reviewing *CHESTER LabNet's* management system for accreditation or contractual purposes and may not be used for any other purpose without the written consent of the laboratory.

3.5 Data Quality Objectives (DQOs)

For environmental laboratory activities, data quality objectives (DQO) may be defined as qualitative and quantitative statements that specify the quality of the data required to support defined analytical requirements (U.S. EPA 1987). Data quality objectives provide the driving force for the level of quality control (QC) required for any analytical task. For example, a field laboratory providing only screening data would have DQOs much less stringent than a laboratory providing data to be used in enforcement actions. Thus the Quality Assurance Management Plan (QAMP) must be written to provide the level of quality control demanded by the end use of the data.

The paramount analytical requirement for *CHESTER LabNet* is that all measurement data be of the quality required to withstand the scrutiny of litigation. To meet this DQO, the *CHESTER LabNet* QAMP is structured to enable the laboratory to provide data of known and acceptable quality. The quality of data is considered known when all components associated with its derivation are thoroughly documented. Data are of acceptable quality when a QA/QC program is carried out and the QC indicators fall within predefined limits of acceptability. One of the primary functions of the QAMP is to detail the methods of documentation and to define the mechanisms to be used in attaining data of acceptable quality.

QA/QC requirements vary widely depending on the task being performed and the methodology utilized in performing said task. As such, it is the responsibility of the analysts performing the work to be familiar with the QA/QC requirements of each analytical test performed and to ensure that work they are performing meet these requirements.

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3.5.1 QA Mechanisms for Attaining DQOs

The quality assurance mechanisms used to attain predefined data quality objectives fall with five broad categories: precision, accuracy, comparability, representativeness, and completeness. The characteristics of these mechanisms are defined below.

3.5.1.1 Precision.

Precision is a measure of mutual agreement among repetitive measurements of the same property. For two measurements (duplicates), the relative percent difference (RPD) will be used to estimate precision. For more than two measurements, the percent relative standard deviation (%RSD, also known as the coefficient of variation or CV) will be used to estimate precision. The precision targets for measurement data are summarized in Section 3.5.2.

3.5.1.2 Accuracy

Accuracy is the agreement of a measurement (or the average of two or more measurements) with an accepted or “true” value. Accuracy can only be determined from the results of measurements of samples of known composition. The accuracy estimate will be the percent recovery (%R).

3.5.1.3 Comparability

Comparability is defined as the confidence with which one data set can be compared to another. Comparability in laboratory operations is important in analyzing samples for large projects where sample analysis may occur continuously over many days or may occur sporadically over a long period of time. Comparability will be evaluated primarily on the basis of accuracy and precision estimates. There are no quality control estimators specific to comparability, and comparability must be approached as a data assessment task at a level above that of simply compiling QC statistics. In order to ensure data comparability, *CHESTER LabNet* will use standard operating procedures and accepted analytical methods, and data will be reported in generally accepted units of measurements.

3.5.1.4 Representativeness

Representativeness can be defined both qualitatively and quantitatively, and is dependent upon the selection of sampling site and choice of sampling methods. The degree of representativeness is important in planning for the collection of samples and has significant ramifications in the subsequent uses of the data. Sample collection methodology is the most significant contributor to sample representativeness. Unless the laboratory is directly involved in the sampling process, this element of representativeness is beyond the laboratory’s control. *CHESTER LabNet* will provide assistance to clients to ensure that the sample collection procedures lead to representative data.

For air sampling, the laboratory can assist in the collection of representative data by minimizing spurious results caused by defective and/or contaminated filter and sorbent media. This is accomplished by acceptance testing filter

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media and by conducting pre-sampling operations (e.g., tare weighing, labeling, packaging, shipping, etc.) in a controlled environment designed to prevent media contamination.

3.5.1.5 Completeness

Completeness is the amount of valid data actually obtained compared to the amount of data that was expected to be obtained under anticipated sampling/analytical conditions. As in the case for representativeness, the laboratory can assist in sampling completeness by providing air sampling media that have been acceptance tested, and have been prepared and shipped to ensure that samples are not lost due to physical deficiencies or contamination.

The analytical component of completeness is controlled by employing qualified, experienced analysts; by adhering to stringent training protocols; and by using written standard operating procedures. The completeness targets for laboratory data are discussed in section 3.5.2.

3.5.2 Targets for the DQO Mechanisms

The basis for the targets for the quantifiable DQO mechanisms is that of the U.S. EPA Contract Laboratory Program (U.S. EPA 1990). The default targets are as follows:

<u>Matrix</u>	<u>Sampling Medium</u>	<u>Precision</u>	<u>Accuracy</u>	<u>Completeness</u>
Solid	N/A	20%	75 - 125%	99%
Water	N/A	20%	75 - 125%	99%
Air	Impinger solution	20%	75 - 125%	99%
Air	Filter	20%	75 - 125%	99%
Air	Sorbent Tube	20%	75 - 125%	99%

Complete directives for all Precision and Accuracy limits may be found in the QA/QC section of the Standard Operating Procedure for each analytical technique. DQOs vary widely from one analytical methodology to another; the table shown above is to be considered a general guideline.

DQOs may also vary from project to project, client to client, and from one analytical technique to another. *CHESTER LabNet* works closely with the client to ensure that the quality of data generated is of a caliber suitable for the client's purposes.

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Section 4

ORGANIZATION

(TNI V1:M2 – Section 4.1)

The laboratory is a legally identifiable organization. The laboratory is responsible for carrying out testing activities that meet the requirements of the 2009 TNI Standard and the ISO/IEC 17025 Standard, and that meet the needs of the client, their client or their client's regulatory agency. Through application of the policies and procedures outlined in this Section and throughout the Quality Assurance Management Plan, the laboratory assures that:

- It is impartial, and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment.
- Management and technical personnel have the authority and resources to carry out their duties, and the procedures to identify and correct departures from the laboratory's management system.
- Personnel understand the relevance and importance of their duties as related to the maintenance of the laboratory's management system.
- Ethics and data integrity procedures ensure personnel do not engage in activities that diminish confidence in the laboratory's capabilities (see Appendix A, Section 5, "Management" and Section 19, "Data Integrity Investigations").
- Confidentiality is maintained.

4.1 Organization

CHESTER LabNet is an independent commercial laboratory, incorporated in the state of Oregon as LabCor, Inc. DBA *CHESTER LabNet*. The laboratory is owned by 2 private individuals and one large organization (Duquesne Light, Pittsburgh, PA) in a 30-30-40 split, and has no legal ties to any other entity that might have any influence over or conflict of interest with the testing performed on site. The federal tax identification number is available upon request, solely on an as-needed basis.

The laboratory operates in Tigard, Oregon.

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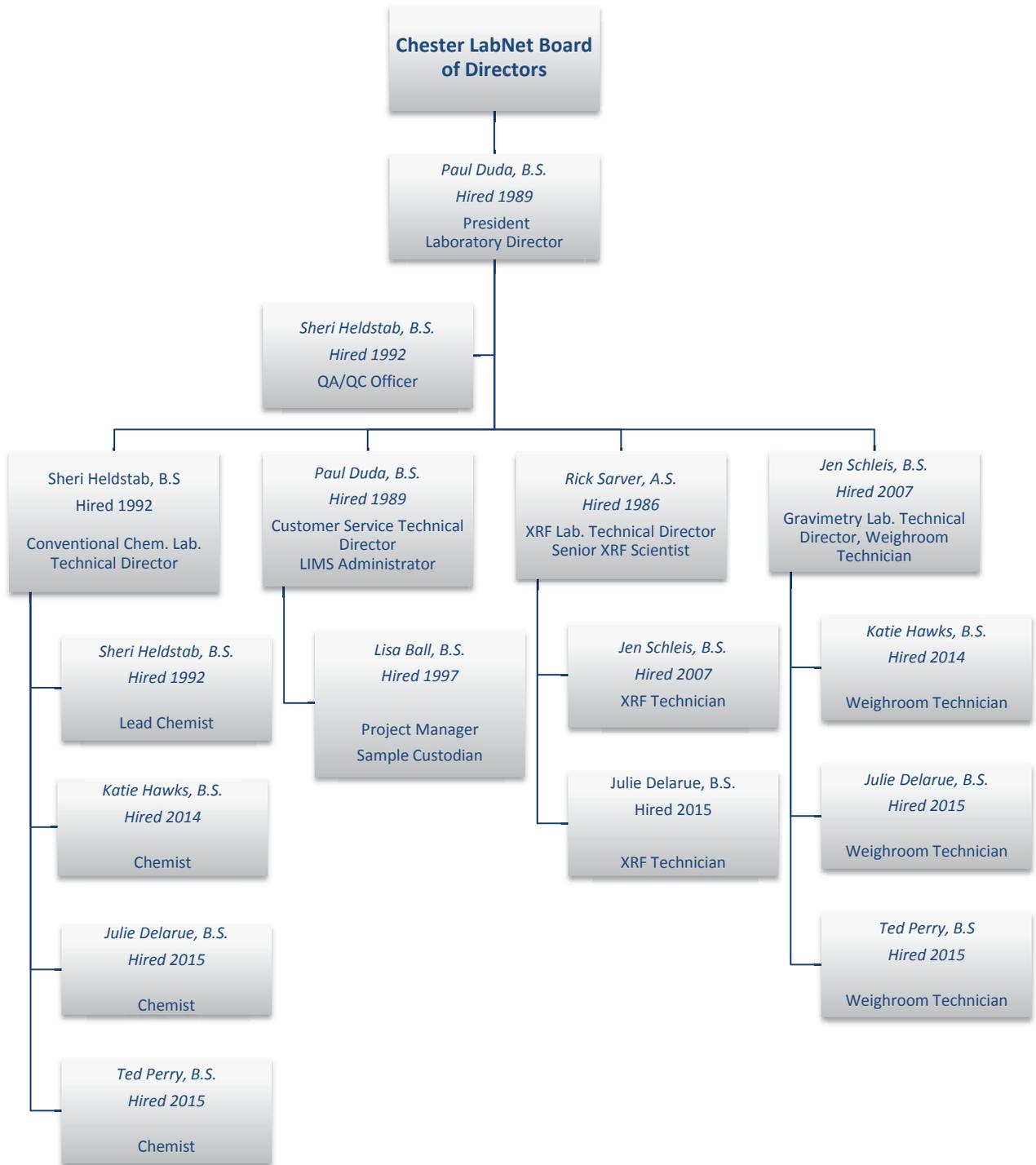


Figure 4-1. *Chester LabNet* Organizational Chart

Additional information regarding responsibilities, authority and interrelationship of personnel who manage, perform or verify testing is included in Section 5, "Management" and Section 20, "Personnel". These Sections also include information on supervision, training, technical management, job descriptions, quality personnel and appointment of deputies for key managerial personnel.

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The laboratory has the resources and authority to operate a management system that is capable of identifying departures from that system and from procedures during testing; and initiates actions to minimize or prevent departures.

4.2 Conflict of Interest and Undue Pressure

The organizational structure minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel. In addition, procedures are in place to prevent outside pressures or involvement in activities that may affect competence, impartiality, judgment, operational integrity, or the quality of the work performed at the laboratory.

Due to the small size of the laboratory, some conflicts of interest are inevitable. For instance, the QA Officer and Chemist may be the same person. In some situations, it may be necessary for a person to audit an area of the laboratory in which they perform analysis or to verify their own data. The corporate culture of **CHESTER LabNet** is such that this is not considered by Management to be a significant conflict of interest. **CHESTER LabNet's** motto is "Good Data, On Time." All employees understand the need for ethical integrity and perform their current task without regard for any previous or future tasks they may be performing. In other words, when the QA Officer puts on her QA Officer hat, she is acting as a QA Officer, not as a chemist. All employees, from the time they begin working at **CHESTER LabNet** are imbued with the understanding that a failure to uphold **CHESTER LabNet's** ethics will result in an investigation and possible termination of the employee. See Section 5.4, "Ethics and Data Integrity" and Appendix A, "Ethics and Data Integrity Policy."

Policies and procedures to prevent commercial, financial or other influences that may negatively affect the quality of the work or negatively reflect on the competence, impartiality, judgment or operational integrity are described in Personal Ethics and Data Integrity Policy.

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Section 5

MANAGEMENT

(TNI V1:M2 – Section 4.2)

The laboratory maintains a management system that is appropriate to the scope of its activities.

5.1 Management Requirements

Top management includes the Laboratory Director, Technical Directors, and the QA Officer.

Management's commitment to good professional practice and to the quality of its products is defined in the Quality Policy statement, Section 5.3.

Management has overall responsibility for the technical operations and the authority needed to generate the required quality of laboratory operations. Management ensures communication within the organization to maintain an effective management system and to communicate the importance of meeting customer, statutory and regulatory requirements. Management assures that the system documentation is known and available so that appropriate personnel can implement their part. When changes to the management system occur or are planned, managers ensure that the integrity of the system is maintained.

Management is responsible for carrying out testing activities that meet the requirements of the 2009 TNI Standard and ISO/IEC 17025 Standard, and that meet the needs of the client.

Managers implement, maintain and improve the management system, and identify non-compliance with the management system of procedures. Managers initiate actions to prevent or minimize non-compliance.

Management ensures technical competence of personnel operating equipment, performing tests, evaluating results or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised. Competence is ensured via review of previous experience/education, signed training documentation, and DoC's. See Section 20, "Personnel."

All personnel performing work at *CHESTER LabNet* possess the necessary knowledge, skills and abilities to perform the work required. No duties or activities will be assigned to staff members not having the qualifications, training and experience to conduct such work. Where possible, training will be provided as needed by a senior analyst to each employee (this excludes method development, which shall be performed by a Technical Director or designated alternate). Refer to SOP QA-001 "Laboratory Training" for further detail.

All personnel performing work at *CHESTER LabNet* are degreed professionals. See Appendix G for resumes of all personnel. Each employee's QC file contains a copy of

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their diploma or university transcripts and résumé as evidence of their educational background and laboratory skills.

All personnel performing non-gravimetric analytical duties possess basic laboratory skills such as the ability to use an analytical balance, to properly read a meniscus line for volumetric work, to use both autopipets and glass fixed volume pipets, to use a burette, to perform basic mathematical calculations including proper canceling of units, and to properly identify glassware and its functions. In addition, these personnel possess knowledge of general laboratory vocabulary (e.g., “buffer”, “titrant”, “reflux”, etc.), fundamental computer skills (e.g., saving files, opening software applications, finding files on a computer, etc.), and general laboratory safety.

Management is responsible for defining the minimal level of education, qualifications, experience and skills necessary for all positions in the laboratory, and assuring that technical staff have demonstrated capabilities in their tasks.

Training is kept up to date as described in Section 20, “Personnel” by periodically reviewing training records, examining QC data from each analysis, and reviewing employee performance annually.

Management bears specific responsibility for maintenance of the management system. This includes defining roles and responsibilities for personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures and documentation. The assignment of responsibilities, authorities and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in Section 20, “Personnel.”

Management ensures that audit findings and corrective actions are completed within required time frames.

Designated deputies may be appointed by management during the absence of the Laboratory Director, Technical Director(s) or the QA Officer, and are always appointed if the absence is more than 15 days.

5.2 Management Roles and Responsibilities

5.2.1 Laboratory Director

The Laboratory Director is responsible for the financial, human resource and service performance of the laboratory. The Laboratory Director provides the resources necessary to implement and maintain an effective quality and data integrity program.

5.2.1.1 Responsibilities

The Laboratory Director is responsible for:

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- ensuring that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work;
- oversight of company financials, to include the purchase of new instrumentation and equipment;
- review of all tenders and contracts;
- oversight of accreditation(s);
- ensuring adequate staffing (in tandem with Technical Directors);
- engagement in management reviews of laboratory systems; and
- oversight of client specific analytical requirements.

5.2.2 Quality Assurance Officer

The QA Officer (or designee) is responsible for the oversight and review of quality control data. Due to the small size of the laboratory, the QA Officer is not free from other obligations in the laboratory. Refer to section 4.2 for a description of **CHESTER LabNet's** resolution of conflicts of interest. The QA Officer's training and proof of experience in QA/QC procedures, knowledge of analytical methods, and the laboratory's management system may be found in the QA Officer's resume in Appendix G, "Staff Resumes."

5.2.2.1 Responsibilities

The QA Officer is responsible for:

- serving as a focal point for QA/QC;
- arranging or conducting annual internal audits without outside (e.g., managerial) influence;
- oversight of accreditation(s);
- notifying management of deficiencies and monitoring corrective actions;
- oversight and review of quality control data;
- monitoring corrective actions;
- ensuring that the management system related to quality is implemented and followed at all times;
- monitoring and maintaining laboratory certifications;
- keeping this Quality Assurance Management Plan current;
- ensuring all SOPs are reviewed annually and keeping them current;
- ensuring that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and that this training has been documented;
- ensuring that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external

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performance or procedural audits - procedures that do not meet the standards set forth in the Quality Manual, laboratory SOPs or laboratory policies may be temporarily suspended by the QA Officer;

- reviewing all logbooks for completeness and correct usage (in tandem with Technical Directors);
- ensuring all project specific data quality objectives and QA/QC targets are satisfied;
- ensuring all mandated systems requirements are met;
- issuing and archiving laboratory logbooks; and
- reviewing and approving all SOPs and policies prior to their implementation, and ensuring availability of and adherence to all approved SOPs and policies.

5.2.3 Technical Director

The Technical Directors are full-time laboratory staff members, and supervise laboratory operations and data reporting. The Technical Directors' proof of experience in the fields of accreditation may be found in their resumes in Appendix G.

If a Technical Director is absent for fifteen (15) calendar days or more, a deputy (see Table 5-1 below) with appropriate qualifications will perform the Technical Director's duties. If no employee has "appropriate qualifications," the most senior analyst will become the deputy or work will cease in that department until such time as the Technical Director returns. Beyond a thirty-five (35) calendar day absence, management will notify the primary accreditation body in writing of the absence of the Technical Director and the appointment of the deputy.

The Technical Director is not the Technical Director of more than one accredited environmental laboratory. Due to the wide variation in Air Quality methods and analytical techniques, each department has its own Technical Director.

5.2.3.1 Responsibilities

The Technical Director is responsible for:

- meeting the general and education requirements and qualifications found in Sections 4.1.7.2 and 5.2.6.1 of the 2009 TNI Standard - EL-V1M2-2009 (note: no requirements are given for gravimetry laboratories);
- monitoring performance data and the validity of the analyses for the laboratory;
- providing technical direction to staff and clients;
- overseeing instrument and equipment maintenance and repairs;
- monitoring data compilation and interpretation;

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- training new employees (or delegating training to a qualified analyst);
- assessing qualifications of employees (education, experience, training, and performance);
- ensuring training records are completed for employees;
- where feasible, ensuring completion of a primary DoC before newly trained analyst may be released from training;
- officially releasing newly trained analyst(s) from training;
- coordinating operations within the laboratory to ensure smooth flow of samples through the analytical process (may need to be done in tandem with other Technical Directors); and
- supervision of all analysts to ensure compliance with all accreditations, regulations and client specific requirements.

5.2.4 Current Technical Directors and qualifications:

Rick Sarver: XRF Laboratory Technical Director
A.S. Science, 1980 (Chemekta Community College)
College Credit Hours in Chemistry: 33
Year hired at *CHESTER LabNet*: 1986

Paul Duda: Customer Service Technical Director
B.S. Engineering Management, 1987 (University of Portland)
College Credit Hours in Chemistry: N/A
Year hired at *CHESTER LabNet*: 1989

Sheri Heldstab: Conventional Chemistry Laboratory Technical Director
B.S. Biology, 1990 (University of Oregon)
College Credit Hours in Chemistry (B.S.): 37
Year hired at *CHESTER LabNet*: 1992

Jennifer Schleis: Gravimetry Laboratory Technical Director
B.S. Environmental Management, 2003 (University of Georgia)
College Credit Hours in Chemistry: 4
Continuing Education – Portland Community College
College Credit Hours in Chemistry: 5
Year hired at *CHESTER LabNet*: 2007

Note that 2009 TNI Volume 1, Section 5.2.6.1 does not make reference to any requirements for the Technical Director of a laboratory or laboratory department in which only gravimetric analysis is performed. *CHESTER LabNet's* Laboratory Director and QA Officer have, together and in unison, agreed that 2 years of work experience in the Gravimetry Laboratory, coupled with a thorough understanding of the QA/QC requirements given in the various appendices of 40 CFR 50 and other promulgated

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methods plus their guidance documents are grounds for promoting a person into the Gravimetry Laboratory Technical Director position.

5.2.5 Laboratory Key Personnel Deputies

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

Table 5-1 Key Personnel Deputies		
Key Personnel	Deputy	Comment
Laboratory Director	QA Officer/Project Manager	
QA Officer	Laboratory Director	
Technical Director – Conventional Chemistry	Most Experienced Chemist	
Technical Director – XRF	Most senior XRF technician	
Technical Director – Gravimetry	Most senior Gravimetry Laboratory technician	

5.3 **Quality Policy**

Management’s commitment to quality and to the management system is stated in the Quality Policy below, which is upheld through the application of related policies and procedures described in the laboratory’s Quality Assurance Management Plan, SOPs and policies.

Quality Policy Statement: Our goal is to provide the most informed and accurate inorganic analyses of air quality samples available from a commercial laboratory by supplying our clients with data of known and documented quality. *CHESTER LabNet’s* management is committed to good professional practice and to the quality of its environmental testing in servicing its clients. This policy is implemented and enforced through the unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. All personnel concerned with environmental testing within the laboratory are familiar with the quality documentation requirements, and implement the policies and procedures in their work as attested to by their signatures on the Concurrences page of this document. The laboratory and its management are committed to complying with all requirements of any accreditations, contracts and governmental mandates.

CHESTER LabNet is proud of having specialized in the inorganic analysis of ambient particulates and source emission samples since its inception (as NEA, Inc.) in the late 1970’s. The laboratory as an organization, its management and its personnel are all committed to the production of the highest quality data achievable with current methodologies and instrumentation, as well being committed to complying with contractual, regulatory and accreditation standards and requirements.

5.4 **Ethics and Data Integrity System**

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The laboratory has an Ethics and Data Integrity policy that is included in Appendix A. The laboratory's Ethics and Data Integrity program, training and investigations are discussed in Section 19, "Data Integrity Investigations".

5.5 Documentation of Management/Quality System

The management system is defined through the policies and procedures provided in this Quality Assurance Management Plan and written laboratory Standard Operating Procedures (SOPs) and policies.

5.5.1 Quality Assurance Management Plan

The Quality Assurance Management Plan contains the following required items:

- 5.5.1.1 document title;
- 5.5.1.2 laboratory's full name and address;
- 5.5.1.3 identification of all major organizational units which are to be covered by this Quality Assurance Management Plan and the effective date of the version;
- 5.5.1.5 identification of the laboratory's approved signatories;
- 5.5.1.6 the signed and dated concurrence (with appropriate names and titles) of all responsible parties including the QA Officer, Technical Director(s) and the Laboratory Director;
- 5.5.1.7 the objectives of the management system and references to the laboratory's policies and procedures (where not explicitly contained herein);
- 5.5.1.8 the laboratory's official quality policy statement including the management system objectives and management's commitment to ethical laboratory practices and to upholding the requirements of all contractual, regulatory and accreditation standards and requirements; and
- 5.5.1.9 a table of contents and applicable lists of references, glossaries and appendices.

This Quality Assurance Management Plan contains or references all required elements as defined by the 2009 TNI Standard - V1:M2, Section 4.2.8.4.

5.5.2 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) represent all phases of current laboratory operations and include an effective date, revision number and signature of the approving authorities as described in SOP QA-003, "Implementation, distribution and control of Standard Operating Procedures." SOPs are available to all personnel, and contain sufficient detail such that someone with similar qualifications could perform the procedures. There are two types of SOPs used in the laboratory: 1) test method SOPs, which have specific requirements as outlined below, and 2) general use SOPs which document general procedures.

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Each accredited analyte or method has an SOP. The laboratory's test method SOPs include the following topics:

- i. identification of the method;
- ii. applicable matrix or matrices;
- iii. limits of detection and quantitation;
- iv. scope and application, including parameters to be analyzed;
- v. summary of the method;
- vi. definitions;
- vii. interferences;
- viii. safety;
- ix. equipment and supplies;
- x. reagents and standards;
- xi. sample collection, preservation, shipment and storage;
- xii. quality control;
- xiii. calibration and standardization;
- xiv. procedure;
- xv. data analysis and calculations;
- xvi. method performance;
- xvii. pollution prevention;
- xviii. data assessment and acceptance criteria for quality control measures;
- xix. corrective actions for out-of-control data;
- xx. contingencies for handling out-of-control or unacceptable data;
- xxi. waste management;
- xxii. references;
- xxiii. any tables, diagrams, flowcharts and validation data; and
- xxiv. Deviations from promulgated methods and technical justifications for those deviations.

Refer to SOP QA-003, "Implementation, distribution and control of Standard Operating Procedures" for more detail on the written structure of each SOP.

5.5.3 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows unless otherwise noted:

- Client Directives ("client trumps all")
- Quality Assurance Management Plan
- SOPs and Policies
- Promulgated methods and associated QA Guideline documents

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Section 6

DOCUMENT CONTROL (TNI V1:M2 – Section 4.3)

This Section describes how the laboratory establishes and maintains a process for document management. Procedures for document management include controlling, distributing, reviewing and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

Documents can be SOPs, policy statements, specifications, calibration tables, charts, textbooks, posters, notices, memoranda, software, drawings, plans, etc. These may be on various media, whether hard copy or electronic, and they may be digital, analog, photographic or written.

The laboratory manages four major types of documents: 1) controlled and approved, 2) suspended, 3) deactivated and 4) obsolete. In addition, they fall into three broad categories: Program documents (e.g., QAMP, Chemical Hygiene Plan), SOPs, and laboratory logbooks.

A controlled document is one that is uniquely identified, issued, tracked and kept current as part of the management system. Controlled documents are always internal and, consequently, must be approved.

An approved document means it has been reviewed, signed and dated by the issuing and approving authorities.

A suspended document is one which has not been used for an extended period of time, typically three to five years. These documents could be unsuspending at any time and brought back into use if there was a request requiring it. For example, *CHESTER LabNet* did not analyze pH using an electrode for over a decade, during which time the SOP for pH by electrode was suspended. A massive change to a promulgated method required the use of a pH electrode, and the method was unsuspending, updated and brought back into use again. The suspension of a document is not permanent. While suspended, the document does not go through the annual review cycle. Once unsuspending, the document resumes its place in the annual review cycle. The purpose of this designation is to avoid the loss of time in reviewing a method which isn't being actively utilized.

A deactivated document is one which the laboratory believes will never be used again. Frequently, these are project or client specific documents required for a single project which has come to an end or documents for an instrument no longer in use. Deactivation of a document may also be the result of merging that document with another (e.g., combining two SOPs into one). Deactivated documents are not reviewed annually and are retained for evidentiary purposes only. By definition, a deactivated document is also an obsolete document.

Obsolete documents are documents that have been superseded by more recent versions or are no longer needed. These documents have an "effective until:" date noted at the bottom of the Cover Page and are retained in the QA Officer's files. In addition to the "effective until:" date, these documents are stapled together along the right-hand margin to indicate that it is not to be used.

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6.1 Controlled Documents

Documents will be reviewed, revised (as appropriate) and approved for use by the QA Officer and the Technical Director most familiar with the document requirements prior to issue. In cases where the QA Officer is the person most familiar with the document contents, a second person with or without the same degree of knowledge shall read and sign the document.

Documents are reviewed annually by all pertinent staff to ensure the contents are suitable, in compliance with the current management systems and requirements, and accurately describe current operations. A master list of SOPs is maintained electronically by the QA officer to ensure annual review. Internal documents are uniquely identified with: 1) a unique name or number identification 2) date of issue, 3) revision identification. All documents are fully paginated in the form of "Page X of Y."

Original, signed SOPs are kept in 3-ring binders in the main office area of the laboratory. The obsolete versions are stapled along the right margin and retained in the archived SOPs file drawers. Deactivated or suspended SOPs are kept in the binders, are clearly marked as being deactivated or suspended, and are stapled along their right-hand edge. The production of new SOPs and the revision of existing SOPs are under the supervision and control of the QA Officer. Each SOP must be approved, signed and dated by a minimum of two people.

Within the laboratory, original SOPs are always used as references. Copies are only made for submission to outside authorities and only on specific contractual request. Any physical copies of SOPs used for submission materials for new projects or for proposals must be stamped "COPY" in red ink across the title page. Electronic copies in .pdf format are watermarked on each page with "Uncontrolled Copy." "Controlled copies" do not exist for SOPs within the confines of the laboratory.

Originals of the general laboratory QAMP, project-specific Quality Assurance Management Plans, and the general laboratory Chemical Hygiene Plan are kept with the original SOPs in the main office area of the laboratory. Production of new QA Manuals and revision of existing QA Manuals is under the supervision and control of the QA Officer. Each QA Manual must be signed and dated by the author. In addition, QA Manuals must be read, signed and dated by all affected laboratory personnel. This process is conducted annually for the general laboratory QA Manual and for all project-specific QA Manuals where an annual review is required. The date of issue is clearly marked on the title page.

As copies are only made for submission to outside authorities, *CHESTER LabNet* does not allow for a controlled copy within the laboratory. This makes the need to trace dispersed documents moot.

A master list of controlled copies is also maintained by the Laboratory Director that includes, by reference, the title, author, copyright date, date of publication and location. The controlled copy list is maintained electronically in a spreadsheet by the Laboratory Director and is updated each time a new document is sent to a requesting entity.

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6.1.1 Document Changes to Controlled Documents

6.1.1.1 Paper Document Changes

Document changes are approved by the QA Officer or pertinent Technical Director during the annual review cycle.

The document management process allows for handwritten modifications to documents. As no controlled copies are distributed throughout the laboratory, and as analysts must always refer to the original document, there is no need to track the changes (changes are “tracked” by their existence in the one master copy). Changes must be written in the original document in non-black ink, and dated and initialed by the person making the change.

All document modifications are approved by the personnel making the change. Changes that are not process modifications but clarifications may be performed without revision, but must still be dated and initialed. Process amendments/modifications to documents are incorporated into a new revision. The document is reissued when it has been reviewed, and updated on or before its scheduled review cycle. Approval of changes by the QA Officer or pertinent Technical Director is required for the issuance of a new version or clean copy of the document.

A reason for the modification or change is provided as historical information in the revised document. All internal documents have a Cover Page and a Review History Page. The Review History Page tabulates the changes made over time to the document. Any major changes to the document content will be noted in this table (see Review History Page of this document).

6.1.1.2 Electronic Document Changes

CHESTER LabNet does not maintain electronically available documents. All documents, including SOPs and quality manuals, whether laboratory or project specific, are used by personnel in hardcopy form only. The QA Officer is responsible for maintaining the electronic versions of the documents. No other personnel are involved in the electronic maintenance or use of documents. Anytime a new electronic version of a document is created, such as during annual reviews, the QA Officer will rename the electronic version of the document by appending a year, or if necessary, a month and year, to the electronic file name of the document. Changes to the document are tracked by comparing the obsolete document to the current hardcopy document in use. Scanned versions of the original hardcopy are in .pdf format, and, aside from the “uncontrolled version” watermark, are unchanged from the original.

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6.2 Obsolete Documents

All invalid or obsolete documents are prevented from unintended use.

Obsolete documents retained for legal use or historical knowledge preservation are appropriately marked and retained. The obsolete versions have an "effective until:" date noted at the bottom of the Cover Page and are retained in the QA Officer's files. In addition to the "effective until:" date, these documents are stapled together along the right-hand margin to indicate that it is not to be used. Deactivated, suspended, or obsolete documents are retained for a minimum of five years.

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Section 7

REVIEW OF REQUESTS, TENDERS AND CONTRACTS

(TNI V1:M2 – Section 4.4)

The review of all new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the customer's needs or requirements. If the test method is mandated by a regulator despite being archaic or contradictory, the laboratory will follow that method as closely as possible and in keeping with the chemistry or intent of the method.

This process assures that all work will be given adequate attention without shortcuts that may compromise data quality. Note: Air Quality methods that are not applicable to the needs of the client may be stipulated by a regulatory body. In such cases, the regulatory body has the final decision in methodology, even if the methodology is not suitable to the process being regulated.

Contracts for new work may be in the form of formal bids, signed documents, or verbal or electronic agreement. The client's requirements, including the methods to be used, must be clearly defined, documented and understood. Requirements might include target analyte lists, project specific reporting limits (if any), project specific quality control requirements (if any), turnaround time, and requirements for data deliverables. The review must also cover any work that will be subcontracted by the laboratory.

7.1 Procedure for the Review of Work Requests

The Laboratory Director and the appropriate Technical Director(s) for the area(s) being affected determine if the laboratory has the necessary accreditations, resources (including schedule), equipment, deliverables and personnel to meet the work request. The review for most work is documented in email exchanges between the Laboratory Director and the client. Note that many samples may arrive without forewarning. This process only applies to work requests made in advance of the receipt of samples. A notice of impending receipt of samples is not considered to be a contractual request (e.g., an email received from a client saying "we shipped the samples today, you should receive them tomorrow" does not qualify as a work request made in advance).

The Laboratory Director, Project Manager or Technical Director informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily.

The client is informed of any deviation from the contract including the test method or sample handling processes. All differences between the request and the final contract are resolved and recorded before any work begins. It is necessary that the contract be acceptable to both the laboratory and the client. This information is recorded in email exchanges between the client and the personnel listed above. For large or ongoing projects, the Laboratory Director prints email exchanges and retains them in a project/contract specific file.

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The review process is repeated when there are amendments to the original contract by the client. The participating personnel are notified, verbally or by email, of the amendments. For small projects or one time only projects (e.g., one sampling event) the amendments are maintained in email exchanges between the client and the laboratory. For large or ongoing contracts requiring more stringent documentation, a contract specific hardcopy file is maintained by the Laboratory Director.

For routine projects and other simple tasks, a review by the Laboratory Director, Project Manager or Technical Director is considered adequate. The aforementioned person confirms that: the laboratory has all required certifications, it can meet the client's data quality and reporting requirements, and the lab has the capacity to meet the client's turn around needs.

For new, complex, or large projects, the proposed work contract is given to the Laboratory Director and the Technical Director(s) whose area(s) will be affected by the contract. The Laboratory Director in tandem with the QA Officer and relevant Technical Director(s) will evaluate such items as:

- contractual obligations, bonding issues and payment terms;
- method capabilities, analyte lists, reporting limits and quality control limits;
- turnaround time feasibility;
- QA/QC issues, including certification/accreditation;
- formal laboratory quote;
- final report formatting and electronic deliverable documents;
- time required to store samples in house after analysis;
- final sample disposal requirements; and
- review of PT sample results, if any.

The Laboratory Director submits the bid and formal quote to the client, and maintains copies of all signed contracts.

Note: For repetitive routine tasks, the review may be made only at the initial inquiry stage or on granting of a contract for on-going routine work performed under a general agreement with the client, provided the client's requirements don't change.

7.2 Documentation of Review

Records are maintained for every contract or work request, when appropriate. This includes pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. Refer to section 7.1 of this document for record keeping procedures.

Records of all project-related communication with the client (including e-mails, fax, telephone conversations, etc.) are generally kept in the Laboratory Director's or

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Project Manager's email client or handwritten notes in each project file. Refer to section 7.1 of this document for record keeping procedures.

Section 8

SUBCONTRACTING OF ENVIRONMENTAL TESTS

(TNI V1:M2 – Section 4.5)

A subcontract laboratory is defined as a laboratory external to this laboratory, or at a different location than the address indicated on the front cover of this manual, that performs analyses for this laboratory.

When subcontracting analytical services, the laboratory assures work is placed with a laboratory that meets applicable statutory and regulatory requirements for performing the tests.

8.1 Procedure

CHESTER LabNet very rarely subcontracts work, and never subcontracts work requiring ORELAP/NELAP accreditation. The Laboratory Director maintains a list of subcontractors.

For the rare occasions that the laboratory does subcontract work, *CHESTER LabNet* operates only as a middle-man. *CHESTER LabNet* may sub-sample or send the samples in their entirety to the subcontracted lab(s) or the client may ship samples directly to the subcontracted lab(s). The subcontracted laboratory's report is included *in toto* in the final report issued by *CHESTER LabNet*. Billing is then performed by *CHESTER LabNet*.

CHESTER LabNet reports do not contain data generated by another laboratory, unless that data is clearly indicated to have originated from another laboratory.

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Section 9

PURCHASING SERVICES AND SUPPLIES

(TNI V1:M2 – Section 4.6)

The laboratory ensures that purchased supplies and services that affect the quality of environmental tests are of the required or specified quality, by using approved suppliers and products.

The laboratory has procedures for purchasing, receiving and storage of supplies that affect the quality of environmental tests.

9.1 Procedure

The Laboratory Director reviews and approves the supplier of services and supplies, and verifies or approves technical content of purchasing documents prior to ordering.

Most frequently used services are provided by companies with known reputations and are procured from the manufacturers when possible. For servicing of instruments where the analyst cannot repair the failure on site, the instrument manufacturer's field service technician is called. For the ICP servicing, this is primarily performed by Perkin-Elmer. IC servicing is performed by a Thermo-Electron (formerly Dionex) field technician. OC/EC servicing is performed by Sunset Laboratories. The CVAA is serviced by a Nippon field representative. XRF's are serviced by Thermo-Electron. Balances are serviced annually by Quality Control Services, which is also the company responsible for recertifying all weights used in the calibration and verification of the balances. The HVAC system is serviced and repaired by Specialty Heating and Cooling. Fume hoods are serviced by USA Mechanical.

Evaluation of suppliers is accomplished by reviewing the packing slips, Certificates of Analysis, or other supply receipt documents to ensure the supplier has shipped the product or material ordered and that the material is of the appropriate quality, then stamping the packing slips and any accompanying Certificates of Analysis "received [date of receipt]." The purchasing documents, including Certificates of Analysis, contain the data that adequately describe the services and supplies ordered. The description may include type, class, grade, identification, specifications or other technical information.

The supplies received are inspected for breakage, leaks or any other damage. Where necessary, the supplies and chemicals are checked for expiration dates, then are marked "rec'd [date and initials of person receiving the supply]". They are stored according to manufacturer's recommendations, laboratory SOPs or test method specifications. Consumable non-perishable supplies such as gloves, pipet tips, paper towels, etc., do not have a received date noted on the container.

Any documents received with the supplies and services including specifications, certificates of analyses, warranties, maintenance records, calibration records, etc., are kept on file. For further information, refer to SOP AD-005, "Reagent Procurement and Control."

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The Conventional Chemistry Laboratory maintains 3-ring binders for the retention of certificates of analysis for: 1) dry chemicals, 2) inorganic liquids, 3) organic liquids, 4) standards, and 5) conventional chemistry laboratory support equipment calibrations. The person who writes the “rec’d” date on the container is responsible for obtaining the certificate of analysis, recording the received date (and their initials) on the certificate of analysis, verifying the expiration date (if any) on the certificate of analysis, and placing the certificate in the appropriate 3-ring binder.

The Gravimetry Laboratory maintains a 3-ring binder containing all the certifications of all NIST traceable weights, as well as balance maintenance and servicing records for all balances and NIST traceable weights. NIST traceability certificates for all NIST traceable electronic thermometers and hygrometers are maintained in the same binder. Note that the laboratory does not recertify electronic NIST traceable thermometers or hygrometers, as it is less expensive to simply purchase new ones with accompanying certifications. NIST traceable glass bodied thermometer certificates are retained in the Conventional Chemistry Laboratory’s Support Equipment binder.

The purchased supplies and reagents that affect the quality of the tests are not used until they are inspected or otherwise verified as complying with requirements defined in the test method.

9.2 Approval of Suppliers

The Laboratory Director maintains a list of approved suppliers. Suppliers with a history of acceptable evaluations are approved as a supplier.

As previously detailed (see section 9.1), evaluation of suppliers is accomplished by reviewing the packing slips or other supply receipt documents to ensure the supplier has shipped the product or material ordered, that the material is of the appropriate quality, and then stamping the packing slips or other supply receipt documents “received [date of receipt]”. The purchasing documents contain the data that adequately describes the services and supplies ordered. The description may include type, class, grade, identification, specifications or other technical information.

9.3 Reagent (De-ionized) Water

Reagent water is manufactured onsite using a Millipore Milli-Q RO/DI system. The manufacture of Reagent or De-ionized (DI) water is discussed thoroughly in SOP AD-006. Briefly, water is generated using the system noted above. At the time of production, the resistivity of the water is measured by the De-ionizing system, and, once per day of use, the resultant measurement is recorded in a DI Water Control Chart kept near the system.

Some methods specify the ASTM Type rating of water to be used during analysis. The ASTM specifications for reagent water include total matter, electrical conductivity, electrical resistivity, minimum color retention, soluble silica, method of preparation and intended use. For the intended uses at *CHESTER LabNet*, both Type I and Type II are applicable:

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- ASTM Type I: "...shall be used where maximum accuracy and precision is indicated, provided dissolved organic matter is not a possible interference."
- ASTM Type II: "...shall be used for most analytical procedures and all procedures requiring water low in organics."

The difference in method of preparation between ASTM Type I and Type II are as follows:

- ASTM Type I: distillation of feed water followed by mixed bed ion exchange polishing followed by a 0.2 μm finishing filter (feed water must have a conductivity $\leq 20 \mu\text{mhos/cm}$ at 25 °C)
- ASTM Type II: distillation of feed water such that the distillate has a conductivity $\leq 1.0 \mu\text{mho/cm}$ at 25 °C, recognizing that to meet this criterion the feed water may have to be treated by distillation (essentially making it a two stage distillation process), ion-exchange, or reverse osmosis (there is NO feed water criterion and NO requirement for a finishing filter).

Of the measure specifications, only resistivity is monitored at *CHESTER LabNet*:

- ASTM Type I: $\geq 16.67 \text{ M}\Omega/\text{cm}$ at 25 °C
- ASTM Type II: $\geq 1.0 \text{ M}\Omega / \text{cm}$ at 25 °C

Technically speaking, the DI water prepared at *CHESTER LabNet* is not strictly either ASTM Type I or Type II, but rather a hybrid missing the specification of distillation. Typically, the resistivity of DI Water at *CHESTER LabNet* is greater than 18.0 M Ω at the time of production.

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Section 10

SERVICE TO THE CLIENT

(TNI V1:M2 – Section 4.7)

The laboratory collaborates with clients and/or their representatives on clarifying their requests and monitoring laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations and without risk to the confidentiality of other clients.

10.1 Client Confidentiality

The laboratory confidentiality policy is to not divulge or release any information to a third party without proper authorization. A "third party" is defined as a person or entity who did not pay for the data generated, and therefore has no legal rights of ownership to the data. Third party requests for data and information are referred to the client. Data and records are not disclosed to third parties without permission from the owner (client), except in the case of subpoena. All subpoenas shall be sent to the company attorney prior to being acted upon.

All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limitations, as required by client or regulation.

All data produced by *CHESTER LabNet* is the property of the client. As such, *CHESTER LabNet* will not and does not release data to any other person, agency or business without prior verbal or written consent of the client. Verbal consent is documented and maintained in the data report.

In cases where data is subpoenaed, *CHESTER LabNet* will contact the laboratory's attorney prior to submitting data. In these rare instances, only the data directly mentioned in the subpoena shall be released to the subpoenaing authority. Data which may be related to the subpoena but was generated for a different client must be subpoenaed independently. Any situations that arise involving legal action shall be brought to the attention of the Laboratory Director and shall involve *CHESTER LabNet's* representing attorney to ensure the subpoena is correct, pertinent, legally viable and that any actions taken by *CHESTER LabNet* in releasing data are legally defensible.

In a situation where the laboratory goes out of business or changes ownership, each client shall be contacted and their wishes regarding what they would like the laboratory to do with any data shall be carried out. The laboratory will not release any data to any organization who is not the client without the client's permission. The laboratory will follow the client's wishes in regards to all data, be it hardcopy, electronic, data packages, or electronic raw data.

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10.2 Client Support

Communication with the client, or their representative, is maintained to provide proper instruction and modification for testing. Technical staff are available to discuss any technical questions or concerns the client may have.

The client, or their representative, may be provided reasonable access to laboratory areas for witnessing testing or for auditing purposes.

Delays or major deviations to the testing are communicated to the client immediately by phone or email. Communication may be made by the Project Manager, applicable Technical Director or analyst, depending on the nature of the communication. Major deviations may also be documented in the Case Narrative of the report.

The laboratory will provide the client with all requested information pertaining to the analysis of their samples. An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or not previously agreed upon.

10.3 Client Feedback

The laboratory seeks both negative and positive feedback following the completion of projects and periodically for ongoing projects. Feedback provides acknowledgement, corrective actions, where necessary, and opportunities for continuous improvement.

Negative customer feedback is documented as a customer complaint (see Section 11, "Complaints").

For the duration of one month per year, *CHESTER LabNet* sends customer surveys out to every client receiving a data report that month. The highest rate of return of these surveys has been 40%. *CHESTER LabNet's* clients tend to be highly brand-loyal, and thus it is the laboratory's experience that customer surveys always yield positive responses for the surveys returned. Historically, clients have verbally reported that they found the surveys annoying. The laboratory now emails links to online surveys, allowing clients to either complete or ignore the links. This has decreased the number of client complaints about receiving surveys.

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Section 11

COMPLAINTS

(TNI V1:M2 – Section 4.8)

The purpose of this Section is to ensure that customer complaints are addressed and corrected. This includes requests to verify results or analytical data. Complaints provide the laboratory an opportunity to improve laboratory operation and client satisfaction.

Complaints by customers or other parties are reviewed by management and an appropriate action is determined. All customer complaints are documented by the person receiving the complaint and addressed to the appropriate member of Management.

If it is determined that a complaint is without merit, it is documented and the client is contacted by the person receiving the complaint, the appropriate project manager or the appropriate Technical Director.

While inquiries into data are not uncommon, actual complaints by clients are rare. In either case, once contacted by the client, the project manager notifies the appropriate Technical Director or the QA Officer of the nature of the issue. That person locates the original data report and investigates the client's concern. If it is determined that the complaint has merit, the procedures outlined in Section 14, "Corrective Action" are utilized.

Errors Made by the Laboratory: While rare, errors do occasionally occur. If the issue at hand is the result of an error made by the laboratory (i.e., miscalculation, transposed numbers, decimal point errors, incorrect sample IDs, etc.), the laboratory will correct the error and issue a revised report to the client. In some cases, the client may request that the samples be re-analyzed. Where possible, this is performed.

Issues resulting from sample characteristics: Air Quality sampling is not a simple matter. Issues may arise over which the laboratory has little or no control (e.g., filter deposits not adhering to the filter, source emission samples having interfering analytes, impinger solutions with large quantities of particulate matter, etc.). In these cases and where possible, the client is notified prior to work being performed, and client agreement as to how to reconcile the matter is noted in the report. Where the client had been previously notified of such issues, the client complaints are referred back to the client's original statements. In cases where the issue could not be detected until after analysis (such as interfering compounds), the client will be notified prior to receiving the data if the problem is severe, otherwise the issue will be documented in the Case Narrative of the data report. The laboratory will explain the cause of the problem to the client, as well as what, if any, other courses of action may be taken to resolve the issue. In some cases, the client may request that the samples be re-analyzed or analyzed following a different method. Where possible, this is performed.

Unethical or Illegal requests by clients: On very rare occasions, client complaints take the form of the laboratory refusing to commit unethical or illegal actions. Requests made by clients to perform such actions are declined and an explanation given as to why the request is declined. Such requests have taken the form of asking the laboratory to analyze Sample A, but report the results as Sample B due to the loss of Sample B during shipping; requesting that re-analysis be performed until the number desired by the client is obtained; or requesting that the laboratory take legal liability for actions performed in the field.

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CHESTER LabNet does not and will not report false data or make false claims to any client. Samples from clients who persist in making such requests shall be refused in the future. **CHESTER LabNet** will not knowingly, directly or indirectly, participate in fraudulent activity. Any indications that the client may be using the laboratory's data in a fraudulent manner are documented in the case narrative and/or other areas of the data report. Requests for the laboratory to oversee or otherwise assume legal liability for actions occurring outside the laboratory's control are summarily refused, to include development of sampling plans and monitoring of field activities.

Billing Complaints: Client complaints regarding billing errors are directed to the Laboratory Director, who also executes all accounting functions for the company. The laboratory President will investigate the billing in question. Where errors are found, a revised invoice or credit memo to rectify the financial records will be issued.

Media and Supplies Complaints: Complaints regarding sampling media are referred to either the Project Manager or the Technical Director responsible for that particular media. In instances where the incorrect media was shipped to a client, the error will be corrected and appropriate media sent in a timely fashion to the client. It is **CHESTER LabNet's** policy that media, once sent to a client, cannot be returned unused as the laboratory cannot vouch for the integrity of the media once outside of its control. Complaints about the inability to return unused media are explained by this policy, with which most clients agree once they understand the logic behind it.

A complaint such as a concern that data is repeatedly late should be reviewed for preventative action (see Section 15, "Preventative Action") to minimize a future occurrence.

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Section 12

CONTROL OF NON-CONFORMING ENVIRONMENTAL TESTING WORK

(TNI V1:M2 – Section 4.9)

Non-conforming work is work that does not meet acceptance criteria or requirements. Non-conformances can include departures from standard operating procedures or test methods, or unacceptable quality control results (see Section 27, “Quality Assurance for Environmental Testing”). Identification of non-conforming work can come through various means including customer complaints, quality control, instrument calibration, consumable materials evaluation, staff observation, final report review, management reviews, and internal and external audits.

12.1 Exceptionally Permitting Departures from Documented Policies and Procedures

Requests for departures from laboratory procedures are approved by the Technical Director for the department in which the departure occurs and documented in the Case Narrative of the report to the client. Planned departures from procedures or policies do not require audits or investigations, and are also documented in the Case Narrative of the report to the client. In the field of Air Quality testing, departures at the request of the client or as a result of sample characteristics are quite common.

12.2 Non-Conforming Work

The lab policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

The responsibilities and authorities for management of non-conforming work are as follows: The Technical Director or analyst is responsible for notifying their Technical Director, Project Manager or the Laboratory Director of the occurrence of a non-conformance. If the non-conformance affects data either in process or already reported, the client will be contacted by the Technical Director, Project Manager or Laboratory Director. The client is responsible for making the decision as to what to do with the non-conforming work (proceed, stop, change methodology, etc.), particularly if the non-conformance is a result of the client’s actions (e.g., DI water used instead of Acetone in probe rinses).

The procedure for investigating and taking appropriate corrective actions of non-conforming work are described in Section 14, “Corrective Actions”. Section 14.3 describes procedures for Technical Corrective Actions. Formal corrective action procedures must be followed for non-conforming work that could recur (beyond expected random QC failures) or where there is doubt about the laboratory’s compliance with its own policies and procedures.

The investigation of and associated corrective actions for non-conforming work involving alleged violations of the company’s Ethics and Data Integrity policies must follow the procedures outlined in Section 19, “Data Integrity Investigations”.

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The laboratory evaluates the significance of the non-conforming work and takes corrective action immediately. The customer is notified if their data has been impacted. The laboratory allows the release of non-conforming data only with approval by the appropriate Technical Director in tandem with the client on a case-by-case basis. Non-conforming data is clearly identified in the Case Narrative of the final report (see Section 28, "Reporting the Results").

The discovery of a non-conformance for results that have already been reported to the customer must be immediately evaluated for significance of the non-conformance, its acceptability to the customer, and determination of the appropriate corrective action.

Corrective action for routine, non-recurring exceedances can be documented on raw data worksheets, logbooks, e-mail, a database or other documents. More serious corrective actions (non-conforming work that could recur or where there is doubt that the laboratory is in compliance with its own policies and procedures) will require a more formal corrective action process that usually includes the use of a corrective action report.

12.3 Stop Work Procedures

Personnel notify the appropriate Technical Director of any non-conformance not addressed in the SOP for that method. The Technical Director reviews the significance of the non-conformance and develops a course of action. If data are questionable, the QA Officer may be involved in the review and clients are notified.

When an investigation of non-conformance indicates that the cause of the non-conformance requires a method be restricted or not used until modifications are implemented, the Laboratory Director and Technical Director will immediately notify all personnel of the suspension/restriction. The lab will hold all relevant reports to clients pending review. The QA Officer must be involved in resolution of the issue and must verify that the issue is resolved before work may resume. Personnel are notified by the Technical Director when resumption of work is authorized. The Technical Director and QA Officer will document the issue, root cause and resolution using the corrective action procedures described in Section 14, "Corrective Action".

The Technical Director for the affected department authorizes resumption of work after it has been stopped.

The reporting of non-conforming work involving alleged violations of the company's Ethics and Data Integrity policies must be reported to the QA Officer and applicable Technical Director. Procedures described in Section 19, "Data Integrity Investigations" are followed.

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Section 13

IMPROVEMENT

(TNI V1:M2 – Section 4.10)

Improvement in the overall effectiveness of the laboratory management system is a result of the implementation of the various aspects of the laboratory's management system: quality policy and objectives (Section 5, "Management"); internal auditing practices (Section 17, "Internal Audits"); the review and analysis of data (Section 27, "Quality Assurance for Environmental Testing"); the corrective action (Section 14, "Corrective Action") and preventative action (Section 15, "Preventative Action") processes; and the annual management review of the quality management system (Section 18, "Management Reviews") in which the various aspects of the management/quality system are summarized and evaluated, and plans for improvement are developed. The resulting Annual Managerial Report is the primary means by which Management monitors and works to improve laboratory systems (Section 18, "Management Reviews").

The Annual Managerial Review includes a detailed summary of the previous twelve months' records (see Section 18.1, "Management Review Topics").

Based on the Annual Managerial Review, Management may make changes to improve overall systems. When the Annual Managerial Review is completed, a staff meeting is held, the results are discussed, and input from all employees is taken for means of improving the laboratory's performance and client service.

All staff are expected to share ideas for improvement with their Technical Director or QA Officer. Most improvements implemented are the result of employees seeing novel approaches to various systems and methods. If an employee has an idea that is approved by the pertinent Technical Director or QA Officer, that idea is communicated to all affected personnel either verbally or by email. All employee-generated improvement schemes must be approved by either the pertinent Technical Director or QA Officer prior to being implemented on a regular basis.

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Section 14

CORRECTIVE ACTION *(TNI V1:M2 – Section 4.11)*

Corrective action is the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.

Deficiencies cited in external assessments, internal quality audits, data reviews, customer feedback/complaints, control of non-conforming work or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

14.1 General Procedure

All corrective actions not specified in method SOPs or other in-house documents are documented using a Corrective Action Report (CAR). This includes corrective actions by analysts, client services personnel, findings from internal audits, customer inquiries and complaints, etc.

The first section of the CAR is completed by the person who discovers the issue. The second section is completed by the person who investigates the issue, determines the root cause and causes the corrective action to be carried out (may be a Technical Director or analyst). The third and fourth sections are completed by the QA Officer, with the fourth section being completed after a check to ensure that the corrective action has been effective.

Completed Corrective Action Reports are retained in a 3-ring binder with a copy of the CAR placed in the client's job file, if applicable.

The person who discovers the non-conformity is responsible for initiating the corrective action where a non-conformance is found that could recur (beyond expected random QC failures) or where there is doubt about the compliance of the laboratory with its own policies and procedures. The QA Officer is responsible for monitoring and recording the corrective action.

All deficiencies are investigated and a corrective action plan is developed and implemented, when determined necessary. The implementation is monitored for effectiveness.

14.1.1 Cause Analysis

When failures due to systematic errors have been identified, the first step of the corrective action process starts with the initial investigation and determination of root cause(s) of the problem. Records of non-conformances requiring corrective action are maintained in a 3-ring binder of Corrective Action Reports including the results of the investigation to show that the root cause(s) was investigated.

Where there may be non-systematic errors, the initial cause is readily identifiable, or the failure is an expected random event (e.g., failed quality control), a formal

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root cause analysis is not performed. In this case, the process begins with selection and implementation of corrective action (also see Section 14.3, "Technical Corrective Actions").

14.1.2 Selection and Implementation of Corrective Actions

Where uncertainty arises regarding the best approach for analysis of the cause of exceedances that require corrective action, involved personnel will recommend corrective actions that are appropriate to the magnitude and risk of the problem and will most likely eliminate the problem and prevent recurrence.

The QA Officer, in tandem with affected personnel, ensures that corrective actions are discharged within the agreed upon time frame. It is not uncommon for the corrective action to have been implemented immediately upon discovery of the non-conformance.

14.1.3 Monitoring of Corrective Action

The QA Officer will monitor implementation and documentation of the corrective action to ensure that the corrective actions were effective.

After a Corrective Action Report (CAR) has been initiated and the root cause determined and addressed, the report is given to the QA Officer. The QA Officer allows the CAR to "age" for a period of 30 to 60 days. The QA Officer then interviews the involved personnel to ensure that the corrective action was both taken and effective, and that no recurrences of the problem have occurred. At this point, the QA Officer signs off on the Corrective Action Report and places it in the 3-ring binder. A copy of the CAR is also placed in the affected job file, where applicable, for traceability purposes.

14.2 Additional Audits

Where the identification of non-conformances or departures from normal lab procedures cast doubt on the laboratory's compliance with its own policies and procedures or on its compliance with the 2009 TNI Standard, the laboratory ensures that the appropriate areas of activity are audited in accordance with Section 17, "Internal Audits" as soon as possible.

These additional audits are follow-ups after the corrective action has been implemented to ensure that it was effective. These are rare and done only when a serious issue or risk to the laboratory has been identified. Since 1994, there has not been a single need to implement this policy.

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14.3 Technical Corrective Action

Sample data associated with a failed quality control parameter are evaluated for the need to be re-analyzed or qualified. Unacceptable quality control results are documented in the data report and, if the evaluation requires cause analysis, the cause and solution are recorded on a Corrective Action Report (also see Section 12, "Control of Non-conforming Environmental Testing Work").

Analysts routinely implement corrective actions for data with unacceptable QC measures. First level correction may include re-analysis without further assessment. If the test method SOP addresses the specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem.

Corrective actions for non-systematic errors or expected random failures are documented in the Case Narrative of the data report. Depending on the severity of the non-conformance, documentation may be noted in the raw data or the non-conformance may be discussed in the Case Narrative of the report. Corrective actions for non-conformances that may recur (beyond expected random QC failures) or where there is concern that the laboratory is not in compliance with its own policies and procedures require that a Corrective Action Report be completed (see Section 14.1).

The QA Officer, in tandem with the Technical Directors and analysts, reviews the Corrective Action Reports and suggest improvements, alternative approaches and procedures where needed.

If the data reported are affected adversely by the non-conformance, the affected data is clearly identified in the Case Narrative of the report and the customer is notified. It is common to contact the client for direction prior to the issuance of a report.

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Section 15

PREVENTATIVE ACTION *(TNI V1:M2 – Section 4.12)*

Preventative action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

Preventative actions include, but are not limited to: encouraging staff to discuss any ideas they may have for improving processes with the appropriate Technical Director, review of QC data to identify quality trends, review of client feedback to look for improvement opportunities, review of proficiency testing data to look for analytes that were nearly missed, annual managerial reviews, scheduled instrument maintenance, and other actions taken to prevent problems.

When improvement opportunities are identified or if preventative action is required, action plans are developed by the pertinent Technical Director, implemented and monitored to reduce the likelihood of the occurrence of non-conformities.

Procedures for preventative actions include initiation of the actions and subsequent monitoring to ensure that they are effective.

All personnel have the authority to offer suggestions for improvements and to recommend preventative actions. Management is responsible for implementing and monitoring preventative action.

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Section 16

CONTROL OF RECORDS (TNI V1:M2 – Section 4.13)

Records are a subset of documents, usually data recordings, that include annotations such as daily refrigerator temperatures posted to a laboratory form, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample-handling and analysis.

The laboratory maintains a record system appropriate to its needs, documents all laboratory activities, and complies with applicable standards or regulations as required. Records of original observations and derived data are retained to establish an audit trail. Records help establish factors affecting the uncertainty of the test and enable test repeatability under conditions as close as possible to the original.

16.1 Records Maintained

Records (or copies of records) are kept of all procedures to which a sample is subjected while in the possession of the laboratory. The laboratory retains all original observations, calculations and derived data (with sufficient information to produce an audit trail), calibration records, personnel records and a copy of the test report for a minimum of five years from generation of the last entry in the records. At a minimum, the following records are maintained by the laboratory to provide the information needed for historical reconstruction:

- i) all raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' worksheets and data output records (chromatograms and other instrument response readout records);
- ii) a written description of, or reference to, the specific method(s) used, including a description of the specific computational steps used to translate parametric observations into reportable analytical values (a copy of all pertinent Standard Operating Procedures);
- iii) laboratory sample ID code;
- iv) date of analysis;
- v) time of analysis, required when the holding time is seventy-two (72) hours or less, or when time-critical steps are included in the analysis (e.g., extractions);
- vi) instrument identification and operating conditions/parameters (or reference to such data);
- vii) all manual calculations (including manual integrations);
- viii) analyst's or operator's initials/signature or electronic identification;

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- ix) sample preparation, ID codes, volumes, weights, filter deposit area, instrument printouts, and reagents;
- x) test results (including a copy of the final report);
- xi) standard and reagent origin, receipt, preparation and use;
- xii) calibration criteria, frequency and acceptance criteria;
- xiii) data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- xiv) quality control protocols and assessment;
- xv) electronic data security, software documentation and verification, software and hardware audits, backups and records of any changes to automated data entries;
- xvi) method performance criteria including expected quality control requirements;
- xvii) proficiency test results;
- xviii) records of demonstration of capability for each analyst;
- xix) a record of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record;
- xx) correspondence relating to laboratory activities for a specific project;
- xxi) corrective action reports;
- xxii) preventative action records;
- xxiii) copies of internal and external audits including audit responses;
- xxiv) copies of all current and historical laboratory SOPs, policies and Quality Manuals;
- xxv) sample receiving records;
- xxvi) sample storage records;
- xxvii) data review and verification records;
- xxviii) personnel qualification, experience and training records;
- xxix) archive records; and
- xxx) management reviews.

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16.2 Records Management and Storage

Program Documents: Process, Approval and Distribution

Currently, *CHESTER LabNet* has two program documents: Laboratory Quality Assurance Management Plan (QAMP) and the Chemical Hygiene Plan (CHP). All program documents are written and polished to a draft condition by the QA Officer prior to being submitted to the Laboratory Director as a draft version for review. The Laboratory Director makes comments on the draft version and resubmits it to the QA Officer for revision. After making the requested revisions, program documents are circulated to the rest of the staff for comments. Once all comments have been addressed, the final copy is read and signed by all *CHESTER LabNet* personnel. The documents are stored in the main office area of the premises and are reviewed annually by all original signatories where possible, or their replacements, if any.

Document Control

All original program documents and SOPs are stored in a bookcase in the main office area. Original finalized copies of these documents or binders containing documents may not be removed from the premises under any circumstances. Photocopies, electronic copies and/or draft copies of documents may only be removed from the premises with the approval of the QA Officer or Laboratory Director.

Due to the small size of *CHESTER LabNet*, the laboratory has no formal document control system, nor does the laboratory have an SOP describing document control within the company. As no controlled copies of documents are permissible, the need to trace dispersed copies is null and void. SOP QA-003 does include a thorough description of the processes the laboratory uses to govern document generation, control and archiving of old documents. The QA Officer maintains a master list of all in-house written documents on the QA Officer's computer. Technical Directors and analysts are responsible for maintaining control of instrument specific manuals and literature.

All laboratory employees have access to the original documents at all times. All laboratory documents are reviewed on an annual basis by the QA Officer, the appropriate Technical Director or an alternate designated by them, and the employee(s) performing the procedure on a regular basis. The QA Officer is also responsible for the preparation, approval and issuance of new documents.

Copies are not allowed to be made, except for submission to the client for the purposes of meeting contractual or proposal obligations. Any photocopy must be approved by either the Laboratory Director or the QA Officer. No copies of client specific documents (QAMP or any SOP) will be submitted to any other client. All original SOPs or laboratory documents must be signed on their Cover Page by at least two laboratory employees in BLUE ink. The Review History Page is signed by the appropriate Technical Director or QA Officer. Any physical copy of a document will be clearly stamped with the word "COPY" on the Cover Page and can be distinguished from the original by a lack of signatures in blue ink. Electronic copies

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may be distinguished by a watermark reading “uncontrolled copy” on each page of the document.

Instrument Manuals are kept in a location near the instrument to which they apply, with the exception of support instrumentation/equipment, which may be kept in a binder in the laboratory where the support instrumentation/equipment is used. Instrument manuals are available at all times to all personnel. A listing of all manuals and their locations may be found in Section 23.1, “General Equipment Requirements,” of this document.

Standard Operating Procedures (SOPs)

Original, signed SOPs are kept in 3-ring binders in the main office area of the laboratory. The retired versions are stapled along the right margin and retained in the archived SOPs file drawers. The production of new SOPs and the revision of existing SOPs are under the supervision and control of the QA Officer. Each SOP must be approved, signed, and dated by a minimum of two people. In cases where the author is the person most familiar with the technique, a second person with or without the same degree of technical knowledge shall read and sign the SOP. Within the laboratory, originals are always used as references. Copies are only made for submission to outside authorities and only by specific contractual request. Any physical copies of SOPs (e.g., to be used for submission materials for new projects or for proposals) must be stamped "COPY" in red ink across the title page. All SOPs are reviewed annually and a master list of SOPs is maintained electronically by the QA Officer to ensure annual review. Electronic copies in .pdf format are notable by a watermark reading “uncontrolled copy” on each page of the document.

QC Guidance Manuals

Originals of the general laboratory Quality Assurance Management Plan, project-specific Quality Assurance Management Plans, and the general laboratory Chemical Hygiene Plan are kept along with the original SOPs in the main office area of the laboratory. The production of new QC guidance manuals and the revision of existing QC guidance manuals are under the supervision and control of the QA Officer. Each QC guidance manual must be signed and dated by the author. In addition, Quality Assurance Management Plans must be read, signed and dated by all affected laboratory personnel. This process is conducted annually for the general laboratory Quality Assurance Management Plan and for all project-specific Quality Assurance Management Plans where an annual review is required. The date of issue is clearly marked on the title page and the total number of pages is clearly marked at the top of each page, next to the specific page number.

Laboratory Notebooks

Bound laboratory notebooks are assigned numbers and dispensed by the QA Officer who maintains a bound book containing the dispensed logbook number, date of origination, use, and date the logbook is retired. The master logbook tracking book is kept in the main office area of the laboratory. Filled logbooks are decommissioned by the QA Officer. The decommission date and archive location are noted in the same bound book and the decommissioned logbooks are kept in a series of labeled banker's boxes in the SPM lab archive area.

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Document Production and Maintenance

All internal documents have a Cover Page and a Review History Page. The Review History Page tabulates the changes made over time to the document. Any major changes to the document content will be noted in this table (see Review History Page of this document). Minor changes can be noted in the original document in NON-BLACK ink, as long as those changes are dated and initialed by the person making the change. Upon the introduction of a newly revised program document, the newly retired version is retained in the QA Officer's files. Upon introduction of a newly revised SOP, the newly retired version is marked with an "effective until" date, stapled along its right-hand margin, and retained in the archived SOPs file drawer.

The production of new documents and the revision of existing documents are under the supervision and control of the QA Officer. Each document is approved, signed, and dated by the QA Officer and at least one other laboratory employee. Any copies of documents (e.g., to be used for submission materials for new projects or for proposals) must be stamped "COPY" in red ink across the title page. Electronic copies in .pdf format are notable by a watermark reading "uncontrolled copy" on each page of the document.

All documents are reviewed annually by the QA Officer and all pertinent employees for currency, accuracy and clarity. Any revisions are noted in the Review History table at the front of the document. If no significant changes are needed, the review is documented by signing and dating the annual review line of the Review History Page. The Review History Page is signed by the pertinent Technical Director or QA Officer. Program documents are signed by, at a minimum, the QA Officer.

All electronic versions of documents are maintained on the QA Officer's computer. Changes to documents are performed by the QA Officer, or, rarely, by the Laboratory Director. Handwritten corrections may be made to the original hardcopy by any employee, as long as that change is dated and initialed. If there are numerous significant changes to content, the document is re-issued as soon as practicable. If the changes are minor, such as typographical errors, re-issuance may be delayed until such time as a major change requires it. The review history of each document notes changes made to the document and the name of the person making the changes. Due largely to the undesirable nature of document maintenance, as well as to the personal integrity of the employees, employees other than the QA Officer do not make changes to the original electronic copy of the document, therefore stringent control of access to the electronic copies of the documents is not undertaken.

Analytical Record Keeping

Data are recorded immediately and legibly in permanent ink. Data generated by automated data collections systems are recorded electronically. Corrections are initialed and dated with the reason noted for corrections other than transcription errors. A single line strikeout is used to make corrections such that the original record is not obliterated.

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Analytical records associated with analysis are retained in varying formats and locations such as to create a documentation trail sufficient to create a historical account of the analysis of any given sample. These records and their locations are listed in the table below:

<u>Record</u>	<u>Location</u>
Client/Laboratory Sample ID	LIMS and final data report
Date/time of analysis	Raw data (final data report)
Instrument ID (may be in the form of analysis type – e.g., only one IC is used for the determination of Anions.)	Header of the instrumental printout or data sheets (final data report), LIMS
Instrument operating conditions	Instrumental method is usually noted in the header of the instrumental printout (final data report)
Analysis type	Final data report (data sheets or case narrative)
Manual calculations	Raw data (final data report)
Analyst’s initials	Raw data (final data report)
Sample Preparation Logs	Raw data (final data report)
Sample Analysis	Raw data (final data report)
Standard and reagent origin, receipt, preparation and use;	Prep logs, standards/reagents logs, SOPs (for reagents needing preparation immediately prior to use), Ordering and Receipt files, Certificate of Analysis logbooks
Calibration Criteria, frequency and acceptance criteria	Applicable SOPs
Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions	Final data report, applicable SOPs
Quality control protocols and assessment	Protocols contained in applicable instrumental SOPs. Assessment found in raw data and final report.
Method performance criteria	Applicable SOPs

The following records are maintained in the finalized hard copy or electronic data report, which is retained for a period of at least 5 years:

- all original data, in hard copy format, or a record of where that data may be found;
- reference to the specific test method used;
- Cover Page, case narrative and copies of final data sheets;
- correspondence relating to the specific project;
- the identity of the personnel involved in sample receipt and log in;
- the identity of the personnel involved in sample preparation;

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- the identity of the personnel involved in sample analysis;
- the identity of the instrumentation used during analysis;
- original observations;
- derived data;
- calibration records;
- staff records; and
- the identity of the person who QC checks the data prior to reporting.

In addition to the above, the record keeping system allows for the retrieval of all working files and archived records via run logs, dates, data file names, preparation logs, etc. All handwritten changes to any logs are lined out using a single line so as not to obscure the original entry, then dated and initialed, and the reason for the change is noted. All data recorded manually are recorded directly, promptly and in indelible black ink. Erasures or intentional overwriting of files are not permissible. Observations, data and calculations are labeled so as to link them unequivocally to the specific task and are recorded at the time they are made.

Changes to electronic files are rare and are usually performed by a project manager during the final data file production stage. The person making the change is evident by which project manager is working with that data package. Entries to electronic records are made in such a way as to not erase or overwrite files. Reasonable measures are taken to avoid loss or change of original data in electronic records; however, unforeseen catastrophic electronic failures can occur, resulting in loss of electronic records.

Control of Data Reports

SOPs AD-007 and AD-008 document the production of data reports. Each data report will have all associated hard copy documents necessary for the historical reconstruction of data contained within it, or within appropriate bound logbooks. This includes, but is not limited to: final data report pages, case narratives, chains of custody, raw data, digestion logs, any notes concerning client directives, observations of the samples, QC summary pages and any other documentation required by verbal or written contract with the client. All software generated data are stored in hard copy format within the data report.

Hard copy data reports of all documentation not easily regenerated by the LIMS are retained for a period of no less than 5 years (e.g., raw data, CoC's, correspondence, Case Narratives, etc.). Copies of all hard copy reports, including documentation easily regenerated by the LIMS, is retained in .pdf format. Disposal of old records is carried out per client specifications (e.g., shredded, recycled, returned, etc.). Archived hardcopy reports are stored on-site in banker's boxes on ventilated shelves in a location with fire suppression devices. Active hardcopy reports are stored in lateral file cabinets. All documents pertaining to data generation are stored in a safe and secure environment, and held in confidence to the client.

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Electronic Data Control

Primary control of electronic data occurs at the physical security level, by preventing any non-authorized persons access to the premises without an escort. Secondary control of electronic data is achieved by employing only personnel with proven ethical understanding of data integrity. Tertiary data control at the instrument level is controlled by the software auditing mechanisms built into the major instrumental software utilized by the laboratory. Quaternary electronic data control is achieved by retaining hard copy records of all electronic data produced by the laboratory in appropriate project files.

The laboratory backs up electronic data including instrument data files, company data files, data reports, company financials, accreditation information, Standard Operating Procedures and administrative documents, detection limit studies and spreadsheets used for data reduction (for non-electronically generated data). This backup is performed daily, first to a different hard drive and then again to cloud storage.

Contract or Accreditation Specific Records

Contract or accreditation specific records shall be maintained for a period of time in keeping with the contractual- or accreditation-specific requirements. These documents are stored safely and securely, as are all other documents, and are available at all times to the accrediting authority or contract representative.

Records, including electronic records, are easy to retrieve, legible and protected from deterioration or damage; held secure and in confidence; and are available to accrediting bodies for a minimum of five years or as required by regulation or contract. Records that are stored *only* on electronic media are supported by the hardware and software necessary for their retrieval. To prevent unauthorized access or amendment, access to protected records is limited to employees in the department in which the records were generated.

Additional information regarding control of data is included in Section 22.5, "Control of Data".

The QA Officer or pertinent Technical Director notes when repositories of Quality and Technical records need archiving. The responsible person collects and, if necessary, binds the records. Records are then archived by the QA Officer using the logbook tracking logbook.

Archived information and access logs are protected against fire, theft, loss, environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources. Archived records have limited access, and are checked out through an access log. Both hardcopy and electronic archived information is stored onsite.

In the event that the laboratory transfers ownership or goes out of business, records will be maintained or transferred according to client instructions. Appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

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16.3 Legal Chain of Custody Records

Evidentiary sample data are used as legal evidence. *CHESTER LabNet* does not *knowingly* analyze data for evidentiary purposes.

To establish the documentation necessary to trace sample possession, a chain of custody record should be filled out at the time of collection and accompany every sample. The record should contain the following minimum information:

- sample identification (*CHESTER LabNet* laboratory identification number or client sample ID);
- sample tag number (if separate tag present);
- site (client sample ID or site location identifier);
- signature of sampler;
- date and time of sample collection;
- type of sample or referenced method number;
- signatures of all persons involved in the chain of custody;
- inclusive dates of possession; and
- analyses requested.

Each person who has custody must sign the chain of custody form. Samples must not be left unattended unless secured and sealed. Note that *CHESTER LabNet* has no control over whether or not a client submits a legally defensible chain of custody.

Due to its small and secured facilities, *CHESTER LabNet* does not utilize internal chains of custody. Samples are kept in a secured part of the facilities at all times, and visitors are not allowed within the confines of the facilities without an escort.

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Section 17

AUDITS

(TNI V1:M2 – Section 4.14)

Audits measure laboratory performance and verify compliance with accreditation/certification and project requirements. Audits specifically provide management with an on-going assessment of the management system. They are also instrumental in identifying areas where improvement in the management/quality system will increase the reliability of data. Audits are of four main types: internal, external, performance and system. Section 17.5 discusses the handling of audit findings.

17.1 Internal Audits

Annually, the laboratory prepares a schedule of internal audits to be performed during the year. These audits verify compliance with the requirements of the management/quality system, including analytical methods, SOPs, the Quality Assurance Management Plan, ethics policies, data integrity, other laboratory policies and the 2009 TNI Standard.

It is the responsibility of the QA Officer to plan and organize audits as required by the schedule and requested by management. These audits are carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited.

In addition to the scheduled internal audits, it may sometimes be necessary to conduct special audits as a follow-up to corrective actions, PT results, complaints, regulatory audits or alleged data integrity issues. These audits address specific issues.

The area audited, the audit findings, and corrective actions are recorded. Audits are reviewed after completion to assure that corrective actions were implemented and effective.

17.2 External Audits

It is the laboratory's policy to cooperate and assist with all external audits, whether performed by clients or an accrediting body. Management ensures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

17.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, on-site auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory includes the word "proprietary" in the title

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page of the document. Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory, however, sample identifiers may not be obscured from the information.

17.3 Performance Audits

Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a provider or client, or anything that tests the performance of the analyst and method.

Proficiency Test Samples are discussed in Section 27, "Quality Assurance for Environmental Testing".

17.4 System Audits

The Laboratory's management system is audited through annual management reviews. Refer to Section 18, "Management Reviews" for further discussion of management reviews.

17.5 Handling Audit Findings

Internal or external audit findings are responded to within the time frame agreed upon at the time of the audit. The response may include action plans that could not be completed within the response time frame. A completion date is established by management for each action item and included in the response.

Development and implementation of corrective actions to findings is the responsibility of the QA Officer in tandem with affected personnel. Corrective actions are documented through the corrective action process described in Section 14, "Corrective Actions". If the corrective action reports described in Section 14 are unmanageable due to the size of the document required, a separate response to audit findings shall be created by the QA Officer. The response to audit findings shall be retained by the Laboratory Director in a file pertinent to the auditing body.

Audit findings that cast doubt on the ability of the laboratory to produce data of known and documented quality or that question the correctness or validity of sample results must be investigated. Corrective action procedures described in Section 14, "Corrective Action" must be followed. Clients must be notified in writing if the investigation shows the laboratory results have been negatively affected and the client's requirements have not been met. The client must be notified within five business days after the laboratory discovers the issue. Laboratory management will ensure that this notification is carried out within the specified time frame.

All investigations resulting in findings of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. See Section 19, "Data Integrity Investigation," for additional procedures for handling inappropriate activity.

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Section 18

MANAGEMENT REVIEWS (TNI V1:M2 – Section 4.15)

Top management reviews the management system on an annual basis and maintains records of review findings and actions.

18.1 Management Review Topics

The following are reviewed to ensure their suitability and effectiveness:

- policies and procedures;
- reports from managerial and supervisory personnel;
- the outcome of recent internal audits;
- corrective and preventative actions;
- assessments by external bodies;
- the results of interlaboratory comparisons or proficiency tests;
- changes in the volume and type of the work;
- customer feedback;
- complaints;
- recommendations for improvement;
- completeness record; and
- other relevant factors, such as quality control activities, resources and staff training.

18.2 Procedure

Once annually, the QA Officer, with the help of the Laboratory Director, shall gather records pertinent to the topics listed in section 18.1. An annual Managerial Review document compiles a detailed analysis of those items. This review is then presented to the entire company during a company meeting for input and discussion.

Managerial reviews are part of the annual internal audit/review process. If needed, at the end of the annual audit cycle, an annual audit summary report is written. This report summarizes the findings, corrective actions, follow-up procedures and any other items of note found during the annual audit. The report is retained by the QA Officer in that year's internal audit file.

The managerial review shall take account of:

- the suitability of policies and procedures including a review of the QAMP to verify that all elements are being followed;

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- reports from managerial and supervisory personnel;
- the outcome of the annual internal audits;
- corrective and preventative actions;
- assessments by external bodies;
- the results of PE tests;
- changes in the volume and type of work;
- summary of client surveys;
- completeness record;
- quality control activities;
- resources: facilities and equipment;
- resources: staff and training; and
- goals, objectives and corrective action plans.

Findings and follow-up actions from management reviews are recorded. Management will determine appropriate completion dates for action items and ensure they are completed within the agreed upon time frame.

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Section 19

DATA INTEGRITY INVESTIGATIONS

(TNI V1:M2 – Section 4.16)

In addition to covering data integrity investigations, this Section covers all topics related to ethics and data integrity policies, procedures and training.

CHESTER LabNet is committed to ensuring the integrity of its data and providing valid data of known and documented quality to its clients. The elements in *CHESTER LabNet's* Ethics and Data Integrity program include:

- annual data integrity training (held in tandem with the annual safety training);
- an audit program that monitors data integrity (see Section 17, "Audits") and procedures for handling data integrity investigations and client notifications;
- procedures for confidential reporting of alleged data integrity issues; and
- documented data integrity procedures signed and dated by top management in the form of an Ethics and Data Integrity Policy signed by all management and staff (see Appendix A) as well as the signatures on this QAMP. All staff shall read and sign the Policy annually (see Appendix A). This policy is signed, dated and distributed by the QA Officer as part of the annual QAMP review and remains an integral part of the QAMP, available to all staff at any point in time by referencing the QAMP.

19.1 Ethics and Data Integrity Procedures

The Ethics and Data Integrity Policy provides an overview of the program. Written procedures that are considered part of the Ethics and Data Integrity program include:

- the Ethics and Data Integrity Policy (see Appendix A);
- manual integration procedures (see instrumental SOPs, varies by instrument);
- corrective action procedures (see Section 14);
- Data Integrity Investigations (see below);
- data recall procedures (see Section 14);
- data integrity training procedures (see Section 19.2);and
- annual management review of data integrity.

19.2 Training

Data integrity training is provided as a formal part of new employee orientation and a refresher is given annually for all employees. Employees are required to read and sign the Personal Ethics and Data Integrity Policy included in this

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document (see Appendix A) during orientation and again annually. This policy clearly states that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences including immediate termination or civil/criminal prosecution. Attendance for required training is documented through the signatures and accompanying dates on the Data Integrity and Ethics Policy.

Data integrity training emphasizes the importance of proper written narration on the part of the analyst in those cases where analytical data may be useful, but are in one sense or another partially deficient. All topics contained in the Personal Ethics and Data Integrity Policy are covered, and employees are given the opportunity to ask questions at the end of the training session.

The following topics and activities are covered:

- the organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting;
- how and when to report data integrity issues;
- record keeping;
- training, including discussion regarding all data integrity procedures;
- data integrity training documentation;
- in-depth data monitoring and data integrity procedure documentation; and
- specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

When contracted technical or support personnel are used, the QA Officer is responsible for ensuring that they are trained in the laboratory's management system and data integrity procedures, competent to perform the assigned tasks, and appropriately supervised. These personnel are treated in the same manner as a regular employee and often become regular employees.

Topics covered are provided to all trainees in writing in the form of the Personal Ethics and Data Integrity Policy located in Appendix A of this document.

19.3 Confidential Reporting of Ethics and Data Integrity Issues

Confidential reporting of data integrity issues is assured through the following procedure: All staff members have the authority and responsibility to bring any problems, discrepancies, or concerns to the attention of their appropriate Technical Director. In situations where privacy is of concern, all staff have access to all other staff members' phone numbers. It is understood and encouraged that when needed, employees contact each other via their private phone numbers.

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19.4 Investigations

All investigations resulting from data integrity issues are conducted confidentially. They are documented and notifications are made to clients who received any negatively affected data that did not meet the client's data quality requirements.

The first stage of investigation is data inspection including, but not limited to: all associated documentation including reagents logbooks, calibrations, run logbooks, computer clocks and/or date/time stamps on the raw data, computer controlled environmental monitoring, etc. The inspection is conducted by the appropriate Technical Director, in conjunction with the Laboratory Director/President and QA Officer. If the inspection results raise concerns, those results and the concerns they raised, along with copies of the associated documentation shall be retained in the employee's personnel file.

If, in their opinion, a breach of ethical conduct has occurred (as opposed to an honest mistake or oversight), the same Management staff member shall then interview the employee. If the interview raises concerns, other employees may be interviewed and the results of the interviews shall be documented.

If the situation is deemed to be a breach of ethics by Management, documentation from both the records inspection and any subsequent interviews, along with a record of any actions taken, shall be placed in the employee's personnel file maintained by the Laboratory Director/President. The employee will be informed of the outcome of the investigation.

CHESTER LabNet does not tolerate unethical behavior of any sort by its employees, whether said behavior is related or unrelated to data production. If a breach of ethics is found to be supported by evidence, the employee may expect to be terminated.

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Section 20

PERSONNEL

(TNI V1:M2 – Section 5.2)

CHESTER LabNet employs competent personnel based on education, training, experience and demonstrated skills as required. The laboratory's organization chart can be found in Section 4, "Organization," of this document.

20.1 Overview

All personnel are responsible for complying with all quality and data integrity policies and procedures that are relevant to their area of responsibility.

All personnel who are involved in activities related to sample analysis, evaluation of results, or who sign test reports must demonstrate competence in their area of responsibility. Appropriate supervision is given to any personnel in training and the trainer is accountable for the quality of the trainee's work. Personnel are qualified to perform the tasks they are responsible for based on education, training, experience and demonstrated skills as required for their area of responsibility.

The laboratory provides goals with respect to education, training and skills of laboratory staff. These goals are outlined in the specific job descriptions in section 20.2.

Training needs are identified at the time of employment and when personnel are moved to a new position or new responsibilities are added to their job responsibilities. Ongoing training, as needed, is also provided to personnel in their current jobs. The effectiveness of the training must be evaluated before the training is considered complete.

Contracted personnel, when used, must meet the same competency standards and follow the same policies and procedures that laboratory employees must meet.

20.2 Job Descriptions

Job descriptions are available for all positions that manage, perform, or verify work affecting data quality, and are located in the table below. Job descriptions include the specific tasks, minimum education, qualifications, skills and experience required for each position. An overview of top Managements' responsibilities is included in Section 5, "Management."

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<u>Title</u>	<u>Job Description</u>
President	<p><u>Goal:</u></p> <ul style="list-style-type: none"> • Ensure the business operates within compliance of all local, state, federal laws, including financial tracking and reporting; • Communicate with board of directors. <p><u>Area of Responsibility:</u> Corporate Affairs</p> <p><u>Minimum education required:</u> Higher degree in a hard science</p> <p><u>Training required:</u> Minimum 5 years as an employee of <i>CHESTER LabNet</i>. Training, by necessity, may be autodidactic.</p> <p><u>Minimum experience required:</u> 5 years project management with <i>CHESTER LabNet</i> or 2 years equivalent Presidential job duties at another laboratory (environmental or other).</p> <p><u>Qualifications:</u></p> <ul style="list-style-type: none"> • Knowledge of legal requirements of running a business; • knowledge of bookkeeping and legal financial reporting; and • knowledge of submission of Requests for Proposals (RFPs). <p><u>Brief description (including Managerial Duties):</u></p> <ul style="list-style-type: none"> • Oversees marketing and sales; • performs legal financial reporting including calculating and disbursing dividend checks to owners, ensuring all taxes are paid in a timely manner, and managing payroll and pay rates for employees; and • where possible, performs no functions related to testing, reporting or method development/modification.

Laboratory Director	<p><u>Goal:</u></p> <ul style="list-style-type: none"> • Ensure human resource and service performance of the laboratory. • Provide the resources necessary to implement and maintain an effective quality and data integrity program. <p><u>Area of Responsibility:</u> Laboratory Management</p> <p><u>Minimum education required:</u> Higher degree in a hard science</p> <p><u>Training required:</u> Minimum 5 years as an employee of <i>CHESTER LabNet</i>. Training, by necessity, may be autodidactic.</p> <p><u>Minimum experience required:</u> 3 years project management or Technical Director experience with <i>CHESTER LabNet</i> or 1 year</p>
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Quality Assurance Management Plan

Title**Job Description**

equivalent Laboratory Director job duties at another laboratory (environmental or other).

Qualifications:

- Knowledge of legal requirements of human resource management; and
- knowledge of submission of Requests for Proposals (RFPs).

Brief description (including Managerial Duties):

- Ensures that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work;
- oversees company financials, to include the purchase of new instrumentation and equipment;
- reviews all tenders and contracts;
- oversees accreditation(s);
- ensures adequate staffing (in tandem with Technical Directors);
- engages in management reviews of laboratory systems;
- oversees client specific analytical requirements; and
- where possible, performs no functions related to testing, reporting or method development/modification.

Quality Assurance Officer (QA Officer) **Goal:**

- Review all data prior to reporting;
- write/maintain all Quality documents including SOPs and this document;
- ensure compliance with this Quality Assurance Management Plan; and
- ensure compliance with Data Integrity and Ethics Policy.

Area of Responsibility: Laboratory Management

Minimum education required: Higher degree in a hard science

Training required: Minimum 5 years as an analyst with **CHESTER LabNet**. Training, by necessity, may be autodidactic.

Minimum experience required: 5 years chemist/analyst experience with **CHESTER LabNet** or 1 year equivalent QA Officer job duties at another laboratory (environmental or other).

Qualifications:

- Knowledge of current TNI Standard requirements;
- knowledge of all QC requirements associated with methods performed; and
- knowledge of the general chemistry and techniques of all methods performed.

Brief description (including Managerial Duties):

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Title

Job Description

- Serves as a focal point for QA/QC;
- arranges or conducts annual internal audits without outside (e.g., managerial) influence;
- notifies management of deficiencies and monitors corrective actions;
- oversees and reviews quality control data;
- monitors corrective actions;
- ensures that the management system related to quality is implemented and followed at all times;
- monitors and maintains laboratory certifications;
- maintains currency of this Quality Assurance Management Plan;
- ensures all SOPs are reviewed annually and maintains currency;
- 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 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 Quality Manual, laboratory SOPs or laboratory policies may be temporarily suspended by the QA Officer;
- reviews all logbooks for completeness and correct usage;
- ensures all project-specific data quality objectives and specific QA/QC targets are satisfied;
- ensures compliance with mandated systems requirements;
- issues and archives laboratory logbooks;
- reviews and approves all SOPs and policies prior to their implementation, and ensures availability of and adherence to all approved SOPs and policies;
- evaluates all results based upon QA elements described above and QC requirements for the pertinent testing;
- ensures new methods brought online meet QC criteria for Precision and Bias studies as required;
- ensures new methods brought online meet QC requirement for detection limit studies as required; and
- reports opinions and interpretations of data, where applicable.

Technical Director Goal:

(all departments) Supervise laboratory department operations, data generation and reporting.

Area of Responsibility: Laboratory Management

Minimum education required: Higher degree in a hard science. In addition, the Technical Director must have a minimum of 24 credit hours of college level chemistry for departments where

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Title**Job Description**

chemical analysis occurs. (Does not apply to gravimetry or customer service)

Training required: Minimum 3 years as an employee of *CHESTER LabNet*. At the discretion of the QA Officer and Laboratory Director, an employee's past work experience may be substituted for 2 of the 3 years. Training, by necessity, may be autodidactic.

Minimum experience required: 2 years chemist/analyst/technician experience with *CHESTER LabNet* or 1 year equivalent Technical Director job duties at another laboratory (environmental or other).

Qualifications:

- Knowledge of the general chemistry and techniques of all methods performed in respective department;
- knowledge of all instruments used in respective department;
- knowledge of all QC requirements associated with methods performed in respective department;
- knowledge of reporting requirements associated with methods performed in respective department; and
- meeting the general and education requirements and qualifications found in Sections 4.1.7.2 and 5.2.6.1 of the 2009 TNI Standard - EL-V1M2-2009 unless not specified.

Brief description (including Managerial Duties):

- Monitors performance data and the validity of the analyses for the laboratory;
- provides technical direction to staff and clients;
- oversees instrument and equipment installation, maintenance and repairs;
- monitors data compilation and interpretation;
- trains new employees (or delegates training to a qualified analyst);
- assesses qualifications of employees (education, experience and training);
- ensures training records are completed for employees;
- ensures completion of initial DoC before newly trained analyst may be released from training, where feasible;
- officially releases newly trained analyst from training;
- coordinates operations within the laboratory to ensure smooth flow of samples through the analytical process (may need to be done in tandem with other Technical Directors);
- supervises all analysts to ensure compliance with all accreditations, regulations and client specific requirements;
- plans tests and ensures adequate flow of work through the department;
- evaluates results against QC criteria as required;

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<u>Title</u>	<u>Job Description</u>
LIMS Administrator	<ul style="list-style-type: none"> • reports opinions and performs data interpretation, where applicable; • oversees all method development, modifications and validation in the department; and • coordinates day to day operations of the department including: flow of work, resource allocations, sample disposal, laboratory hygiene, supplies procurement and instrument maintenance and repair.
	<hr/> <p><u>Goal:</u> Ensure proper functioning, configuration and use of the LIMS.</p> <p><u>Area of Responsibility:</u> Administrative</p> <p><u>Minimum education required:</u> Higher degree in a hard science</p> <p><u>Training required:</u> Minimum 2 years as an employee of CHESTER LabNet. Training, by necessity, may be autodidactic.</p> <p><u>Minimum experience required:</u> 2 years LIMS usage at CHESTER LabNet or 1 year equivalent job duties at another laboratory using NWA LIMS software (environmental or other).</p> <p><u>Qualifications:</u></p> <ul style="list-style-type: none"> • Computer literate, and • a general understanding of database operations. <p><u>Brief description (including Managerial Duties):</u></p> <ul style="list-style-type: none"> • Operates and maintains (hardware/software) Laboratory Information Management System (LIMS); • creates/edits/validates report scripts and worklists in tandem with the appropriate Technical Director; and • where possible, performs no functions related to testing, reporting or method development/modification.
Project Manager & Senior Project Manager	<hr/> <p><u>Goal:</u> Coordinate sample receipt, log-in, analysis and reporting to suit the clients' needs.</p> <p><u>Area of Responsibility:</u> Administrative</p> <p><u>Minimum education required:</u> Higher degree in a hard science</p> <p><u>Training required:</u> Minimum 2 years as an employee of CHESTER LabNet. Training by LIMS Administrator in all functions of the LIMS.</p> <p><u>Minimum experience required:</u></p>

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Title**Job Description**

- Senior Project Manager: 2 years Project Management at *CHESTER LabNet*
- Project Manager: none

Qualifications:

- Computer literate;
- professional demeanor, both written and spoken; and
- good communication skills.

Brief description (including Managerial Duties):

- Functions as primary contact person for client interactions;
- receives samples;
- performs chain of custody procedures;
- interfaces with client and Laboratory on corrective actions;
- packages and ships sample media to clients;
- performs data entry in LIMS;
- reports data;
- coordinates sample receipt, sample analysis and data reporting activities to ensure project turnaround times; and
- performs no functions related to testing or method development/modification.
- Additionally, the Senior Project manager acts as a resource to other project managers, may act as another layer of Quality Control prior to submission of reports, and is responsible for adequate flow of work through the department.

Chemist/Senior Chemist**Goal:**

Produce the most accurate data possible that meets QC and documentation requirements of all applicable methods, accreditations and contracts.

Area of Responsibility: Analytical

Minimum education required: Higher degree in a hard science

Training required: Must be trained in all areas, including the Quality System and Technical/Analytical procedures by a lead analyst.

For the Lead Chemist, training may, by necessity, be autodidactic.

Minimum experience required:

- Lead Chemist: 2 years as a Chemist at *CHESTER LabNet*.
- Chemist: none.

Qualifications:

- Computer literate;
- professional demeanor, both written and spoken;

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Quality Assurance Management Plan

Title**Job Description**

- good communication skills;
- mathematical skills at the algebraic level or higher; and
- 1 year college level general chemistry OR 1 year experience in performing laboratory analysis at another laboratory.

Brief description (including Managerial Duties):

- Lead Chemist/Analyst is defined as the person with the most experience with a given method or analysis;
- Analyzes samples under the direction/coordination of either the Technical Director or Senior Chemist in compliance with requirements of this document, pertinent SOPs, contracts or guideline documents;
- keeps records in compliance with requirements of this document, pertinent SOPs, contracts or guideline documents;
- enters data into LIMS;
- safely handles chemicals and laboratory equipment;
- troubleshoots, maintains and repairs instrumentation, with or without input from the Technical Director or Lead Chemist;
- evaluates data against pertinent QC requirements; and
- reports opinions and performs data interpretation, where applicable.
- Additionally, the Lead Chemist acts as a resource to other chemists and may act as another layer of Quality Control prior to submission of data.

**XRF Analyst/
Senior XRF
Analyst****Goal:**

Produce the most accurate data possible that meets QC and documentation requirements of all applicable methods, accreditations and contracts.

Area of Responsibility: Analytical

Minimum education required: Higher degree in a hard science

Training required: Must be trained in all areas, including the Quality System and Technical/Analytical procedures by a senior analyst.

For the Senior analyst, training may, by necessity, be autodidactic.

Minimum experience required:

- Senior XRF Analyst: 2 years as an XRF Analyst at **CHESTER LabNet**.
- XRF Analyst: none.

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<u>Title</u>	<u>Job Description</u>
Gravimetry Laboratory Technician	<p><u>Qualifications:</u></p> <ul style="list-style-type: none"> • Computer literate; • professional demeanor, both written and spoken; • good communication skills; • mathematical skills at the algebraic level or higher; and • 1 year college physics or 1 year experience operating an XRF (experience may include on-the-job training). <p><u>Brief description (including Managerial Duties):</u></p> <ul style="list-style-type: none"> • Analyzes samples under the direction/coordination of either the Technical Director or Senior Analyst in compliance with requirements of this document, pertinent SOPs, contracts or guideline documents; • keeps records in compliance with requirements of this document, pertinent SOPs, contracts or guideline documents; • performs data compilation and spectral interpretation; • enters data into LIMS; • troubleshoots, maintains and repairs instrumentation, under the supervision of the Technical Director or Senior Analyst; • evaluates data against pertinent QC requirements; and • reports opinions and performs data interpretation, where applicable. • Additionally, the Senior Analyst acts as a resource to other analysts and may act as another layer of Quality Control prior to submission of data.
	<p><u>Goal:</u></p> <p>Produce the most accurate data possible that meets QC and documentation requirements of all applicable methods, accreditations and contracts.</p> <p><u>Area of Responsibility:</u> Analytical</p> <p><u>Minimum education required:</u> High School diploma</p> <p><u>Training required:</u> Must be trained in all areas, including the Quality System and Technical/Analytical procedures by a senior analyst.</p> <p><u>Minimum experience required:</u> none</p> <p><u>Qualifications:</u></p> <ul style="list-style-type: none"> • Computer literate; • professional demeanor, both written and spoken; and • good communication skills. <p><u>Brief description (including Managerial Duties):</u></p> <ul style="list-style-type: none"> • Performs all Gravimetry Laboratory operations and QA/QC,

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<u>Title</u>	<u>Job Description</u>
	including acceptance testing and gravimetry; <ul style="list-style-type: none"> • maintains appropriate inventory levels of filters and supplies; • archives analyzed samples; • follows all QA/QC protocols; and • evaluates data against pertinent QC requirements.

20.3 Training

All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is Management's responsibility to ensure personnel are trained. Training records are used to document Management's approval of personnel competency. The date on which authorization and/or competence is confirmed is included.

Training records are generated by the person who performs the training and are maintained by the QA Officer. Records include the dates that training occurred and a brief description of what the training was, along with a "training completed" date.

20.3.1 Training for New Staff

New staff members are trained in the following:

- requirements of the Quality Assurance Management Plan;
- requirements of the Chemical Hygiene Plan;
- relevant methods or SOPs which they will be performing;
- LIMS operation to the extent necessary for their job requirements; and
- administrative tasks to the extent necessary for their job requirements.

For further detail, refer to SOP QA-001, "Laboratory Training."

20.3.2 Ongoing Training

Refer to SOP QA-001, "Laboratory Training."

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Section 21

ACCOMODATIONS AND ENVIRONMENTAL CONDITIONS

(TNI V1:M2 – Section 5.3)

21.1 Environmental

The laboratory facility is designed and organized to facilitate testing of environmental samples. Environmental conditions are monitored to ensure that conditions do not invalidate results or adversely affect the required quality of any measurement, such as the temperature and humidity in the Gravimetry Laboratory.

If the laboratory environment is required to be controlled by a method or regulation, the adherence is recorded. Gravimetry Laboratory temperature and humidity are recorded using a combination temperature and humidity digital data logger, and the balances are placed upon marble slabs to avoid problems with vibration. Environmental tests are stopped when the environmental conditions jeopardize the results. Relevant temperature/humidity readings are recorded in the raw data for methods that are not performed in the Gravimetry Laboratory but that have specific temperature/humidity requirements.

21.2 Work Areas

Work areas include access and entryways to the laboratory, the administrative area (which may serve as a sample receipt area also), sample storage areas, sample processing and analysis areas, and chemical and waste storage areas.

Access to and use of areas affecting the quality of the environmental tests is controlled by restriction of areas to authorized persons only. See Section 21.4 below. Due to the small size of the laboratory, all employees are, by default, authorized personnel in all areas of the laboratory. Unauthorized persons could be people such as plumbers, field service technicians, visitors, etc.

The laboratory work spaces are adequate for their use, and appropriately clean to support environmental testing and ensure an unencumbered work area.

Laboratory space is arranged to minimize cross-contamination between incompatible areas of the laboratory. The Gravimetry Laboratory is on a separate HVAC system from the rest of the laboratory areas to ensure proper temperature and humidity control. Areas with high mineral acid usage are located in a different part of the conventional chemistry laboratory from where ion chromatography is performed. Sulfuric acid is not utilized near areas where the currently promulgated Method 202 is being performed. Resuspension of particulates onto filters is performed in a separate area to prevent particulate contamination of other samples.

Testing occurs only within the laboratory's analytical areas (e.g., Conventional Chemistry laboratory, XRF Laboratory or Gravimetry Laboratory). Adequate laboratory space is maintained for the testing performed in each area. Electronic

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balances are located away from drafts and doorways, and mounted on marble slabs in areas where their use is affected by vibrations. Neighboring test areas of incompatible activities are effectively separated. Specific work areas are defined and access is controlled. (Only authorized laboratory personnel and escorted visitors may enter the work area.) Good housekeeping measures are employed to avoid the possibility of contamination. Smoking is prohibited.

All equipment and reference materials required for accredited tests are available in the laboratory (no equipment is kept off-site). Records are maintained for all equipment, reference measurement materials and services used by the laboratory.

Reference materials traceable to national standards of measurement (NIST) or to national standard reference materials (SRM's) are stored away from heavy use areas or major equipment that may affect the proper operation of the materials. Certificates of Traceability are available for NIST traceable thermometers and hygrometers, for the Class 1 weights, and for all pre-prepared aqueous standards. The reference materials are used only for calibration or calibration verification in order to maintain the validity of performance. Certificates of Analysis are available for all standards and reagents.

21.3 Floor Plan

A floor plan can be found in Appendix C.

21.4 Building Security

The laboratory is kept secure during off hours by the use of locks and an alarm system.

Access to the facilities is by cardlock during non-business hours, seven days a week. During business hours, the main door is unlocked and is monitored personnel. Visitors are taken into the main laboratory under escort only.

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Section 22

ENVIRONMENTAL METHODS AND METHOD VALIDATION

(TNI V1:M2 – Section 5.4 and Sections 1.4, 1.5 and 1.6 of Technical Modules TNI V1:M 3-7)

Methods and/or procedures are available for all activities associated with the analysis of the sample including preparation and testing. For purposes of this Section, “method” refers to both the sample preparation and determinative methods. See Appendix B for a listing of all *CHESTER LabNet* SOPs. See Section 25, “Collection of Samples,” and Appendix D, “*CHESTER LabNet* utilized methods” for a listing of the most common promulgated methods in use at *CHESTER LabNet*.

Before being put into use, a test method is confirmed by a demonstration of capability or method validation process, where possible.

All methods are published or documented. Deviations from the methods are allowed only if the deviation is documented, technically justified, authorized by management and accepted by the customer. Note that most source sampling methods (CFR methods) are extremely outdated and archaic, and *CHESTER LabNet*'s clients are well aware of this. The laboratory does not notify clients of changes to methods necessitated either by the EPA's failure to update methods to reflect current technology or by the laws of chemistry and physics.

Every SOP has an appendix which lists all of the differences between the laboratory's SOP and the promulgated method. Examples include using a computer to gather and process data from an IC rather than a strip chart recorder, and not draining “the bottom organic layer” from a separatory funnel when the organic fraction has a lower density than water.

22.1 Method Selection

A reference method is a method issued by an organization generally recognized as competent to do so. (When ISO refers to a “standard method”, that term is equivalent to “reference method”.) When a laboratory is required to analyze a parameter by a specified method due to a regulatory requirement, the parameter/method combination is recognized as a reference method.

The laboratory will use methods that meet the needs of the customer. Such methods will be based on the latest edition of the method unless it does not meet the needs of the customer. Generally speaking, the customer has little room for guesswork as there are a very limited number of methods promulgated for the analysis of either ambient air or source emissions. Both the client and the laboratory may be forced by a regulatory agency to use a method that is not appropriate to the ultimate client's needs. When the regulatory authority mandates a specific method, the laboratory will follow that method as closely as possible and in keeping with the chemistry of the method. This statement is most commonly applicable to archaic methods found in the CFR for source emission testing.

CHESTER LabNet does not inform the client when a method is considered to be inappropriate or out-of-date, as our clients are already aware of those issues.

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If a method is not specified by the client, the client shall be contacted and clarification shall be obtained prior to proceeding with any analytical work. Air quality methods (ambient or source) have two major components to them: sampling and analytical. *CHESTER LabNet* only performs the analytical portion of the method. The client will be aware of what method/analytes are needed. Typically, the omission of an analytical method request is a simple documentation error.

All communications between the laboratory and the client are documented via printed email correspondence or notes on the Chain of Custody that have been dated and initialed by the laboratory agent contacting the client.

22.2 Laboratory-Developed Methods

If the laboratory develops a method, the process of designing and validating the method is carefully planned and documented. One person, usually the Technical Director of the affected department, will be responsible for developing the method.

In some cases, methods may be developed to fill in gaps found in other published or promulgated methods. On rare occasions, a method will be developed due to a lack of a promulgated method (e.g., Alkalinity in Teflon Filters). All methods developed in house, for whatever reason, will have an associated SOP. The in-house methods will undergo the same annual review cycle as all other SOPs.

Laboratory-developed methods are only used if they are validated by a demonstration of capability study (where possible) and only if they are appropriate for the intended use. As with other new methods, the Technical Director is responsible for ensuring that the laboratory is capable of performing the method in such a manner as to meet all applicable QC requirements. This is achieved via a Demonstration of Capability Study and a Precision and Bias Study where possible. Where not possible, other method specific QC criteria may be utilized to demonstrate capability. The development of new methods will always be assigned to the staff member with the greatest knowledge relating to that method and the ability to obtain all the resources needed to carry out the method.

When an occasion arises in which the employment of a non-standard method is needed, the method will be developed in conjunction with the client. These methods are almost never used by any other client or for any other project, and tend to fall into one of two categories: contingency and contractual.

Contractual methods are usually developed based on a method or methods supplied by the client. These may or may not be publicly published methods. Method development then proceeds until such time as the laboratory can demonstrate method proficiency and Precision and Bias, where possible (see SOP QA-006). Methods developed for contractual reasons must meet the client's approval prior to samples being analyzed. As method development may generate large quantities of documentation, most documentation is kept in a 3-ring binder in chronological order with notes as to what changes were being made during the maturation of the method.

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Contingency methods tend to be utilized on a one-time basis, for engineering purposes or for the purposes of testing obscure/difficult/non-regulated matrices. As such, full validation of the method may not be possible and presents an undue burden on the laboratory. Such analyses will be documented fully, all directives issued by the client will be noted in the data file, and attempts are always made to get written confirmation from the client as to the acceptance of the proposed methodology. Documentation by the analyst will include specifics, where not obvious, pertaining to the analysis.

The acceptance/rejection criteria for non-standard methods default to methods of similar chemistries or to CLP guidelines, if at all possible. When not possible, acceptance/rejection criteria may be based upon Precision and Bias studies and/or IDL/MDL studies, or other method specific QC where IDL/MDL and Precision and Bias Studies are not applicable (e.g., Method 202, filter impregnation, etc.).

22.3 Method Validation

Validation is the confirmation, by examination and objective evidence, that the particular requirements for a specific intended use are fulfilled.

At a minimum, reference methods are validated by performing an initial demonstration of capability, where possible. Additional requirements are discussed for each technology.

All non-reference methods are validated before use, where possible. The validation is designed to enable the laboratory to demonstrate that the method is appropriate for its intended use. All records (e.g., planning, method procedure, raw data and data analysis) shall be retained while the method is in use. Based on the validation process, the method's SOP will contain a statement of the intended use of the method and whether or not the validated method meets the use requirements.

Method validation and Demonstration of Capability procedures for methods in use at *CHESTER LabNet* can be found in Appendix H, "Chemistry."

22.4 Estimation of Analytical Uncertainty

Analytical Uncertainty is a subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

When requested and where possible, the laboratory will provide an estimate of the analytical uncertainty (reported as a percent) determined by calculating three times the standard deviation of a statistically significant set of recovery values for known standards analyzed by the same method.

Due to the unique analytical requirements for air testing, this may not always be possible, as is the case with all gravimetric analyses (e.g., particulate measurements).

Two methods utilized at the laboratory issue uncertainties as part of standard reporting formats: analysis of metals by XRF and analysis of Carbon by OC/EC. A

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full explanation of determination of uncertainty for measurements by XRF is contained within SOP XR-005. Determination of uncertainties for OC/EC is performed by the instrument software.

22.5 Control of Data

To ensure that data are protected from inadvertent changes or unintentional destruction, the laboratory uses procedures to check calculations and data transfers (both manual and automated).

22.5.1 Computer and Electronic Data Requirements

The laboratory assures that computers, user-developed computer software, automated equipment, or microprocessors used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are:

- documented in sufficient detail and validated as being adequate for use;
- protected for integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;
- maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and
- held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records. Data archive security is addressed in Section 16, "Control of Records" and building security is addressed in Section 21, "Accommodations and Environmental Conditions".

Primary control of electronic data occurs at the physical security level, by preventing any non-authorized persons access to the premises without an escort. Secondary control of electronic data is achieved by employing only personnel with proven ethical understanding of data integrity. Tertiary data control at the instrument level is controlled by the software auditing mechanisms built into the major instrumental software utilized by the laboratory. Quaternary electronic data control is achieved by retaining hard copy records in appropriate job files of all electronic data produced by the laboratory.

Note that due to the small staff size of the laboratory, all employees are considered "authorized users" on all computers. For analytical computers, the user's initials will appear on the electronic files and in the associated run logs for that instrument.

The laboratory uses spreadsheets to calculate final results from the raw data for some analyses. Before reporting any results derived from these spreadsheets, the laboratory validates the underlying calculations by performing a sample calculation on at least 10% of the total data, selected at random throughout the spreadsheet. All mathematical steps from raw data to final reported data are verified manually. If a new calculation is created within the LIMS, the procedure for verifying spreadsheets is used.

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After a spreadsheet has been developed and verified, subsequent use of the spreadsheet is verified by testing each set of cells used for input and output of the calculation. Any changes made to the spreadsheet are revalidated manually as described above. Some spreadsheets may be used only rarely; any spreadsheet that has not been used in more than 3 months will be revalidated as described above.

Data from all electronic media, including the LIMS, company financials, client contracts, SOPs and program documents, and any computer governing an instrument used for NELAC accredited methods, are backed up to both a separate hard drive and to the cloud daily. See SOP AD-007 for further details.

22.5.2 Data Reduction

In cases where the analyst calculates final results manually from raw data, all manual calculations will be verified by a second individual. The second individual shall document their verification by writing out the formula/e they used to determine the final results on the raw data, then placing a tick or check mark next to each calculation they verified and, finally, writing "QC OK" at the top right corner of the raw data sheet along with their initials and the date they verified the data.

In addition and wherever possible, 100% of all manual data transfers (e.g., hand transcription, data entry into the LIMS) will be checked for accuracy by a different analyst than the one performing the transfer. The second individual shall document their verification by placing a tick or check mark next to each entry they verified, and writing their initials and the date they verified the data at the top right corner of the page.

Appropriate computer programs may provide the results in a reportable format, although that is not typical for air quality methods. Usually, several different data sets are entered into the LIMS and the LIMS reports the data in the units as requested by the client. Typical units requested by the client include: mg/Sample or $\mu\text{g}/\text{Sample}$; mg/m^3 or $\mu\text{g}/\text{m}^3$; and $\mu\text{g}/\text{L}$ (gas volume, not liquid volume).

The test methods may provide required concentration units, calculation formulae and any other information required to obtain final analytical results, but do not always do so in a manner that meets the clients' needs. The clients' requests shall always be honored above any calculations given in any method. For example: 40 CFR 60, Appendix A, Method 8 requires reporting units of $\text{meq SO}_x/\text{m}^3$, with an intermediary calculation of $\text{meq SO}_x/\text{sample}$. Most clients request results in $\text{mg H}_2\text{SO}_4/\text{sample}$ or $\text{mg SO}_2/\text{sample}$. In these cases, the client's requested reporting units shall be the units reported, regardless of the calculations in the method.

Some promulgated methods, particularly CFR methods, have errors in the promulgated calculations. In such cases, the laboratory calculates the data using correct formulae, regardless of that contained in the promulgated method.

The laboratory has manual integration procedures that must be followed when integrating peaks during data reduction. These procedures are taught to new analysts by the Technical Director/Senior analyst chemist/analyst overseeing the instrument that the trainee is learning to operate. The manual integration procedures are in the associated instrument SOPs in the section on data reduction.

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The laboratory reports data to the lowest numerical place of the detection limit (e.g., if the detection limit is 0.05, undiluted samples will be reported to the hundredths place); however, the maximum number of significant figures reported is four. Thus, if a result is 975.53 with a detection limit of 0.02, the reported result will be 975.5 (four significant figures). If a result is 1452.86 with a detection limit of 10, the reported result will be 1450 (reported to the tens place, per the detection limit). If the detection limit is 0.05 and the instrument result is 0.0623, the reported result will be 0.06 (two significant figures, not four, reported to the hundredths place, per the detection limit). A result lower than the detection limit shall not be reported as a number, except for instruments where uncertainty, rather than hard detection limits, are utilized (i.e., XRF and OC/EC). Gravimetric analyses have no detection limits and therefore the actual results are reported, even when negative values are obtained.

In cases of dilutions to remove matrix interferences (not for samples over the calibration range), the same rules apply; however, the detection limit will be multiplied by the dilution factor as well. Thus, for a ten-fold dilution of a sample with a detection limit of 10 and a raw data result of 14528.6, the reported result will be 14500. For a ten-fold dilution of a sample with a detection limit of 0.02 and a raw data result of 975.53, the reported result will be 975.5.

All raw data are retained in hardcopy form in the report folder and in the form in which it was generated (e.g., computer files, logbooks, spreadsheets, etc.). It is maintained as described in Section 16, "Control of Records".

22.5.3 Confidentiality, Storage, Transmission and Processing

Data confidentiality is discussed in Section 10.1, "Client Confidentiality," and applies to all stages of data production.

Data storage is described in Section 16, "Control of Records" and Section 22.5, "Control of Data."

Data transmission is described in Section 28, "Reporting the Results."

Data processing is described in Section 22.5, "Control of Data."

22.5.4 Data Review Procedures

Data review procedures are located in Section 27.4, "Data Review".

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Section 23

CALIBRATION REQUIREMENTS (TNI V1:M2 – Sect 5.5 and Section 1.7 of Technical Modules TNI V1:M 3-7)

23.1 General Equipment Requirements

The laboratory provides all the necessary equipment required for the correct performance of the scope of environmental testing performed by the laboratory.

All equipment and software used for testing and sampling are capable of achieving the accuracy required for complying with the specifications of the environmental test methods as specified in the laboratory SOPs.

Equipment is operated only by authorized and trained personnel (see Section 20, "Personnel").

The laboratory has procedures for the use, maintenance, handling and storage of equipment, and they are readily available to laboratory personnel. Manuals received from the manufacturer of the equipment provide information on use, maintenance, handling and storage of the equipment. Below is an equipment manual table that includes additional information on storage location:

<u>Document</u>	<u>Title</u>	<u>Location</u>
OC/EC Manual	Sunset Laboratory OC/EC Instruction Manual	Drawer below instrument
ICP Manual	Perkin Elmer Optima 8300 Hardware Guide	Drawer below instrument
WinLab32 software guide	Perkin Elmer WinLab32 for ICP software CD-ROM	Drawer below instrument
XRF Manual	XRF Instruction Manual	Cabinet in center island near XRFs
Sartorius Manual (B120S)	Sartorius 120 Basic Series Instrument Manual & Operating Instructions	Drawer in center island in XRF room
CAHN Manual	CAHN C30/31 Instruction Manual	Drawer in center island in XRF room.
Sartorius Manual (ME5)	Sartorius ME & SE Series Operating Instructions	Drawer in center island in XRF room
Sartorius Manual (CPA224S)	Sartorius GemPlus Series	Drawer under balance in conventional chemistry lab
Sartorius Manual (MSA225S)	Sartorius Cubis Series	Drawer under balance in SPM laboratory

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<u>Document</u>	<u>Title</u>	<u>Location</u>
Dehumidifier Manual	Kenmore Dehumidifier Manual	Drawer in center island in XRF room.
Dehumidifier Manual	Whirlpool Dehumidifier Manual	Drawer in center island in XRF room.
Humidifier Manual	LASKO Recirculating Console Humidifier Model 1128	Drawer in center island in XRF room.
Humidifier Manual	Duracraft Moisture Humidifier Owner's Manual	Drawer in center island in XRF room.
IC Manual	Dionex ICS3000 User Manual and CD-ROM	Black bookcase in laboratory and drawer under IC computer
DI system manual	User Manual Milli-Q Direct 8/16 System	Countertop next to DI system cartridges
Air compressor dryer	Hankison Compressed Air Dryer Instruction Manual	Black bookcase in laboratory
CVAA Manual	Nippon 3320A Instruction Manual	Drawer under CVAA computer
UV/Vis Manual	Spectronic UV/Vis Model 20D Owner's Manual and Bench Manual	Black bookcase in laboratory
Hot Plate manuals	Cimarec Hot Plate/Stirrer Operating Instructions Thermolyne Hot Plate Operating Instruction	Black bookcase in laboratory
Sonicator Manual	Branson Model 8510 Operator's Manual	Black bookcase in laboratory
Heated Sonicator Manual	ElmaSonic P Ultrasonic Cleaning Units	Black bookcase in laboratory
Hot bath Manual	Precision Water Bath 280 Series Installation and Service Manual	Black bookcase in laboratory
Oven Manual (VWR)	VWR Utility Oven Operating Instructions	Drawer near muffle furnace
Oven Manual (Binder)	Binder Operating Manual Heating Oven with Forced Convection	Drawer near muffle furnace
Muffle furnace manual	Thermolyne Furnace Owner's Manual	Drawer near muffle furnace
pH/mV meters (2)	VWR SympHony benchtop model	Center drawer, titration desk

The laboratory also has a policy for planned equipment maintenance. A summarized plan for equipment maintenance can be found in table 23.5. These procedures ensure proper functioning of the equipment and prevent contamination or deterioration.

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Each instrument has a bound maintenance logbook in which all problems, repairs and service visits are documented. Support equipment for each department has one common maintenance logbook. The maintenance logbooks are stored next to the appropriate instrument or in the department in which they are used. Every entry in a maintenance logbook shall have the following elements:

- date and initials of the analyst making the entry;
- name of the person performing the repair or maintenance, if different than the analyst;
- a complete description of the nature of the problem, symptoms or preventative maintenance;
- a description of the parts repaired/replaced/realigned; and
- proof that equipment is functioning properly after service.

The description of the maintenance/repair shall be thorough enough that another person reading the entry can identify what the symptoms were (if any), what the suspect parts were (if any), and what steps were taken to repair or maintain the instrument. Also, any hardware or software upgrades will be noted in the maintenance logbook.

Preventative maintenance is scheduled based on guidance from the manufacturer and analyst familiarity with their respective instruments. Preventative maintenance is noted in each instrument's maintenance logbook. All Technical Directors are responsible for scheduling/performing preventative maintenance on their instruments. Corrective maintenance can be performed either by the primary analyst or by a field service technician, depending on the complexity of the repair needed. All corrective maintenance is noted in the maintenance logbook and the name of the field service technician (if any) is included in the description of the repair. These procedures ensure proper functioning of the equipment and prevent contamination or deterioration.

All equipment is calibrated or verified before being placed in use to ensure that it meets laboratory specifications and relevant standard specifications. Records are maintained by the QA Officer in tandem with the Laboratory Director for each major item of equipment and its software used for testing. The records include checks that equipment complies with the specifications; dates, results and copies of reports; and certificates of all calibrations, adjustments, acceptance criteria and the due date of next calibration where applicable; and the date received and date placed in service (if available). This record is the same record as described below.

Test equipment, including hardware and software, are safeguarded from adjustments that would invalidate the test result measurements by limiting access to the equipment to authorized personnel only (see Section 22.5, "Control of Data").

Equipment that has been subject to overloading, mishandling, given suspect results, or shown to be defective or outside specifications is taken out of service. The equipment is isolated to prevent its use or clearly labeled as being out of service until it has been shown to function properly. In addition, it is the Technical

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Director's job to verbally or electronically notify all people within their domain, and all project managers, of the condition of the equipment. If it is shown that previous tests are affected, then procedures for non-conforming work are followed and results are documented (see Section 12, "Control of Non-conforming Environmental Testing Work" and Section 14, "Corrective Action").

No equipment outside of the permanent control of the laboratory is used.

Each item of equipment and software used for testing, and significant to the results, is uniquely identified. Records of equipment and software are maintained. This information includes the following:

- a) identity of the equipment and its software;
- b) manufacturer's name, type identification, serial number or other unique identifier;
- c) checks that equipment complies with specifications of applicable tests;
- d) current location;
- e) manufacturer's instructions, if available, or a reference to their location;
- f) dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria and the due date of next calibration;
- g) maintenance plan, where appropriate, and maintenance carried out to date;
- h) documentation on all routine and non-routine maintenance activities and reference material verifications;
- i) any damage, malfunction, modification or repair to the equipment;
- j) date received and date placed into service (if available); and
- k) condition when received, if available (new, used, reconditioned).

Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number (<i>Italicized numbers are capital equipment inventory numbers</i>)	Month/Year Placed into Service
Gravimetry Laboratory/Gravimetry Laboratory				
Cahn 1 microbalance	Gravimetry Laboratory	Cahn C31	73139	2/1988
ME5 microbalance	Gravimetry Laboratory	Sartorius ME5	22006645	9/2007
Sartorius B120S balance	Gravimetry Laboratory	Sartorius B120S	38070080	6/1990

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Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number (<i>Italicized numbers are capital equipment inventory numbers</i>)	Month/Year Placed into Service
100 mg Class 1 Daily weight	Gravimetry Laboratory	unknown	2008014	Date put into service changes annually
500 mg Class 1 Daily weight	Gravimetry Laboratory	unknown	1000100661	Date put into service changes annually
3.0000g Class 1 Daily weight	Gravimetry Laboratory	unknown	10139	Date put into service changes annually
5.0000g Class 1 Daily weight	Gravimetry Laboratory	unknown	10139	Date put into service changes annually
100.0000g Class 1 Daily weight	Gravimetry Laboratory	unknown	27853	Date put into service changes annually
100 mg Class 1 Monthly weight	Gravimetry Laboratory	unknown	21386	Date put into service changes annually
500 mg Class 1 Monthly weight	Gravimetry Laboratory	unknown	1000085970	Date put into service changes annually
3.0000g Class 1 Monthly weight	Gravimetry Laboratory	unknown	10147	Date put into service changes annually
5.0000g Class 1 Monthly weight	Gravimetry Laboratory	unknown	10147	Date put into service changes annually
Computer tracked thermometer/hygrometer	Gravimetry Laboratory	Dickson TP125	(unreadable)	2/2007
Secondary thermometer/hygrometer	Gravimetry Laboratory	VWR 36934-164	Serial number changes with expiration date	Date put into service changes annually
Max/Min thermometer	OC/EC Freezer	VWR 89094-770	Serial number changes with expiration date	Date put into service changes annually
Max/Min thermometer	Standards Refrigerator	VWR 89094-770	Serial number changes with expiration date	Date put into service changes annually
Max/Min thermometer	Conventional Lab Fridge/Freezer	VWR 89094-770	Serial number changes with expiration date	Date put into service changes annually

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Quality Assurance Management Plan

Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number (<i>Italicized numbers are capital equipment inventory numbers</i>)	Month/Year Placed into Service
Max/Min thermometer	SPM Freezer	VWR 89094-770	Serial number changes with expiration date	Date put into service changes annually
Max/Min thermometer	SPM Freezer	VWR 89094-770	Serial number changes with expiration date	Date put into service changes annually
IR thermometer	Sample Receiving	VWR 36934-176	Serial number changes with expiration date	Date put into service changes annually
Cabinet Desiccator (small)	Weigh Room	Boekel	None	3/2011
Humidifier	Gravimetry Laboratory	LASKO 1128	225651	3/2013
Humidifier	SPM Laboratory	Holmes HM3650	unknown	Pre-1992
Humidifier	SPM Laboratory	DuroCraft DH-836/837	unknown	Pre-1992
Humidifier	SPM Laboratory	Kenmore 758.154120	08128	Pre-1992
Dehumidifier	Gravimetry Laboratory	Kenmore 106.57500790	QG1104204	8/1997
Dehumidifier	SPM Laboratory	Whirlpool AD50USLI	QM1328295	8/2002
Dehumidifier	SPM Laboratory	Whirlpool AD50USLI	QM3743639	8/2002
Dehumidifier	Gravimetry Laboratory	HISENCE IKD070	0113Z0PKK69Y 5A0174	6/2015
Laminar flow hood	Gravimetry Laboratory	ATMOSTECH Industries	436	Pre-1992
XRF & Resuspension Laboratory				
XRF 770	XRF Laboratory	KeveX 770	80000647A665	2/1997
Pulse Processor for 770	XRF Laboratory	IXRF/4461	9004-A1-0375	11/2014
Vacuum pump for 770	XRF Laboratory	Leroy/Somer	110946	2015
X-ray tube chiller for 770	XRF Laboratory	KeveX	1402	4/2015
XRF 772	XRF Laboratory	KeveX 770	8003407A1327	8/2001
Pulse Processor for 772	XRF Laboratory	IXRF/4460	128	8/2001

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Quality Assurance Management Plan

Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number (<i>Italicized numbers are capital equipment inventory numbers</i>)	Month/Year Placed into Service
Vacuum pump for 772	XRF Laboratory	Alcatel	164208	9/2015
X-ray tube chiller for 772	XRF Laboratory	KeveX	1349	8/2001
Quant'X XRF	XRF Laboratory	Thermo	1111540	(1/2012) Data generation started in 8/2012
Vacuum pump for Quant'X	XRF Laboratory	Edwards RV8	119493083	1/2012
Refrigerator (dorm sized)	XRF Laboratory	Sanyo	960825190	Pre-1992
Sieve Catch Pans (3)	Compressor Room	USA Standard	None	Pre-1986
#400 Sieve Pans (3)	Compressor Room	USA Standard	38 µm	Pre-1986
#200 Sieve Pans (3)	Compressor Room	USA Standard	75 µm	Pre-1986
#80 Sieve Pans (2)	Compressor Room	USA Standard	180 µm	Pre-1986
#60 Sieve Pans (3)	Compressor Room	USA Standard	250 µm	Pre-1986
#40 Sieve Pans (4)	Compressor Room	USA Standard	425 µm	Pre-1986
#18 Sieve Pans (3)	Compressor Room	USA Standard	1 mm	Pre-1986
#10 Sieve Pans (3)	Compressor Room	USA Standard	2 mm	Pre-1986
#6 Sieve Pans (2)	Compressor Room	USA Standard	3.35 mm	Pre-1986
#5 Sieve Pans (3)	Compressor Room	USA Standard	4 mm	Pre-1986
Sieve Pan Lids (2)	Compressor Room	USA Standard	None	Pre-1986
Dichot inlet	SPM room	Sierra/Anderson	165	Pre-1986
Dichot pump	SPM room	11/244	165	Pre-1986
Pump	SPM room	Gast/0322-V103-G8DX	0784	Pre-1986
Digital flow meter	SPM room	Kurz/545-1-SP	NE2243	Pre-1986
Resuspension apparatus	SPM room	In-house	In-house	Pre-1986

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Quality Assurance Management Plan

Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number (<i>Italicized numbers are capital equipment inventory numbers</i>)	Month/Year Placed into Service
Conventional Chemistry Laboratory				
Air compressor for ICP	Compressor room	PowerEx OTS015242	(H) 6/24/2002 1860271-02	8/2002
Microwave oven	Conventional Chemistry Lab	Magic Chef MCM1110B	288500200168	11/2012
200mg Class 1 Weight	SPM Laboratory	Unknown	5316	Date put into service changes annually
100.0000g Class 1 weight	SPM Laboratory	unknown	14091	Date put into service changes annually
Cabinet Desiccator 1	SPM Laboratory	Boekel	None	Pre-1992
Cabinet Desiccator 2	SPM Laboratory	Unknown	None	4/2011
Cabinet Desiccator 3	SPM Laboratory	Fisher	None	6/2011
Cabinet Desiccator 4	SPM Laboratory	Boekel	None	10/2011
Cabinet Desiccator 5	SPM Laboratory	Fisher	None	10/2011
Combination thermometer/hygrometers	SPM Laboratory Desiccators	VWR 36934-164	Serial numbers change with expiration date	Dates put into service change when expired
Freezer/Refrigerator #5	Conventional Chemistry Lab	Amana TR18KW	8810077163 467	Pre-1992
Freezer #10	SPM Laboratory	GE FP21DSCRWH	SL163859 901	11/1994
Freezer #11	SPM Laboratory	GE FP21DSCRWH	TL162281 902	11/1994
Freezer/Refrigerator #6	Conventional Chemistry Lab	Frigidaire FFHT1814QW1	BA52800708	8/2015
AND static eliminator	Conventional Chemistry Lab	AND AD1688	None	7/2009
Lab balance	Conventional Chemistry Lab	Sartorius CPA 224S	25650404	12/2010
SPM balance	SPM Laboratory	Sartorius MSA 225S	33503396	12/2015
Milli-Q RO/DI Unit	Conventional Chemistry Lab	Millipore	F2KA41704D	1/2013

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Quality Assurance Management Plan

Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number (<i>Italicized numbers are capital equipment inventory numbers</i>)	Month/Year Placed into Service
ICS-3000 (Anion & Cation IC)	Conventional Chemistry Lab	Dionex ICS-3000	07080408	1/2008
AS Autosampler (ICS-3000)	Conventional Chemistry Lab	Dionex AS	07080663	1/2008
pH/mV meter	SPM Laboratory	VWR SympHony	D04910	1/2011
pH/mV meter	Conventional Chemistry Lab	Orion 3 Star	B43712	2012
pH electrode	SPM Laboratory	Orion 8107UWMMD	(lot code) QX1	2/2013
Small sonicator	SPM Laboratory	AmericanBrand	48L5287	Pre-1992
Big Sonicator	Conventional Chemistry Lab	Branson	RPA02112447G	2/2011
Heated Sonicator	Conventional Chemistry Lab	Elmasonic P	102048034	4/2014
ICS-1100 (Cr6 IC)	Conventional Chemistry Lab	Dionex	11050922	8/2011
Cr6 autosampler	Conventional Chemistry Lab	Dionex AS-DV	11050840	8/2011
Cr6 detector	Conventional Chemistry Lab	Dionex VWD	11050494	8/2011
OC/EC analyzer	Conventional Chemistry Lab	Sunset Labs	141A	1/2002
CVAA	Conventional Chemistry Lab	Nippon Instruments 3320A	08400784	8/2010
CVAA autosampler	Conventional Chemistry Lab	SC-3	09410401	8/2010
CVAA Reagent Dispenser	Conventional Chemistry Lab	RD-3	08420583	8/2010
Waterbath	Conventional Chemistry Lab	Thermo 280 Series	206799-339	1/2009
Thermometer – waterbath (electronic)	Conventional Chemistry Lab	VWR	140774934	9/2015
Oven – Forced Air	SPM room	Baxter DIV48	198002	Pre-1992
Oven – Forced Air	Conventional Chemistry Lab	Binder	13-21559	10/2014

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Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number <i>(Italicized numbers are capital equipment inventory numbers)</i>	Month/Year Placed into Service
Oven – muffle	Conventional Chemistry Lab	American Scientific Products FP-41	132028	Pre-1992
Centrifuge	Conventional Chemistry Lab	Thermo CL2	42620462	4/2011
ICP	Conventional Chemistry Lab	PerkinElmer Optima 8300	078S1401204	4/2014
Chiller for ICP	Conventional Chemistry Lab	PolyScience	2F1411787	4/2014
ICP Autosampler	Conventional Chemistry Lab	PerkinElmer AS S10	102513020605	4/2014
ISE: fluoride	Conventional Chemistry Lab	Thermo	249030-A01	9/2008
Thermometers – Fluoride distillation	Conventional Chemistry Lab	Various	Various (considered consumable)	Various (considered consumable)
5mg Class 1 weight	Conventional Chemistry Lab	Troemer	1000085970	Dates put into service change when expired
50g Class 1 weight	Conventional Chemistry Lab	Troemer	1000085970	Dates put into service change when expired
500mg Class 1 weight	Conventional Chemistry Lab	Troemer	1000085970	Dates put into service change when expired
Separatory funnel shaker	Conventional Chemistry Lab	In-house	In-house	Pre-1994
Stirplate 663	Conventional Chemistry Lab	Thermolyne Syborn	30708171	Pre-1992
Stirplate 652	Conventional Chemistry Lab	Thermo Cimarec 1	46402186	Pre-1992
Stirplate	Conventional Chemistry Lab	Thermo Cimarec 2	63891800366 <i>1006</i>	1/2011
Stirring Hotplate (Hotplate no longer functional)	Conventional Chemistry Lab	Thermo Cimarec 3	Unreadable	Pre-1992
Hotplate, 12" yellow	Conventional Chemistry Lab	Thermo Cimarec 3	Unreadable	Pre-1992
Hotplate, 12" yellow	Conventional Chemistry Lab	Thermo Cimarec 3	1073990872646	Pre-2006
Hotplate, 10" gray	Conventional Chemistry Lab	Corning	Unknown <i>948</i>	5/2005

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Table 23-1 Laboratory Equipment				
Name - Unique Identifier	Location	Brand/Model	Serial Number <i>(Italicized numbers are capital equipment inventory numbers)</i>	Month/Year Placed into Service
Hotplate, 10" yellow digital	Conventional Chemistry Lab	Thermo Cimarec	C1757110206628 <i>1012</i>	4/2011
Hotplate, 10" yellow digital	Conventional Chemistry Lab	Thermo Cimarec	C1757110104596 <i>1008</i>	4/2011
Hotplate, 12" Gray	Conventional Chemistry Lab	Cole-Parmer HP11C-P	50002174	11/2015
UV/Vis Spectrometer	Conventional Chemistry Lab	MiltonRoy Spec 20D	3321025001	Pre-1992
Orbital Shaker	Conventional Chemistry Lab	LabLine	3520	Pre-1992
Laminar Hood	Conventional Chemistry Lab	LabConco (unreadable model#)	195468	Pre-1992

23.2 Support Equipment

Support Equipment includes but is not limited to: balances, ovens, refrigerators, freezers, water baths, chillers, temperature/humidity measuring devices, humidifiers, dehumidifiers, vacuum pumps where needed by instrumentation, and volumetric dispensing devices.

All support equipment is maintained in proper working order. Records are kept for all repair and maintenance activities including service calls. For NIST-traceable items (including weights, thermometers and hygrometers), certifications are maintained near their point of use. For the DI water system, cartridge replacement is noted on the daily control chart. All refrigerators containing samples are monitored with a max/min thermometer and recorded on each business day. As water baths, ovens and sonicators tend to fail catastrophically, the equipment is usually replaced rather than repaired. One common maintenance log is maintained for the water bath, ovens, heated ultrasonicator, muffle furnace and lab thermometers (glass body) and other support equipment.

All raw data records are retained to document equipment performance where performance is an integral part of the method being performed. These records include primarily logbooks. Some records however, may take the form of certificates by certifying laboratories or invoices retained by the Laboratory Director.

23.2.1 Support Equipment Maintenance

Regular maintenance of support equipment, such as balances, ovens, water baths, furnaces, class 1 weights and fume hoods, is conducted at least annually.

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Maintenance of other support equipment, especially those with manufacturer's expiration dates, such as thermometers, thermometer/hygrometers, is conducted on an as-needed basis.

Records of maintenance to support equipment are documented in various locations depending on the department, as follows:

- For the gravimetry lab, maintenance is documented in the NIST certificates three ring binder.
- For the XRF laboratory, maintenance is documented in the run log for each instrument or the QS control charts.
- For the Conventional Chemistry laboratory, maintenance is documented in the Support Equipment Maintenance Log.

Table 23-2 includes a summary of support equipment maintenance.

Table 23-2 Summary of Support Equipment Calibration And Maintenance			
Instrument	Activity	Frequency	Documentation
Gravimetry Laboratory			
100 mg Class 1 Daily Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
500 mg Class 1 Daily Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
3.0000 g Class 1 Daily Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
5.0000 g Class 1 Daily Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
100.0000 g Class 1 Daily Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
100 mg Class 1 Monthly Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate

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Table 23-2 Summary of Support Equipment Calibration And Maintenance			
Instrument	Activity	Frequency	Documentation
500 mg Class 1 Monthly Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
3.0000 g Class 1 Monthly Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
5.0000 g Class 1 Monthly Weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Computer Tracked thermometer/hygrometer	Calibrate for accuracy against NIST-traceable thermometer/hygrometer (see below)	Monthly or as needed	Spreadsheet Logbook
Secondary Thermometer/hygrometer	Buy new when NIST traceability expires	As needed	Keep certificate
Max/Min thermometer(s)	Buy new when NIST traceability expires	As needed	Keep certificate
Cabinet Desiccator (small)	Verify seal maintaining	Day of use	Record percent humidity in raw data
IR thermometer	Buy new when NIST traceability expires	As needed	Keep certificate
Humidifier	Fill with water	As needed	N/A
Dehumidifiers	Empty water	As needed	N/A
Laminar Flow Hood	Check flow rate with vanometer	Annually	Label on side of hood
XRF Laboratory			
Pulse Processor for 770	Energy Calibration	As needed	QS control charts
Vacuum pump for 770	Maintain oil level	As needed	QS control charts
X-ray tube chiller for 770	Maintain water level	Weekly	Maintenance log
Pulse Processor for 772	Energy Calibration	As needed	QS control charts
Vacuum pump for 772	Maintain oil level	As needed	QS control charts
X-ray tube chiller for 772	Maintain water level	Weekly	Maintenance log
Vacuum pump for Quant'X	Maintain oil level	As needed	QS control charts

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Table 23-2 Summary of Support Equipment Calibration And Maintenance			
Instrument	Activity	Frequency	Documentation
Refrigerator (dorm sized)	Check with IR gun thermometer	Day of use	Control chart
Sieve Catch Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
#400 Sieve Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
#200 Sieve Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
#80 Sieve Pans (2)	Clean with warm water and dry at 60 °C	After each use	none
#60 Sieve Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
#40 Sieve Pans (4)	Clean with warm water and dry at 60 °C	After each use	none
#18 Sieve Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
#10 Sieve Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
#6 Sieve Pans (2)	Clean with warm water and dry at 60 °C	After each use	none
#5 Sieve Pans (3)	Clean with warm water and dry at 60 °C	After each use	none
Sieve Pan Lids (2)	Clean with warm water and dry at 60 °C	After each use	none
Dichot pump	Calibrate with rotameters	As needed	None
Pump	Calibrate with digital flow meter	Each use	None
Digital flow meter	N/A	N/A	N/A
Conventional Chemistry Laboratory			
Microwave oven	Verify working by determining if digestion bombs are hot to the touch	Each use	none
200mg Class 1 weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
100.0000g Class 1 weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Cabinet Desiccator 1	Verify seal maintaining	Day of use	Record percent humidity in raw data
Cabinet Desiccator 2	Verify seal maintaining	Day of use	Record percent humidity in raw data

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Table 23-2 Summary of Support Equipment Calibration And Maintenance			
Instrument	Activity	Frequency	Documentation
Cabinet Desiccator 3	Verify seal maintaining	Day of use	Record percent humidity in raw data
Cabinet Desiccator 4	Verify seal maintaining	Day of use	Record percent humidity in raw data
Cabinet Desiccator 5	Verify seal maintaining	Day of use	Record percent humidity in raw data
Combination thermometer/ Hygrometers	Buy new when NIST traceability expires	As needed	Keep certificate
Millipore RO/DI Unit	Verify MΩ within control	Day of use	Control chart
Freezer #10	check temperature with NIST-traceable max/min thermometer	Daily	control chart
Freezer #11	check temperature with NIST-traceable max/min thermometer	Daily	control chart
Refrigerator #4	check temperature with NIST-traceable max/min thermometer	Daily	control chart
Freezer #4	check temperature with NIST-traceable max/min thermometer	Daily	control chart
Refrigerator #6	check temperature with NIST-traceable max/min thermometer	Daily	control chart
Freezer #6	check temperature with NIST-traceable max/min thermometer	Daily	control chart
Waterbath	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Thermometer – waterbath (electronic)	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Ovens – Forced Air	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Oven – muffle	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Chiller for ICP	Keep fins clean of dust/debris	As needed	None

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Table 23-2 Summary of Support Equipment Calibration And Maintenance			
Instrument	Activity	Frequency	Documentation
Air compressor for ICP	Drain water from tank	Weekly	none
Thermometers – Fluoride distillation	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
5mg Class 1 weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
50g Class 1 weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
500mg Class 1 weight	Accuracy determined by A2LA-accredited weights and measurement laboratory	Annually	Keep certificate
Laminar Hood	Check flow rate with vanometer	Annually	Label on side of hood
Fume Hoods	Check flow rate with vanometer	Annually	Label on side of hood

23.2.2 Support Equipment Calibration

Calibration requirements for analytical support equipment are found in Tables 23-3 and 23-4.

All support equipment is calibrated or verified annually, across the entire range of use, using NIST traceable references where available. If the results of the calibration of support equipment are not within specifications: (1) the equipment is removed from service until repaired or (2) records are maintained of correction factors to correct all measurements. If correction factors are used, this information is clearly marked on or near the equipment.

Each day prior to use, support equipment such as balances, refrigerators and freezers are verified with an NIST traceable reference if available to ensure operation is within the expected range for the application for which the equipment is to be used. Ovens, analytical thermometers (e.g., Fluoride distillation thermometers), and water baths are verified annually by an A2LA certified laboratory

Volumetric dispensing devices (except Class A glassware) are checked for accuracy on a monthly basis.

Quality Assurance Management Plan

Table 23-3 Calibration Acceptance Criteria for Support Equipment				
Equipment	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Gravimetric Laboratory (Gravimetry Laboratory)				
100 mg Class 1 Daily Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.003 mg	Send back for recertification
500 mg Class 1 Daily Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.003 mg	Send back for recertification
3.0000 g Class 1 Daily Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.0005 g	Send back for recertification
5.0000 g Class 1 Daily Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.0005 g	Send back for recertification
100.0000 g Class 1 Daily Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.0000 g (used for calibration, must be exact)	Send back for recertification
100 mg Class 1 Monthly Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.005 mg	Send back for recertification
500 mg Class 1 Monthly Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.005 mg	Send back for recertification
3.0000 g Class 1 Monthly Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.0005 g	Send back for recertification
5.0000 g Class 1 Monthly Weight	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.0005 g	Send back for recertification
Computer Tracked thermometer/hygrometer	Calibrated against secondary NIST-traceable thermometer/hygrometer	Monthly or as needed	N/A	replace
Secondary Thermometer/hygrometer(s)	Purchased newly certified	When NIST traceability expires	Per manufacturer	replace

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Table 23-3 Calibration Acceptance Criteria for Support Equipment				
Equipment	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Max/Min thermometer(s)	Purchased newly certified	When NIST traceability expires	Per manufacturer	replace
IR thermometer	Purchased newly certified	When NIST traceability expires	Per manufacturer	replace
Humidifier	Adjust controller	When humidity is out of acceptance	Refer to Gravimetry Laboratory SOPs	Adjust controller or replace unit.
Dehumidifier	Adjust controller	When humidity is out of acceptance	Refer to Gravimetry Laboratory SOPs	Adjust controller or replace unit.
Conventional Chemistry Laboratory				
Freezer #10	Adjust thermostat	When temperature is out of acceptance	≤0 °C (as verified by NIST traceable thermometer)	Adjust thermostat or replace
Freezer #11	Adjust thermostat	When temperature is out of acceptance	≤0 °C (as verified by NIST traceable thermometer)	Adjust thermostat or replace
Refrigerator #4	Adjust thermostat	When temperature is out of acceptance	≤4 °C (as verified by NIST traceable thermometer)	Adjust thermostat or replace
Freezer #4	Adjust thermostat	When temperature is out of acceptance	≤0 °C (as verified by NIST traceable thermometer)	Adjust thermostat or replace
Freezer #6	Adjust thermostat	When temperature is out of acceptance	≤0 °C (as verified by NIST traceable thermometer)	Adjust thermostat or replace
Refrigerator #6	Adjust thermostat	When temperature is out of acceptance	≤4 °C (as verified by NIST traceable thermometer)	Adjust thermostat or replace

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Table 23-3 Calibration Acceptance Criteria for Support Equipment				
Equipment	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
5mg, 500mg, 50g; 200mg, 100g Class 1 weights	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	± 0.00010 g	Send back for recertification
Combination thermometer/ hygrometers	Purchased newly certified	When NIST traceability expires	Per manufacturer	replace
Waterbath	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	$\pm 2.0^{\circ}\text{C}$ from set value	Have re- inspected and recalibrated by A2LA accredited laboratory.
Thermometer – waterbath (electronic)	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	$\pm 2.0^{\circ}\text{C}$ from 100 $^{\circ}\text{C}$	Have re- inspected and recalibrated by A2LA accredited laboratory.
Ovens – Forced Air	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	$\pm 2.0^{\circ}\text{C}$ from set value in range of 95 – 105 $^{\circ}\text{C}$	Have re- inspected and recalibrated by A2LA accredited laboratory.
Oven – muffle	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	$\pm 50^{\circ}\text{C}$ from set value in range of 550 – 600 $^{\circ}\text{C}$	Have re- inspected and recalibrated by A2LA accredited laboratory.
Thermometers – Fluoride distillation	Inspected and calibrated by A2LA accredited laboratory annually.	Annually	$\pm 2.0^{\circ}\text{C}$ from 180 $^{\circ}\text{C}$	Have re- inspected by A2LA accredited laboratory.
Fume Hoods	N/A	Annually	100 fpm with sash in marked position	Service as needed.

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Table 23-4 Acceptance Criteria for Support Equipment		
Equipment Identification	Use	Acceptance Criteria
Gravimetric Laboratory (Gravimetry Laboratory)		
100 mg Class 1 Daily Weight	Verification of ME5 balance	± 0.003 mg
500 mg Class 1 Daily Weight	Verification of ME5 balance	± 0.003 mg
3.0000 g Class 1 Daily Weight	Verification of B120S balance	± 0.0005 g
5.0000 g Class 1 Daily Weight	Verification of B120S balance	± 0.0005 g
100.0000 g Class 1 Daily Weight	Calibration of B120S balance	± 0.0000 g
100 mg Class 1 Monthly Weight	Verification of ME5 balance	± 0.005 mg
500 mg Class 1 Monthly Weight	Verification of ME5 balance	± 0.005 mg
3.0000 g Class 1 Monthly Weight	Verification of B120S balance	± 0.0005 g
5.0000 g Class 1 Monthly Weight	Verification of B120S balance	± 0.0005 g
Computer Tracked thermometer/hygrometer	Daily verification of room temperature and humidity; weekly compilation of environmental data	Matches secondary thermometer/hygrometer
Secondary Thermometer/hygrometer	Verification of computer tracked thermometer/hygrometer	Within NIST expiry date
Max/Min thermometers	Daily monitoring of freezer	Within NIST expiry date
IR thermometer	Daily freezer/refrigerator monitoring; Sample receipt temperature	Within NIST expiry date
Cabinet Desiccator (small)	Desiccating M5/M201/M202 samples	Maintains humidity ≤10%
Conventional Chemistry Laboratory		
Freezer #6	Sample storage	≤0 °C
Refrigerator #6	Sample storage	≤4 °C
Freezer #10	Sample storage	≤0 °C
Freezer #11	Sample storage	≤0 °C

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Table 23-4 Acceptance Criteria for Support Equipment

Equipment Identification	Use	Acceptance Criteria
Refrigerator #4	Sample storage	≤ 4 °C
Freezer #4	Sample storage	≤ 0 °C
5mg, 500mg, 50g; 200mg, 100g Class 1 weights	Verification of Lab balance calibration	± 0.00010 g or as given on certification
Cabinet Desiccator 1	Desiccating M5/M201/M202 samples	Maintains humidity $\leq 10\%$
Cabinet Desiccator 2	Desiccating M5/M201/M202 samples	Maintains humidity $\leq 10\%$
Cabinet Desiccator 3	Desiccating M5/M201/M202 samples	Maintains humidity $\leq 10\%$
Cabinet Desiccator 4	Desiccating M5/M201/M202 samples	Maintains humidity $\leq 10\%$
Cabinet Desiccator 5	Desiccating M5/M201/M202 samples	Maintains humidity $\leq 10\%$
Combination thermometer/ hygrometers	Monitoring desiccators	Within NIST expiry date
Waterbath	Digesting Hg and other metals (range 90 – 95 °C)	Within NIST certification expiry date
Thermometer – waterbath (glass)	Monitoring electronic readout on waterbath	Within NIST certification expiry date
Ovens – Forced Air	Drying/Evaporating (range 30 – 300 °C)	Within NIST certification expiry date
Oven – muffle	Pre-firing quartz filters to remove carbon; Sodium fusion for M13B (range 500 – 600 °C)	Within NIST certification expiry date
Thermometers – Fluoride distillation	Monitoring distillation temperature (range 180°C)	Within NIST certification expiry date
Fume Hoods	Exhausts fumes from laboratory air	100 fpm draw when sash is at mark
RO/DI water unit (Millipore)	Making DI water	≥ 16.7 M Ω

23.3 Analytical Equipment**23.3.1 Maintenance for Analytical Equipment**

All equipment is properly maintained, inspected and cleaned.

Maintenance of analytical instruments and other equipment may include regularly scheduled preventative maintenance or maintenance on an as-needed basis.

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Instrument malfunction is documented in the pertinent instrument maintenance log, which becomes part of the laboratory's permanent records. A description of the problem, what was done to repair the malfunction, and proof of return to control are also documented in the log.

Table 23-5 Analytical Equipment Maintenance		
Instrument	Procedure	Frequency
Gravimetry Laboratory (Gravimetry Laboratory)		
Cahn 1 microbalance (currently not in use, not certified)	Clean inside of chamber with Ethanol Calibrate Verify calibration Serviced and certified by A2LA lab	Day of use Day of use Day of use (Instrument Suspended)
ME5 microbalance	Check level of balance Clean surrounding area with air and Ethanol Clean inside chamber with air and Ethanol Calibrate Verify calibration Service and certify by A2LA lab	Day of use Day of use As needed Day of use Day of use Annually
B120S balance	Check level of balance Clean inside chamber and surrounding area with air and Ethanol Calibrate Verify calibration Service and certify by A2LA lab	Day of use Day of use Day of use Day of use Annually
XRF Laboratory		
XRF 770	Fill liquid Nitrogen dewer Clean excitation chamber	Weekly Weekly
XRF 772	Fill liquid Nitrogen dewer Clean excitation chamber	Weekly Weekly
Quant'X XRF	Perform energy calibration Clean excitation chamber	Weekly Weekly
Dichot inlet	Disassemble and clean	After each use
Resuspension apparatus	Disassemble and clean	After each use
Conventional Chemistry Laboratory		
Lab balances	Clean Check level Calibrate Verify calibration Service and certify by A2LA lab	As needed Day of use Day of use Day of use annually

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Table 23-5 Analytical Equipment Maintenance		
Instrument	Procedure	Frequency
ICS-3000 Anion/Cation IC	Check background pressure Check suppressor flow Check background conductivity Check all fluid levels (eluent & regenerant) Check autosampler water level Calibrate Replace columns Replace suppressors Rebuild injector switches	Day of use Day of use Day of use Day of use Day of use As needed Annually or as needed Bi-annually or as needed Annually or as needed
pH/mV meter	Calibrate	Day of use
pH electrode	Inspect frit for build-up Calibrate with minimum of 2 standards Verify Nernst slope	Day of use Day of use Day of use
ICS-1100 (Cr6 IC)	Clean UV/Vis cell Prime AXP Clean colorimetric reagent carboy with acetone Check waste container level Check background pressure Check all fluid levels (eluent & colorimetric) Calibrate Replace columns Rebuild injector switches Replace UV lamp	Once per week of use Day of use Once per week of use Day of use Day of use Day of use As needed Annually or as needed Annually or as needed As needed
OC/EC analyzer	Clean oven by pre-firing Monitor temperature steps during pre-fire Clean surrounding area with ethanol Record calibration area, psig, and transmittance for trend comparison	Day of use Day of use Day of use Day of use
CVAA	Check reagent delivery tubing Prime reagent delivery tubing three times Rinse/drain tubing after use Check level of 1% HCl rinse solution	Annually or as needed Day of use Day of use Day of use
ICP	Check torch for debris/dirt Rebuild torch assembly Check waste container level Clean/replace windows Check tubing Replace tubing Check Argon level in tank Drain compressor Replace nebulizer Replace spray chamber	Day of use As needed Day of use As needed Day of use As needed Day of use End of week of use As needed As needed

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Table 23-5 Analytical Equipment Maintenance		
Instrument	Procedure	Frequency
De-ionized Water	Check conductivity Replace cartridges Sanitize System Replace UV lamp	Day of use As needed As needed As needed
Fluoride ISE (rarely used)	Empty/refill filling solution Verify Nernst slope	Day of use Day of use
UV/Vis spectrometer (has not been used in >10 years)	Check cell for cleanliness Zero out absorbance Set 100% T to 100 Check/replace light bulb	Day of use Day of use Day of use As needed

23.3.2 Instrument Calibration

Information on instrument calibration can be found in Appendix H and the relevant SOPs for that instrument.

Initial instrument calibration verification and continuing instrument calibration verifications are an important part of ensuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here or in laboratory SOPs, unless the method is archaic (see Appendix A of each SOP). Generally, procedures and criteria regarding instrument calibrations are provided in the laboratory SOPs.

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Section 24

MEASUREMENT TRACEABILITY

(TNI V1:M2 – Section 5.6)

Measurement quality assurance comes in part from traceability of standards to certified materials.

All equipment used affecting the quality of test results are calibrated prior to being put into service and on a continuing basis (see Section 23, "Calibration Requirements"). These calibrations are traceable to national standards of measurement where available.

If traceability of measurements to NIST is not possible or not relevant, evidence for correlation of results through inter-laboratory comparisons, proficiency testing, or independent analysis is provided, if possible.

24.1 Reference Standards

Reference standards are standards of the highest quality available at a given location, from which measurements are derived. These standards are used to verify standards used on a daily basis such as weights used to check balance calibrations, or thermometers used to verify other thermometers. They are the standards by which other standards are verified.

Reference Standards, such as NIST Class 1 weights, are used for calibration and to verify other standards, unless it is shown that their performance as reference standards does not become invalidated by use.

Where possible, reference standards are calibrated typically by an A2LA certified reference lab that can provide traceability to national or international standards. An example of a situation in which this is not possible is the NIST thin film standards for XRF analysis. NIST no longer manufactures these standards and, although they are "expired," there is no other NIST traceable provider, and it is highly unlikely that the standard will degrade without visible signs of deterioration due to the physical nature of the standard and the limited use to which the standards are put.

The following reference standards are calibrated to a national standard as indicated in Section 23:

- Class 1 weights;
- NIST traceable reference thermometers;
- balances; and
- NIST traceable combination thermometer/hygrometers.

Note: For cost efficiency purposes, some thermometers and combination thermometer/hygrometers are simply replaced rather than recalibrated as

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recalibration is more expensive than replacing the unit with a new NIST traceable one. (See Table 23-3.)

24.2 Reference Materials

Reference materials are substances that have concentrations that are sufficiently well established to use for calibration or as a frame of reference.

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis. Purchased reference materials require a Certificate of Analysis.

Internal reference materials, such as working standards or intermediate stock solutions, are checked as far as is technically and economically practical.

Where possible, working standards or intermediate stock solutions are checked against a second source at first time of use. When a second source is not available, a vendor-certified different lot is accepted as a second source. In most cases, the analysis of an Initial Calibration Verification (ICV) standard or a Laboratory Control Sample (LCS) can be used as a second source confirmation. Working standards and intermediate stock solutions are given unique IDs and expiration dates when they are prepared based on method requirements, regulatory requirements, Technical Director's knowledge of the method, or, where none exist, the earliest expiration date of the primary standards from which the working standards are prepared. These standards are used in their entirety or disposed of by the expiration date.

Additional working standards such as working Class 1 weights or internal thermometers are checked using the frequency summarized in Table 23-3.

24.3 Transport and Storage of Reference Standards and Materials

The laboratory handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standards and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards and materials are stored according to manufacturer's recommendations, method SOP requirements and separately from samples. See Table 24-1 below.

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Table 24-1 Standard Storage and Preparation				
Instrument	Stock Storage	Preparation	Intermediate Stock Solution or Working Standard Storage	Frequency of Preparation
ICP	Room Temperature, metals cabinet	Working Standards from Stock	Room Temperature	As needed
IC – Anions and Cations	Standards Refrigerator	Working Standards from Stock	Room Temperature	As needed
IC-PCR (Cr6)	Room Temperature, metals cabinet	Working Standards from Stock	Room Temperature	As needed
CVAA	Room Temperature, Hg hood	Working Standards from Stock	Room Temperature	Every 5 days
OC/EC	Room Temperature (dry chemical)	Working Standard from dry chemical	Standards Refrigerator	Every 6 months
pH meter	Room Temperature, pH supplies	N/A	N/A	N/A
All Class 1 weights	Room Temperature, gravimetric areas	N/A	N/A	N/A
XRF	Room Temperature, XRF laboratory	N/A	N/A	N/A

24.4 Labeling of Reference Standards, Reagents and Reference Materials

The laboratory has procedures for purchase, receipt and storage of standards, reagents and reference materials. Purchase procedures are described in Section 9, "Purchasing Services and Supplies".

All standards and reagents are disposed of after their expiration date.

Reagent quality is verified upon receipt by examination of the Certificate of Analysis and again upon use for blank analysis.

24.4.1 Stock Standards, Reagents, Reference Materials and Media

Records, in the form of Certificates of Analysis, for all standards, reagents, reference materials and media* include:

- the manufacturer/vendor name and lot number (or traceability to purchased stocks or neat compounds);
- the manufacturer's Certificate of Analysis or purity (if available);

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- the date of receipt (stamped or hand-written on the CoA and container); and
- recommended storage conditions (if available).

*Note: It is assumed that "media" here is referring to microbiological media. However, as the term is not well defined, *CHESTER LabNet* is defining the term to mean "air filters and sorbent tubes." Most media for Air Quality do not have Certificates of Analysis available.

If the original container does not have an expiration date provided by the manufacturer or vendor either on the container or on the Certificate of Analysis, the analyst will write "X NG" on the label to indicate that the expiration date was "none given". If an expiration date is provided on the Certificate of Analysis but not printed on the label, the receiving analyst must label the container with the expiration date as provided by the manufacturer.

In methods where the purity of reagents is not specified, analytical reagent grade or better is used. If the purity is specified, that is the minimum acceptable grade. Purity is verified and documented according to Section 9, "Purchasing Services and Supplies". Certificates of Analysis are maintained in appropriate binders throughout the laboratory.

24.4.2 Prepared Standards, Reagents, Reference Materials and Media

Prepared standards and reagents are recorded in the applicable bound standards and reagents logbook. Records for standards and reagents preparation include:

- traceability to purchased stock compounds;
- reference to or description of the method of preparation;
- date of preparation;
- an expiration date after which the material shall not be used;
- preparer's initials; and
- unique standard ID.

Reagents used NEAT have the following information recorded with the raw data at time of usage:

- manufacturer and lot number; and
- expiration date.

All containers of prepared standards, reagents or materials are labeled with a unique ID and an expiration date. The unique ID is in the format of LLL-PPP-SS where:

LLL = laboratory logbook number as issued from the QA Officer;
PPP = page number within the logbook; and
SS = sequential number on the page.

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Prepared reagents are verified to meet the requirements of the test method through the blank analysis performed with each run (e.g., Cal blank, ICB, etc.). If the blank results are suspect, an investigation into the cause of the suspect results will be undertaken and the reagent shall be made fresh if deemed necessary, even if it is still within its expiry date. Prepared standards are verified against existing non-expired standards where possible.

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Section 25

COLLECTION OF SAMPLES

(TNI V1:M2 – Section 5.7)

CHESTER LabNet does not provide sampling services and has no control over the actions or inactions of the client in the field or the reagents used by the client, unless the reagents are purchased directly from the laboratory (atypical). The laboratory does not supply the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, ice or packing materials. The nature of most air quality methods (ambient or source) makes doing so prohibitively expensive to the laboratory and the client. The laboratory does, upon request, supply clients with Chain of Custody forms and filter or sorbent media.

25.1 Sampling Containers

The 2009 TNI Standard QAMP Template states, *“...The laboratory’s responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.”*

The nature of air quality sampling generally requires clients to provide their own coolers, reagent water, sample containers (as defined in the disclaimer at the beginning of this document), secondary sample containers, custody seals (if needed), ice and packing materials. The laboratory does not offer clean bottles for use by clients unless specifically requested by the client.

For ambient sampling, the laboratory may or may not be asked to provide filters or sorbent tubes in appropriate secondary containers. The laboratory does offer filters of various types and cassette rental for filters loaded in cassettes (not all filters are loaded prior to shipment, this occurs at the request of the client).

The laboratory also offers shipment of sorbent media, but makes no guarantees as to the cleanliness of the media (e.g., Anasorb tubes, acidified silica gel tubes). For sorbent media, the laboratory is acting as a middle-man and not a supplier. The quality of the media rests solely on the manufacturer.

25.1.1 Preparing Container Orders

Filters and sorbent tubes are provided to the client upon request.

The Gravimetry Laboratory Technical Director is informed of the request by the project manager or personnel who took the order (verbally or by email). The request is filled as soon as possible based upon availability, the type of analysis the client is performing, the need or lack thereof for cassettes, and the client’s sampling schedule.

Once ready to be shipped, the media are given to the project manager. The project manager packages the media in a suitable shipping container (suitability

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depends upon the type of media). Shipping is by common carrier (e.g., USPS, UPS, FedEx, DHL) and often performed using the client's account number.

Media is packaged and shipped in such a manner as to prevent harm or breakage of the media under typical shipping conditions. The laboratory will ship to any address specified by the client and in the manner specified by the client. For example, shipping filters to Antarctica involves following very specific instructions from the client. Shipping to foreign countries involves following the customs regulations of that country carefully. All factors involving receipt of the media by the client must be taken into account during the shipping process.

25.1.2 Sampling Containers, Preservation Requirements, Holding Times

Sampling container, preservation and holding time requirements can be found in the promulgated methods. *CHESTER LabNet* has no control over the activities of clients in the field, the sample containers used, impinger solutions used, whether or not the clients keep the samples at the temperature specified in the method, or any other activity which occurs prior to the samples being received at the laboratory.

For instance, a client may request sodium bicarbonate impregnated acid hardened cellulose filters for the purposes of sampling for Hexavalent Chromium in air. The laboratory will impregnate the filters, load them in cassettes, and store the filters (loaded or unloaded) frozen. The client then may take the filters out to the field where sampling may take 24 hours at ambient temperatures, and the samples may not be retrieved from the sampler for up to 3 days after the sampler has shut off, thereby allowing the sample 4 days at ambient outdoor temperatures (ranging from below freezing to over 100 °F). After the samples are collected, they may or may not be stored frozen prior to the samples being returned to the laboratory, where the samples will again be stored frozen. *CHESTER LabNet* has no control over the actions or inactions of the clients once the filters are in their possession. The same lack of control is true for all filters, impinger solutions and sorbent media.

Since air samples cannot be collected in the same manner as water or soil samples (e.g., scooping some up and putting it in a bottle), "containers" becomes a rather inappropriate term for sample collection devices and solutions; and the collection itself is an integral part of the "preservation". Below is a table listing the Analyte(s), Promulgated Method, type of "container", "Preservation" and Holding Time as given in the promulgated method.

If preservation or holding time requirements are not met, the procedures in Section 12, "Control of Non-conforming Environmental Testing Work" are followed.

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Table 25-1 Summary of Sampling Container, Preservation and Holding Time Requirements				
Analyte(s)	Promulgated Method	Method specified "Container"	Preservation	Holding Time
Ambient Air (note: filters or sorbent tubes are the "container" for ambient air samples)				
TSP	40 CFR 50, Appendix B	8"x10" Glass Fiber or Quartz Filter	None Given	None Given
PM ₁₀	40 CFR 50, Appendix J	8"x10" Glass Fiber or Quartz Filter	None Given	None Given
PM ₁₀ Dichotomous	IO 2.2	37mm Teflon or Quartz Filter	None Given	None Given
PM _{2.5}	40 CFR 50, Appendix L	47mm Teflon filter	None OR <4 °C	10 days with no refrigeration, OR 30 days if stored at <4 °C
Total Metals (ambient air)	40 CFR 50, Appendix G; IO 3.2; IO 3.4	8"x10" Glass Fiber; IO 3.0 specifies a filter "meeting specifications" but not the actual matrix or size	None Given	None Given
Mercury	EPA 7471, by reference in other methods	Any type of filter the client uses	None Given for ambient air samples	None Given for ambient air
Total Metals	IO 3.3 (XRF)	IO 3.0 specifies a filter "meeting specifications" but not the actual matrix or size	None Given	None Given
Anions & Cations	IO 4.2	Teflon filter & denuder rinses	None Given	"analyze as soon as possible after collection"; also "analyze on day of extraction"
Organic Carbon/Elemental Carbon	NIOSH 5040; IMPROVE A Method	Pre-fired Quartz filters (37mm or 47mm)	"frozen"	None Given
Hexavalent Chromium	CARB SOP MLD 039 (not promulgated)	Bicarb impregnated cellulose	"frozen"	90 days prior to extraction, 24 hours after extraction
Total Nuisance Dust	NIOSH 0500	37mm Teflon or PVC filter	None Given	None Given
Respirable Particles	NIOSH 0600	37mm Teflon or PVC filter	None Given	None Given
Arsine	NIOSH 6001	Coconut Charcoal sorbent Tube	None Given	6 days
Phosphine	NIOSH 6002	(Hg(CN) ₂ -coated silica gel sorbent tube	None Given	7 days
SO ₂	NIOSH 6004	0.8µm cellulose ester membrane filter FOLLOWED BY bicarb impregnated cellulose fiber filter	None Given	None Given

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Table 25-1 Summary of Sampling Container, Preservation and Holding Time Requirements				
Analyte(s)	Promulgated Method	Method specified "Container"	Preservation	Holding Time
Diborane	NIOSH 6006	PTFE membrane filter, 13-mm diameter, 1- μ m pore size <u>FOLLOWED BY</u> oxidizer-impregnated charcoal sorbent tube	None Given	7 days
Mercury	NIOSH 6009	Hopcalite Tube (no longer manufactured)	None Given	30 days
Br ₂ & Cl ₂	NIOSH 6011	Teflon filter with 0.5- μ m pore size <u>FOLLOWED BY</u> a 25mm silver membrane filter with 0.45- μ m pore size	None Given	30 days
NO ₂	NIOSH 6014	7mm sorbent tube containing 400 mg TEA-coated molecular sieve (type 13x, 30-40 mesh) <u>FOLLOWED BY</u> 7mm sorbent tube containing 800 mg oxidizer (chromate) <u>FOLLOWED BY</u> 7mm sorbent tube containing 400 mg TEA-coated molecular sieve (type 13x, 30-40 mesh)	None Given	7 days
Ammonia	NIOSH 6016	Acidified silica gel sorbent tube	None Given	35 days
Ammonia	OSHA ID188	H ₂ SO ₄ acidified carbon bead sorbent tube	None Given	29 days
Multi-elements [metals]	NIOSH 7300	37mm cellulose ester or Teflon filter	None Given	None Given
Chromium (VI)	NIOSH 7605	37mm PVC filter [unimpregnated]	None Given	14 days at room temp; 28 days "refrigerated"
Fluorides	NIOSH 7902	37mm cellulose ester membrane filter 0.8- μ m pore size <u>FOLLOWED BY</u> bicarb impregnated cellulose pad	None Given	None Given

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Source Emissions Sampling (note: impinger solutions are the “container” for source emission gases)				
Particulates	40 CFR 60, Appendix A, Methods 5 – 5F	Glass or polyethylene petri dishes for filter (filter type not specified); 500 or 100mL glass bottles for Acetone	None Given	None Given
SO ₂	40 CFR 60, Appendix A, Method 6	100 mL polyethylene bottles for H ₂ O ₂ solution	None Given	None Given
NO _x	40 CFR 60, Appendix A, Method 7A	Polyethylene bottles for H ₂ SO ₄ /H ₂ O ₂ solution	None Given	None Given
NO _x	40 CFR 60, Appendix A, Method 7D	Polyethylene bottles for NaOH/KMnO ₄ solution	None Given	None Given
H ₂ SO ₄ & SO ₂	40 CFR 60, Appendix A, Method 8	1L polyethylene bottles, 1 each for IPA solution and H ₂ O ₂ solution	None Given	None Given
Pb	40 CFR 60, Appendix A, Method 12	1000 mL borosilicate glass bottles for 0.1N HNO ₃ solution	None Given	None Given
Total Fluoride	40 CFR 60, Appendix A, Method 13B	1L wide mouth HDPE bottles for impinger water <u>and</u> filter	None Given	None Given
HX & X ₂	40 CFR 60, Appendix A, Method 26	100- or 250-mL HDPE bottles with Teflon screw cap liners for both H ₂ SO ₄ and NaOH fractions	None Given	None Given
HX & X ₂	40 CFR 60, Appendix A, Method 26A	1L HDPE bottles with Teflon screw cap liners for both H ₂ SO ₄ and NaOH fractions	None Given	None Given
Multi-metals	40 CFR 60, Appendix A, Method 29	500 - 1000 mL glass for KMnO ₄ /H ₂ SO ₄ impinger solution; HDPE or glass for all other solutions; Glass or plastic petri dishes for filter.	None Given	None given for any metal except Hg. Hg has a “suggested maximum” hold time of 28 days by reference to SW-846 method 7470.
Hg	40 CFR 61, Appendix B, Method 101	100 mL & 1000 mL glass with Teflon-lined caps for ICI solution	None Given	None Given
Hg	40 CFR 61, Appendix B, Method 101A	100 mL & 1000 mL glass with Teflon-lined caps for KMnO ₄ /H ₂ SO ₄ solution	None Given	“suggested maximum” hold time of 28 days by reference to SW-846 method 7470

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Hg	40 CFR 61, Appendix B, Method 102	100 mL & 1000 mL glass with Teflon- lined caps for ICI solution	None Given	None Given
Be	40 CFR 61, Appendix B, Method 103	Glass bottles for filter and acetone washes	None Given	None Given
Be	40 CFR 61, Appendix B, Method 104	1L glass bottles with Teflon-lined lids for water impinger solution combined with acetone rinses; Glass or plastic petri dishes for filter	None Given	None Given
As	40 CFR 61, Appendix B, Method 108	500mL – 1000mL polyethylene or polypropylene for water impinger solution combined with NaOH rinse solutions	None Given	None Given
Particulates 201A	40 CFR 51, Appendix M, Method 201A	Any leak-proof container for acetone rinses; Glass or plastic petri dishes for filter	None Given	None Given
Particulates 202	40 CFR 51, Appendix M, Method 202	500 mL amber glass bottles for water impinger solutions; and Hexane/Acetone rinses	None Given	None Given
Hexavalent and Total Chromium	40 CFR 63, Appendix A, Method 306	250 mL, 500 mL or 1,000 mL polyethylene, with leak-free screw cap for 0.1N NaOH or 0.1N NaHCO ₃ impinger solution	4 °C for Cr ₆ ; None Given for total Cr	14 days at 4 °C for Cr ₆ ; 60 days at room temperature for total Cr
Hexavalent Chromium	SW-846, Method 0061	250 mL, 500 mL or 1,000 mL polyethylene, with leak-free screw cap for 0.1M KOH impinger solution	None Given	14 days
H ₂ SO ₄ & SO ₂ (Titration)	CTM-013 (aka NCASI 8A)	None Given for water rinse or H ₂ O ₂ impinger solution	None Given	None Given
H ₂ SO ₄ & SO ₂ (IC)	CTM-013A	125 mL Nalgene bottles for water rinse or H ₂ O ₂ impinger solution	None Given	None Given
Ammonia	EPA CTM-027 ("draft" as of 1997, not yet given promulgated method status)	250mL – 500 mL HDPE bottles for 0.1N H ₂ SO ₄ impinger solutions	4 °C	"2 weeks"

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HF/F ₂ & HCl/Cl ₂	CARB 421	"...borosilicate glass bottles for impinger solutions and washes, 1000 mL. Teflon or high-density polyethylene or polypropylene bottles may be used. Use screw-cap liners that are either rubber-backed Teflon or leak-free" for impinger solution of 1.7 mM Sodium Bicarbonate and 1.8 mM Sodium Carbonate.	None Given	None Given
Total and Hexavalent Chromium	CARB 425	500 ml or 1000 ml borosilicate glass bottles, screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free. Alternatively, polyethylene bottles may be used for 0.1N NaOH impinger solutions.	None Given	None Given
Multi-metals	CARB 436	Glass or polyethylene petri dishes for Quartz fiber or glass fiber filters without organic binders; 500 ml or 1000 ml borosilicate glass bottles, screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free. Alternatively, polyethylene bottles may be used for HNO ₃ /H ₂ O ₂ impinger solutions, KMnO ₄ /H ₂ SO ₄ impinger solutions, 0.1N HNO ₃ rinse solutions and 8N HCl rinse solutions.	None Given	None Given

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<p>Particulates</p>	<p>Oregon DEQ 5</p>	<p>[By reference to EPA Method 5] Glass or polyethylene petri dishes for filter (filter type not specified); 500 or 100mL glass bottles each for Acetone rinse, water impinger solution and Dichloromethane</p>	<p>None Given</p>	<p>None Given</p>
<p>Particulates</p>	<p>Oregon DEQ 8</p>	<p>Acetone or Methanol is given as the rinse solution; Glass fiber filters are given as the filter matrix; No guidance is given for containers for the rinse solution or filters.</p>	<p>None Given</p>	<p>None Given</p>

25.2 Sampling Plan

The laboratory does not perform sampling. For purposes of remaining independent from the sampling group and the ultimate client, the laboratory does not act as a consultant for determining sampling plans.

25.3 Sampling Records

Sampling records are maintained by the client. If sampling records are given to the laboratory, they will be used as directed by the client and retained in the client’s job folder.

Section 26

HANDLING SAMPLES AND TEST ITEMS (TNI V1:M2 – Section 5.8 and Section 1.7 of Technical Modules TNI V1:M 3-7)

26.1 Sample Receipt

When samples are received at the laboratory, chain-of-custody is reviewed, condition is documented, samples are given unique identifiers, and they are logged into the sample tracking system.

26.1.1 Chain of Custody

The chain of custody is reviewed. The chain of custody form provides information on what type of testing is being requested and can act as an order for laboratory services in the absence of a formal contract. An example chain of custody form can be found in Figure 26-1. Chain of custody and any additional records received at the time of sample submission are maintained by the laboratory in each client's job file.

26.1.1.1 Legal Chain of Custody

The laboratory does not *knowingly* receive samples for evidentiary purposes.

26.2 Sample Acceptance

Procedures for opening shipping containers and examining samples are provided in SOP AD-008. Samples received outside normal business hours are handled in the same manner as those received during normal business hours.

The 2009 TNI Standard QAMP template states, "*The laboratory has a sample acceptance policy that is made available to sample collection personnel. An example is provided in Figure 26-2. It emphasizes the need for use of water resistant ink, providing proper documentation (to include sample ID, location, date and time of collection, collector's name, preservation type, sample type and any special remarks about the sample), labeling of sample containers to include a unique sample ID, use of appropriate containers, adherence to holding times, and sample volume requirements. In addition the laboratory has nonconformance/corrective action procedures to handle samples that don't meet the requirements above or show signs of damage, contamination or inadequate preservation. Data will be appropriately qualified where samples are reported that do not meet sample acceptance requirements.*" Note that this list is a required element of the QAMP by the 2009 TNI Standard, although is not particularly applicable to air quality samples.

The laboratory has a sample acceptance policy provided in SOP AD-008 and below in Figure 26-2. As the laboratory does not perform sampling, the policy is not provided to sample collection personnel.

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The incompatibilities between air/source sampling and water/soil sampling encountered with the above requirements are as follows:

- water resistant ink is rarely needed as the vast majority of samples are filters, and these samples are destroyed if they become wet;
- sample location may not be provided to the laboratory by the client;
- date of sampling is usually known and often provided to the laboratory; however, many samples may have a collection “time” of 2 hours to 14 days and this timing is rarely reported to the laboratory;
- collector’s name is rarely reported to the laboratory, and more than one person may be involved in collecting the sample, particularly if the sample has a long collection time;
- samples do not have “preservation” except in a few cases where thermal preservation is called for. Preservation is typically achieved by the media on/in which the sample is collected;
- sample type is usually identified by method number and is understood within the air quality industry;
- filters sent to clients for ambient air sampling will have unique IDs assigned to them prior to leaving the laboratory, however, source samples rarely have a unique ID as each project/job site constitutes a unique identifying characteristic and the laboratory has no control over the actions, including identification of containers, of the client in the field;
- appropriate containers are the responsibility of the client, and as they often must travel to extremely remote locations, by necessity, they may be forced to use what they have on-hand;
- very few methods utilized by the laboratory have holding times promulgated with the method; and,
- sample “volume” may mean either the gas volume pulled during sampling or the liquid volume of impinger contents post-sampling and is dictated by the amount of gas volume pulled by the clients in the field, the method utilized to capture said gasses, and in the case of source emission samples, the moisture content of the source.

The laboratory has non-conformance/corrective action procedures to handle samples that don’t meet the requirements of the promulgated method, or that show signs of damage or contamination. Data will be appropriately qualified where samples are reported that do not meet sample acceptance requirements.

The laboratory checks samples for the following, to evaluate sample acceptance:

- samples are intact;
- samples are not damaged; and

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Quality Assurance Management Plan

- samples submitted appear to be submitted in good faith and are not, to the laboratory's knowledge, fraudulent.

Criteria regarding holding time, sample matrix, and sample containers can be found in Table 25-1 of this document. If these conditions are not met, the client is contacted prior to any further processing, then 1) the sample is rejected as agreed with the client, 2) the decision to proceed is documented and agreed upon with the client, 3) the condition is noted on the Chain of Custody form and/or lab receipt documents, and/or 4) the data are qualified in the Case Narrative of the report.

26.2.1 Preservation Checks

The following preservation checks are performed and documented upon receipt:

26.2.1.1 *Thermal preservation:*

- a) For temperature preservation, the temperature must be within the guidelines specified by the promulgated method. Note that some methods merely say "ship with blue ice" and do not specify a temperature.
- b) This 2009 TNI Standard QAMP template states, "*Samples that are delivered to the lab the same day as they are collected are likely not to have reached a fully chilled temperature. This is acceptable if the samples were received on ice and the chilling process has begun.*" The laboratory, however, never receives samples on the same day they are collected due to the complexity of sample collection for air quality methods.
- c) Where necessary, record the received temperature on the Chain of Custody and note if ice is present.

Chlorine checks:

CHESTER LabNet performs no methods requiring Chlorine checks.

pH checks:

CHESTER LabNet performs no methods requiring pH checks; however, a few select methods have pH checks performed on them for the laboratory's benefit. These checks are usually performed after analysis of the samples to prevent contamination of the sample.

26.3 **Sample Identification**

The 2009 TNI Standard QAMP Template states, "*Samples, including subsamples, extracts and digestates, are uniquely identified in a permanent chronological record ... to prevent mix-up and to document receipt of all sample containers.*"

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Due to the wide variety of matrices an air sample may include, it is not practicable, nor is it clear to the client, nor unambiguous during reporting, to assign each container, digestate, extract or combined fractions of samples a unique ID.

Samples (in their entirety) are uniquely identified in the laboratory's LIMS, which can generate a chronological record. Depending on the method, digests, subsamples, and multi-fraction samples may or may not be given a unique ID.

Samples are assigned sequential numbers that reference more detailed information kept in the LIMS. Refer to SOPs AD-007 and AD-008 for the laboratory's sample identification procedure.

The following information is included in the LIMS:

- client and, where known, project name;
- date and time of receipt at the lab;
- unique laboratory identification number; and
- signature or initials of the person making the entries.

In addition, the following information, where known, is maintained and linked to the log-in record:

- date and time of sampling linked to the date and time of laboratory receipt;
- unique field identification number linked to the laboratory sample ID (*note: the laboratory has no control over the Field ID. Field ID's may not be unique. Assignment of Field ID's is the responsibility of the client*);
- analyses requested (including applicable approved method numbers) linked to the laboratory sample ID; and
- comments regarding rejection or other issues (if any).

All documentation received regarding the sample, such as memos or chain of custody, are retained in the job file.

26.4 Sample Aliquots / Subsampling

In order for analysis results to be representative of the sample collected in the field, the laboratory has subsampling procedures. Note that the vast majority of subsampled samples consist of 8" x 10" filters. Refer to SOP ME-008 for subsampling of 8" x 10" filters. Nearly all other samples are either consumed in their entirety during analysis or not subsampled.

26.5 Sample Storage

Storage conditions are monitored for any required criteria, verified and the verification recorded in logbooks where appropriate.

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Samples that require thermal preservation are stored in a manner compliant with the promulgated method. 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. For samples required to be kept “frozen”, any temperature below 0 °C is acceptable.

Samples are held secure, as required. Samples are accessible only to laboratory personnel.

Samples are stored apart from standards, reagents, food or potentially contaminating sources, and in a manner that minimizes cross-contamination. All portions of samples, including extracts, digestates, leachates or any product of the sample is maintained according to the required conditions.

The majority of samples, based upon promulgated method requirements, are stored at room temperature, or in a temperature and humidity controlled room.

26.6 Sample Disposal

Samples are retained for a minimum of 60 days after the report is sent out unless other arrangements have been made with the client.

Samples are disposed of according to Federal, State and local regulations. Procedures are described in SOP AD-002 for the disposal of samples, digestates, leachates and extracts.

26.7 Sample Transport

Samples that are transported under the responsibility of the laboratory, where necessary, are done so safely and according to storage conditions. This includes moving bottles within the laboratory. Specific safety operations are addressed outside of this document in method specific SOPs and the laboratory’s Chemical Hygiene Plan.

Samples are not shipped by the laboratory. Sample media (e.g. filters and sorbent tubes) are shipped in a manner consistent with client request.

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Figure 26-2

Example Sample Acceptance Policy

Disclaimer: The 2009 TNI Standard has a number of requirements for sample acceptance. When all of the requirements are not met, the sample is to be rejected. As these requirements are designed for water or soil samples, most are not generally applicable to the analysis of ambient air or source samples. Meeting the requirements of the 2009 TNI Standard would require the laboratory to contact nearly every client or reject their samples for every project.

CHESTER LabNet will not reject any sample except at the request of the client, unless the acceptance of the sample would be fraudulent. The laboratory will note its opinion if the data are suspected to be of dubious usefulness to the client or to the client’s client or regulator. The laboratory will notify clients if their samples are received in such a state as to make analysis impracticable or lead to suspect data. Notification will occur, wherever possible, upon receipt of the samples. Ultimately, it is the client’s directives that will determine acceptance of samples.

To demonstrate the laboratory’s good-faith effort to fulfill the 2009 TNI requirements, a checklist is completed at the time of sample receipt. The checklist shall be maintained with the job file. It will not, however, be reported to the client.

CHESTER LABNET

SAMPLE RECEIPT CHECKLIST FOR NELAC REQUIREMENTS

Client _____ Method _____ Date _____

Archaic methods or methods that can't be analyzed as written: M26/26A; M202; M12; M101/101A/102 (This is not a complete listing)																															
<table border="1"> <thead> <tr> <th><u>NELAC Required Sample Condition</u></th> <th>(circle one)</th> </tr> </thead> <tbody> <tr> <td>Received in condition required by method? ¹</td> <td>Y N N/A</td> </tr> <tr> <td>Samples in appropriate containers? ¹</td> <td>Y N N/A</td> </tr> <tr> <td>Correct temperature?</td> <td>Y N N/A *</td> </tr> <tr> <td>Within hold time?</td> <td>Y N N/A *</td> </tr> <tr> <td>Broken/damaged?</td> <td>Y N N/A !!</td> </tr> <tr> <td>Sufficient sample present to perform analysis? ¹</td> <td>Y N N/A !!</td> </tr> <tr> <td>Preserved appropriately? ¹</td> <td>Y N N/A</td> </tr> </tbody> </table>	<u>NELAC Required Sample Condition</u>	(circle one)	Received in condition required by method? ¹	Y N N/A	Samples in appropriate containers? ¹	Y N N/A	Correct temperature?	Y N N/A *	Within hold time?	Y N N/A *	Broken/damaged?	Y N N/A !!	Sufficient sample present to perform analysis? ¹	Y N N/A !!	Preserved appropriately? ¹	Y N N/A	<table border="1"> <thead> <tr> <th><u>Chain of Custody</u></th> <th>(circle one)</th> </tr> </thead> <tbody> <tr> <td>Chain of Custody present?</td> <td>Y N N/A !!</td> </tr> <tr> <td>Client contact information present on CoC? ¹</td> <td>Y N N/A</td> </tr> <tr> <td>All requested analyses definitively identified? ²</td> <td>Y N N/A !!</td> </tr> <tr> <td> If no, is this a long-standing project with understood analyses?</td> <td>Y N N/A</td> </tr> </tbody> </table>	<u>Chain of Custody</u>	(circle one)	Chain of Custody present?	Y N N/A !!	Client contact information present on CoC? ¹	Y N N/A	All requested analyses definitively identified? ²	Y N N/A !!	If no, is this a long-standing project with understood analyses?	Y N N/A				
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¹ **CHESTER LabNet** will not notify clients of these "deficiencies" to avoid alienating clients by perpetual contact.

² may be identified by Method number if method contains no room for doubt as to analytes of interest.

³ Many Air Quality/Soure Emission methods are archaic, contradict themselves or are inappropriate. Some regulators require the use of older versions of a method. **CHESTER** will follow, to the best of their ability, the method requested by the client.

!! address **prior to any analytical work being started**.

* **note in case narrative** upon reporting of results to client.

Signed _____

Notes _____

Note: NELAC requirements are designed for Water/Soils, and are often incompatible with Ambient or Source Air Promulgated Methods.

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For Source Sampling, a second, more specific and applicable checklist (below) was created prior to the advent of TNI or ORELAP and has been in use by the laboratory for many years. This checklist is reported to the client.

**CHESTER LABNET
SOURCE SAMPLE RECEIPT CHECKLIST**

Client _____ Date _____
 # Runs _____ Time _____

Custody Seals Inspected, If Present

Chain-of-Custody Form Inspected
CoC present with samples? *
 CoC indicate analytical methodology to be used? (eg M29 etc) !!
 CoC indicate if compliance testing? (esp. M26) !!
 M26 samples have Thiosulfate added in field? !!
 M29 indicate FH/BH separate or combined? !!
 Has Form Been Signed?
 Have Date and Time Custody Released Been Noted on Form?

All Sample Containers Inspected
 Does Number of Samples Match Number on CoC Form? !!
 Do All Sample ID Numbers Match Those on the CoC Form? !!
Did client mark sample volumes prior to shipment? *
 If required by method, did client vent samples prior to shipment?
 Are the Sample Containers Intact? !!
Are signs of leakage present? *

Chain-of-Custody Form Signed and Dated by CLN

Corrective Actions
 Client Contacted Due to Mismatching Sample ID Numbers
 Client Contacted Due to Broken Sample Container(s)
 Client Contacted Due to Leaking Sample Container(s)
 Client contacted for verification of methodology?
 Corrective Actions Documented?
 Corrective Actions Accomplished?

*Items marked !! shall be addressed prior to any analytical work being started.
 Items marked * shall be noted in case narrative upon reporting of results to client.*

Signed _____

Notes _____

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Section 27

QUALITY ASSURANCE FOR ENVIRONMENTAL TESTING (*TNI V1:M1, V1:M2 – Section 5.9 and Section 1.7 of Technical Modules TNI V1:M 3-7*)

CHESTER LabNet has procedures for monitoring the validity of the testing it performs. The qualities of test results are recorded in such a way that trends are detectable, and where practicable, are statistically evaluated. To evaluate the quality of test results, the laboratory utilizes certified reference materials, PT samples (where available), interlaboratory comparisons (where available), replicate testing using different methods (e.g., Methods 6 and 8) and results for non-sample-based QC elements (e.g., ICVs, LCS's, etc.).

In addition to procedures for calibration, the laboratory monitors quality control measurements such as blanks, laboratory control samples (LCS), matrix spikes (MS), duplicates and certified Class 1 weights to assess precision and accuracy. Proficiency Testing samples are required by the 2009 TNI Standard, however there are none available from a Proficiency Testing Provider Accreditor Approved Proficiency Test Provider for any *accredited* method performed by *CHESTER LabNet*.

Quality control data are analyzed and, when found to be outside pre-defined criteria, action is taken to correct the problem and to prevent incorrect results from being reported. Data associated with quality control data outside of criteria and still deemed reportable will be qualified such that the end user of the data may make a determination of the usability of the data (see Section 28, "Reporting of Results").

27.1 Essential Quality Control Procedures

When not archaic, the quality control procedures specified in test methods are followed by laboratory personnel. The most stringent of control procedures is used in cases where multiple controls are offered. If it is not clear which is the most stringent, that mandated by test method or listed in the 2009 TNI Standard (Appendix H) is followed. Often a hybrid of the TNI, CLP and method specific QC elements and control limits is used.

The 2009 TNI Standard requires that "*If it is not clear which is the most stringent, that mandated by test method or regulation*" be followed. The laboratory rarely knows what the applicable regulation is for any set of samples, as each source and project may have different regulatory limits, regulatory agencies and QC requirements. In such situations, the laboratory defaults to its own internally-generated quality control procedures or defers to client request.

For test methods that do not provide acceptance criteria for an essential quality control element or where no regulatory criteria exist, acceptance criteria are developed. The criteria used vary from method to method and may be found in the method-specific SOPs.

For the Gravimetry Laboratory, criteria are set based upon the narrowest ranges of quality control which meet all of the methods being utilized in that department.

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For the XRF lab, criteria are set based upon the determination of uncertainties for the instruments. Static limits are set for the percent recovery of the quality control standard analyzed with each run and the replicate analyses of samples.

The conventional chemistry lab generally relies on CLP guidelines for static limits on most quality control elements. Where CLP guidelines are not applicable, other means of determining limits for quality control elements are defined.

Written procedures to monitor routine quality controls, including acceptance criteria, are located in the test method SOPs, except where noted, and include such procedures as:

- use of laboratory control samples and blanks to serve as positive and negative controls for chemistry methods;
- use of laboratory control samples, where possible, to monitor test variability of laboratory results;
- use of calibrations, continuing calibrations, certified reference materials and/or PT samples to monitor accuracy of the test method;
- measures to monitor test method capability, such as limit of detection, limit of quantitation and/or range of test applicability, such as linearity;
- use of regression analysis, internal/external standards, or statistical analysis to reduce raw data to final results;
- use of reagents and standards of appropriate quality, and use of second source materials as appropriate;
- measures to assure constant and consistent test conditions, such as temperature, humidity, etc., when required by test method; and
- “*procedures to ensure the selectivity of the test method for its intended use*” as required by the 2009 TNI Standard. However, it is rare that the laboratory has any discretion when it comes to the method utilized. Method selection lies with the laboratory’s clients, their clients and/or their clients’ regulatory agencies. The laboratory attempts to follow the method chosen by the aforementioned entities to achieve results which are, at a minimum, useable, and preferably accurate.

27.2 Internal Quality Control Practices

Analytical data generated with QC samples that fall within all prescribed acceptance limits indicate that the test method is deemed to be in control.

QC samples that fall outside QC limits indicate that the test method is out of control (non-conforming) and corrective action is required, and/or that the data need to be qualified (see Section 12, “Control of Non-conforming Environmental Testing Work” and Section 14, “Corrective Actions”).

Detailed QC procedures and QC limits are included in test method standard operating procedures (SOPs).

Quality Assurance Management Plan

All QC measures are assessed and evaluated on an on-going basis so that trends are detected.

27.2.1 General Controls

The following general controls are used, where possible:

27.2.1.1 Positive and Negative Controls such as:

- a) blanks (negative) and
- b) laboratory control samples (positive).

27.2.1.2 Selectivity is assured through:

- a) absolute and relative retention times in chromatographic analyses;
- b) use of the correct method according to its scope assessed during method validation;
- c) use of qualitative spikes where sample matrices may “push” peaks around;
- d) use of element specific wavelengths for analysis by IC;
- e) use of element specific KeV excitation lines for analysis by XRF; and,
- f) use of temperature and transmittance/reflectance for analysis by OCEC.

27.2.1.3 Consistency, Variability, Repeatability and Accuracy are assured through:

- a) proper installation and operation of instruments according to manufacturer’s recommendations or the processes used during method validation;
- b) monitoring and controlling environmental conditions (temperature, access and proximity to potential contaminants);
- c) selection and use of reagents and standards of appropriate quality;
- d) cleaning glassware appropriate to the level required by the analysis as demonstrated with preparation blanks (See SOP AD-004);
- e) following SOPs and documenting any deviation, assessing for impact, and treating data appropriately;
- f) testing to define the variability and/or repeatability of the laboratory results, such as replicates; and
- g) use of 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.

27.2.1.4 Test Method Capability (also see Section 22, “Environmental Methods and Method Validation”) is assured through:

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- a) establishment of the limit of detection where applicable;
- b) establishment of the limit of quantitation or reporting level where applicable; and/or
- c) establishment of the range of applicability where applicable, such as linearity.

27.2.1.5 Data reduction is assured to be accurate by:

- a) selection of appropriate formulae to reduce raw data to final results, such as regression;
- b) following specific procedures for data reduction, such as manual integration procedures; and
- c) periodic review of data reduction processes to assure applicability.

27.2.1.6 Sample specific controls are used to evaluate the effect of sample matrix on the performance of the selected analytical method (not a measure of laboratory performance). For example:

- Matrix Spike and Matrix Spike Duplicate (MS/MSD)
- Sample Duplicates

27.2.1.7 The following tables summarize the key elements of a quality control system for a laboratory performing chemical testing. Note that many air methods are “one shot” and do not allow for redigestion or reanalysis. Many also are not compatible with some of the elements listed below (e.g., Method 5 and Method 202 cannot have an LCS). Some instrumentation used in air quality analyses does not lend itself to all of the elements listed below (e.g., LCS or blanks for XRF analysis, spikes for PM_{2.5} analysis). All QC elements defined in Table 27-1 are understood to be “where applicable.”

Table 27-1 Essential Quality Control Elements for Chemistry			
Item	Frequency	Acceptance Criteria	Corrective action
Negative Control (Laboratory Blank)	1/batch	Laboratory defined	Note in Report.
Negative Control (Preparation Blank)	1/batch	Method specific, client specific, regulatory specific, contract specific or as determined by the laboratory	Reprocess, reanalyze, or qualify data.
Negative Control (Method Blank)	1/batch	Method specific, client specific, regulatory specific, contract specific or as determined by the laboratory	Reprocess, reanalyze, or qualify data.

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Quality Assurance Management Plan

Table 27-1 Essential Quality Control Elements for Chemistry			
Item	Frequency	Acceptance Criteria	Corrective action
Positive Control (Laboratory Control Sample - LCS)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Spike; Matrix Spike Duplicates (pre- or post-digestion) <i>Note : Spiked samples are designed as data quality indicators for a specific sample using the designated method. These controls alone are not used to judge a laboratory's performance.</i>	Per method requirement, client request, or laboratory discretion. Minimum of 1/batch where possible.	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Duplicates/Replicates <i>See note above.</i>	Per method requirement, client request, or laboratory discretion. Minimum of 1/batch where possible.	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Continuing Calibration Verification - CCV	Per method requirement or laboratory discretion	Method specific or determined by the laboratory	Corrective action as given in SOP
Initial Calibration Verification - ICV	Per method requirement or laboratory discretion	Method specific or determined by laboratory	Corrective action as given in SOP
Continuing Calibration Blank - CCB	Per method requirement or laboratory discretion	Method specific or determined by the laboratory	Corrective action as given in SOP
Initial Calibration Blank - ICB	Per method requirement or laboratory discretion	Method specific or determined by laboratory	Corrective action as given in SOP

27.2.2 Specific Controls

27.2.2.1 Blanks

Laboratory blanks (Lab Blanks) are used for Air Quality Methods requiring evaporation and/or gravimetry (Appendix B, J and L; Methods 5, 5A – 5F, 201A, 202 and similar). Laboratory blanks consist of an empty weighing vessel (e.g., beaker, pan, or filter) which follows the other weighing vessels through the process, to the extent possible, and are then gross weighed with the rest of the weighing vessels. A lab blank must be analyzed at a minimum of one per sampling batch, which

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may exceed 20 samples although it rarely does. For Appendices B, J and L analyses, a lab blank is a blank filter which has been tare weighed, but has never left the confines of the laboratory. It is gross weighed along with its associated samples and must meet the same QC criteria as those samples. Control limits exist only for PM_{2.5} Lab Blanks ($\pm 15\mu\text{g}$). The other gravimetric methods have no controls for blank filters. The data is reported "as-is" since even negative numbers have interpretive value to the client. Filter Laboratory Blanks are only performed at the request of the client.

Preparation Blanks are processed along with and under the same conditions as the associated samples to include all steps in the method and all reagents used. They do not, however, contain any of the matrices on or in which a sample is captured (e.g., no filter or sorbent material). A preparation blank must be analyzed at a minimum of one per preparation batch. When no separate preparation method is used, the batch is defined as the environmental samples that are analyzed with the same method and personnel, using the same lots of reagents, not to exceed the analysis of twenty environmental samples, not including method blanks, LCS, matrix spikes and matrix duplicates. In the case of no separate preparation method, an ICB or CCB is considered equivalent. Due to the complex nature of many source sampling methods, preparation blanks may have detectable levels of analytes of interest present. Preparation blank results should be lower than any sample result, or within 20% RPD of the sample result in cases where the result is greater than five times the detection limit.

Method blanks are processed along with and under the same conditions as the associated samples to include all steps and matrices (e.g., filter type, sorbent material) in the method. A method blank must be analyzed at a minimum of one per preparation batch. The matrix of the method blank must be as similar to the associated samples as possible, including matching lots numbers of filters where possible. Nearly all matrices used in the sampling of ambient or source air have some background contamination from either the manufacturing or the sampling process.

The Method Blank results should be lower than the lowest sample result, or within 20% of the sample result in cases where the result is greater than five times the detection limit. In some cases, such as OC/EC analysis, the Preparation Blank and the Method blank will be the same blank. Method blanks are not required for some analyses such as XRF analysis and pH.

Contaminated blanks are identified according to the acceptance limits in the test method SOPs or laboratory documentation. Note that all filter matrices are not created equal and all will have some form of contamination on them. The laboratory has no control over filter manufacturing or the choice of filter matrix and, thus, it is expected that some filters for some analyses will show detectable quantities for some analytes.

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The laboratory identifies a blank as contaminated based upon the method being used. For Method 29 Mercury analysis, for example, a preparation blank is considered contaminated if the result is higher than the detection limit. For Glass Fiber filter analysis, the list of commonly seen contaminants is quite long, thus the performance of the laboratory would not be considered insufficient if the method blank were to have analytes of interest present. For Quartz filters, the list is somewhat shorter. Cellulose filters will always be very high in Organic Carbon if analyzed for OC/EC as cellulose is very high in Carbon. Teflon filters are generally very clean for most analytes, but if used for Method 13B, will yield high amounts of fluoride. Each matrix, analyte and test method must be taken into account when determining if a method blank is considered contaminated enough to induce corrective actions.

When a blank is determined to be contaminated, the cause must be investigated and measures taken to minimize or eliminate the problem.

Data that are unaffected by the blank contamination (non-detects or other analytes) are reported unqualified.

Sample data that are suspect due to the presence of a contaminated blank are reanalyzed if possible, or the client is contacted for further instruction. If the blank results are less than the sample results and the contaminant is common in the media being analyzed, no notation is made in the report. Method Blank results are reported to the client. It is the policy of the laboratory to never blank subtract.

Client provided Field Blanks, Trip Blanks, Train Blanks and Reagent Blanks have no control limits and are treated as samples.

27.2.2.2 Laboratory Control Samples

Laboratory Control Samples (LCS) are prepared from analyte-free water or the matrix upon which the sample was collected, and spiked with verified and known amounts of analytes for the purpose of establishing precision or bias measurements. Not all methods are amenable to LCS's (e.g., OCEC, XRF, PM10, PM2.5, Method 202, etc.).

Laboratory control samples are analyzed at a frequency mandated by method, regulation, laboratory discretion or client request, whichever is more stringent. The standard frequency of LCS preparation and analysis is one per preparation batch of 20 or fewer samples, or as otherwise stated in a laboratory SOP. Exceptions would be for those analytes or methods where no spiking solution is available, such as Method 202, OCEC and XRF analysis, PM10 or PM2.5 analysis, etc. When no separate preparation method is used, the batch is defined as the environmental samples that are analyzed with the same method and personnel, using the same lots of reagents, not to exceed the analysis of twenty environmental samples, not including method blanks, LCS, matrix spikes and matrix duplicates. In the case of no separate preparation method, an ICV or CCV is considered equivalent.

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The analytes to be spiked in the LCS are the same as the analytes specified by the client or in the test method SOP. The client's requests take priority over the published method (e.g., for Method 29, if the client requests 5 elements, the laboratory does not spike the sample with all 17 analytes mentioned in the method).

The results of laboratory control samples (LCS) are calculated in percent recovery. The calculation for percent recovery is given below:

$$\%R = \frac{(AV - MV) * 100}{KV}$$

Where:

AV = Analyzed Value

MV = Method Blank Value (where method blanks are performed)

KV = "known value" (True Value Spiked)

The individual LCS percent recovery is compared to the acceptance criteria as published in the mandated test method, or the laboratory established limits when there are no established criteria, as described above. Where no established criteria exist, the laboratory defaults to $\pm 20\%$ of the known value, per CLP guidelines.

27.2.2.3 Matrix Spikes and Matrix Spike Duplicates

Matrix Spikes and Matrix Spike Duplicates (MS/MSD) are a second/third aliquot of an environmental sample fortified with a known amount of analyte to help assess the effect of the matrix on method performance. **CHESTER LabNet** rarely performs Matrix Spike Duplicates. In some cases, a second aliquot of the sample may not be possible, in which case a second aliquot of the extract/digestate will be utilized (called a Post-Digestion Spike or "post spike" to differentiate it from a true spiked analysis).

The laboratory procedure for a matrix spike includes spiking appropriate analytes at appropriate concentrations, calculating percent recoveries, and evaluating and reporting the results. The procedure can be found in the appropriate test method SOPs. The calculation for percent recovery is given below:

$$\%R = \frac{(AV - SV) * 100}{KV}$$

Where:

AV = Analyzed Value

SV = Sample Value

KV = "known value" (True Value Spiked)

The individual spike percent recovery is compared to the acceptance criteria as published in the mandated test method, or the laboratory established limits when there are no established criteria. Where there

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are no established criteria, the laboratory defaults to the CLP guidelines of $\pm 25\%$ off of the true value.

For spike results outside established criteria, the data are reported with annotations in the report. For some methods, such as Fluoride by Method 26, it is common to have matrix interferences which cause the spike to fall out of control. For other methods, it is not possible to spike the sample at all (e.g., OCEC, XRF, Method 202, PM_{2.5}, PM₁₀).

27.2.2.4 Matrix Duplicates

Matrix Duplicates (“dups”) are a second aliquot of an environmental sample processed along with and under the same conditions as the associated sample to include all steps in the method. In some cases, a second aliquot of the sample may not be possible, in which case a second aliquot of the extract/digestate will be utilized (called a Replicate or “rep” to differentiate it from a true duplicate analysis).

The laboratory procedure for a matrix duplicate includes calculating the relative percent difference (RPD) and evaluating and reporting the results. The calculation for percent recovery is given below:

$$\%RPD = \frac{|(SV - DV)|}{\bar{X}_{SV,DV}} * 100$$

Where:

SV = Sample Value

DV = Duplicate Value

$\bar{X}_{SV,DV}$ = average of sample and duplicate values

Some methods, notably Method 26/26A and most Source Mercury methods, require all samples to be analyzed in duplicate. These methods stipulate that the RPD of a given sample analysis be within 5% RPD or 3% RPD (method dependent). Method 12 requires triplicate analyses, with no more than 5% relative standard deviation (RSD) between data points for the same sample. That calculation is not shown here. Where no established criteria exist, the laboratory defaults to $\pm 20\%$ RPD, per CLP guidelines.

27.3 Proficiency Test Samples or Interlaboratory Comparisons

27.3.1 Compliance with Accreditation Requirements

The 2009 TNI Standard QAMP template states, “*The laboratory analyzes at least two TNI-compliant PT samples per calendar year for each accreditation Fields of Proficiency Testing (FoPT) for which the laboratory is accredited. An exception is made for analytes where there is no PT available from any PTPA approved PT provider at least twice per year. In these cases the lab will run the PTs in the minimum time frame the PTs are available and not at all if they are not available.*”

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The laboratory specializes in air quality analysis and, as yet, there are no Fields of Proficiency Testing (FoPT) for ambient air. An FoPT does exist for source sampling. At this time, the only method for which the laboratory is accredited and for which a PT sample exists is 40CFR60 Method 26A.

For accredited methods, the laboratory, where possible, analyzes a third party PT sample at least twice per calendar year. If that is not possible, the laboratory analyzes an in-house PT sample twice per calendar year. If that is not possible, no PT samples are analyzed. Note that of the seven methods for which the laboratory is accredited, only Method 26/26A has commercially available PT samples, and only Cr6 has the ability to create an in-house PT sample.

The successive PTs are analyzed at least five months apart and no more than 7 months apart unless the PT is being used for corrective action to maintain or reinstate accreditation, in which case the dates of successive PT samples for the same accredited method is at least fifteen days apart.

27.3.2 PT Sample Handling, Analysis and Reporting

The 2009 TNI Standard QAMP template states that *"The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider."*

PT samples are obtained by the client and sent to the laboratory with the client's associated samples. The laboratory does not share PT samples with other laboratories and does not communicate with other laboratories regarding current PT sample results. In cases where PT/PE or interlaboratory samples are provided by the client, the laboratory does not attempt to obtain the assigned value of any PT sample from the PT provider prior to submission of results.

The results are reported to the client or PE provider, not directly to the regulator. To determine whether the laboratory's method is in control, the laboratory must find out the assigned value of the PT sample from the PT provider (agency, client or manufacturer). If the assigned value cannot be obtained, the laboratory makes a good faith effort to determine, at the very least, whether the laboratory passed or failed the PE sample.

When requesting a PT from a third party provider, the laboratory may give the PT provider a concentration range to ensure that the PT samples are neither higher than the high end of the calibration curve nor below the detection limit. The laboratory may request a "trip blank" PE sample, in addition to the usual PT samples requested, to prove that no contamination occurred during the shipping and handling of the sample media. It is highly unusual for the laboratory to request a PE sample from a third party.

Proficiency Testing (PT) samples are treated in the same manner as typical samples in the normal production process where possible, including the same analysts, preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not

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analyzed multiple times unless routine environmental samples are analyzed multiple times. Where PT samples present special problems in the analysis process, they will be treated as laboratory samples where samples present special problems.

The type, composition, concentration and frequency of quality control samples analyzed with the PT samples are the same as with typical samples.

Prior to the reporting of a PT sample, laboratory personnel do not:

- subcontract analysis of a PT sample to another laboratory being run for accreditation purposes;
- knowingly receive and analyze a PT for another laboratory being run for accreditation purposes;
- communicate with an individual from another laboratory concerning the analysis of the PT sample; or
- attempt to find out the assigned value of a PT from the PT Provider (see paragraph 3, this section – above - for exception).

The laboratory's procedure for handling low level PT samples is to treat the PT sample in exactly the same manner as it would treat any other sample of low concentration. This may include the reporting of "< [LOD]" as a result.

As there are no FoPT PT samples available for ambient air sampling methods, the laboratory cannot participate in the TNI FoPT PT study for ambient air methods.

Per the SSAS program, which is functionally parallel to the water/soil programs, PT samples for source samples are to be reported directly to the PT Provider and the client. When requested, the PT results for source samples are also reported directly to the regulator associated with the compliance testing.

In June, 2013, the US EPA required all source samples analyzed for the purposes of compliance with permits or regulatory purposes to be analyzed with a PE sample, where a PE sample is available. In 2015, the laboratory analyzed 96 PE samples for Method 26/26A compliance sampling events, or approximately two PE samples per week. At the request of the current ORELAP administrator (Gary Ward), only two of these 96 PE samples are reported to the laboratory's accrediting body, one in January and one in July of the calendar year. For some reason, he felt that having 96 PE results per year was excessive. Air is not water.

For interlaboratory comparison samples submitted with other samples (e.g., "Round Robin" samples), the laboratory reports the data alongside the data for the samples received in conjunction with the interlaboratory comparison. For in-house PT samples, the QA Officer documents the passing or failing of each analyst's PT performance on a PT form which is kept in the QA Officers files.

Any result at or above the detection limit is reported as the resultant value. Any result less than the detection limit is reported as < [LOD].

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The laboratory institutes corrective action procedures for failed PT samples following the guidelines in Section 14, "Corrective Action".

Retention of PT records is similar to that maintained for typical analytical records.

Note: It has been the laboratory's experience to date that most PT providers do not understand the methods for which the PT is supplied, and consequently, it is very common for the laboratory to need to heavily modify the instructions and calculations in order to meet the criterion of treating the PT sample in the same manner as the samples. For example, a Method 12 (Pb in Source Emissions) PT sample's instructions may say "dilute 1 mL to 1000 mL and analyze by ICP" where the method requires the entire impinger catch to be evaporated down to 50 mL at sub-boiling temperatures. The PT instructions to 'dilute and shoot' do not come anywhere near the amount of sample preparation/manipulation that the actual samples undergo. The laboratory will, to the best of its ability, treat the PT sample as closely as possible to the promulgated method and will document these changes in a case narrative specific to samples analyzed with the PT.

27.4 Data Review

The laboratory reviews all data generated in the laboratory for compliance with method, laboratory and, where appropriate, client requirements.

Three levels of data validation are performed. Levels 0 and I are performed on all samples received by *CHESTER LabNet*. Level II data validation is only performed when required by contractual obligation. The purpose of data validation is to ensure that the reported data are free from transcription and calculation errors (manual or electronic), and that all quality control measures are reviewed and evaluated prior to data being reported.

27.4.1 Level 0

Level 0 validation occurs at the sample receipt and log in stage of sample analysis. Elements of Level 0 validation include:

- examining the integrity of custody seals, if present;
- taking the temperature of a transit temperature bottle or samples, if required;
- examining the integrity of shipping bottles or containers;
- examining the chain of custody (CoC) form(s) for the presence of all required information and signatures;
- verifying sample ID numbers against those listed on the CoC form(s); and
- contacting the appropriate authority upon finding irregularities, then documenting and carrying out corrective actions.

For projects requiring additional documentation of the level 0 validation process, *CHESTER LabNet* provides a written checklist covering the above

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steps. This checklist is filled out, signed, and dated by the Sample Custodian or designated alternate. The completed checklist is added to the project file.

27.4.2 Level I

Level I data validation begins during sample analysis and is carried out at the instrument by the analyst. This phase of level I validation involves performing and maintaining instrument calibration and assessing precision and accuracy of the data via the analysis of all of the appropriate QC checks, as discussed in Section 27.1 and 27.2. The analyst ensures that the QC statistics are within control limits and takes appropriate corrective actions during analysis, if needed.

For projects requiring additional documentation of the level I validation process, the laboratory provides a written analyst's checklist. This checklist is filled out, signed and dated by the analyst. The completed checklist is added to the project file.

The second phase of level I data validation is performed by the QA Officer or Technical Director for that particular department. During this phase, raw data is verified as being in control with the appropriate QC parameters, worklists are checked for accuracy against the raw data, raw data is checked for any discrepancies which may have been missed by the analyst (e.g., spike lot numbers or expiration dates) and any corrective actions are taken to remedy deficiencies prior to the data being submitted to the project manager.

The third phase of level I data validation is performed by the QA Officer or Project Manager, who confirms all keyboard entries and electronic data entries into the LIMS, then confirms that the correct analyses have been completed on the correct samples. The Project Manager then reviews all of the data and QC results for a given project or report and, for certain clients, prepares QC summary tables and data assessments. Problem data discovered during this review are annotated in the report.

If any analytical errors are found in any of these stages of data review, and there is enough sample extract remaining, and holding times have not been exceeded, the preparation and/or analysis will be repeated and the new results will be subjected to the same QC/validation.

The final report is reviewed by the Laboratory Director, who signs the report prior to its release to the client. SOPs QA-002 and AD-007 are relevant to this stage of review.

27.4.3 Level II (by client request only)

Level II data validation is only performed for CLP style reports, is carried out by the QA Officer, and occurs after the data package has been correctly assembled. The first step is to recalculate, by hand, the final result for a randomly chosen sample. This is accomplished by first taking the raw calibration data and recalculating the appropriate calibration statistics (i.e., slope, intercept and correlation coefficient). Next, using the raw instrument response, the instrument concentration result is recalculated. Finally, the

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sample preparation data (i.e., digestate volume, filter aliquot size, etc.) are used to recalculate the final result as reported to the client. All of these steps are documented on a Sample Calculation form, which is signed and dated by the reviewer and included in the final data report.

The second step is to review all QC statistics and raw data for compliance with control limits, frequency of application, and correct sequences. In addition, flagging is checked as well as reporting units, holding times and the correct use of significant figures. Finally, corrective actions (if applied) are noted. The review is aided by following a preprinted checklist, which is signed and dated by the QA Officer and placed in the data report. Results for all data review, verification and cross checking procedures are documented within each data package, to the extent that is required for each particular client's needs. At a very minimum, documentation shall consist of at least one person's signature or initials attesting to the performance of data review.

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Section 28

REPORTING THE RESULTS

(TNI V1:M2 – Section 5.10)

The result of each test performed is reported accurately, clearly, unambiguously and objectively, and complies with all specific instructions contained in the test method and/or required by client or regulator.

The 2009 TNI Standard QAMP template states, “*Laboratory results are reported in a test report that includes all the information requested by the client and necessary for the interpretation of the test results and all information required by the method used.*” For Aqueous samples, this usually includes both sampling and analysis. As the laboratory’s clients perform the sampling from collection to shipment (see Disclaimer prior to Section 3), the laboratory has no knowledge of the sampling methods nor control over the actions or inactions of the clients in the field. Accordingly, the laboratory cannot include in its report information for which it is neither responsible nor privy to. Thus, if a method requires samples be reported in µg/dscm, but the client does not provide air volumes, temperature or humidity data, it is impossible for the laboratory to report all information required by the method used. The laboratory reports do include all the information requested by the client and necessary for the interpretation of the test results where possible.

Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity.

28.1 Test Reports

The report formats have been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse. The laboratory does not issue multiple reports for the same samples where there is different information on each report unless requested to do so by the client (e.g., one report for regulatory purposes, a second report for engineering purposes).

A typical test report contains the following elements:

- a Cover Page/Title Page;
- a Case Narrative page;
- qualification of results with values outside the calibration range as appropriate (usually in the case narrative);
- data summary sheets;
- a QA/QC summary section;
- a Chain of Custody form; and,
- a page stating that raw data are available upon request.

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Note that raw data is not included in a report unless specifically requested by the client. Raw data are reported as an Appendix.

Each test report generated, electronic or hardcopy, contains the following information:

- a) a title, in the format of [Client Name; Project Name or Number*, Client Number, Report Number] (*if the project name or number has been provided by the client);
- b) the name and address of the laboratory, the phone number and name of a contact person;
- c) unique identification of the test report, in the form of a report number, on each page and a pagination system that ensures that each page is recognized as part of the test report and a clear identification of the end of the report, such as "3 of 10";
- d) the name and address of the client, where provided by the client;
- e) the identification of the method used, including any modifications;
- f) the date of sampling for each sample, where provided by the client;
- g) a description of, the condition of, and unambiguous identification of the sample(s) tested, including the client identification code;
- h) the date of sample receipt, date and time of sample collection (where provided), the time of sample preparation and analysis if the required holding time for either activity is less than or equal to 72 hours and, when requested, dates the tests were performed;

Note that depending on the method and client, a sampling "date and time" may cover two or more days and range from 2 hours to 14 days in length. The entry will be as reported to the laboratory by the client, if the client provides the laboratory with the information. If the client reports a "start time" and "end time", that information will be provided.

- i) procedures used by the laboratory where these are relevant to the validity or application of the results;

The 2009 TNI Standard requires the reports to include a reference to the sampling plan as well. As the client - not the laboratory - performs sampling, the laboratory does not include this in test reports. It is the responsibility of the client collecting the samples to have a copy of their own sampling plan. It is exceedingly rare that the laboratory has ever seen the sampling plan for any set of samples, let alone been in possession of a copy of it or able to reference it in any way. For some samples, a sampling plan may not even exist, and the laboratory would have no means of discerning this fact based upon the samples at time of receipt.

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- j) the test results, units of measurement, failures identified (See Appendix F for a list of laboratory qualifiers or note where this can be found.);

The 2009 NELAC Standard QAMP template states, “*an indication of when results are reported on any basis other than as received (e.g., dry weight).*” Many of the methods require results to be reported “on any basis other than received.” In those cases (e.g., Method 202 or Method 29), no notation is given since the “basis other than received” is an integral part of the promulgated method.

- k) the name, function and signature or an equivalent electronic identification of the person authorizing the test report and the date of issue;
- l) where relevant, a statement to the effect that the results relate only to the samples;
- m) any non-accredited tests or parameters shall be clearly identified as such to the client when claims of accreditation to this Standard are made in the analytical report or in the supporting electronic or hardcopy deliverables; and
- n) A statement that the report shall not be reproduced, except in full, without written approval of the laboratory.

28.2 Supplemental Test Report Information

When necessary for interpretation of the results or when requested by the client, test reports include the following additional information, usually found in the Case Narrative:

- a) deviations from, additions to, or exclusions from the test method, information on specific test conditions such as environmental conditions, any non-standard conditions that may have affected the quality of the results, and any information on the use and definitions of data qualifiers;
- b) a statement of compliance/non-compliance when requirements of the management system are not met, including identification of test results that did not meet the laboratory and regulatory sample acceptance requirements, such as holding time, preservation, etc.;
- c) a statement on the estimated uncertainty of the measurement, where applicable and when requested by the client;
- d) opinions and interpretations, where appropriate and needed (When opinions and interpretations are included, the basis of those opinions and interpretations is documented. Opinions and interpretations are clearly marked as such in the test report.);
- e) additional information which may be required by specific methods or client; and
- f) qualification of results with values outside the calibration range as appropriate.

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28.3 Environmental Testing Obtained from Subcontractors

Test results obtained from tests performed by subcontractors are most commonly sent directly to the client by the subcontractor and are not included in the laboratory's test report. Where the laboratory submits subcontracted data to the client, the entire subcontractor's report is submitted to the client.

28.4 Electronic Transmission of Results

All test results transmitted by telephone, fax, telex, e-mail, or other electronic means comply with the requirements of the 2009 TNI Standard and associated procedures to protect the confidentiality and proprietary rights of the client (see Section 22, "Environmental Methods and Method Validation").

28.4.1 Electronic Data Deliverables

CHESTER LabNet provides electronic data deliverables in a variety of formats on a client specific basis. E-reports are most commonly sent as email attachments. Files have been formatted as: CSV files, MS Excel files, fixed width column files, Adobe Acrobat files (.pdf), spreadsheet files, text files or proprietary client software files. *CHESTER LabNet* works closely with the client to ensure that e-reports are in a useable and acceptable format, to include the use of password protected delivery where requested by client. Preparation of electronic deliverables is highly specific to the client and/or project (some clients may have more than one project in progress, and each project may have a different electronic reporting format requirement).

28.5 Amendments to Test Reports

Material amendments to a test report after it has been issued are made only in the form of another document or data transfer. All supplemental reports meet all the requirements for the initial report and the requirements of this *Quality Manual*.

Amended test reports are re-issued and the re-issuance is documented by appending a chronological revision number to the report number (i.e., "Report #12-421 revision 1").

When it is necessary to issue a complete new report, the new report is uniquely identified and contains a reference to the original that it replaces, using the same nomenclature as above (i.e., "Report #12-421 revision 1"). One exception to this is minor changes to a single page in the report. Often, the client is already in possession of the hardcopy report and the client is then responsible for replacing the corrected page(s).

28.6 Exceptions

Due to the highly complex nature of air quality testing, the wide variances between each regulatory jurisdiction, the wide variances between each individual client's

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preferences, attempting to list exceptions to the reporting procedures above would be a monumental undertaking.

Reporting shall meet the needs of the client first, then, whenever possible, the requirements of the 2009 TNI standard.

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Appendix A

Personal Ethics and Data Integrity Policy

A.1 Introduction

CHESTER LabNet's goal is to provide the most informed and accurate inorganic analysis of air quality samples possible from a commercial laboratory. *CHESTER LabNet's* management is committed to good professional practice and to the quality of its environmental testing in servicing its clients. To achieve this goal, it is critical that all employees understand: the need for honesty and full disclosure of variances in all areas of analyses performed; when and how to report data integrity issues; and the documentation of such issues when they arise.

Data integrity is defined as data of known quality, analyzed by documented procedures, fulfilling all Quality Control standards established by those procedures, and meeting the requirements of the client. Inherent in the concept of data integrity is that no false manipulations of data or samples or omissions of pertinent information be performed to meet the Quality Control criteria. This inherent need is governed by the personal ethics of each employee and the overall corporate culture of *CHESTER LabNet*.

The personal ethics of each and every employee results in the laboratory's ability to:

- Produce accurate results, which include QA/QC information that meets the client's or method's pre-defined Data Quality Objectives (DQOs);
- Present services in a confidential, honest and forthright manner;
- Provide employees with guidelines and an understanding of the ethical and quality standards of our industry;
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same;
- Educate clients as to the extent and kinds of services available;
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made; and
- Promote the status of environmental laboratories, their employees and the value of services rendered by them.

A.2 Management Responsibilities

Management responsibilities are many and begin with creating a culture of trust and honesty within the organization. Technical directors of each department understand that employees are human and do make mistakes. Honest mistakes are corrected and addressed to the employee. Technical Directors are charged with upholding the intent of this policy and implementing the specific requirements not only of this policy, but also of each documented procedure practiced by the laboratory. In addition, Technical Directors must perform their oversight duties with a positive attitude, maintaining focus on the goal of producing high quality data, and without personal attacks or negative attitudes which might lower morale or decrease the likelihood of employees being open and honest.

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Managers and Technical Directors must do their utmost to encourage a corporate culture of honesty and security for each employee, such that no employee is ever afraid to bring forth issues or problems they might encounter.

Technical Directors monitor the adherence of this document by supervising their employees and the data and/or reports produced by their employees. Evidence of unethical behavior such as improper manipulations of data, clock rolling, inappropriate changes in concentrations of standards, failure to follow written procedures to bypass Quality Control checks, insufficient documentation, etc., are addressed to the employee and are documented via the annual review or addenda to the annual review, which are kept in the employee's personnel file. Technical Directors are charged with monitoring the breach after such a discussion to ensure that the employee's behavior has changed. If no change has occurred, the Technical Director and Laboratory Director shall decide upon the appropriate action to be taken. Actions may include termination of the employee, moving the employee to a different department, revoking some of the employee's duties or other actions to resolve the issue and prevent its further occurrence. The worst-case scenario may result in criminal or civil prosecution of the individual employee, fines or possible prison sentences. The laboratory does not and will not defend any employee charged in a court of law who, despite management's best efforts, knowingly submits false, incomplete or undocumented flawed data.

The QA Officer is responsible for initial data integrity and ethics training for all new personnel. In addition, the QA Officer performs annual refresher training for all staff. The QA Officer is responsible for maintaining documentation of the training of all personnel in the form of signatures in this appendix.

In addition, the QA Officer is responsible for performing in depth data monitoring on a regular basis. This monitoring occurs during data review, periodic and random logbook checks, periodic and random standards checks, the internal audit process, review of corrective action reports, and investigations of any issues brought up by other employees.

Management has a zero tolerance policy for unethical behavior. *CHESTER LabNet* does not tolerate unethical behavior of any sort by its employees, whether said behavior is related or unrelated to data production. If a breach of ethics is found to be supported by evidence, the employee may expect to be terminated.

A.3 Employee Responsibilities

"Employees" include both managerial and non-managerial staff. Employee responsibilities include following written procedures and known scientific principles to produce data of the highest degree of scientific defensibility possible within the limitations of the sample matrices and currently available instrumentation. Each employee is responsible for ensuring that the data and/or reports they produce are accurate and complete, and meet the Quality Control criteria described in the method or written procedure for the task.

An employee's personal ethics play a large role in maintaining data integrity. While ethics are more difficult to define and certainly more difficult to instill and enforce, for the purposes of this document, the most fundamental ethic required by *CHESTER LabNet* is honesty. Lying, either by data manipulation, verbal falsification of procedures followed, or by omission, is not supported in any way by *CHESTER LabNet*.

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If the issue is not addressed in the relevant SOP, all employees are charged with reporting any data integrity issue, be it their own or that of others to their Technical Director or supervisor in a timely manner. If that person seems unresponsive, employees should report their concern to the QA Officer or to the Laboratory Director. Non-reporting of known breaches of ethics is considered equally as damaging as having performed the breach oneself, and is subject to the same consequences as described in section A.4. A Corrective Action Report shall be initiated by the person discovering the issue.

Breaches of ethical behavior include, but are not limited to:

- blatant falsification of data;
- improper data manipulations, such as questionable hand integrations, peak shaving, undocumented blank subtractions, not following established rounding rules in order to meet quality control criteria, etc.;
- changing computer clocks to show a different time in order to meet holding time criteria;
- changing standard or QC sample concentrations to force them to meet QC criteria (e.g., diluting or spiking LCSs);
- intentional failure to record information as described in the relevant SOPs (e.g., not recording balance calibration data or temperature/humidity during gravimetric analysis, etc.); and
- intentional failure to record information which may be of value to the client in interpreting results (e.g., “filter corner missing” for negative mass filters, “Acetone fraction shipped in plastic bottles” for gravimetric analysis, “non-homogenous sample deposit” for chemical analysis of filters, etc.).

Given the wide variety of matrices, sampling methods, background contaminants and physical states of samples analyzed at *CHESTER LabNet*, it is to be expected that Quality Control criteria will occasionally fail. It is the responsibility of the employee to properly document the failure, attempt to meet the Quality Control criteria, where possible, and ensure the client is informed of such deviations from normal protocol.

Any errors must be lined out with a single line, such that the original entry is still legible. The line out must be dated and initialed by the employee correcting the mistake. With the exception of obvious typographical or handwritten errors, the reason for the correction or redaction of the entry shall be noted.

In cases where non-conforming data is submitted to a client anyway, the client must be notified, usually in the case narrative, as to the nature of the non-conformance and the reason(s) and/or opinions as to why the non-conformances could not be rectified. In addition, any opinions about the possible value of the data are included in the case narrative.

Other observations of samples, such as possible interfering peaks, mass changes as a result of filter defects, precipitation occurring during sample preparation which are out of the norm for a given method or any other observance which is not typical for a particular method must be noted in the raw data and/or the case narrative. Any opinions of the laboratory concerning data quality, integrity, accuracy or legal defensibility must be clearly

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documented, and must be noted to be the opinion of the laboratory. This documentation must be contained in the case narrative or conveyed to the client by some written means.

A.4 Ramifications of Unethical Behavior

All employees of *CHESTER LabNet* understand the ramifications of unethical behavior, and by their signatures on this document, attest to knowing the possible outcomes of such behavior. By their signatures on this document, the employees also attest that they are free from any undue pressures or influences which may adversely affect the quality of their work, and will avoid involvement in activities that would diminish confidence in their competency, impartiality, judgment or operational integrity.

A.5 Summary

CHESTER LabNet endeavors to foster an open and non-retaliative corporate atmosphere where all employees are not only encouraged, but also expected, to bring any data integrity issues to the notice of the appropriate personnel. All employees understand the need to produce the highest quality data possible. While management holds the ultimate responsibility for data integrity issues, it is the personal ethics of every employee that supports the production of high quality data, and, thereby, the reputation of the company as a laboratory interested in providing the best data possible to their clients.

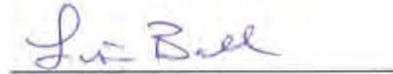
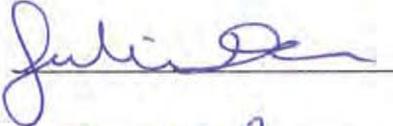
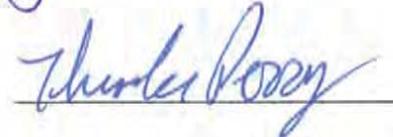
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Personal Ethics and Data Integrity Agreement

The following employees, by their signature, attest to having read, understood and agreed to the most current version of the Personal Ethics and Data Integrity Policy for **CHESTER LabNet**:

<u>Name</u>	<u>Title/Responsibility</u>	<u>Signature</u>	<u>Date</u>
Paul Duda	President Laboratory Director LIMS Administrator Customer Service Technical Director		<u>2/15/16</u>
Sheri Heldstab	QA Officer Conventional Chemistry Technical Director Senior Chemist Health & Safety Officer		<u>2-1-16</u>
Rick Sarver	XRF Technical Director Senior XRF Analyst		<u>2.15.16</u>
Lisa Ball	Project Manager Sample Custodian		<u>2-15-16</u>
Jennifer Schleis	Gravimetry Laboratory Technical Director XRF Analyst Senior Gravimetry Laboratory Technician		<u>2.02.16</u>
Katie Hawks	Chemist Gravimetry Laboratory Technician		<u>2-5-16</u>
Julie Delarue	Chemist XRF Analyst Gravimetry Laboratory Technician		<u>02-09-16</u>
Theodore ("Ted") Perry	Chemist Gravimetry Laboratory Technician		<u>2-4-16</u>

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