Environmental Resources Management

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ERM

Sampling and Analysis Plan (SAP)
Phase II Environmental Site Assessment

Ewa Mill Manager's Mansion and Three-House Camp
Ewa Sugar Mill, Honolulu, Hawaii

City and County of Honolulu
Department of Community Services
Office of Special Project
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09 September 2008

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For EPA use:

Approved by EPA Project Manager: Date:

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Expedited Review? G Yes G No

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Acronyms

ACM	- Asbestos Containing Materials
ACBM	- Asbestos Containing Building Materials
ARARs	- Applicable or Relevant and Appropriate Requirements
bgs	- below ground surface
CCH	- City and County of Honolulu
CLP	- Contract Laboratory Program
COC	- Chain of Custody
COPCs	- Chemicals of Potential Concern
DCS	- Department of Community Services
DEM	- Department of Environmental Management
DQIs	- Data Quality Indicators
DQOs	- Data Quality Objectives
DU	- Decision Unit
EAL	- Environmental Action Level
ERM	- Environmental Resources Management
ESA	- Environmental Site Assessment
ESM	- Ewa Sugar Mill
EWSP	- Ewa Weed and Seed Program
GPS	- Global Positioning System
HDOH	- Hawaii Department of Health
HEER	- Hazard Evaluation and Emergency Response Office
HSP	- Health and Safety Plan
LDC	- Laboratory Data Consultants
mg/L	- milligrams per liter
mg/kg	- milligram per kilogram
MS/MSD	- Matrix Spike/Matrix Spike Duplicate
OERR	- Office of Emergency and Remedial Response
PM	- Project Manager
ppm	- part per million
PRGs	- Preliminary Remediation Goals
QAM	- Quality Assurance Manager
QA/QC	- Quality Assurance / Quality Control
RCRA	- Resource Conservation and Recovery Act
RSD	- Relative Standard Deviation
SAP	- Sampling and Analysis Plan
TCLP	- Toxic Characteristic Leaching Potential
THC	- Three House Camp
USEPA	- U.S. Environmental Protection Agency
USGS	- United States Geological Survey
TMK	- Tax Map Key

1.0 INTRODUCTION

Environmental Resources Management, Inc. (ERM) was retained by the City and County of Honolulu (CCH) Department of Community Services (DCS) to conduct an environmental and hazardous material survey of the former Ewa Plantation Manager's Mansion and the Three House Camp (THC) comprises of three buildings currently occupied by Hale Kipa and the Easter Seal of Hawaii. This study is undertaken under the Environmental Protection Agency (EPA) Brownfield's program. The proposed Phase II Environmental Site Assessment (ESA) builds upon the body of information gathered from historical records, interviews, and a site walk conducted on 5 June 2008. The Manager's Mansion and the THC (subject property) occupy a portion of a 61.3-acre parcel (TMK: 9-1-017:046) owned and maintained by the CCH. The subject property is located to the northwest of the former Ewa Sugar Mill (ESM). The general location of the property and the physiographic features of the surrounding area are shown on Figure 1-1, developed from the United States Geological Survey (USGS) 250K quadrangle for Nanakuli, Hawaii, dated 1983.

The 61.3-acre property was acquired by the CCH in 1990 from the Ewa Sugar Plantation Company with a plan to develop the site as a commercial center and community park. The CCH Department of Design and Construction plans to revive the Manager's Mansion and the THC as a historical site and utilize as a neighborhood gathering place. The subject property is part of an economic master plan for an open market in Ewa Village proposed by the CCH in 2001 (Architects Hawaii, 2001).

This Phase II ESA is a component of a combined Phase I and II ESA for the subject property aimed to determine whether potential contaminants and hazardous materials are present at the site in surface soils and in building materials at levels that could present a hazard to human health or the environment. During the Phase II ESA, incremental surface soil samples from five Decision Units (DUs) will be collected and analyzed. Section 3.1

discusses the chemicals of concern at the site. The DUs have been selected based on historic and current site utilization. Due to the age of the buildings at the site, a hazardous materials survey will also be performed to determine the presence of asbestos, arsenic, and lead-based paint on and within building structures.

1.1 Sampling Area

The soil sampling areas consist of a 5-foot wide continuous strip around the perimeter of the Manager's Mansion and around the Hale Kipa and the Easter Seal buildings. The open areas fronting the Manager's Mansion and the Hale Kipa and Easter Seal buildings will also be sampled for chemicals of potential concern.

1.2 Sampling Area Decision Units

The project site will be divided into five (5) DUs based on historical site utilization and proposed use. The DUs will be designed to cover all building structures within the subject property. The proposed environmental sampling will focus on a hazardous materials survey of building structures and surface soil sampling around the buildings and in open areas within the subject property.

1.3 Responsible Agency

ERM will conduct this Phase II ESA in collaboration with the DCS and the CCH. ERM has developed this Sampling and Analysis Plan (SAP) for the Phase II ESA for review and approval by the USEPA Region 9 and the Hawaii Dept. of Health (HDOH), Hazard Evaluation and Emergency Response (HEER) Office.

1.4 Project Organization

The Project Managers (PMs) for this Phase II ESA are Mr. Paul Kobata and Mr. Timothy Houghton of the CCH. Mr. Kobata and Mr. Houghton will coordinate with EPA Region 9 on the progress of the

project, including approval of the SAP prior to actual fieldwork. Mr. Kobata will also coordinate with the agency currently responsible for the site in order to provide access during the course of the Phase II ESA. Mr. Achie Reyes of ERM will serve as the Technical Field Manager for this study and will be responsible for site mobilization and sample collection, and will serve as the Health and Safety Officer during field operations. Mr. William Cutler of ERM will serve as the Quality Assurance / Quality Control (QA/QC) Manager, overseeing the implementation of the quality control procedures and will coordinate all laboratory analysis and reporting for the project.

Key personnel involved in the project and their phone numbers are listed in Table 1-1.

Table 1-1. Project Organization

Title/Responsibility	Name	Phone Number
EPA Project Manager	Wallace Woo	415-972-3270
Project Manager - DCS	Paul Kobata Timothy Houghton	808-592-2293 808-768-3475
EPA QA Manager	Eugenia McNaughton	415-972-3411
ERM Field Manager	Achie Reyes	808-521-4404
ERM QA Manager	William Cutler	808-521-4404
Data Validation, LDC	Erlinda Rauto	760-634-0437

2.0 BACKGROUND

2.1 Site Area Description

The subject property is located to the east of Renton Road, in the town of Ewa, on the island of Oahu, Hawaii. It is located approximately 1/8 mile northwest of the former ESM. The project site is occupied by four building structures that include the Manager's Mansion and the THC which served as the plantation supervisors' housing. The THC is currently being used by non-profit organizations: the Easter Seals of Hawaii and Hale Kipa, Inc. Hale Kipa provides emergency shelter services for troubled youths and Easter Seals provides adult day health care for people with disabilities and/or special needs.

The subject property is bounded by Renton Road to the west and the Mahiko Park to the east. Across Renton Road is residential housing (Renton Village) and a Post Office. The Ewa Elementary School is located northwest of the subject property across Renton Road. To the south of the Manager's Mansion are the Lanakila Baptist High School and a Child Care Center. Further southeast is the former ESM. The Pacific Ocean is located approximately 2.5 miles south and represents the closest body of surface water. The THC is currently maintained by the CCH Department of Facility Management. A site location map of the subject property is shown in Figure 1-2.

2.2 Operational History

The THC and the two-story colonial style Manager's Mansion, were built in 1925 and abandoned in the early 1970s after sugar operations ended. In 1995, the subject property was acquired by the CCH in 1995 and became listed under the National Register of Historic Places.

The Manager's Mansion was regularly used as a neighborhood gathering place until 2004 when it was closed to the public due to safety concerns. The Ewa Villages Association currently occupies a ground floor office space on the northeast corner of the Manager's Mansion. The THC used to house plantation supervisors and is currently occupied by Hale Kipa, Inc. and Easter Seals of Hawaii.

Historical agricultural practices in the area included the use of pesticides containing arsenic and mercuric compounds. Some of the chemicals reportedly applied on sugarcane fields in Hawaii include sodium arsenite, amthryn, diuron, atrazine, 2,4-D, 2,4,5-TP and tilt. Often times these same chemicals were used in home gardens by plantation workers. Analytical data from previous investigations of sugar mills in Hawaii (Kekaha Sugar Mill Site Investigation, TEC 2005) and plantation camps (HDOH, 2007) show that former sugarcane soils maybe contaminated with arsenic, lead, benzo(a)pyrene, and other various pesticides. In addition to former agricultural use, the THC and the Manager's Mansion are suspected to contain lead-based paint.

2.3 Previous Investigations/Regulatory Involvement

A lead-based paint survey on one of the three building at the THC was conducted in April 2001, revealing the presence of lead-based paint in both the exterior and interior of the structure (WEC, 2001). No previous survey or environmental assessment for the Manager's Mansion and Easter Seals buildings are available at this time.

2.4 Environmental and/or Human Impact

Based on historical site utilization and the limited study on lead-based paint at the THC, the potential for elevated levels of lead, arsenic and pesticides in soils and the presence of

asbestos and lead-based paint at the THC and former Manager's Mansion are the primary concerns at the site.

Some of the health effects of exposure to arsenic are nausea and vomiting, damaged blood vessels, abnormal heart rhythm and skin lesions. Ingestion of a very high level of arsenic can cause death. Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer of the lungs, bladder, liver, kidneys and prostate. Inhalation of inorganic arsenic can increase the risk of lung cancer.

Chronic exposure to lead may result in lead encephalopathy, which includes symptoms such as headache, vomiting, delirium or hallucinations, convulsions, coma, death from exhaustion and respiratory failure. This is especially prevalent in children, with typical symptoms being weight loss, weakness, and anemia.

3.0 PROJECT DATA QUALITY OBJECTIVES

3.1 Project Task and Problem Definition

Based on the THC and former Manager's Mansion historical site utilization and the previous study (WEC, 2001), soils at the THC could potentially be impacted by arsenic, lead and/or pesticides, while the building structures may contain asbestos, lead-base paint, and arsenic in Canec wall and ceiling board. The primary objective of this Phase II ESA is to determine the presence of these hazardous materials in building structures and whether contaminants may be present in site soils at levels that could present a potential human health or environmental risk. To achieve this objective, a lead and asbestos survey of the building structures will be conducted and collection and analysis of soil samples will be performed for five DUs within the subject property.

Sample analytical results will be screened against: 1) USEPA Region 9 Preliminary Remediation Goals (PRGs) for both industrial and residential exposure scenarios, and 2) HDOH Environmental Action Levels (Residential exposure scenario) where groundwater is a current or potential source of drinking water (Appendix A: Table A, HDOH, 2005). Generally, the HDOH EALs have equivalent or lower numerical concentrations than the USEPA residential PRGs. For the residential screening, the lower of the EAL or the residential PRG will be utilized. Table 3-1 lists all chemicals of potential concern in soils at the project site and the corresponding HDOH EALs and USEPA PRGs. Also included in the table are the Laboratory Reporting Limits for the analytes under investigation. The USEPA Region 9 PRGs and HDOH EALs documents are included as Appendix A. Screening will allow categorization of detected compounds into one of four categories with concentrations either: 1) below residential screening levels, 2) above residential but below industrial (PRG) levels, 3) above industrial screening levels, or 4) no screening levels available.

Sample results at or below residential or industrial screening levels will indicate that human health and environmental risks are unlikely for that particular exposure scenario. Analytical results exceeding the regulatory screening levels will be considered as impacts that could pose a potential risk to humans, and will be evaluated in consultation with USEPA and HDOH. Any additional studies or potential remedial actions that may result from the evaluation of a potential exceedence of a screening level cannot be forecasted at this stage. Arsenic will be screened in accordance with HDOH Guidance issued by HDOH (2006b).

The USEPA defines friable ACM as materials that contain more than 1% asbestos and can be "crumbled, pulverized, or reduced to powder by hand pressure when dry." The U.S. government defines "lead-based paint" as any "paint or surface coating that contains lead equal to or exceeding one milligram per square centimeter (1.0 mg/cm2) or 0.5% by weight".

3.2 Data Quality Objectives (DQOs)

Based on the primary study objective described in the prior section, data quality objectives have been developed. The fundamental data quality objectives are:

1. To collect a sufficient number of representative samples such that the potential for chemical impacts to soils and/or building structures above screening levels, if present, can be identified and quantified;

2. Select appropriate target compounds such that specific chemicals of potential concern are evaluated; and

3. Utilize appropriate analytical methods and reporting limits such that target compounds are quantified with reporting limits lower than the corresponding screening levels (PRGs/EALs).

In order to achieve DQO 1, five (5) DUs have been selected based on historical and current site utilization as shown in Figure 1-3. At each DU, surface soils will be sampled using a multi-increment sampling technique as described in Section 4. This sampling procedure, applied at five DUs, is a conservative and representative approach to achieving DQO 1.

DQO 2 will be addressed by analyzing for a broad suite of target compounds that are the most likely contaminants based on the previous land use (agricultural), presence of known hazardous materials, and observed impacts. Analytical suites for pesticides and metals are considered sufficient to assess potential impacts of site soils. Section 5 of this SAP describes the analytical methods and target compounds in greater detail.

Finally, DQO 3 will be addressed by ensuring that the laboratory reporting limits for target compounds are sufficiently sensitive (low enough) to allow comparison of concentrations to screening levels.

In addition, to ensure the integrity of the sample analytical data, quality assurance/quality control (QA/QC) field and laboratory procedures will be followed. QA/QC procedures will include the following:

- Cleaning or decontaminating all reusable field equipment prior to moving from one sampling location to the next;
- DU01 will be multi-increment sampled three times, in order to generate replicate field samples and will be submitted to the laboratory as blind samples for determination of field sampling variability of a single selected analyte (lead).
- Three samples per every homogenous area will be sampled for asbestos;
- A duplicate sample for lead-based paint will be taken on 10% (or a fraction thereof) of all samples;
- Collecting one equipment rinsate sample per day to determine the effectiveness of the decontamination

procedure on reusable field equipment;

- Performing matrix spike and matrix spike duplicate (MS/MSD) analysis on a select soil sample;
- Properly labeling, handling, and storing all collected samples;
- Documenting all field observations and measurements in a dedicated bound field log book; and
- Documenting all sample information, including requested analysis on a Chain-of-Custody form (COC).

3.3 Data Quality Indicators (DQIs)

There are three key data quality indicators:

1. Equipment rinsate sampling and analysis.
2. Laboratory QC samples (MS/MSD).
3. Reporting limits.

One equipment rinsate sample will be collected for quality control purposes. The rinsate water will be generated using high-performance liquid chromatography (HPLC) grade water poured over decontaminated or pre-cleaned sampling equipment and collected in appropriate sample containers. The collected rinsate sample(s) will be analyzed for the same analytical parameters as the soil samples.

To demonstrate the quality of the sample preparation and analysis by the laboratory, the precision and accuracy of the results of the analytical procedures will be monitored through the analysis of its quality control samples. These QC samples include the MS/MSD, and laboratory control samples.

In addition, as long as there are no major matrix interferences when performing these analyses, the laboratory is expected to be able to report compound concentrations below corresponding screening levels for all target compounds.

3.4 Data Review and Validation

The analytical laboratory will provide analytical results and initial data qualifiers for all soil and bulk and QC samples. Tier 1A data validation will be conducted on all laboratory results by Ms. Erlinda Rauto of Laboratory Data Consultants, Inc. (LDC). Ms. Rauto is a Senior Chemist with USEPA CLP laboratory credentials and will oversee the validation process for this Phase II ESA. This involves a review of the laboratory QC procedures to determine if they meet the USEPA CLPAS acceptance criteria and determination of whether the data contains any biases. All sample results will undergo a Tier 1A review and at least 10% of the data will undergo a more thorough Tier 3 validation process. The Tier 3 data validation aims to identify significant and noticeable data quality issues/deficiencies and indicates whether the quality of the data is sufficient for the intended use. As a contaminant of major concern, the analytical results of soil for total lead for DU01 will be evaluated using the Tier 3 data validation procedure.

Typical validation checks include instrument calibration, laboratory blanks, duplicates, matrix spikes and matrix spike duplicates (MS/MSD), surrogates, holding times, detection and quantitation limits, and target compound identification. Data that is unusable or only usable under certain circumstances will be assigned an appropriate data qualifier (e.g., "R" or "J"). ERM will finalize all data qualifiers.

LDC's evaluation of the analytical data will be provided along with reporting of the study results to USEPA Region 9 QA office and to HDOH HEER office. USEPA Region 9 and HDOH will determine whether or not the data is acceptable given its intended purpose, comparing the results and comments from the data validator. Qualified results indicate that adequate QC was maintained during all sampling and analytical activities, and may be used without further inquiry. If any data is R-qualified, USEPA and HDOH will consult with the ERM QA manager to determine data usability.

3.5 Data Management

Data management will commence prior to initiating the field investigation. Each soil sample collected will be recorded in a bound field logbook that describes the sample location, soil type, depth, and provides a cross-reference to the sample ID, date and time of collection, and chain-of-custody. All laboratory results, including electronic deliverables, will be reviewed by the ERM QA manager to ensure receipt of all requested analytes and again be crosschecked with the chain-of-custodies (COCs). Analytical results, including field notes, will be submitted to LDC as part of the data validation process. Data will be tabulated in electronic spreadsheets and again checked to ensure proper entry before use in reporting.

3.6 Assessment Oversight

The QA manager for this Phase II ESA, Mr. William Cutler, will be in constant communication with the Technical Field Manager (Mr. Achie Reyes) during field operations to ensure that all sample methods and documentation are being practiced. He will ensure that all necessary field forms have been completed, including the QA/QC form. In addition, any modifications to the SAP will be fully documented and approved by Mr. Cutler. Site visits by the QA manager will be performed during the sampling program to ensure proper execution and adherence to the SAP. Finally, ERM senior technical staff will perform a peer review of the Final Report.

Table 3-1
Chemicals of Concern with
Reporting Limits and Screening Levels (mg/kg)
Matrix = Soil

Analysis	Method	Contaminant	Test America RL/MDL	HDOH EALs [1]	EPA PRGs (res.) [2]	EPA PRGs (ind.) [3]
Metals	EPA 6010	Arsenic	1.0/0.167	22[4]	0.39	1.6
		Lead	10/0.200	200	400	800
Pesticides	EPA 8081	4,4'-DDE	0.004	2.4	1.7	7
		4,4'-DDT	0.004	1.7	1.7	7
		Aldrin	0.004	0.029	0.029	0.1
		alpha-BHC	0.004		0.09	0.36
		beta-BHC	0.004		0.32	1.3
		Chlordane	0.033	1.6	1.6	6.5
		delta-BHC	0.004			
		Endosulfan I	0.004	0.018	370	3700
		Toxaphene	0.05	0.4	0.44	1.6
		Endosulfan sulfate	0.004			
		Endrin	0.004	0.01	180	1800
		Endrin aldehyde	0.004			
		Endrin ketone	0.004			
		gamma-BHC (Lindane)	0.004	0.098	0.44	1.7
		Heptachlor	0.004	0.11	0.11	0.38
		Heptachlor epoxide	0.004	0.053	0.053	0.19
		Methoxychlor	0.02	19	310	3100
		Dieldrin	0.004	0.0052	0.03	0.11
		alpha-Chlordane	0.004			
		gamma-Chlordane	0.004			

1. Hawaii Department of Health Environmental Action Levels for soil where groundwater is a current or potential source of drinking water and is more than 150m to surface water body. (May 2005)
2. EPA Region IX PRGs for residential soil exposure. (October 2004)
3. EPA Region IX PRGs for industrial soil exposure. (October 2004)
4. Soil Action Levels and Categories for Bioaccessible Arsenic. HDOH, 2006

4.0 SAMPLING RATIONALE

For this Phase II ESA, only surface soil samples and no subsurface soil will be collected, since potential chemical impacts will have been introduced to the top of the soil column (as opposed to subsurface releases, e.g. USTs). The subject property will be subdivided into five (5) Decision Units (DUs) based on physical geography, historical site utilization and proposed future uses of the site. These decision units are shown in Figure 1-3 and described as follows:

1) Perimeter of Manager's Mansion (DU-01) - The Manager's Mansion and the area covering a 5-foot perimeter around the building structure. Ten surface soil samples at 0 to 6 inches below ground surface (bgs) will be collected on each face of the building for a total of 40 sample increments. The sample increments will be composited and homogenized prior to collecting a representative sample for laboratory analysis. Suspected asbestos containing material (ACM) and lead-based paint samples will be collected from the exterior and interior of the Manager's Mansion. ⇒ Sieve?

2) Perimeter of Easter Seals Houses (DU-02a and DU-02b) - The Easter Seal of Hawaii occupies two of the three houses in the THC. This DU includes the building structure and the area covering a 5-foot perimeter around each of the Easter Seals House. Ten surface soil samples at 0 to 6 inches below ground surface (bgs) will be collected on each face of the building for a total of 40 sample increments. The sample increments will be composited and homogenized prior to collecting a representative sample for laboratory analysis. Suspected asbestos containing material (ACM) and lead-based paint samples will be collected on the interior and exterior of the buildings.

3) Perimeter of Hale Kipa House #3 (DU-03) - includes the building structure and the area covering a 5-foot perimeter around the Hale Kipa House. The same number of sample increments will be collected to prepare a multi-incremental sample as for DU-02. The sample increments will be composited and homogenized prior to collecting a representative sample for laboratory analysis. Suspected asbestos containing material (ACM) and lead-based paint samples will be collected from the interior and exterior of the building.

4) Open Area around Manager's Mansion (DU-04) - includes the open area on the west and north section of the Manager's Mansion, excluding driveways. A 40-increment multi-increment sample will be collected for DU-04.

5) Open Area around Hale Kipa and Easter Seals (DU-05) - includes the open area to the west of the Easter Seals and Hale Kipa house fronting Renton Road. A 40-increment multi-increment sample will be collected for DU-05. Sampling area does not include driveways and the paved parking lot.

DU-01 (Manager's Mansion) surface soil is suspected to be impacted by lead (and possible chlordane) and thereby will be used for triplicate replication (sampled and analyzed three times), in order to generate three similar but uniquely collected samples. The triplicate samples will be analyzed separately for total lead to develop a relative standard deviation (RSD) that will describe the degree of variability inherent in sampling and laboratory protocols.

[$RSD = 100 \times S \div \bar{x}$; where S is standard deviation and $\bar{x}$ is average]

Based on results of previous site investigations using incremental soil sampling procedures (ERM, 2005; Cutler, 2007),

the RSD for field replicate samples (triplicate) were less than 35%. Hence the DQO control limit for the field sample replicates for this Phase II ESA is set at +/- 35% RSD. If the RSD exceeds +/- 35%, this signifies a process and/or control failure, deeming the results to be unacceptable and unfit for regulatory decision making.

It should be recognized that the analytical results for the field sampling replicates contain the combined variability inherent in the field sampling procedures, sample preparation, and laboratory sub-sampling and analytical procedures.

4.1 Surface Soil Sampling

A two-dimensional systematic random multi-increment sampling procedure will be implemented for this Phase II ESA (Ramsey, 2005). For DU-01, DU-02a and b, and DU-03, ten surface soil samples at 0 to 6 inches below ground surface (bgs) will be collected on each face of the building within an area covering a 5-foot perimeter around each building structure for a total of 40 sample increments per building. The sample increments will be composited and homogenized prior to collecting a representative sample for laboratory analysis. For DU-04, 21 incremental sampling lots will be laid out to encompass the whole DU prior to collecting incremental soil samples as shown in Figure 1.4. Each incremental sampling lot will be sub-divided to 9 equal parts and a representative soil sample collected from sub-cell #5. The same procedure will be undertaken at DU-05 with 24 incremental sampling lots.

All soil sample increments will be collected from a depth of 0 to 6 inches bgs. Each sampling location will be cleared of debris, vines and dead surface vegetation and hand-excavated with a shovel or pick to loosen the soil. A shovel or spade will be wedged into the soil and levered to expose a portion of the soil column approximately 0-6 inches bgs. A sample increment will be

collected from the exposed soil "face" using pre-cleaned stainless steel trowels. Each collected sample increment from a DU will be placed along with other previously collected increments into a clean glass bowl and homogenized with stainless steel trowels. Large rocks, sticks and other debris will be selectively removed from the sample. The 30 sample increments will be composited and homogenized in the field to create a single representative "average" sample. Field personnel shall wear clean disposable nitrile gloves when collecting samples. Soil samples will be identified as DU-01 through DU-05 and labeled accordingly. DU-06 and DU-07 will be used for the triplicate samples.

In the event that unforeseen circumstances result in some sampling locations becoming inaccessible or result in the identification of other sampling locations with a higher potential for identifying hazardous constituents, modifications to the sampling locations will be made in the field. In this case, field personnel will use their best professional judgment. Any deviations to this SAP will be documented in the field logbook and described in the ESA report.

4.2 Sediment Sampling

No sediment sampling will be conducted for this Phase II ESA.

4.3 Water Sampling

No surface and groundwater sampling will be conducted for this Phase II ESA.

4.4 Other Sampling

Other sample media such as arsenic in canec, ACM and lead-based paint chips will be collected for this Phase II ESA.

5.0 REQUEST FOR ANALYSES

A total of seven (7) surface soil samples (DU-01 to DU-07), and an equipment rinsate will be transported to Test America Laboratory in Aiea, Hawaii (Oahu) for analysis. The requested analytical parameters for each surface soil sample are detailed in Table 5-1 on a standard turn-around-time (TAT). Bulk samples for asbestos and lead-based paint analysis will be labeled to indicate the source and location where the sample was collected. Photos will be taken to document sample collection including a layout of the building floor plan to indicate the location of the bulk samples for the hazardous materials survey.

5.1 Analyses Narrative

All soil samples will be analyzed for pesticides, total arsenic, and total lead. An analysis of the TCLP-lead will be done if the soil total lead result is greater than 80 ppm and bioaccessible arsenic will be done when the results of soil total arsenic is above 22 ppm (HDOH EALs). All analysis will be done according to methods provided in Table 5-1. Other information regarding container types, sample volumes, preservatives, special handling, and analytical hold times for each parameter are also included in this table.

5.2 Analytical Laboratory

Test America Laboratory will be utilized for all soil sample analysis for this Phase II ESA. Test America has a rigid quality control/quality assurance procedure to ensure quality sample results.

This procedure includes the following quality control samples:

Bottle Blanks - consisting of extraction fluid only, are run through the complete procedure at a frequency of 1 in 20 samples.

Duplicate samples - consisting of duplicate sample extractions, are performed on 1 in 10 samples.

Matrix Spike - a sub-sample of each material used will be spiked at concentrations of 10 mg/L lead and 1 mg/L arsenic and run through the extraction procedure (frequency of 1 in 10 samples).

Control Soil - National Institute of Standards and Testing (NIST) Standard Reference Material (SRM) 2711 will be used as a control soil, and analyzed at a frequency of 1 in 20 samples.

ERM has determined that Test America's QA/QC program and DQOs will satisfy the project analytical objective (DQO 3). Appendix B shows the Standard Operating Procedures for Test America Analytical Laboratory.

Asbestos and lead-based paint analyses will be conducted by NVL Labs, who hold both AIHA and NVLLAP accreditations.

Table 5-1
Request for Analytical Services
Matrix = Soil

ANALYSES REQUESTED						ORGANIC	INORGANIC		
ANALYSES AND METHODS						Pesticides EPA 8081	Total Arsenic and Total Lead	TCLP Lead EPA 1311	Bio-accessible Arsenic
PRESERVATIVES						Chill 4°C	None	None	None
ANALYTICAL HOLDING TIME						Hold <14 days to extraction, 40 days after extraction	Hold <180 days (28 days for Hg)	Hold <180 days (28 days for Hg)	Hold <180 days
CONTRACT HOLDING TIME						Hold <10 days to extraction, 40 days after	Hold <35 days (26 days for Hg)	Hold <35 days (26 days for Hg)	Hold <35 days
NUMBER OF SAMPLES X NUMBER OF SAMPLE CONTAINERS						Containers/Analysis	Containers/ Analysis	Containers/ Analysis	Containers/ Analysis
Sample Number OBGP-	Sample Location	Depth (bgs)	Special Designation	Conc L/M		1 x 8 ounce wide mouth glass jar	1 x 8 ounce wide mouth glass jar	1 x 8 ounce wide mouth glass jar	1 x 8 ounce wide mouth glass jar
DU-01	MM	0-6"			X	1	1	1	
DU-02	Easter Seal	0-6"			X	1	1	1	
DU-03	Hale Kipa	0-6"		X		1	1	1	
DU-04	Open area THC	0-6"	MS/MSD		X	1	1		1
DU-05	Open area MM	0-6"			X	1	1		1
THV-06	MM	0-6"	DU-01 Duplicate		X	1	1		
THV-07	MM	0-6"	DU-01 Triplicate		X	1	1		
EqR 01	Equipment Rinsate		QC	X		1			
Total						7	6	3	2

6.0 FIELD METHODS AND PROCEDURES

This section presents the field investigation procedures for the soil sampling effort. Proper sample storage and shipping procedures are discussed in Sections 7 and 9, respectively.

6.1 Field Equipment

6.1.1 List of Equipment Needed

The following equipment will be used for obtaining surface soil samples:

Equipment	Fabrication	Dedicated
Digging bar /pick/ shovel/ soil probe	Hardened Steel	No
Hand Trowels	Stainless Steel	No
Brush (decon)	Plastic	No
Basin (decon)	Plastic	No
Spray bottles (decon)	Plastic	No
Bowl	Glass	No

6.1.2 Calibration of Field Equipment

The field equipment (Global Positioning System) to be used is factory calibrated.

6.2 Field Screening

There will be no field screening conducted for this sampling plan.

6.3 Soil

6.3.1 Surface Soil Sampling

Please see Section 4.1 for surface soil sampling discussion.

6.3.2 Subsurface Soil Sampling

No subsurface sampling will be collected for this Phase II ESA.

6.4 Sediment Sampling

No sediment sampling will be collected for this Phase II ESA.

6.5 Water Sampling

No surface water and groundwater samples will be collected for this Phase II ESA. The only water samples to be collected are the equipment rinsate.

6.6 Other

Other sample media such as asbestos containing materials (ACM) and lead-based paint chips will be collected for this Phase II ESA.

6.7 Decontamination Procedures

Decontamination of sampling equipment must be conducted consistently to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated soil or water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to moving from one DU to the next. All sampling devices used, including trowels and picks, will be cleaned or decontaminated according to USEPA Region 9 recommended procedures as follows:

- Non-phosphate detergent and tap water wash, using a brush if necessary

- Tap-water rinse
- 0.1 N nitric acid rinse
- Deionized/distilled water rinse
- Pesticide-grade solvent (reagent grade hexane) rinse in a decontamination bucket
- Deionized/distilled water rinse (twice)

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

7.0 SAMPLE CONTAINERS, PRESERVATION AND STORAGE

Sample container numbers, volumes, and materials are listed in Table 5-1. The containers will be pre-cleaned and will not be rinsed prior to sample collection. Chemical preservatives, if required, will be added by Test America's Aiea, HI Laboratory prior to shipment of the samples to mainland laboratories.

7.1 Soil Samples

Soil samples to be analyzed for pesticides and RCRA-8 metals will be homogenized and transferred from the sample-dedicated homogenization bowl into clean, glass jars using a stainless steel trowel. Samples will be chilled in an ice cooler to 4°C immediately upon collection in the field.

7.2 Sediment Samples

No sediment sampling will be collected for this Phase II ESA.

7.3 Water Samples

No surface water and groundwater sample will be collected for this Phase II ESA except for equipment rinsate.

7.4 Other Samples

Other sample media such as ACM and lead-based paint chips will be collected for this Phase II ESA.

8.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples during the Phase II ESA, the ERM sampling team will generate different types of potentially contaminated investigation-derived waste (IDW) that include the following:

- Used personal protective equipment (PPE);
- Disposable sampling equipment; and
- Decontamination fluids.

The USEPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides the guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

- Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.

- Decontamination fluids that will be generated in the sampling event will consist of diluted nitric acid, pesticide grade solvent, deionized water, residual contaminants, and water with non-phosphate detergent (Alconox™). The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground. Pesticide

grade solvents will be allowed to evaporate from the decontamination bucket. The nitric acid will be diluted and neutralized with sodium hydroxide and tested with pH paper before pouring onto the ground.

9.0 SAMPLE DOCUMENTATION AND SHIPMENT

9.1 Field Notes

A dedicated field logbook will be used to document vital project information. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks are bound with consecutively numbered pages, and each page will be dated and the time of entry noted. All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology that might prove ambiguous.

9.1.1 Field Logbooks

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

- Sample location and description;
- Site or sampling area sketch showing sample location and measured distances;
- Sampler's name(s);
- Date and time of sample collection;
- Designation of sample as composite or grab;
- Type of sample (soil, sediment or water);
- Type of sampling equipment used;
- Field instrument readings and calibration;
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.);
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for water: clear water with strong ammonia-like odor);

- Sample preservation;
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and COC form numbers;
- Shipping arrangements (overnight air bill number); and
- Name of recipient laboratory.

In addition to the sampling information, the following specific information will also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities;
- Time of arrival/entry on site and time of site departure;
- Other personnel or visitors on site;
- Summary of any meetings or discussions with tribal, contractor, or federal agency personnel;
- Deviations from sampling plans, site safety plans, and QAPP procedures;
- Changes in personnel and responsibilities with reasons for the changes; and
- Level of safety protection.

9.1.2 Photographs

Photographs will be taken at the sampling locations and at other areas of interest on site or in the sampling area. They will serve to verify information entered in the field logbook. The digital camera for this sampling event will be equipped with a date/time stamp. Other information will be written in the logbook or recorded in a separate field photography log:

- Location and weather conditions;
- Description of the subject photographed; and
- Name of person taking the photograph.

9.2 Labeling

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: sample location, date of collection, analytical parameter(s), and method of preservation. Every sample, including samples collected from a single location but being used as duplicate and triplicate samples, will be assigned a unique sample number.

9.3 Sample COC Forms and Custody Seals

A chain of custody (COC) form will accompany all sample shipments for analyses. Form(s) will be completed and sent with the samples to each laboratory with each shipment. If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The COC form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of ERM. The sampling team leader or designee will sign the COC form in the "relinquished by" box and note the date, time, and air bill number.

The sample numbers for all rinsate samples, reference samples, laboratory QC samples, and duplicates will be documented on this form (see Section 10.0). A photocopy will be made for ERM's master files.

A self-adhesive custody seal will be placed across the lid of each sample. The shipping containers in which samples are stored (a sturdy picnic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

9.4 Packaging and Shipment

All sample containers will be placed in a sturdy picnic cooler or ice chest. The following outlines the packaging procedures that will be followed for low concentration samples.

1. Frozen Blue-ice will be used instead of regular ice to prevent leakage during transport.

2. The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment.

3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.

4. Secure bottle/container tops with clear tape and custody seal all container tops.

5. Affix sample labels onto the containers with clear tape.

6. Wrap all glass sample containers in bubble wrap to prevent breakage.

7. Seal all sample containers in heavy-duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.

8. Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.

9. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Vermiculite should also be placed in the cooler to absorb spills if they occur.

10. Regular ice will be used to immediately chill the samples to the correct holding temperature.

11. Each cooler will be securely taped shut with a strapping tape, and custody seals will be affixed to the front, right and back of each cooler.

Records will be maintained at ERM's Honolulu office and will contain the following information:

- Name and location of the site or sampling area;
- ERM project number;
- Total number(s) by estimated concentration and matrix of samples shipped to each laboratory;
- Carrier, air bill number(s), method of shipment;
- Shipment date and when it should be received by lab;
- Irregularities or anticipated problems associated with the samples; and
- Whether additional samples will be shipped or if this is the last shipment.

10.0 QUALITY CONTROL

The QC samples for this Phase II ESA will include the laboratory blanks, blank spikes, surrogates, MS/MSD, and laboratory control samples.

10.1 Field Quality Control Samples

Equipment rinsate(s) will be collected from non-disposable equipment on a daily basis. No trip blanks and field blanks will be done for this Phase II ESA.

10.1.1 Assessment of Field Contamination (Blanks)

No field blanks are planned for this program.

10.1.1.1 Equipment Blanks

An equipment rinsate will be generated once a day during the Phase II ESA sampling activiy.

10.1.1.2 Field Blanks

No field blanks will be collected for this Phase II ESA.

10.1.1.3 Trip Blanks

No trip blanks will be collected for this Phase II ESA.

10.1.1.4 Temperature Blanks

For each cooler that is shipped or transported to an analytical laboratory a 40 mL VOA vial will be included that is marked temperature blank. This blank will be used by the sample

custodian to check the temperature of samples upon arrival at the laboratory.

10.1.2 Assessment of Field Variability (Field Duplicate Samples)

A triplicate field sample is planned for this Phase II ESA. Due to site accessibility and high probability of contamination, DU-01 (Manager's Mansion) will be selected for triplicate replication (sampled three times), in order to generate three similar but uniquely collected samples.

10.2 Background Samples

Upon further consideration, no background sample will be collected during this investigation because either the chemicals of concern for this site do not have significant background levels on the island of Oahu (pesticides) or natural background concentrations are know to be below applicable screening levels (arsenic and lead).

10.3 Field Screening and Confirmation Samples

No field screening will be done and no confirmation samples will be collected for this Phase II ESA.

10.4 Laboratory Quality Control Samples

The MS/MSD laboratory control sample will be collected from DU-04 (THC Open Area). Based on prior site utilization, DU-04 is suspected to have low to moderate level of contaminants. The designation "Laboratory QC" will be written on the DU-04 sample label and the COC record to alert the laboratory as to which sample is to be used for QC analysis. A routinely collected soil sample (a full 8-oz sample jar) contains sufficient volume for both routine sample analysis and additional laboratory QC

analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

The laboratory will be alerted as to which sample is to be used for QC analysis by a notation on the sample container label and the COC record or packing list.

At a minimum, one laboratory QC sample is required per 14 days of sampling or one per 20 samples (including blanks and duplicates), whichever is greater. In case the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated.

11.0 FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate and if possible, the ERM QA manager and the USEPA QA Office will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

12.0 FIELD HEALTH AND SAFETY PROCEDURES

Field personnel will adhere to the health and safety procedures detailed in the attached Site-Specific Health and Safety Plan. It is anticipated that all fieldwork will be performed in Level D modified PPE that will include: safety glasses, steel toed boots, and nitrile and leather gloves. Potential hazards that may be encountered include heat stress, slips, trips, falls, and exposure to insects. The nearest hospital is St. Francis West Medical Center located at 91-2141 Fort Weaver Road, Ewa Beach, HI. An emergency contact list and emergency route map is included as part of the Health and Safety Plan for the project. The ERM field team will have current certifications for First Aid, and at least one member of the team will have a cellular phone. All emergency response services will be reached by calling 911.

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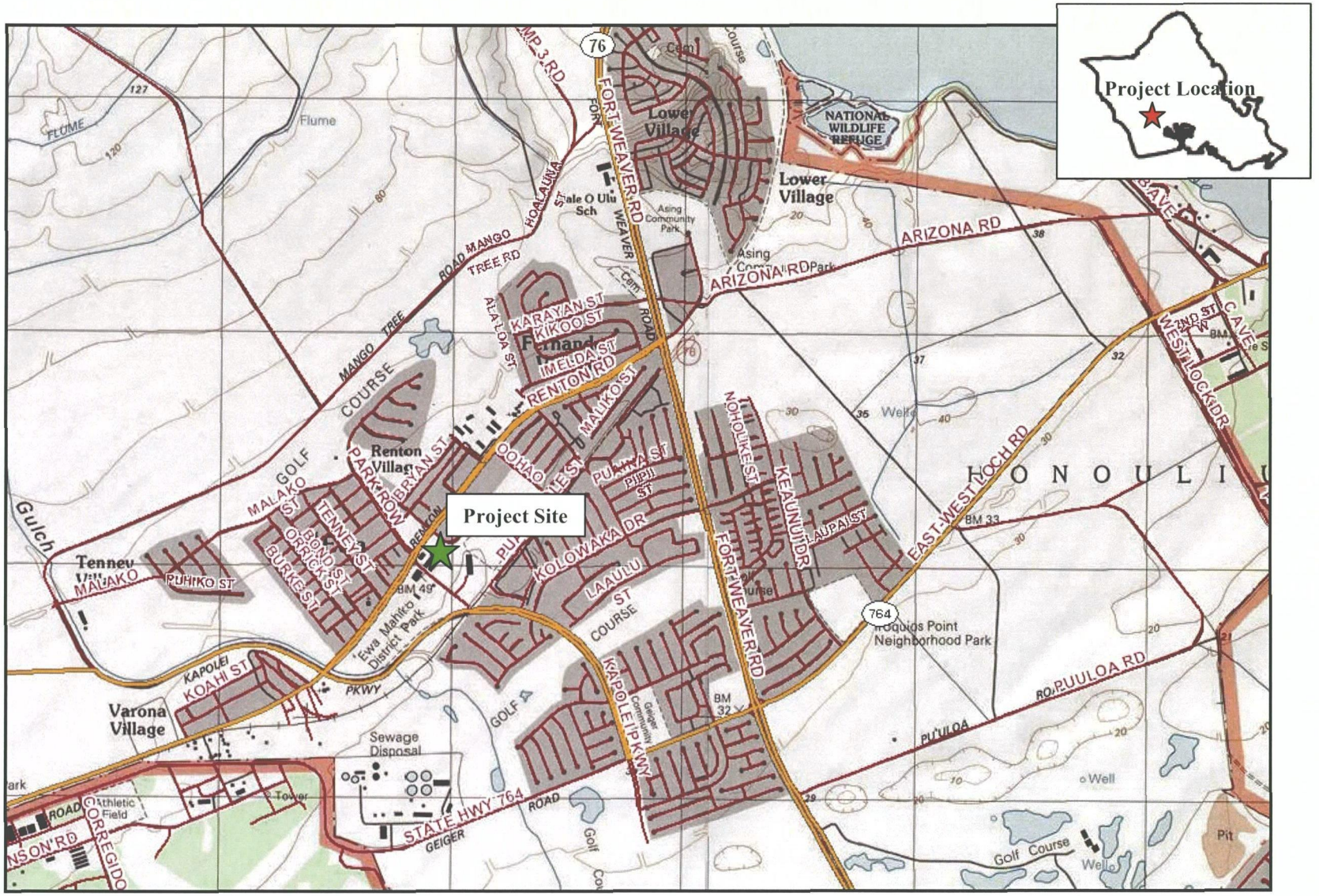

ERM
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Figure 1-1. Project Location Map
Manager's Mansion & Three House Camp

TMK: 9-1-017: 046 (portion)

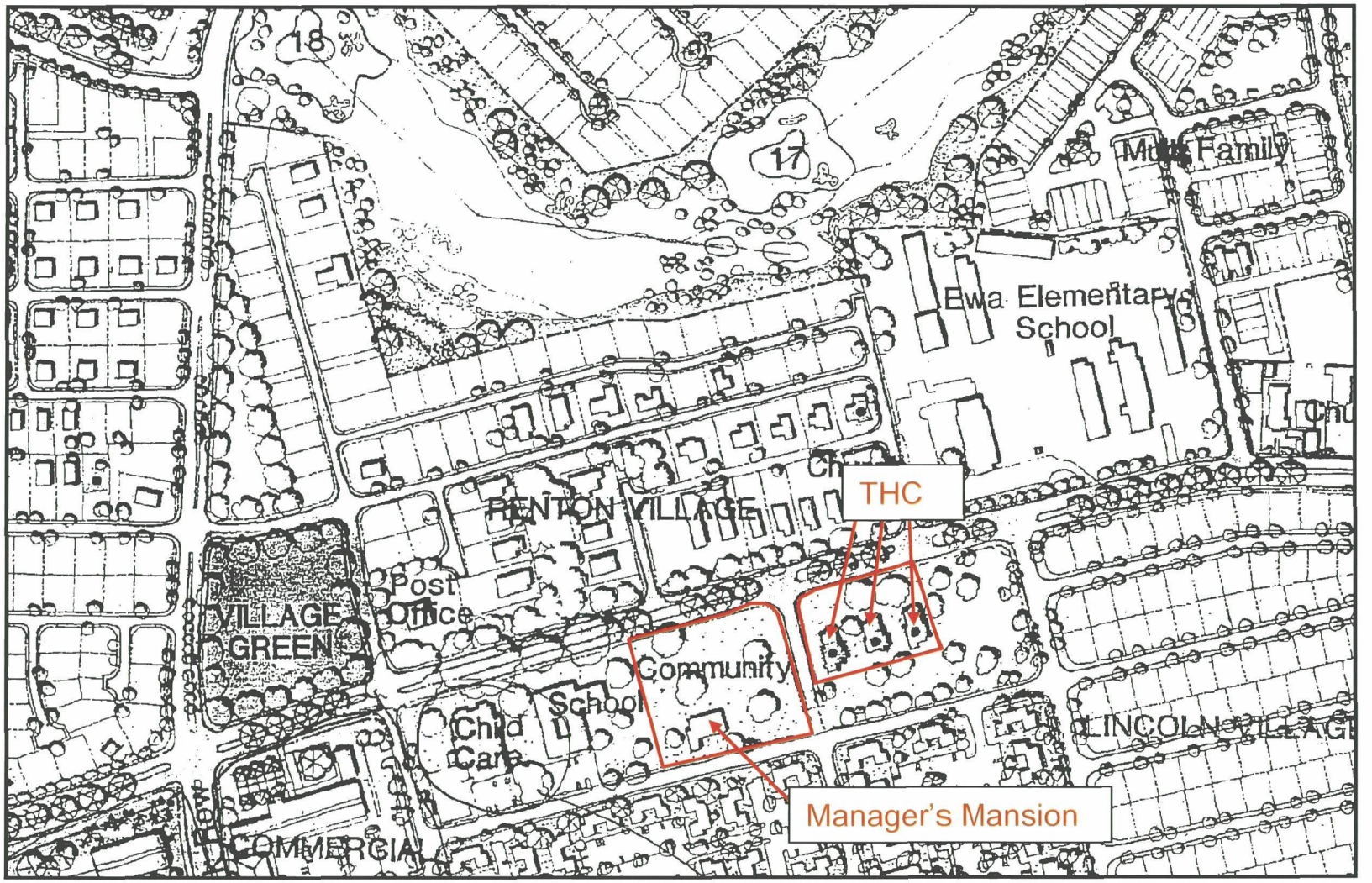

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Figure 1-2. Site Map
Manager's Mansion & Three-House Camp

TMK: 9-1-017: 046 (portion)

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Figure 1-3. Sampling Location Map
Decision Units

TMK: 9-1-017: 046 (portion)

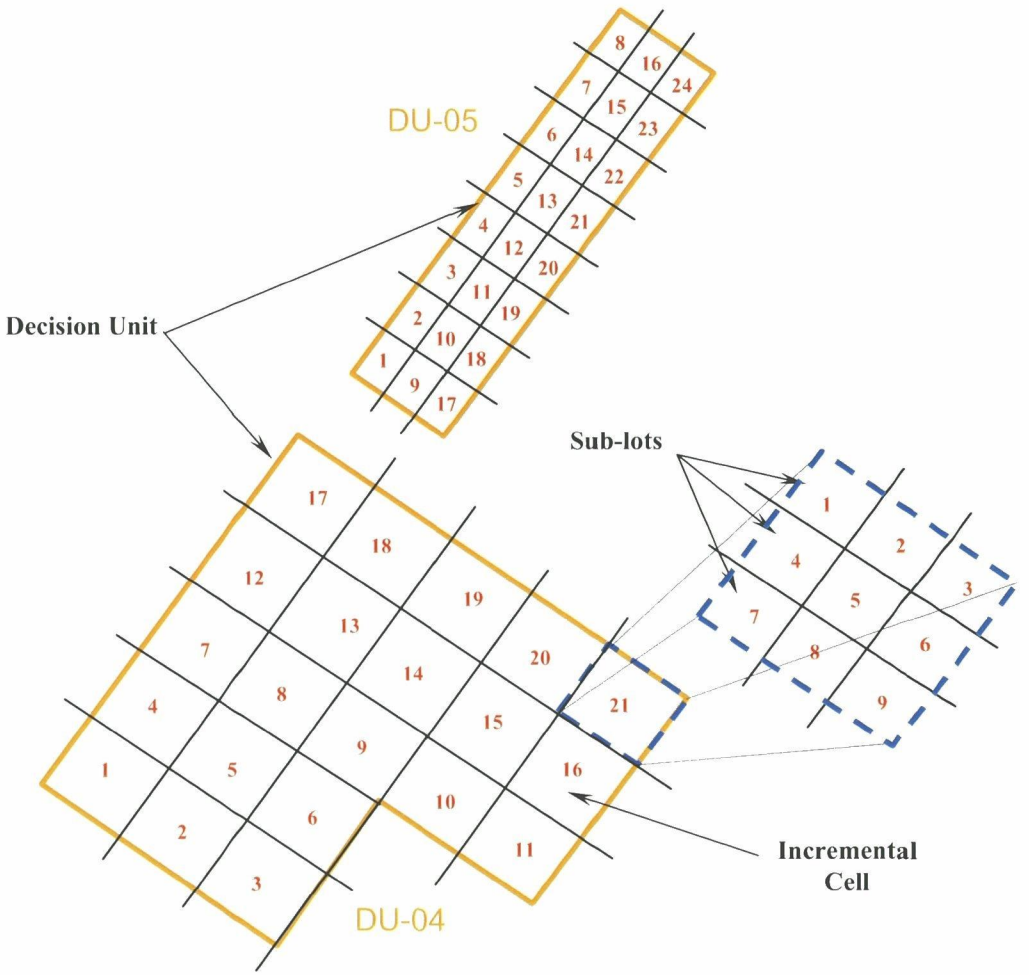

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Figure 1-4. Incremental Cells and Sublot (DU-04 and 05)
Manager's Mansion & Three-House Camp Open Area

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Figure 1-5. Exterior of Manager's Mansion

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Figure 1-6. Inside Manager's Mansion

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Figure 1-7. Hale Kipa Building

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Figure 1-8. Easter Seals of Hawaii

APPENDIX A

USEPA REGION 9 PRELIMINARY REMEDIATION GOALS

AND

HAWAII DEPARTMENT OF HEALTH ENVIRONMENTAL ACTION LEVELS

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils / CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.7E-03	i	4.0E-03	i	8.7E-03	r	4.0E-03	r	0.1 30560-19-1	Acephate	5.6E+01	ca**	2.0E+02	ca*	7.7E-01	ca*	7.7E+00	ca*		
				7.7E-03	i	2.6E-03	i	y 75-07-0	Acetaldehyde	1.1E+01	ca**	2.3E+01	ca**	8.7E-01	ca*	1.7E+00	ca		
		2.0E-02	i			2.0E-02	r	0.1 34256-82-1	Acetochlor	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		9.0E-01	i			9.0E-01	r	y 67-64-1	**Acetone**	1.4E+04	nc	5.4E+04	nc	3.3E+03	nc	5.5E+03	nc	1.6E+01	8.0E-01
		8.0E-04	h			8.0E-04	r	0.1 75-86-5	Acetone cyanohydrin	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
		1.7E-02	r			1.7E-02	i	y 75-05-8	Acetonitrile	4.2E+02	nc	1.8E+03	nc	6.2E+01	nc	1.0E+02	nc		
		5.0E-04	i			5.7E-06	i	y 107-02-8	**Acrolein**	1.0E-01	nc	3.4E-01	nc	2.1E-02	nc	4.2E-02	nc		
4.5E+00	i	2.0E-04	i	4.5E+00	i	2.0E-04	r	0.1 79-06-1	Acrylamide	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca		
		5.0E-01	i			2.9E-04	i	0.1 79-10-7	Acrylic acid	2.9E+04	nc	1.0E+05	max	1.0E+00	nc	1.8E+04	nc		
5.4E-01	i	1.0E-03	h	2.4E-01	i	5.7E-04	i	y 107-13-1	Acrylonitrile	2.1E-01	ca*	4.9E-01	ca*	2.8E-02	ca*	3.9E-02	ca*		
1.0E+00	r			1.0E+00	c			y	**"CAL-Modified PRG"**	5.5E-02	ca	1.2E-01	ca	6.7E-03	ca	1.1E-02	ca		
8.1E-02	h	1.0E-02	i	8.0E-02	r	1.0E-02	r	0.1 15972-60-8	Alachlor	6.0E+00	ca	2.1E+01	ca	8.4E-02	ca	8.4E-01	ca		
		1.5E-01	i			1.5E-01	r	0.1 1596-84-5	Alar	9.2E+03	nc	9.2E+04	nc	5.5E+02	nc	5.5E+03	nc		
		1.0E-03	i			1.0E-03	r	0.1 116-06-3	Aldicarb	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	i			1.0E-03	r	0.1 1646-88-4	Aldicarb sulfone	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
1.7E+01	i	3.0E-05	i	1.7E+01	i	3.0E-05	r	0.1 309-00-2	Aldrin	2.9E-02	ca*	1.0E-01	ca	3.9E-04	ca	4.0E-03	ca	5.0E-01	2.0E-02
		2.5E-01	i			2.5E-01	r	0.1 74223-64-6	Ally	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		5.0E-03	i			5.0E-03	r	0.1 107-18-6	Allyl alcohol	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.9E-04	r			2.9E-04	i	0.1 107-05-1	**Allyl chloride**	1.7E+01	nc	1.8E+02	nc	1.0E+00	nc	1.0E+01	nc		
		1.0E+00	p			1.4E-03	p	7429-90-5	Aluminum	7.6E+04	nc	1.0E+05	max	5.1E+00	nc	3.6E+04	nc		
		4.0E-04	i					20859-73-8	Aluminum phosphide	3.1E+01	nc	4.1E+02	nc			1.5E+01	nc		
		3.0E-04	i			3.0E-04	r	0.1 67485-29-4	Amdro	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		9.0E-03	i			9.0E-03	r	0.1 834-12-8	Ametryn	5.5E+02	nc	5.5E+03	nc	3.3E+01	nc	3.3E+02	nc		
		2.0E-04	n			2.0E-04	r	0.1 1321-12-6	**Aminodinitrotoluene**	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc		
		7.0E-02	h			7.0E-02	r	0.1 591-27-5	m-Aminophenol	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-05	h			2.0E-05	r	0.1 504-24-5	4-Aminopyridine	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
		2.5E-03	i			2.5E-03	r	0.1 33089-61-1	Amitraz	1.5E+02	nc	1.5E+03	nc	9.1E+00	nc	9.1E+01	nc		
						2.9E-02	i	7664-41-7	Ammonia					1.0E+02	nc				
		2.0E-01	i					0.1 7773-06-0	Ammonium sulfamate	1.2E+04	nc	1.0E+05	max			7.3E+03	nc		
5.7E-03	i	7.0E-03	p	5.7E-03	r	2.9E-04	i	0.1 62-53-3	Aniline	8.5E+01	ca**	3.0E+02	ca*	1.0E+00	nc	1.2E+01	ca*		
		4.0E-04	i					7440-36-0	Antimony and compounds	3.1E+01	nc	4.1E+02	nc			1.5E+01	nc	5.0E+00	3.0E-01
		1.3E-02	i			1.3E-02	r	0.1 74115-24-5	Apollo	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
2.5E-02	i	5.0E-02	h	2.5E-02	i	5.0E-02	r	0.1 140-57-8	Aramite	1.9E+01	ca	6.9E+01	ca	2.7E-01	ca	2.7E+00	ca		
1.5E+00	i	3.0E-04	i	1.5E+01	i			0.03 7440-38-2	Arsenic	3.9E-01	ca*	1.6E+00	ca	4.5E-04	ca	4.5E-02	ca	2.9E+01	1.0E+00
9.5E+00	c			1.2E+01	c			0.03	**"CAL-Modified PRG"**	6.2E-02	ca	2.5E-01	ca	5.6E-04	ca	7.1E-03	ca		
						1.4E-05	i	7784-42-1	Arsine (see arsenic for cancer endpoint)					5.2E-02	nc				
		9.0E-03	i			9.0E-03	r	0.1 76578-14-8	Assure	5.5E+02	nc	5.5E+03	nc	3.3E+01	nc	3.3E+02	nc		
		5.0E-02	i			5.0E-02	r	0.1 3337-71-1	Asulam	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
2.2E-01	h	3.5E-02	i	2.2E-01	r	3.5E-02	r	0.1 1912-24-9	Atrazine	2.2E+00	ca	7.8E+00	ca	3.1E-02	ca	3.0E-01	ca		
		4.0E-04	i			4.0E-04	r	0.1 71751-41-2	Avermectin B1	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
1.1E-01	i			1.1E-01	i			0.1 103-33-3	Azobenzene	4.4E+00	ca	1.6E+01	ca	6.2E-02	ca	6.1E-01	ca		
		7.0E-02	i			1.4E-04	h	7440-39-3	Barium and compounds	5.4E+03	nc	6.7E+04	nc	5.2E-01	nc	2.6E+03	nc	1.6E+03	8.2E+01

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES								CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		4.0E-03	i			4.0E-03	r 0.1	114-26-1	Baygon	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		3.0E-02	i			3.0E-02	r 0.1	43121-43-3	Bayleton	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r 0.1	68359-37-5	Baythroid	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-01	i			3.0E-01	r 0.1	1861-40-1	Benefin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		5.0E-02	i			5.0E-02	r 0.1	17804-35-2	Benomyl	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		3.0E-02	i			3.0E-02	r 0.1	25057-89-0	Bentazon	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-01	i			1.0E-01	r 0.1	100-52-7	Benzaldehyde	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
5.5E-02	i	4.0E-03	i	2.7E-02	i	8.6E-03	i y	71-43-2	**Benzene**	6.4E-01	ca*	1.4E+00	ca*	2.5E-01	ca	3.5E-01	ca	3.0E-02	2.0E-03
2.3E+02	i	3.0E-03	i	2.3E+02	i	3.0E-03	r 0.1	92-87-5	Benzidine	2.1E-03	ca	7.5E-03	ca	2.9E-05	ca	2.9E-04	ca		
		4.0E+00	i			4.0E+00	r 0.1	65-85-0	Benzoic acid	1.0E+05	max	1.0E+05	max	1.5E+04	nc	1.5E+05	nc	4.0E+02	2.0E+01
1.3E+01	i			1.3E+01	r		0.1	98-07-7	Benzotrichloride	3.7E-02	ca	1.3E-01	ca	5.2E-04	ca	5.2E-03	ca		
		3.0E-01	h			3.0E-01	r 0.1	100-51-6	Benzyl alcohol	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
1.7E-01	i	2.9E-03	r	1.7E-01	r	2.9E-03	n y	100-44-7	Benzyl chloride	8.9E-01	ca*	2.2E+00	ca	4.0E-02	ca	6.6E-02	ca		
		2.0E-03	i	8.4E+00	i	5.7E-06	i	7440-41-7	Beryllium and compounds	1.5E+02	nc	1.9E+03	ca**	8.0E-04	ca*	7.3E+01	nc	6.3E+01	3.0E+00
		1.0E-04	i			1.0E-04	r 0.1	141-66-2	Bidrin	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
		1.5E-02	i			1.5E-02	r 0.1	82657-04-3	Biphenthrin (Talstar)	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r y	92-52-4	**1,1-Biphenyl**	3.0E+03	nc	2.3E+04	nc	1.8E+02	nc	3.0E+02	nc		
1.1E+00	i			1.1E+00	i		y	111-44-4	Bis(2-chloroethyl)ether	2.2E-01	ca	5.8E-01	ca	6.1E-03	ca	1.0E-02	ca	4.0E-04	2.0E-05
7.0E-02	x	4.0E-02	i	3.5E-02	x	4.0E-02	r y	108-60-1	Bis(2-chloroisopropyl)ether	2.9E+00	ca	7.4E+00	ca	1.9E-01	ca	2.7E-01	ca		
2.2E+02	i			2.2E+02	i		y	542-88-1	Bis(chloromethyl)ether	1.9E-04	ca	4.3E-04	ca	3.1E-05	ca	5.2E-05	ca		
7.0E-02	x	4.0E-02	i	3.5E-02	x	4.0E-02	r y	108-60-1	Bis(2-chloro-1-methylethyl)ether	2.9E+00	ca	7.4E+00	ca	1.9E-01	ca	2.7E-01	ca		
1.4E-02	i	2.0E-02	i	1.4E-02	r	2.0E-02	r 0.1	117-81-7	Bis(2-ethylhexyl)phthalate (DEHP)	3.5E+01	ca*	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.0E-02	i			5.0E-02	r 0.1	80-05-7	Bisphenol A	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.00E-01	i			5.7E-03	h	7440-42-8	Boron	1.6E+04	nc	1.0E+05	max	2.1E+01	nc	7.3E+03	nc		
						2.0E-04	h	7637-07-2	Boron trifluoride					7.3E-01	nc				
7.0E-01	i	4.0E-03	i	7.0E-01	r	4.0E-03	r 0.1	15541-45-4	**Bromate**	6.9E-01	ca	2.5E+00	ca	9.6E-03	ca	9.6E-02	ca		
		2.0E-02	p			2.9E-03	p y	108-86-1	Bromobenzene	2.8E+01	nc	9.2E+01	nc	1.0E+01	nc	2.0E+01	nc		
6.2E-02	i	2.0E-02	i	6.2E-02	r	2.0E-02	r y	75-27-4	Bromodichloromethane	8.2E-01	ca	1.8E+00	ca	1.1E-01	ca	1.8E-01	ca	6.0E-01	3.0E-02
7.9E-03	i	2.0E-02	i	3.9E-03	i	2.0E-02	r 0.1	75-25-2	Bromoform (tribromomethane)	6.2E+01	ca*	2.2E+02	ca*	1.7E+00	ca*	8.5E+00	ca*	8.0E-01	4.0E-02
		1.4E-03	i			1.4E-03	i y	74-83-9	Bromomethane (Methyl bromide)	3.9E+00	nc	1.3E+01	nc	5.2E+00	nc	8.7E+00	nc	2.0E-01	1.0E-02
		5.0E-03	h			5.0E-03	r 0.1	2104-96-3	Bromophos	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r 0.1	1689-84-5	Bromoxynil	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	i			2.0E-02	r 0.1	1689-99-2	Bromoxynil octanoate	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
1.1E-01	r	5.7E-04	r	1.1E-01	i	5.7E-04	i y	106-99-0	**1,3-Butadiene**	5.8E-02	ca*	1.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*		
6.0E-01	r	5.7E-03	r	6.0E-01	c	5.7E-03	c y	106-99-0	**"CAL-Modified PRG"**	1.1E-02	ca	2.3E-02	ca	1.1E-02	ca	1.9E-02	ca		
		1.0E-01	i			2.6E-03	n 0.1	71-36-3	1-Butanol	6.1E+03	nc	6.1E+04	nc	9.5E+00	nc	3.6E+03	nc	1.7E+01	9.0E-01
		5.0E-02	i			5.0E-02	r 0.1	2008-41-5	Butylate	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-02	n			4.0E-02	r y	104-51-8	n-Butylbenzene	2.4E+02	sat	2.4E+02	sat	1.5E+02	nc	2.4E+02	nc		
		4.0E-02	n			4.0E-02	r y	135-9-88	sec-Butylbenzene	2.2E+02	sat	2.2E+02	sat	1.5E+02	nc	2.4E+02	nc		
		4.0E-02	n			4.0E-02	r y	98-06-6	tert-Butylbenzene	3.9E+02	sat	3.9E+02	sat	1.5E+02	nc	2.4E+02	nc		
		2.0E-01	i			2.0E-01	r 0.1	85-68-7	Butyl benzyl phthalate	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc	9.3E+02	8.1E+02
		1.0E+00	i			1.0E+00	r 0.1	85-70-1	Butylphthalyl butylglycolate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		

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TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils / CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		5.0E-04	i	6.3E+00	i			0.001 7440-43-9	Cadmium and compounds	3.7E+01	nc	4.5E+02	nc	1.1E-03	ca	1.8E+01	nc	8.0E+00	4.0E-01
		5.0E-01	i			5.0E-01	r	0.1 105-60-2	Caprolactam	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
8.6E-03	h	2.0E-03	i	8.6E-03	r	2.0E-03	r	0.1 2425-06-1	Captafol	5.7E+01	ca**	2.0E+02	ca**	7.8E-01	ca**	7.8E+00	ca**		
3.5E-03	h	1.3E-01	i	3.5E-03	r	1.3E-01	r	0.1 133-06-2	Captan	1.4E+02	ca*	4.9E+02	ca	1.9E+00	ca	1.9E+01	ca		
		1.0E-01	i			1.1E-01	r	0.1 63-25-2	Carbaryl	6.1E+03	nc	6.2E+04	nc	4.0E+02	nc	3.6E+03	nc		
2.0E-02	h			2.0E-02	r			0.1 86-74-8	Carbazole	2.4E+01	ca	8.6E+01	ca	3.4E-01	ca	3.4E+00	ca	6.0E-01	3.0E-02
		5.0E-03	i			5.0E-03	r	0.1 1563-66-2	Carbofuran	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-01	i			2.0E-01	i	y 75-15-0	Carbon disulfide	3.6E+02	nc	7.2E+02	sat	7.3E+02	nc	1.0E+03	nc	3.2E+01	2.0E+00
1.3E-01	i	7.0E-04	i	5.3E-02	i	7.0E-04	r	y 56-23-5	Carbon tetrachloride	2.5E-01	ca**	5.5E-01	ca*	1.3E-01	ca*	1.7E-01	ca*	7.0E-02	3.0E-03
		1.0E-02	i			1.0E-02	r	0.1 55285-14-8	Carbosulfan	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-01	i			1.0E-01	r	0.1 5234-68-4	Carboxin	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		1.5E-02	i			1.5E-02	r	0.1 133-90-4	Chloramben	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
4.0E-01	h			4.0E-01	r			0.1 118-75-2	Chloranil	1.2E+00	ca	4.3E+00	ca	1.7E-02	ca	1.7E-01	ca		
3.5E-01	i	5.0E-04	i	3.5E-01	i	2.0E-04	i	0.04 12789-03-6	Chlordane (technical)	1.6E+00	ca*	6.5E+00	ca*	1.9E-02	ca*	1.9E-01	ca*	1.0E+01	5.0E-01
		2.0E-02	i			2.0E-02	r	0.1 90982-32-4	Chlorimuron-ethyl	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			5.7E-05	n	7782-50-5	Chlorine					2.1E-01	nc				
		3.0E-02	i			5.7E-05	i	10049-04-4	Chlorine dioxide					2.1E-01	nc				
		2.0E-03	h			2.0E-03	r	0.1 79-11-8	Chloroacetic acid	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		8.6E-06	r			8.6E-06	i	y 532-27-4	2-Chloroacetophenone	3.3E-02	nc	1.1E-01	nc	3.1E-02	nc	5.2E-02	nc		
		4.0E-03	i			4.0E-03	r	0.1 106-47-8	4-Chloroaniline	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc	7.0E-01	3.0E-02
		2.0E-02	i			1.7E-02	n	y 108-90-7	Chlorobenzene	1.5E+02	nc	5.3E+02	nc	6.2E+01	nc	1.1E+02	nc	1.0E+00	7.0E-02
2.7E-01	h	2.0E-02	i	2.7E-01	h	2.0E-02	r	0.1 510-15-6	Chlorobenzilate	1.8E+00	ca	6.4E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-01	h			2.0E-01	r	0.1 74-11-3	p-Chlorobenzoic acid	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	h			2.0E-02	r	0.1 98-56-6	4-Chlorobenzotrifluoride	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	h			2.0E-03	h	y 126-99-8	2-Chloro-1,3-butadiene	3.6E+00	nc	1.2E+01	nc	7.3E+00	nc	1.4E+01	nc		
		4.0E-01	h			4.0E-01	r	y 109-69-3	1-Chlorobutane	4.8E+02	sat	4.8E+02	sat	1.5E+03	nc	2.4E+03	nc		
		1.4E+01	r			1.4E+01	i	y 75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	3.4E+02	sat	3.4E+02	sat	5.2E+04	nc	8.7E+04	nc		
		1.4E+01	r			1.4E+01	i	y 75-45-6	Chlorodifluoromethane	3.4E+02	sat	3.4E+02	sat	5.1E+04	nc	8.5E+04	nc		
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	y 75-00-3	Chloroethane	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
		1.0E-02	i	8.1E-02	i	1.4E-02	n	y 67-66-3	**Chloroform**	2.2E-01	ca	4.7E-01	ca	8.3E-02	ca	1.7E-01	ca	6.0E-01	3.0E-02
3.1E-02	c			1.9E-02	c			y	"CAL-Modified PRG"	9.4E-01	ca	2.0E+00	ca	3.5E-01	ca	5.3E-01	ca		
		2.6E-02	r			2.6E-02	i	y 74-87-3	**Chloromethane (methyl chloride)**	4.7E+01	nc	1.6E+02	nc	9.5E+01	nc	1.6E+02	nc		
5.8E-01	h			5.8E-01	r			0.1 95-69-2	4-Chloro-2-methylaniline	8.4E-01	ca	3.0E+00	ca	1.2E-02	ca	1.2E-01	ca		
4.6E-01	h			4.6E-01	r			0.1 3165-93-3	4-Chloro-2-methylaniline hydrochloride	1.1E+00	ca	3.7E+00	ca	1.5E-02	ca	1.5E-01	ca		
		8.0E-02	i			8.0E-02	r	y 91-58-7	beta-Chloronaphthalene	4.9E+03	nc	2.3E+04	nc	2.9E+02	nc	4.9E+02	nc		
9.7E-03	p	1.0E-03	p	9.7E-03	r	2.0E-05	p	y 88-73-3	o-Chloronitrobenzene	1.4E+00	nc**	4.5E+00	nc**	7.3E-02	nc**	1.5E-01	nc**		
6.7E-03	p	1.0E-03	p	6.7E-03	r	1.7E-04	p	y 100-00-5	p-Chloronitrobenzene	1.0E+01	nc**	3.7E+01	nc**	6.2E-01	nc**	1.2E+00	nc**		
		5.0E-03	i			5.0E-03	r	y 95-57-8	2-Chlorophenol	6.3E+01	nc	2.4E+02	nc	1.8E+01	nc	3.0E+01	nc	4.0E+00	2.0E-01
		2.9E-02	r			2.9E-02	h	y 75-29-6	2-Chloropropane	1.7E+02	nc	5.9E+02	nc	1.0E+02	nc	1.7E+02	nc		
1.1E-02	h	1.5E-02	i	1.1E-02	r	1.5E-02	r	0.1 1897-45-6	Chlorothalonil	4.4E+01	ca*	1.6E+02	ca*	6.1E-01	ca*	6.1E+00	ca*		
		2.0E-02	i			2.0E-02	r	y 95-49-8	o-Chlorotoluene	1.6E+02	nc	5.6E+02	nc	7.3E+01	nc	1.2E+02	nc		
		2.0E-01	i			2.0E-01	r	0.1 101-21-3	Chlorpropham	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES								CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
	3.0E-03	i			3.0E-03	r	0.1	2921-88-2	Chlorpyrifos	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
	1.0E-02	h			1.0E-02	r	0.1	5598-13-0	Chlorpyrifos-methyl	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	5.0E-02	i			5.0E-02	r	0.1	64902-72-3	Chlorsulfuron	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
	8.0E-04	h			8.0E-04	r	0.1	60238-56-4	Chlorthiophos	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
			4.2E+01	i					Total Chromium (1:6 ratio Cr VI:Cr III)+++	2.1E+02	ca	4.5E+02	ca	1.6E-04	ca			3.8E+01	2.0E+00
	1.5E+00	i						16065-83-1	Chromium III	1.0E+05	max	1.0E+05	max			5.5E+04	nc		
	3.0E-03	i	2.9E+02	i	2.2E-06	i		18540-29-9	Chromium VI+++	3.0E+01	ca**	6.4E+01	ca	2.3E-05	ca	1.1E+02	nc	3.8E+01	2.0E+00
	2.0E-02	p	9.8E+00	p	5.7E-06	p		7440-48-4	Cobalt	9.0E+02	ca**	1.9E+03	ca*	6.9E-04	ca*	7.3E+02	nc		
			2.2E+00	i				8007-45-2	Coke Oven Emissions					3.1E-03	ca				
	4.0E-02	h						7440-50-8	Copper and compounds	3.1E+03	nc	4.1E+04	nc			1.5E+03	nc		
1.9E+00	h		1.9E+00	r			y	123-73-9	Crotonaldehyde	5.3E-03	ca	1.1E-02	ca	3.5E-03	ca	5.9E-03	ca		
	1.0E-01	i			1.1E-01	i	y	98-82-8	Cumene (isopropylbenzene)	5.7E+02	nc	2.0E+03	nc	4.0E+02	nc	6.6E+02	nc		
8.4E-01	h 2.0E-03	h	8.4E-01	r	2.0E-03	r	0.1	21725-46-2	Cyanazine	5.8E-01	ca	2.1E+00	ca	8.0E-03	ca	8.0E-02	ca		
	2.0E-02	i					0.1	57-12-5	Cyanide (free)	1.2E+03	nc	1.2E+04	nc			7.3E+02	nc		
	2.0E-02	i			8.6E-04	i	y	74-90-8	Cyanide (hydrogen)	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc		
	4.0E-02	i			4.0E-02	r	y	460-19-5	Cyanogen	1.3E+02	nc	4.3E+02	nc	1.5E+02	nc	2.4E+02	nc		
	9.0E-02	i			9.0E-02	r	y	506-68-3	Cyanogen bromide	2.9E+02	nc	9.7E+02	nc	3.3E+02	nc	5.5E+02	nc		
	5.0E-02	i			5.0E-02	r	y	506-77-4	Cyanogen chloride	1.6E+02	nc	5.4E+02	nc	1.8E+02	nc	3.0E+02	nc		
	1.7E+00	r			1.7E+00	i	y	110-82-7	**Cyclohexane**	1.4E+02	sat	1.4E+02	sat	6.2E+03	nc	1.0E+04	nc		
	5.0E+00	i			5.0E+00	r	0.1	108-94-1	Cyclohexanone	1.0E+05	max	1.0E+05	max	1.8E+04	nc	1.8E+05	nc		
	2.0E-01	i			2.0E-01	r	0.1	108-91-8	Cyclohexylamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
	5.0E-03	i			5.0E-03	r	0.1	68085-85-8	Cyhalothrin/Karate	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
	1.0E-02	i			1.0E-02	r	0.1	52315-07-8	Cypermethrin	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	7.5E-03	i			7.5E-03	r	0.1	66215-27-8	Cyromazine	4.6E+02	nc	4.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
	1.0E-02	i			1.0E-02	r	0.1	1861-32-1	Dacthal	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	3.0E-02	i			3.0E-02	r	0.1	75-99-0	Dalapon	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
	2.5E-02	i			2.5E-02	r	0.1	39515-41-8	Danitol	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
2.4E-01	i		2.4E-01	r			0.03	72-54-8	DDD	2.4E+00	ca	1.0E+01	ca	2.8E-02	ca	2.8E-01	ca	1.6E+01	8.0E-01
3.4E-01	i		3.4E-01	r			0.03	72-55-9	DDE	1.7E+00	ca	7.0E+00	ca	2.0E-02	ca	2.0E-01	ca	5.4E+01	3.0E+00
3.4E-01	i 5.0E-04	i	3.4E-01	i	5.0E-04	r	0.03	50-29-3	DDT	1.7E+00	ca*	7.0E+00	ca*	2.0E-02	ca*	2.0E-01	ca*	3.2E+01	2.0E+00
	1.0E-02	i			1.0E-02	r	0.1	1163-19-5	Decabromodiphenyl ether	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	4.0E-05	i			4.0E-05	r	0.1	8065-48-3	Demeton	2.4E+00	nc	2.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
6.1E-02	h		6.1E-02	r			0.1	2303-16-4	Diallate	8.0E+00	ca	2.8E+01	ca	1.1E-01	ca	1.1E+00	ca		
	9.0E-04	h			9.0E-04	r	0.1	333-41-5	Diazinon	5.5E+01	nc	5.5E+02	nc	3.3E+00	nc	3.3E+01	nc		
	2.0E-03	n			2.0E-03	r	y	132-64-9	**Dibenzofuran**	1.5E+02	nc	1.6E+03	nc	7.3E+00	nc	1.2E+01	nc		
	1.0E-02	i			1.0E-02	r	0.1	106-37-6	1,4-Dibromobenzene	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
8.4E-02	i 2.0E-02	i	8.4E-02	r	2.0E-02	r	y	124-48-1	Dibromochloromethane	1.1E+00	ca	2.6E+00	ca	8.0E-02	ca	1.3E-01	ca	4.0E-01	2.0E-02
1.4E+00	h 5.7E-05	r	2.4E-03	x	5.7E-05	i	y	96-12-8	**1,2-Dibromo-3-chloropropane (DBCP)**	4.6E-01	ca**	2.0E+00	ca**	2.1E-01	nc	4.8E-02	ca**		
7.0E+00	c		7.0E+00	c			y	96-12-8	**"CAL-Modified PRG"**	3.0E-02	ca	7.6E-02	ca	9.6E-04	ca	1.6E-03	ca		
2.0E+00	i 9.0E-03	i	2.0E+00	i	2.6E-03	i	y	106-93-4	**1,2-Dibromoethane (EDB)**	3.2E-02	ca	7.3E-02	ca	3.4E-03	ca	5.6E-03	ca		
	1.0E-01	i			1.0E-01	r	0.1	84-74-2	Dibutyl phthalate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc	2.3E+03	2.7E+02
	3.0E-02	i			3.0E-02	r	0.1	1918-00-9	Dicamba	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		

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ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils / CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		9.0E-02	i			5.7E-02	h	y	95-50-1	**1,2-Dichlorobenzene**	6.0E+02	sat	6.0E+02	sat	2.1E+02	nc	3.7E+02	nc	1.7E+01	9.0E-01
		3.0E-02	n			3.0E-02	r	y	541-73-1	**1,3-Dichlorobenzene**	5.3E+02	nc	6.0E+02	sat	1.1E+02	nc	1.8E+02	nc		
2.4E-02	h	3.0E-02	n	2.2E-02	n	2.3E-01	i	y	106-46-7	1,4-Dichlorobenzene	3.4E+00	ca	7.9E+00	ca	3.1E-01	ca	5.0E-01	ca	2.0E+00	1.0E-01
4.5E-01	i			4.5E-01	r			0.1	91-94-1	3,3-Dichlorobenzidine	1.1E+00	ca	3.8E+00	ca	1.5E-02	ca	1.5E-01	ca	7.0E-03	3.0E-04
		3.0E-02	n			3.0E-02	r	0.1	90-98-2	4,4'-Dichlorobenzophenone	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
9.3E+00	r			9.3E+00	h			y	764-41-0	1,4-Dichloro-2-butene	7.9E-03	ca	1.8E-02	ca	7.2E-04	ca	1.2E-03	ca		
		2.0E-01	i			5.7E-02	h	y	75-71-8	Dichlorodifluoromethane	9.4E+01	nc	3.1E+02	nc	2.1E+02	nc	3.9E+02	nc		
		1.0E-01	h			1.4E-01	h	y	75-34-3	1,1-Dichloroethane	5.1E+02	nc	1.7E+03	nc	5.2E+02	nc	8.1E+02	nc	2.3E+01	1.0E+00
5.7E-03	c			5.7E-03	c			y		"CAL-Modified PRG"	2.8E+00	ca	6.0E+00	ca	1.2E+00	ca	2.0E+00	ca		
9.1E-02	i	2.0E-02	n	9.1E-02	i	1.4E-03	n	y	107-06-2	1,2-Dichloroethane (EDC)	2.8E-01	ca*	6.0E-01	ca*	7.4E-02	ca*	1.2E-01	ca*	2.0E-02	1.0E-03
		5.0E-02	i			5.7E-02	i	y	75-35-4	1,1-Dichloroethylene	1.2E+02	nc	4.1E+02	nc	2.1E+02	nc	3.4E+02	nc	6.0E-02	3.0E-03
		1.0E-02	p			1.0E-02	r	y	156-59-2	1,2-Dichloroethylene (cis)	4.3E+01	nc	1.5E+02	nc	3.7E+01	nc	6.1E+01	nc	4.0E-01	2.0E-02
		2.0E-02	i			2.0E-02	r	y	156-60-5	1,2-Dichloroethylene (trans)	6.9E+01	nc	2.3E+02	nc	7.3E+01	nc	1.2E+02	nc	7.0E-01	3.0E-02
		3.0E-03	i			3.0E-03	r	0.1	120-83-2	2,4-Dichlorophenol	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc	1.0E+00	5.0E-02
		8.0E-03	i			8.0E-03	r	0.1	94-82-6	4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc		
		1.0E-02	i			1.0E-02	r	0.05	94-75-7	2,4-Dichlorophenoxyacetic Acid (2,4-D)	6.9E+02	nc	7.7E+03	nc	3.7E+01	nc	3.6E+02	nc		
6.8E-02	h	1.1E-03	r	6.8E-02	r	1.1E-03	i	y	78-87-5	1,2-Dichloropropane	3.4E-01	ca*	7.4E-01	ca*	9.9E-02	ca*	1.6E-01	ca*	3.0E-02	1.0E-03
		2.0E-02	p			2.0E-02	r	y	142-28-9	**1,3-Dichloropropane**	1.0E+02	nc	3.6E+02	nc	7.3E+01	nc	1.2E+02	nc		
1.0E-01	i	3.0E-02	i	1.4E-02	i	5.7E-03	i	y	542-75-6	1,3-Dichloropropene	7.8E-01	ca	1.8E+00	ca	4.8E-01	ca	4.0E-01	ca	4.0E-03	2.0E-04
		3.0E-03	i			3.0E-03	r	0.1	616-23-9	2,3-Dichloropropanol	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
2.9E-01	i	5.0E-04	i	2.9E-01	r	1.4E-04	i	0.1	62-73-7	Dichlorvos	1.7E+00	ca*	5.9E+00	ca*	2.3E-02	ca*	2.3E-01	ca*		
4.4E-01	x			4.4E-01	r			0.1	115-32-2	Dicofol	1.1E+00	ca	3.9E+00	ca	1.5E-02	ca	1.5E-01	ca		
		3.0E-02	h			5.7E-05	x	y	77-73-6	Dicyclopentadiene	5.4E-01	nc	1.8E+00	nc	2.1E-01	nc	4.2E-01	nc		
1.6E+01	i	5.0E-05	i	1.6E+01	i	5.0E-05	r	0.1	60-57-1	Dieldrin	3.0E-02	ca	1.1E-01	ca	4.2E-04	ca	4.2E-03	ca	4.0E-03	2.0E-04
		1.0E-02	p			5.7E-03	p	0.1	112-34-5	Diethylene glycol, monobutyl ether	6.1E+02	nc	6.2E+03	nc	2.1E+01	nc	3.6E+02	nc		
		6.0E-02	p			8.6E-04	p	0.1	111-90-0	Diethylene glycol, monoethyl ether	3.7E+03	nc	3.7E+04	nc	3.1E+00	nc	2.2E+03	nc		
		4.0E-04	p			4.0E-04	r	0.1	617-84-5	Diethylformamide	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
1.2E-03	i	6.0E-01	i	1.2E-03	r	6.0E-01	r	0.1	103-23-1	Di(2-ethylhexyl)adipate	4.1E+02	ca	1.4E+03	ca	5.6E+00	ca	5.6E+01	ca		
		8.0E-01	i			8.0E-01	r	0.1	84-66-2	Diethyl phthalate	4.9E+04	nc	1.0E+05	max	2.9E+03	nc	2.9E+04	nc		
4.7E+03	h			4.7E+03	r			0.1	56-53-1	Diethylstilbestrol	1.0E-04	ca	3.7E-04	ca	1.4E-06	ca	1.4E-05	ca		
		8.0E-02	i			8.0E-02	r	0.1	43222-48-6	Difenzoquat (Avenge)	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0.1	35367-38-5	Diflubenzuron	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.1E+01	r			1.1E+01	i	y	75-37-6	1,1-Difluoroethane					4.2E+04	nc	6.9E+04	nc		
		2.0E-02	n			2.0E-02	r	0.1	28553-12-0	Diisononyl phthalate	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
						1.1E-01	p		108-20-3	**Diisopropyl ether**					4.0E+02	nc				
		8.0E-02	i			8.0E-02	r	0.1	1445-75-6	Diisopropyl methylphosphonate	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0.1	55290-64-7	Dimethipin	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-04	i			2.0E-04	r	0.1	60-51-5	Dimethoate	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc		
1.4E-02	h			1.4E-02	r			0.1	119-90-4	3,3'-Dimethoxybenzidine	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.7E-06	r			5.7E-06	x	y	124-40-3	Dimethylamine	6.7E-02	nc	2.5E-01	nc	2.1E-02	nc	3.5E-02	nc		
		2.0E-03	i			2.0E-03	r	0.1	121-69-7	N-N-Dimethylaniline	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
7.5E-01	h			7.5E-01	r			0.1	95-68-1	2,4-Dimethylaniline	6.5E-01	ca	2.3E+00	ca	9.0E-03	ca	9.0E-02	ca		

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TOXICITY VALUES							CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
5.8E-01 h		5.8E-01 r			0.1	21436-96-4	2,4-Dimethylaniline hydrochloride	8.4E-01	ca	3.0E+00	ca	1.2E-02	ca	1.2E-01	ca		
2.3E+00 p		2.3E+00 r			0.1	119-93-7	**3,3'-Dimethylbenzidine**	2.1E-01	ca	7.5E-01	ca	2.9E-03	ca	2.9E-02	ca		
	1.0E-01 h		8.6E-03 i		0.1	68-12-2	N,N-Dimethylformamide	6.1E+03	nc	6.2E+04	nc	3.1E+01	nc	3.6E+03	nc		
	1.0E-03 n		1.0E-03 r		0.1	122-09-8	Dimethylphenethylamine	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	2.0E-02 i		2.0E-02 r		0.1	105-67-9	2,4-Dimethylphenol	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc	9.0E+00	4.0E-01
	6.0E-04 i		6.0E-04 r		0.1	576-26-1	2,6-Dimethylphenol	3.7E+01	nc	3.7E+02	nc	2.2E+00	nc	2.2E+01	nc		
	1.0E-03 i		1.0E-03 r		0.1	95-65-8	3,4-Dimethylphenol	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	1.0E+01 h		1.0E+01 r		0.1	131-11-3	Dimethyl phthalate	1.0E+05	max	1.0E+05	max	3.7E+04	nc	3.6E+05	nc		
	1.0E-01 i		1.0E-01 r		0.1	120-61-6	Dimethyl terephthalate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
	1.0E-04 p		1.0E-04 r		0.1	534-52-1	**4,6-Dinitro-o-cresol**	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
	2.0E-03 i		2.0E-03 r		0.1	131-89-5	4,6-Dinitro-o-cyclohexyl phenol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
	1.0E-04 p		1.0E-04 r		0.1	528-29-0	1,2-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
	1.0E-04 i		1.0E-04 r		0.1	99-65-0	1,3-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
	1.0E-04 p		1.0E-04 r		0.1	100-25-4	1,4-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
	2.0E-03 i		2.0E-03 r		0.1	51-28-5	2,4-Dinitrophenol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	3.0E-01	1.0E-02
6.8E-01 i		6.8E-01 r			0.1	25321-14-6	Dinitrotoluene mixture	7.2E-01	ca	2.5E+00	ca	9.9E-03	ca	9.9E-02	ca	8.0E-04	4.0E-05
	2.0E-03 i		2.0E-03 r		0.1	121-14-2	2,4-Dinitrotoluene (also see Dinitrotoluene mixture)	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	8.0E-04	4.0E-05
	1.0E-03 h		1.0E-03 r		0.1	606-20-2	2,6-Dinitrotoluene (also see Dinitrotoluene mixture)	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc	7.0E-04	3.0E-05
	1.0E-03 i		1.0E-03 r		0.1	88-85-7	Dinoseb	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	4.0E-02 p		4.0E-02 r		0.1	117-84-0	di-n-Octyl phthalate	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc	1.0E+04	1.0E+04
1.1E-02 i		1.1E-02 r			0.1	123-91-1	1,4-Dioxane	4.4E+01	ca	1.6E+02	ca	6.1E-01	ca	6.1E+00	ca		
1.5E+05 h		1.5E+05 h			0.03	1746-01-6	Dioxin (2,3,7,8-TCDD)+++	3.9E-06	ca	1.6E-05	ca	4.5E-08	ca	4.5E-07	ca		
	3.0E-02 i		3.0E-02 r		0.1	957-51-7	Diphenamid	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
	2.5E-02 i		2.5E-02 r		0.1	122-39-4	Diphenylamine	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
	3.0E-04 p		3.0E-04 r		0.1	74-31-7	N,N-Diphenyl-1,4 benzenediamine (DPPD)	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
8.0E-01 i		8.0E-01 i			0.1	122-66-7	1,2-Diphenylhydrazine	6.1E-01	ca	2.2E+00	ca	8.4E-03	ca	8.4E-02	ca		
	3.0E-03 p		3.0E-03 r		0.1	127-63-9	Diphenyl sulfone	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
	2.2E-03 i		2.2E-03 r		0.1	85-00-7	Diquat	1.3E+02	nc	1.4E+03	nc	8.0E+00	nc	8.0E+01	nc		
8.6E+00 h		8.6E+00 r			0.1	1937-37-7	Direct black 38	5.7E-02	ca	2.0E-01	ca	7.8E-04	ca	7.8E-03	ca		
8.1E+00 h		8.1E+00 r			0.1	2602-46-2	Direct blue 6	6.0E-02	ca	2.1E-01	ca	8.3E-04	ca	8.3E-03	ca		
9.3E+00 h		9.3E+00 r			0.1	16071-86-6	Direct brown 95	5.2E-02	ca	1.9E-01	ca	7.2E-04	ca	7.2E-03	ca		
	4.0E-05 i		4.0E-05 r		0.1	298-04-4	Disulfoton	2.4E+00	nc	2.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
	1.0E-02 i		1.0E-02 r		0.1	505-29-3	1,4-Dithiane	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	2.0E-03 i		2.0E-03 r		0.1	330-54-1	Diuron	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
	4.0E-03 i		4.0E-03 r		0.1	2439-10-3	Dodine	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
	1.0E-01 n					7429-91-6	Dysprosium	7.8E+03	nc	1.0E+05	max			3.6E+03	nc		
	6.0E-03 i		6.0E-03 r		0.1	115-29-7	Endosulfan	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc	1.8E+01	9.0E-01
	2.0E-02 i		2.0E-02 r		0.1	145-73-3	Endothall	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	3.0E-04 i		3.0E-04 r		0.1	72-20-8	Endrin	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc	1.0E+00	5.0E-02
9.9E-03 i	2.0E-03 h	4.2E-03 h	2.9E-04 i	y		106-89-8	Epichlorohydrin	7.6E+00	nc	2.6E+01	nc	1.0E+00	nc	2.0E+00	nc		

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation I=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.00E-02	r			8.00E-02	c			y		**"CAL-Modified PRG"**	1.3E+00	nc	2.9E+00	nc	8.4E-02	nc	1.4E-01	nc		
		5.7E-03	r			5.7E-03	i	0.1	106-88-7	1,2-Epoxybutane	3.5E+02	nc	3.5E+03	nc	2.1E+01	nc	2.1E+02	nc		
		2.5E-02	i			2.5E-02	r	0.1	759-94-4	EPTC (S-Ethyl dipropylthiocarbamate)	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		5.0E-03	i			5.0E-03	r	0.1	16672-87-0	Ethephon (2-chloroethyl phosphonic acid)	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		5.0E-04	i			5.0E-04	r	0.1	563-12-2	Ethion	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
		4.0E-01	h			5.7E-02	i	0.1	110-80-5	2-Ethoxyethanol	2.4E+04	nc	1.0E+05	max	2.1E+02	nc	1.5E+04	nc		
		3.0E-01	h			3.0E-01	r	0.1	111-15-9	2-Ethoxyethanol acetate	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		9.0E-01	i			9.0E-01	r	y	141-78-6	Ethyl acetate	1.9E+04	nc	3.7E+04	sat	3.3E+03	nc	5.5E+03	nc		
4.8E-02	h			4.8E-02	r			y	140-88-5	Ethyl acrylate	2.1E-01	ca	4.5E-01	ca	1.4E-01	ca	2.3E-01	ca		
		1.0E-01	i			2.9E-01	i	y	100-41-4	**Ethylbenzene**	4.0E+02	sat	4.0E+02	sat	1.1E+03	nc	1.3E+03	nc	1.3E+01	7.0E-01
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	y	75-00-3	Ethyl chloride	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
		3.0E-01	h			3.0E-01	r	0.1	109-78-4	Ethylene cyanohydrin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		9.0E-02	p			9.0E-02	r	0.1	107-15-3	**Ethylene diamine**	5.5E+03	nc	5.5E+04	nc	3.3E+02	nc	3.3E+03	nc		
		2.0E+00	i			2.0E+00	r	0.1	107-21-1	Ethylene glycol	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		5.0E-01	i			3.7E+00	i	0.1	111-76-2	Ethylene glycol, monobutyl ether	3.1E+04	nc	1.0E+05	max	1.4E+04	nc	1.8E+04	nc		
1.0E+00	h			3.5E-01	h			y	75-21-8	Ethylene oxide	1.4E-01	ca	3.4E-01	ca	1.9E-02	ca	2.4E-02	ca		
1.1E-01	h	8.0E-05	i	1.1E-01	r	8.0E-05	r	0.1	96-45-7	Ethylene thiourea (ETU)	4.4E+00	ca**	1.6E+01	ca**	6.1E-02	ca**	6.1E-01	ca**		
		2.0E-01	i			2.0E-01	r	y	60-29-7	Ethyl ether	1.8E+03	sat	1.8E+03	sat	7.3E+02	nc	1.2E+03	nc		
		9.0E-02	h			9.0E-02	r	y	97-63-2	Ethyl methacrylate	1.4E+02	sat	1.4E+02	sat	3.3E+02	nc	5.5E+02	nc		
		1.0E-05	i			1.0E-05	r	0.1	2104-64-5	Ethyl p-nitrophenyl phenylphosphorothioate	6.1E-01	nc	6.2E+00	nc	3.7E-02	nc	3.6E-01	nc		
		3.0E+00	i			3.0E+00	r	0.1	84-72-0	Ethylphthalyl ethyl glycolate	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		8.0E-03	i			8.0E-03	r	0.1	101200-48-0	Express	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc		
		2.5E-04	i			2.5E-04	r	0.1	22224-92-6	Fenamiphos	1.5E+01	nc	1.5E+02	nc	9.1E-01	nc	9.1E+00	nc		
		1.3E-02	i			1.3E-02	r	0.1	2164-17-2	Fluometuron	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		6.0E-02	i					0.1	16984-48-8	Fluorine (soluble fluoride)	3.7E+03	nc	3.7E+04	nc			2.2E+03	nc		
		8.0E-02	i			8.0E-02	r	0.1	59756-60-4	Fluoridone	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0.1	56425-91-3	Flurprimidol	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-02	i			6.0E-02	r	0.1	66332-96-5	Flutolanil	3.7E+03	nc	3.7E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-02	i			1.0E-02	r	0.1	69409-94-5	Fluvalinate	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
3.5E-03	i	1.0E-01	i	3.5E-03	r	1.0E-01	r	0.1	133-07-3	Folpet	1.4E+02	ca*	4.9E+02	ca	1.9E+00	ca	1.9E+01	ca		
1.9E-01	i			1.9E-01	r			0.1	72178-02-0	Fomesafen	2.6E+00	ca	9.1E+00	ca	3.5E-02	ca	3.5E-01	ca		
		2.0E-03	i			2.0E-03	r	0.1	944-22-9	Fonofos	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.5E-01	i	4.6E-02	i			0.1	50-00-0	Formaldehyde	9.2E+03	nc	1.0E+05	nc	1.5E-01	ca	5.5E+03	nc		
		2.0E+00	h			8.6E-04	p	0.1	64-18-6	**Formic Acid**	1.0E+05	max	1.0E+05	max	3.1E+00	nc	7.3E+04	nc		
		3.0E+00	i			3.0E+00	r	0.1	39148-24-8	Fosetyl-al	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		3.0E+01	i			8.6E+00	h	y	76-13-1	Freon 113	5.6E+03	sat	5.6E+03	sat	3.1E+04	nc	5.9E+04	nc		
		1.0E-03	i			1.0E-03	r	y	110-00-9	Furan	2.5E+00	nc	8.5E+00	nc	3.7E+00	nc	6.1E+00	nc		
3.8E+00	h			3.8E+00	r			0.1	67-45-8	Furazolidone	1.3E-01	ca	4.5E-01	ca	1.8E-03	ca	1.8E-02	ca		
		3.0E-03	i			1.4E-02	h	0.1	98-01-1	Furfural	1.8E+02	nc	1.8E+03	nc	5.2E+01	nc	1.1E+02	nc		
5.0E+01	h			5.0E+01	r			0.1	531-82-8	Furium	9.7E-03	ca	3.4E-02	ca	1.3E-04	ca	1.3E-03	ca		
3.0E-02	i			3.0E-02	r			0.1	60568-05-0	Furmecyclox	1.6E+01	ca	5.7E+01	ca	2.2E-01	ca	2.2E+00	ca		
		4.0E-04	i			4.0E-04	r	0.1	77182-82-2	Glufosinate-ammonium	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc		

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TOXICITY VALUES								CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
	4.0E-04	i			2.9E-04	h	0.1	765-34-4	Glycidaldehyde	2.4E+01	nc	2.5E+02	nc	1.0E+00	nc	1.5E+01	nc		
	1.0E-01	i			1.0E-01	r	0.1	1071-83-6	Glyphosate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
	5.0E-05	i			5.0E-05	r	0.1	69806-40-2	Haloxyfop-methyl	3.1E+00	nc	3.1E+01	nc	1.8E-01	nc	1.8E+00	nc		
	1.3E-02	i			1.3E-02	r	0.1	79277-27-3	Harmony	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
4.5E+00 i	5.0E-04	i	4.6E+00	i	5.0E-04	r	0.1	76-44-8	Heptachlor	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca	2.3E+01	1.0E+00
9.1E+00 i	1.3E-05	i	9.1E+00	i	1.3E-05	r	0.1	1024-57-3	Heptachlor epoxide	5.3E-02	ca*	1.9E-01	ca*	7.4E-04	ca*	7.4E-03	ca*	7.0E-01	3.0E-02
	2.0E-03	i			2.0E-03	r	0.1	87-82-1	Hexabromobenzene	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
1.6E+00 i	8.0E-04	i	1.6E+00	i	8.0E-04	r	0.1	118-74-1	Hexachlorobenzene	3.0E-01	ca	1.1E+00	ca	4.2E-03	ca	4.2E-02	ca	2.0E+00	1.0E-01
7.8E-02 i	3.0E-04	n	7.8E-02	i	3.0E-04	r	0.1	87-68-3	Hexachlorobutadiene	6.2E+00	ca**	2.2E+01	ca**	8.6E-02	ca*	8.6E-01	ca*	2.0E+00	1.0E-01
6.3E+00 i	5.0E-04	n	6.3E+00	i	5.0E-04	r	0.04	319-84-6	HCH (alpha)	9.0E-02	ca	3.6E-01	ca	1.1E-03	ca	1.1E-02	ca	5.0E-04	3.0E-05
1.8E+00 i	2.0E-04	n	1.8E+00	i	2.0E-04	r	0.04	319-85-7	HCH (beta)	3.2E-01	ca	1.3E+00	ca	3.7E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
1.3E+00 h	3.0E-04	i	1.3E+00	r	3.0E-04	r	0.04	58-89-9	HCH (gamma) Lindane	4.4E-01	ca*	1.7E+00	ca	5.2E-03	ca	5.2E-02	ca	9.0E-03	5.0E-04
1.8E+00 i			1.8E+00	i			0.04	608-73-1	HCH-technical	3.2E-01	ca	1.3E+00	ca	3.8E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
	6.0E-03	i			5.7E-05	i	0.1	77-47-4	Hexachlorocyclopentadiene	3.7E+02	nc	3.7E+03	nc	2.1E-01	nc	2.2E+02	nc	4.0E+02	2.0E+01
1.4E-02 i	1.0E-03	i	1.4E-02	i	1.0E-03	r	0.1	67-72-1	Hexachloroethane	3.5E+01	ca**	1.2E+02	ca**	4.8E-01	ca**	4.8E+00	ca**	5.0E-01	2.0E-02
	3.0E-04	i			3.0E-04	r	0.1	70-30-4	Hexachlorophene	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
1.1E-01 i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0.1	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4E+00	ca*	1.6E+01	ca	6.1E-02	ca	6.1E-01	ca		
	2.9E-06	r			2.9E-06	i	0.1	822-06-0	1,6-Hexamethylene diisocyanate	1.7E-01	nc	1.8E+00	nc	1.0E-02	nc	1.0E-01	nc		
	1.1E+01	p			5.7E-02	i	y	110-54-3	**n-Hexane**	1.1E+02	sat	1.1E+02	sat	2.1E+02	nc	4.2E+02	nc		
	3.3E-02	i			3.3E-02	r	0.1	51235-04-2	Hexazinone	2.0E+03	nc	2.0E+04	nc	1.2E+02	nc	1.2E+03	nc		
	5.0E-02	i			5.0E-02	r	0.1	2691-41-0	HMX	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
3.0E+00 i			1.7E+01	i			0.1	302-01-2	Hydrazine, hydrazine sulfate	1.6E-01	ca	5.7E-01	ca	3.9E-04	ca	2.2E-02	ca		
3.0E+00 n			1.7E+01	n			0.1	60-34-4	Hydrazine, monomethyl	1.6E-01	ca	5.7E-01	ca	4.0E-04	ca	2.2E-02	ca		
3.0E+00 n			1.7E+01	n			0.1	57-14-7	Hydrazine, dimethyl	1.6E-01	ca	5.7E-01	ca	4.0E-04	ca	2.2E-02	ca		
					5.7E-03	i		7647-01-0	Hydrogen chloride					2.1E+01	nc				
	2.0E-02	i			8.6E-04	i	y	74-90-8	Hydrogen cyanide	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc		
	3.0E-03	i			2.9E-04	i		7783-06-4	Hydrogen sulfide					1.0E+00	nc	1.1E+02	nc		
5.6E-02 p	4.0E-02	p	5.6E-02	r	4.0E-02	r	0.1	123-31-9	**p-Hydroquinone**	8.7E+00	ca	3.1E+01	ca	1.2E-01	ca	1.2E+00	ca		
	1.3E-02	i			1.3E-02	r	0.1	35554-44-0	Imazalil	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
	2.5E-01	i			2.5E-01	r	0.1	81335-37-7	Imazaquin	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
	4.0E-02	i			4.0E-02	r	0.1	36734-19-7	Iprodione	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
	3.0E-01	n						7439-89-6	Iron	2.3E+04	nc	1.0E+05	max			1.1E+04	nc		
	3.0E-01	i			3.0E-01	r	y	78-83-1	Isobutanol	1.3E+04	nc	4.0E+04	sat	1.1E+03	nc	1.8E+03	nc		
9.5E-04 i	2.0E-01	i	9.5E-04	r	2.0E-01	r	0.1	78-59-1	Isophorone	5.1E+02	ca*	5.1E+02	ca*	7.1E+00	ca	7.1E+01	ca	5.0E-01	3.0E-02
	1.5E-02	i			1.5E-02	r	0.1	33820-53-0	Isopropalin	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
	1.0E-01	i			1.1E-01	r	0.1	1832-54-8	Isopropyl methyl phosphonic acid	6.1E+03	nc	6.2E+04	nc	4.0E+02	nc	3.6E+03	nc		
	5.0E-02	i			5.0E-02	r	0.1	82558-50-7	Isoxaben	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
8.0E+00 p	2.0E-04	p	8.0E+00	r	2.0E-04	r	0.1	143-50-0	Kepone	6.1E-02	ca	2.2E-01	ca	8.4E-04	ca	8.4E-03	ca		
	2.0E-03	i			2.0E-03	r	0.1	77501-63-4	Lactofen	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
www.epa.gov/superfund/programs/lead/leubk.htm								7439-92-1	**Lead+++**	4.0E+02	nc	8.0E+02	nc						
www.dtsc.ca.gov/ScienceTechnology/ledspred.html									"CAL-Modified PRG"+++	1.5E+02	nc								
	1.0E-07	i					0.1	78-00-2	Lead (tetraethyl)	6.1E-03	nc	6.2E-02	nc			3.6E-03	nc		

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TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		2.0E-03	i			2.0E-03	r	0.1	330-55-2	Linuron	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		2.0E-02	x						7439-93-2	Lithium	1.6E+03	nc	2.0E+04	nc			7.3E+02	nc		
		2.0E-01	i			2.0E-01	r	0.1	83055-99-6	Londax	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	i			2.0E-02	r	0.1	121-75-5	Malathion	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			1.0E-01	r	0.1	108-31-6	Maleic anhydride	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		5.0E-01	i			5.0E-01	r	y	123-33-1	Maleic hydrazide	1.7E+03	nc	2.4E+03	sat	1.8E+03	nc	3.0E+03	nc		
		1.0E-04	p			1.0E-04	r	0.1	109-77-3	**Malononitrile**	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
		3.0E-02	h			3.0E-02	r	0.1	8018-01-7	Mancozeb	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
6.0E-02	o	5.0E-03	i	6.0E-02	r	5.0E-03	r	0.1	12427-38-2	Maneb	8.1E+00	ca*	2.9E+01	ca	1.1E-01	ca	1.1E+00	ca		
		2.4E-02	i			1.4E-05	i		7439-96-5	Manganese and compounds+++	1.8E+03	nc	1.9E+04	nc	5.1E-02	nc	8.8E+02	nc		
		9.0E-05	h			9.0E-05	r	0.1	950-10-7	Mephosfolan	5.5E+00	nc	5.5E+01	nc	3.3E-01	nc	3.3E+00	nc		
		3.0E-02	i			3.0E-02	r	0.1	24307-26-4	Mepiquat chloride	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.9E-02	n	1.0E-01	n	2.9E-02	r	1.0E-01	r	0.1	149-30-4	2-Mercaptobenzothiazole	1.7E+01	ca	5.9E+01	ca	2.3E-01	ca	2.3E+00	ca		
		3.0E-04	i						7487-94-7	Mercury and compounds	2.3E+01	nc	3.1E+02	nc			1.1E+01	nc		
						8.6E-05	i		7439-97-6	Mercury (elemental)					3.1E-01	nc				
		1.0E-04	i					0.1	22967-92-6	Mercury (methyl)	6.1E+00	nc	6.2E+01	nc			3.6E+00	nc		
		3.0E-05	i			3.0E-05	r	0.1	150-50-5	Merphos	1.8E+00	nc	1.8E+01	nc	1.1E-01	nc	1.1E+00	nc		
		3.0E-05	i			3.0E-05	r	0.1	78-48-8	Merphos oxide	1.8E+00	nc	1.8E+01	nc	1.1E-01	nc	1.1E+00	nc		
		6.0E-02	i			6.0E-02	r	0.1	57837-19-1	Metalaxyl	3.7E+03	nc	3.7E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-04	i			2.0E-04	h	y	126-98-7	Methacrylonitrile	2.1E+00	nc	8.4E+00	nc	7.3E-01	nc	1.0E+00	nc		
		5.0E-05	i			5.0E-05	r	0.1	10265-92-6	Methamidophos	3.1E+00	nc	3.1E+01	nc	1.8E-01	nc	1.8E+00	nc		
		5.0E-01	i			5.0E-01	r	0.1	67-56-1	Methanol	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
		1.0E-03	i			1.0E-03	r	0.1	950-37-8	Methidathion	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	y	16752-77-5	Methomyl	4.4E+01	nc	1.5E+02	nc	9.1E+01	nc	1.5E+02	nc		
		5.0E-03	i			5.0E-03	r	0.1	72-43-5	Methoxychlor	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc	1.6E+02	8.0E+00
		1.0E-03	h			5.7E-03	i	0.1	109-86-4	2-Methoxyethanol	6.1E+01	nc	6.2E+02	nc	2.1E+01	nc	3.6E+01	nc		
		2.0E-03	h			2.0E-03	r	0.1	110-49-6	2-Methoxyethanol acetate	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
4.6E-02	h			4.6E-02	r			0.1	99-59-2	2-Methoxy-5-nitroaniline	1.1E+01	ca	3.7E+01	ca	1.5E-01	ca	1.5E+00	ca		
		1.0E+00	h			1.0E+00	r	y	79-20-9	Methyl acetate	2.2E+04	nc	9.2E+04	nc	3.7E+03	nc	6.1E+03	nc		
		3.0E-02	h			3.0E-02	r	y	96-33-3	Methyl acrylate	7.0E+01	nc	2.3E+02	nc	1.1E+02	nc	1.8E+02	nc		
2.4E-01	h			2.4E-01	r			0.1	95-53-4	2-Methylaniline (o-toluidine)	2.0E+00	ca	7.2E+00	ca	2.8E-02	ca	2.8E-01	ca		
1.8E-01	h			1.8E-01	r			0.1	636-21-5	2-Methylaniline hydrochloride	2.7E+00	ca	9.6E+00	ca	3.7E-02	ca	3.7E-01	ca		
		5.0E-04	i			5.0E-04	r	0.1	94-74-6	2-Methyl-4-chlorophenoxyacetic acid	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
		1.0E-02	i			1.0E-02	r	0.1	94-81-5	4-(2-Methyl-4-chlorophenoxy) butyric acid	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-03	i			1.0E-03	r	0.1	93-65-2	2-(2-Methyl-4-chlorophenoxy) propionic acid	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	i			1.0E-03	r	0.1	16484-77-8	2-(2-Methyl-1,4-chlorophenoxy) propionic acid	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		8.6E-01	r			8.6E-01	h	y	108-87-2	Methylcyclohexane	2.6E+03	nc	8.7E+03	nc	3.1E+03	nc	5.2E+03	nc		
2.5E-01	h			2.5E-01	r			0.1	101-77-9	4,4'-Methylenebisbenzeneamine	1.9E+00	ca	6.9E+00	ca	2.7E-02	ca	2.7E-01	ca		
1.3E-01	h	7.0E-04	h	1.3E-01	h	7.0E-04	r	0.1	101-14-4	4,4'-Methylene bis(2-chloroaniline)	3.7E+00	ca*	1.3E+01	ca*	5.2E-02	ca*	5.2E-01	ca*		
4.6E-02	i			4.6E-02	r			0.1	101-61-1	4,4'-Methylene bis(N,N'-dimethyl)aniline	1.1E+01	ca	3.7E+01	ca	1.5E-01	ca	1.5E+00	ca		
		1.0E-02	h			1.0E-02	r	y	74-95-3	Methylene bromide	6.7E+01	nc	2.3E+02	nc	3.7E+01	nc	6.1E+01	nc		
7.5E-03	i	6.0E-02	i	1.6E-03	i	8.6E-01	h	y	75-09-2	Methylene chloride	9.1E+00	ca	2.1E+01	ca	4.1E+00	ca	4.3E+00	ca	2.0E-02	1.0E-03

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ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		1.7E-04	r			1.7E-04	i	0.1	101-68-8	4,4'-Methylene diphenyl diisocyanate	1.0E+01	nc	1.0E+02	nc	6.2E-01	nc	6.2E+00	nc		
		6.0E-01	i			1.4E+00	i y		78-93-3	**Methyl ethyl ketone (2-Butanone)**	2.2E+04	nc	1.1E+05	nc	5.1E+03	nc	7.0E+03	nc		
		8.0E-02	h			8.6E-01	i y		108-10-1	**Methyl isobutyl ketone**	5.3E+03	nc	4.7E+04	nc	3.1E+03	nc	2.0E+03	nc		
		5.7E-04	r			5.7E-04	n	0.1	74-93-1	Methyl Mercaptan	3.5E+01	nc	3.5E+02	nc	2.1E+00	nc	2.1E+01	nc		
		1.4E+00	i			2.0E-01	i y		80-62-6	Methyl methacrylate	2.2E+03	nc	2.7E+03	sat	7.3E+02	nc	1.4E+03	nc		
3.3E-02	h			3.3E-02	r			0.1	99-55-8	2-Methyl-5-nitroaniline	1.5E+01	ca	5.2E+01	ca	2.0E-01	ca	2.0E+00	ca		
		2.5E-04	i			2.5E-04	r	0.1	298-00-0	Methyl parathion	1.5E+01	nc	1.5E+02	nc	9.1E-01	nc	9.1E+00	nc		
		5.0E-02	i			5.0E-02	r	0.1	95-48-7	2-Methylphenol	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc	1.5E+01	8.0E-01
		5.0E-02	i			5.0E-02	r	0.1	108-39-4	3-Methylphenol	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	h			5.0E-03	r	0.1	106-44-5	4-Methylphenol	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	p			2.0E-02	r	0.1	993-13-5	Methyl phosphonic acid	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-03	h			1.1E-02	h y		25013-15-4	Methyl styrene (mixture)	1.3E+02	nc	5.4E+02	nc	4.2E+01	nc	6.0E+01	nc		
		7.0E-02	h			7.0E-02	r y		98-83-9	Methyl styrene (alpha)	6.8E+02	sat	6.8E+02	sat	2.6E+02	nc	4.3E+02	nc		
1.8E-03	c	8.6E-01	r	9.1E-04	c	8.6E-01	i y		1634-04-4	**Methyl tertbutyl ether (MTBE)**	3.2E+01	ca	7.0E+01	ca	7.4E+00	ca	1.1E+01	ca		
		1.5E-01	i			1.5E-01	r	0.1	51218-45-2	Metolaclor (Dual)	9.2E+03	nc	9.2E+04	nc	5.5E+02	nc	5.5E+03	nc		
		2.5E-02	i			2.5E-02	r	0.1	21087-64-9	Metribuzin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.8E+00	x	2.0E-04	i	1.8E+00	r	2.0E-04	r	0.1	2385-85-5	Mirex	2.7E-01	ca*	9.6E-01	ca	3.7E-03	ca	3.7E-02	ca		
		2.0E-03	i			2.0E-03	r	0.1	2212-67-1	Molinate	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-03	i						7439-98-7	Molybdenum	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc		
		1.0E-01	i			1.0E-01	r	0.1	10599-90-3	Monochloramine	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r	0.1	300-76-5	Naled	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.0E-01	i			1.0E-01	r	0.1	15299-99-7	Napropamide	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-02	i						7440-02-0	Nickel (soluble salts)	1.6E+03	nc	2.0E+04	nc			7.3E+02	nc	1.3E+02	7.0E+00
				8.4E-01	i					Nickel refinery dust					8.0E-03	ca				
				1.7E+00	i				12035-72-2	Nickel subsulfide			1.1E+04	ca	4.0E-03	ca				
Tap Water PRG Based on Infant NOAEL (see IRIS)									14797-55-8	Nitrate+++							1.0E+04	nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)									14797-65-0	Nitrite+++							1.0E+03	nc		
		3.0E-03	p			3.0E-05	p	0.1	88-74-4	**2-Nitroaniline**	1.8E+02	nc	1.8E+03	nc	1.1E-01	nc	1.1E+02	nc		
2.1E-02	p	3.0E-04	p	2.1E-02	r	3.0E-04	p	0.1	99-09-2	**3-Nitroaniline**	1.8E+01	nc	8.2E+01	ca**	3.2E-01	ca**	3.2E+00	ca**		
2.1E-02	p	3.0E-03	p	2.1E-02	r	1.0E-03	p	0.1	100-01-6	**4-Nitroaniline**	2.3E+01	ca**	8.2E+01	ca*	3.2E-01	ca*	3.2E+00	ca*		
		5.0E-04	i			5.7E-04	h y		98-95-3	Nitrobenzene	2.0E+01	nc	1.0E+02	nc	2.1E+00	nc	3.4E+00	nc	1.0E-01	7.0E-03
		7.0E-02	h			7.0E-02	r	0.1	67-20-9	Nitrofurantoin	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
1.5E+00	h			1.5E+00	r			0.1	59-87-0	Nitrofurazone	3.2E-01	ca	1.1E+00	ca	4.5E-03	ca	4.5E-02	ca		
1.4E-02	n			1.4E-02	r			0.1	55-63-0	Nitroglycerin	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
		1.0E-01	i			1.0E-01	r	0.1	556-88-7	Nitroguanidine	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
9.4E+00	r	5.7E-03	r	9.4E+00	h	5.7E-03	i y		79-46-9	2-Nitropropane					7.2E-04	ca	1.2E-03	ca		
5.4E+00	i			5.6E+00	i		y		924-16-3	N-Nitrosodi-n-butylamine	2.4E-02	ca	5.8E-02	ca	1.2E-03	ca	2.0E-03	ca		
2.8E+00	i			2.8E+00	r			0.1	1116-54-7	N-Nitrosodiethanolamine	1.7E-01	ca	6.2E-01	ca	2.4E-03	ca	2.4E-02	ca		
1.5E+02	i			1.5E+02	i			0.1	55-18-5	N-Nitrosodiethylamine	3.2E-03	ca	1.1E-02	ca	4.5E-05	ca	4.5E-04	ca		
5.1E+01	i	8.0E-06	p	4.9E+01	i	8.0E-06	r	0.1	62-75-9	***N*-Nitrosodimethylamine**	9.5E-03	ca*	3.4E-02	ca	1.4E-04	ca	1.3E-03	ca		
4.9E-03	i	2.0E-02	p	4.9E-03	r	2.0E-02	r	0.1	86-30-6	***N*-Nitrosodiphenylamine**	9.9E+01	ca*	3.5E+02	ca*	1.4E+00	ca*	1.4E+01	ca*	1.0E+00	6.0E-02
7.0E+00	i			7.0E+00	r			0.1	621-64-7	N-Nitroso di-n-propylamine	6.9E-02	ca	2.5E-01	ca	9.6E-04	ca	9.6E-03	ca	5.0E-05	2.0E-06

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
2.2E+01	i			2.2E+01	r			0.1	10595-95-6	N-Nitroso-N-methylethylamine	2.2E-02	ca	7.8E-02	ca	3.1E-04	ca	3.1E-03	ca		
2.1E+00	i			2.1E+00	i			0.1	930-55-2	N-Nitrosopyrrolidine	2.3E-01	ca	8.2E-01	ca	3.1E-03	ca	3.2E-02	ca		
		2.0E-02	p			2.0E-02	r y		99-08-1	**m-Nitrotoluene**	7.3E+02	nc	1.0E+03	sat	7.3E+01	nc	1.2E+02	nc		
2.3E-01	p	1.0E-02	h	2.3E-01	r	1.0E-02	r y		88-72-2	**o-Nitrotoluene**	8.8E-01	ca	2.2E+00	ca	2.9E-02	ca	4.9E-02	ca		
1.7E-02	p	1.0E-02	p	1.7E-02	r	1.0E-02	r y		99-99-0	**p-Nitrotoluene**	1.2E+01	ca*	3.0E+01	ca*	4.0E-01	ca*	6.6E-01	ca*		
		4.0E-02	i			4.0E-02	r	0.1	27314-13-2	Norflurazon	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		7.0E-04	i			7.0E-04	r	0.1	85509-19-9	NuStar	4.3E+01	nc	4.3E+02	nc	2.6E+00	nc	2.6E+01	nc		
		3.0E-03	i			3.0E-03	r	0.1	32536-52-0	Octabromodiphenyl ether	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		2.0E-03	h			2.0E-03	r	0.1	152-16-9	Octamethylpyrophosphoramide	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-02	i			5.0E-02	r	0.1	19044-88-3	Oryzalin	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	i			5.0E-03	r	0.1	19666-30-9	Oxadiazon	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.5E-02	i			2.5E-02	r	0.1	23135-22-0	Oxamyl	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-03	i			3.0E-03	r	0.1	42874-03-3	Oxyfluorfen	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		1.3E-02	i			1.3E-02	r	0.1	76738-62-0	Paclobutrazol	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		4.5E-03	i			4.5E-03	r	0.1	4685-14-7	Paraquat	2.7E+02	nc	2.8E+03	nc	1.6E+01	nc	1.6E+02	nc		
		6.0E-03	h			6.0E-03	r	0.1	56-38-2	Parathion	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc		
		5.0E-02	h			5.0E-02	r	0.1	1114-71-2	Pebulate	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-02	i			4.0E-02	r	0.1	40487-42-1	Pendimethalin	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
2.3E-02	h			2.3E-02	r			0.1	87-84-3	Pentabromo-6-chloro cyclohexane	2.1E+01	ca	7.5E+01	ca	2.9E-01	ca	2.9E+00	ca		
		2.0E-03	i			2.0E-03	r	0.1	32534-81-9	Pentabromodiphenyl ether	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		8.0E-04	i			8.0E-04	r	0.1	608-93-5	Pentachlorobenzene	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
2.6E-01	h	3.0E-03	i	2.6E-01	r	3.0E-03	r	0.1	82-68-8	Pentachloronitrobenzene	1.9E+00	ca*	6.6E+00	ca	2.6E-02	ca	2.6E-01	ca		
1.2E-01	i	3.0E-02	i	1.2E-01	r	3.0E-02	r	0.25	87-86-5	Pentachlorophenol	3.0E+00	ca	9.0E+00	ca	5.6E-02	ca	5.6E-01	ca	3.0E-02	1.0E-03
		1.0E-04	n						7601-90-3	Perchlorate	7.8E+00	ca/nc	1.0E+02	ca/nc			3.6E+00	ca/nc		
		5.0E-02	i			5.0E-02	r	0.1	52645-53-1	Permethrin	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.5E-01	i			2.5E-01	r	0.1	13684-63-4	Phenmedipham	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		3.0E-01	i			3.0E-01	r	0.1	108-95-2	**Phenol**	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc	1.0E+02	5.0E+00
		2.0E-03	n			2.0E-03	r	0.1	92-84-2	Phenothiazine	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		6.0E-03	i			6.0E-03	r	0.1	108-45-2	m-Phenylenediamine	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc		
4.7E-02	h			4.7E-02	r			0.1	95-54-5	**o-Phenylenediamine**	1.0E+01	ca	3.7E+01	ca	1.4E-01	ca	1.4E+00	ca		
		1.9E-01	h			1.9E-01	r	0.1	106-50-3	p-Phenylenediamine	1.2E+04	nc	1.0E+05	max	6.9E+02	nc	6.9E+03	nc		
		8.0E-05	i			8.0E-05	r	0.1	62-38-4	Phenylmercuric acetate	4.9E+00	nc	4.9E+01	nc	2.9E-01	nc	2.9E+00	nc		
1.9E-03	h			1.9E-03	r			0.1	90-43-7	2-Phenylphenol	2.5E+02	ca	8.9E+02	ca	3.5E+00	ca	3.5E+01	ca		
		2.0E-04	h			2.0E-04	r	0.1	298-02-2	Phorate	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc		
		2.0E-02	i			2.0E-02	r	0.1	732-11-6	Phosmet	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		3.0E-04	i			8.6E-05	i	0.1	7803-51-2	Phosphine	1.8E+01	nc	1.8E+02	nc	3.1E-01	nc	1.1E+01	nc		
						2.9E-03	i		7664-38-2	Phosphoric acid					1.0E+01	nc				
		2.0E-05	i						7723-14-0	Phosphorus (white)	1.6E+00	nc	2.0E+01	nc			7.3E-01	nc		
		1.0E+00	h			1.0E+00	r	0.1	100-21-0	p-Phthalic acid	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
		2.0E+00	i			3.4E-02	h	0.1	85-44-9	Phthalic anhydride	1.0E+05	max	1.0E+05	max	1.2E+02	nc	7.3E+04	nc		
		7.0E-02	i			7.0E-02	r	0.1	1918-02-1	Picloram	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
		1.0E-02	i			1.0E-02	r	0.1	29232-93-7	Pirimiphos-methyl	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		

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TOXICITY VALUES								CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.9E+00	h 7.0E-06	h	8.9E+00	r	7.0E-06	r	0.1		Polybrominated biphenyls	5.5E-02	ca**	1.9E-01	ca*	7.6E-04	ca*	7.6E-03	ca*		
									Polychlorinated biphenyls (PCBs, see IRIS)										
7.0E-02	i 7.0E-05	i	7.0E-02	i	7.0E-05	r	0.14	12674-11-2	PCBs (unspeciated mixture, low risk, e.g. Aroclor 1016)	3.9E+00	nc	2.1E+01	ca**	9.6E-02	ca**	9.6E-01	ca**		
2.0E+00	i 2.0E-05	i	2.0E+00	i	2.0E-05	r	0.14	11097-69-1	PCBs (unspeciated mixture, high risk, e.g. Aroclor 1254)	2.2E-01	ca**	7.4E-01	ca*	3.4E-03	ca*	3.4E-02	ca*		
4.5E+00	n		4.5E+00	r			0.1	61788-33-8	Polychlorinated terphenyls	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca		
									Polynuclear aromatic hydrocarbons (PAHs)										
	6.0E-02	i			6.0E-02	r	y	83-32-9	Acenaphthene	3.7E+03	nc	2.9E+04	nc	2.2E+02	nc	3.7E+02	nc	5.7E+02	2.9E+01
	3.0E-01	i			3.0E-01	r	y	120-12-7	Anthracene	2.2E+04	nc	1.0E+05	max	1.1E+03	nc	1.8E+03	nc	1.2E+04	5.9E+02
7.3E-01	n		7.3E-01	r			0.13	56-55-3	Benz[a]anthracene	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca	2.0E+00	8.0E-02
7.3E-01	n		7.3E-01	r			0.13	205-99-2	Benzo[b]fluoranthene	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca	5.0E+00	2.0E-01
7.3E-02	n		7.3E-02	r			0.13	207-08-9	Benzo[k]fluoranthene	6.2E+00	ca	2.1E+01	ca	9.2E-02	ca	9.2E-01	ca	4.9E+01	2.0E+00
1.2E+00	c		3.9E-01	c			0.13	207-08-9	"CAL-Modified PRG"	3.8E-01	ca	1.3E+00	ca	1.7E-02	ca	5.6E-02	ca		
7.3E+00	i		7.3E+00	r			0.13	50-32-8	Benzo[a]pyrene	6.2E-02	ca	2.1E-01	ca	9.2E-04	ca	9.2E-03	ca	8.0E+00	4.0E-01
7.3E-03	n		7.3E-03	r			0.13	218-01-9	Chrysene	6.2E+01	ca	2.1E+02	ca	9.2E-01	ca	9.2E+00	ca	1.6E+02	8.0E+00
1.2E-01	c		3.9E-02	c			0.13		"CAL-Modified PRG"	3.8E+00	ca	1.3E+01	ca	1.7E-01	ca	5.6E-01	ca		
7.3E+00	n		7.3E+00	r			0.13	53-70-3	Dibenz[ah]anthracene	6.2E-02	ca	2.1E-01	ca	9.2E-04	ca	9.2E-03	ca	2.0E+00	8.0E-02
	4.0E-02	i			4.0E-02	r		0.13 206-44-0	Fluoranthene	2.3E+03	nc	2.2E+04	nc	1.5E+02	nc	1.5E+03	nc	4.3E+03	2.1E+02
	4.0E-02	i			4.0E-02	r	y	86-73-7	*Fluorene*	2.7E+03	nc	2.6E+04	nc	1.5E+02	nc	2.4E+02	nc	5.6E+02	2.8E+01
7.3E-01	n		7.3E-01	r			0.13	193-39-5	Indeno[1,2,3-cd]pyrene	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca	1.4E+01	7.0E-01
	2.0E-02	i			8.6E-04	i	y	91-20-3	Naphthalene	5.6E+01	nc	1.9E+02	nc	3.1E+00	nc	6.2E+00	nc	8.4E+01	4.0E+00
1.2E-01	r		1.2E-01	c					**"CAL-Modified PRG"**	1.7E+00	ca	4.2E+00	ca	5.6E-02	ca	9.3E-02	ca		
	3.0E-02	i			3.0E-02	r	y	129-00-0	Pyrene	2.3E+03	nc	2.9E+04	nc	1.1E+02	nc	1.8E+02	nc	4.2E+03	2.1E+02
1.5E-01	i 9.0E-03	i	1.5E-01	r	9.0E-03	r	0.1	67747-09-5	Prochloraz	3.2E+00	ca	1.1E+01	ca	4.5E-02	ca	4.5E-01	ca		
	6.0E-03	h			6.0E-03	r	0.1	26399-36-0	Profluralin	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc		
	1.5E-02	i			1.5E-02	r	0.1	1610-18-0	Prometon	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
	4.0E-03	i			4.0E-03	r	0.1	7287-19-6	Prometryn	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
	7.5E-02	i			7.5E-02	r	0.1	23950-58-5	Pronamide	4.6E+03	nc	4.6E+04	nc	2.7E+02	nc	2.7E+03	nc		
	1.3E-02	i			1.3E-02	r	0.1	1918-16-7	Propachlor	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
	5.0E-03	i			5.0E-03	r	0.1	709-98-8	Propanil	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
	2.0E-02	i			2.0E-02	r	0.1	2312-35-8	Propargite	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	2.0E-03	i			2.0E-03	r	0.1	107-19-7	Propargyl alcohol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
	2.0E-02	i			2.0E-02	r	0.1	139-40-2	Propazine	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	2.0E-02	i			2.0E-02	r	0.1	122-42-9	Propham	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	1.3E-02	i			1.3E-02	r	0.1	60207-90-1	Propiconazole	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
								98-82-8	*Isopropylbenzene (see Cumene)*										
	4.0E-02	n			4.0E-02	r	y	103-65-1	n-Propylbenzene	2.4E+02	sat	2.4E+02	sat	1.5E+02	nc	2.4E+02	nc		
	5.0E-01	p			8.6E-04	p	0.1	57-55-6	Propylene glycol	3.0E+04	nc	1.0E+05	max	3.1E+00	nc	1.8E+04	nc		
	7.0E-01	h			7.0E-01	r	0.1	52125-53-8	Propylene glycol, monoethyl ether	4.3E+04	nc	1.0E+05	max	2.6E+03	nc	2.6E+04	nc		
	7.0E-01	h			5.7E-01	i	0.1	107-98-2	Propylene glycol, monomethyl ether	4.3E+04	nc	1.0E+05	max	2.1E+03	nc	2.6E+04	nc		
2.4E-01	i 8.6E-03	r	1.3E-02	i	8.6E-03	i	y	75-56-9	Propylene oxide	1.9E+00	ca*	6.6E+00	ca*	5.2E-01	ca*	2.2E-01	ca		
	2.5E-01	i			2.5E-01	r	0.1	81335-77-5	Pursuit	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
	2.5E-02	i			2.5E-02	r	0.1	51630-58-1	Pydrin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		

Key : SFo,i=Cancer Slope Factor oral, Inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		1.0E-03	i			1.0E-03	r	0.1	110-86-1	Pyridine	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		5.0E-04	i			5.0E-04	r	0.1	13593-03-8	Quinalphos	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
3.0E+00	i			3.0E+00	r			0.1	91-22-5	Quinoline	1.6E-01	ca	5.7E-01	ca	2.2E-03	ca	2.2E-02	ca		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0.1	121-82-4	RDX (Cyclonite)	4.4E+00	ca*	1.6E+01	ca	6.1E-02	ca	6.1E-01	ca		
		3.0E-02	i			3.0E-02	r	0.1	10453-86-8	Resmethrin	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		5.0E-02	h			5.0E-02	r	0.1	299-84-3	Ronnel	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-03	i			4.0E-03	r	0.1	83-79-4	Rotenone	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		2.5E-02	i			2.5E-02	r	0.1	78587-05-0	Savey	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		5.0E-03	i					0.1	7783-00-8	Selenious Acid	3.1E+02	nc	3.1E+03	nc			1.8E+02	nc		
		5.0E-03	i						7782-49-2	Selenium	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc	5.0E+00	3.0E-01
		5.0E-03	h					0.1	630-10-4	Selenourea	3.1E+02	nc	3.1E+03	nc			1.8E+02	nc		
		9.0E-02	i			9.0E-02	r	0.1	74051-80-2	Sethoxydim	5.5E+03	nc	5.5E+04	nc	3.3E+02	nc	3.3E+03	nc		
		5.0E-03	i						7440-22-4	Silver and compounds	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc	3.4E+01	2.0E+00
1.2E-01	h	5.0E-03	i	1.2E-01	r	5.00E-03	r	0.1	122-34-9	Simazine	4.1E+00	ca*	1.4E+01	ca	5.6E-02	ca	5.6E-01	ca		
		4.0E-03	i						26628-22-8	Sodium azide										
2.7E-01	h	3.0E-02	i	2.7E-01	r	3.0E-02	r	0.1	148-18-5	Sodium diethyldithiocarbamate	1.8E+00	ca	6.4E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-05	i			2.0E-05	r	0.1	62-74-8	Sodium fluoroacetate	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
		1.0E-03	h			1.0E-03	r	0.1	13718-26-8	Sodium metavanadate	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		6.0E-01	i						7440-24-6	Strontium, stable	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		3.0E-04	i			3.0E-04	r	0.1	57-24-9	Strychnine	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E-01	i			2.9E-01	i	y	100-42-5	Styrene	1.7E+03	sat	1.7E+03	sat	1.1E+03	nc	1.6E+03	nc	4.0E+00	2.0E-01
		5.0E-03	p			5.0E-03	r		80-07-9	**1,1'-Sulfonylbis (4-chlorobenzene)**	3.9E+02	nc	5.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.5E-02	i			2.5E-02	r	0.1	88671-89-0	Systhane	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.5E+05	h			1.5E+05	h			0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.9E-06	ca	1.6E-05	ca	4.5E-08	ca	4.5E-07	ca		
		7.0E-02	i			7.0E-02	r	0.1	34014-18-1	Tebuthiuron	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-02	h			2.0E-02	r	0.1	3383-96-8	Temephos	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r	0.1	5902-51-2	Terbacil	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		2.5E-05	h			2.5E-05	r	0.1	13071-79-9	Terbufos	1.5E+00	nc	1.5E+01	nc	9.1E-02	nc	9.1E-01	nc		
		1.0E-03	i			1.0E-03	r	0.1	886-50-0	Terbutryn	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		3.0E-04	i			3.0E-04	r	0.1	95-94-3	1,2,4,5-Tetrachlorobenzene	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
2.6E-02	i	3.0E-02	i	2.6E-02	i	3.0E-02	r	y	630-20-6	1,1,1,2-Tetrachloroethane	3.2E+00	ca	7.3E+00	ca	2.6E-01	ca	4.3E-01	ca		
2.0E-01	i	6.0E-02	p	2.0E-01	i	6.0E-02	r	y	79-34-5	1,1,2,2-Tetrachloroethane	4.1E-01	ca	9.3E-01	ca	3.3E-02	ca	5.5E-02	ca	3.0E-03	2.0E-04
5.4E-01	c	1.0E-02	i	2.1E-02	c	1.0E-02	c	y	127-18-4	**Tetrachloroethylene (PCE)**	4.8E-01	ca*	1.3E+00	ca	3.2E-01	ca	1.0E-01	ca	6.0E-02	3.0E-03
		3.0E-02	i			3.0E-02	r	0.1	58-90-2	2,3,4,6-Tetrachlorophenol	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.0E+01	h			2.0E+01	r			0.1	5216-25-1	p,a,a,a-Tetrachlorotoluene	2.4E-02	ca	8.6E-02	ca	3.4E-04	ca	3.4E-03	ca		
2.4E-02	h	3.0E-02	i	2.4E-02	r	3.0E-02	r	0.1	961-11-5	Tetrachlorovinphos	2.0E+01	ca*	7.2E+01	ca	2.8E-01	ca	2.8E+00	ca		
		5.0E-04	i			5.0E-04	r	0.1	3689-24-5	Tetraethyldithiopyrophosphate	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
7.6E-03	n	2.1E-01	n	6.8E-03	n	8.6E-02	n	y	109-99-9	Tetrahydrofuran	9.4E+00	ca	2.1E+01	ca	9.9E-01	ca	1.6E+00	ca		
		6.6E-05	i						7440-28-0	Thallium and compounds+++	5.2E+00	nc	6.7E+01	nc			2.4E+00	nc		
		1.0E-02	i			1.0E-02	r	0.1	28249-77-6	Thiobencarb	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-02	n			5.0E-02	r	0.1	N/A	Thiocyanate	3.1E+03	nc	1.0E+05	max	1.8E+02	nc	1.8E+03	nc		
		3.0E-04	h			3.0E-04	r	0.1	39196-18-4	Thiofanox	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		

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TOXICITY VALUES								CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		8.0E-02	i			8.0E-02	r 0.1	23564-05-8	Thiophanate-methyl	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		5.0E-03	i			5.0E-03	r 0.1	137-26-8	Thiram	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		6.0E-01	h					7440-31-5	Tin (inorganic, also see tributyltin oxide)	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		4.0E+00	n			8.6E-03	n	7440-32-6	Titanium	1.0E+05	max	1.0E+05	max	3.1E+01	nc	1.5E+05	nc		
		2.0E-01	i			1.1E-01	i y	108-88-3	Toluene	5.2E+02	sat	5.2E+02	sat	4.0E+02	nc	7.2E+02	nc	1.2E+01	6.0E-01
3.2E+00	h			3.2E+00	r		0.1	95-80-7	Toluene-2,4-diamine	1.5E-01	ca	5.4E-01	ca	2.1E-03	ca	2.1E-02	ca		
		6.0E-01	h			6.0E-01	r 0.1	95-70-5	Toluene-2,5-diamine	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc		
		2.0E-01	h			2.0E-01	r 0.1	823-40-5	Toluene-2,6-diamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
1.9E-01	i			1.9E-01	r		0.1	106-49-0	p-Toluidine	2.6E+00	ca	9.1E+00	ca	3.5E-02	ca	3.5E-01	ca		
1.1E+00	i			1.1E+00	i		0.1	8001-35-2	Toxaphene	4.4E-01	ca	1.6E+00	ca	6.0E-03	ca	6.1E-02	ca	3.1E+01	2.0E+00
		7.5E-03	i			7.5E-03	r 0.1	66841-25-6	Tralomethrin	4.6E+02	nc	4.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.3E-02	i			1.3E-02	r 0.1	2303-17-5	Triallate	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		1.0E-02	i			1.0E-02	r 0.1	82097-50-5	Triasulfuron	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-03	i			5.0E-03	r 0.1	615-54-3	1,2,4-Tribromobenzene	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
9.2E-03	p	2.0E-01	p	9.2E-03	r	2.0E-01	r 0.1	126-73-8	**Tributyl phosphate**	5.3E+01	ca	1.9E+02	ca	7.3E-01	ca	7.3E+00	ca		
		3.0E-04	i				0.1	56-35-9	Tributyltin oxide (TBTO)	1.8E+01	nc	1.8E+02	nc			1.1E+01	nc		
3.4E-02	h			3.4E-02	r		0.1	634-93-5	2,4,6-Trichloroaniline	1.4E+01	ca	5.1E+01	ca	2.0E-01	ca	2.0E+00	ca		
2.9E-02	h			2.9E-02	r		0.1	33663-50-2	2,4,6-Trichloroaniline hydrochloride	1.7E+01	ca	5.9E+01	ca	2.3E-01	ca	2.3E+00	ca		
		1.0E-02	i			1.0E-03	p y	120-82-1	**1,2,4-Trichlorobenzene**	6.2E+01	nc	2.2E+02	nc	3.7E+00	nc	7.2E+00	nc	5.0E+00	3.0E-01
		2.8E-01	n			6.3E-01	p y	71-55-6	1,1,1-Trichloroethane	1.2E+03	sat	1.2E+03	sat	2.3E+03	nc	3.2E+03	nc	2.0E+00	1.0E-01
5.7E-02	i	4.0E-03	i	5.6E-02	i	4.0E-03	r y	79-00-5	1,1,2-Trichloroethane	7.3E-01	ca*	1.6E+00	ca*	1.2E-01	ca	2.0E-01	ca	2.0E-02	9.0E-04
4.0E-01	n	3.0E-04	n	4.0E-01	n	1.0E-02	n y	79-01-6	Trichloroethylene (TCE)	5.3E-02	ca	1.1E-01	ca	1.7E-02	ca	2.8E-02	ca	6.0E-02	3.0E-03
1.3E-02	c			7.0E-03	c	1.7E-01	c y	79-01-6	**"CAL-Modified PRG"**	2.9E+00	ca	6.5E+00	ca	9.6E-01	ca	1.4E+00	ca		
		3.0E-01	i			2.0E-01	h y	75-69-4	Trichlorofluoromethane	3.9E+02	nc	2.0E+03	sat	7.3E+02	nc	1.3E+03	nc		
		1.0E-01	i			1.0E-01	r 0.1	95-95-4	2,4,5-Trichlorophenol	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc	2.7E+02	1.4E+01
1.1E-02	i	1.0E-04	n	1.1E-02	i	1.0E-04	r 0.1	88-06-2	2,4,6-Trichlorophenol	6.1E+00	nc**	6.2E+01	nc**	3.7E-01	nc**	3.6E+00	nc**	2.0E-01	8.0E-03
7.0E-02	c			7.0E-02	c		0.1	88-06-2	"CAL-Modified PRG"	6.9E+00	ca	2.5E+01	ca	9.6E-02	ca	9.6E-01	ca		
		1.0E-02	i			1.0E-02	r 0.1	93-76-5	2,4,5-Trichlorophenoxyacetic Acid	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		8.0E-03	i			8.0E-03	r 0.1	93-72-1	2-(2,4,5-Trichlorophenoxy) propionic acid	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc		
		5.0E-03	i			5.0E-03	r y	598-77-6	**1,1,2-Trichloropropane**	7.1E+01	nc	2.7E+02	nc	1.8E+01	nc	3.0E+01	nc		
2.0E+00	n	6.0E-03	i	2.0E+00	r	1.4E-03	n y	96-18-4	**1,2,3-Trichloropropane**	3.4E-02	ca	7.6E-02	ca	3.4E-03	ca	5.6E-03	ca		
		1.0E-02	p			3.0E-04	p y	96-19-5	**1,2,3-Trichloropropene**	5.2E+00	nc	1.7E+01	nc	1.1E+00	nc	2.2E+00	nc		
		3.0E-03	i			3.0E-03	r 0.1	58138-08-2	Tridiphane	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		2.0E-03	r			2.0E-03	i y	121-44-8	Triethylamine	2.3E+01	nc	8.6E+01	nc	7.3E+00	nc	1.2E+01	nc		
7.7E-03	i	7.5E-03	i	7.7E-03	r	7.5E-03	r 0.1	1582-09-8	Trifluralin	6.3E+01	ca**	2.2E+02	ca*	8.7E-01	ca*	8.7E+00	ca*		
		1.4E-04	r			1.4E-04	n 0.1	552-30-7	Trimellitic Anhydride (TMAN)	8.6E+00	nc	8.6E+01	nc	5.1E-01	nc	5.1E+00			
		5.0E-02	p			1.7E-03	p y	95-63-6	1,2,4-Trimethylbenzene	5.2E+01	nc	1.7E+02	nc	6.2E+00	nc	1.2E+01	nc		
		5.0E-02	p			1.7E-03	p y	108-67-8	1,3,5-Trimethylbenzene	2.1E+01	nc	7.0E+01	nc	6.2E+00	nc	1.2E+01	nc		
3.7E-02	h			3.7E-02	r		0.1	512-56-1	Trimethyl phosphate	1.3E+01	ca	4.7E+01	ca	1.8E-01	ca	1.8E+00	ca		
		3.0E-02	i			3.0E-02	r 0.1	99-35-4	1,3,5-Trinitrobenzene	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-02	h			1.0E-02	r 0.1	479-45-8	Trinitrophenylmethylnitramine	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
3.0E-02	i	5.0E-04	i	3.0E-02	r	5.0E-04	r 0.1	118-96-7	2,4,6-Trinitrotoluene	1.6E+01	ca**	5.7E+01	ca**	2.2E-01	ca**	2.2E+00	ca**		

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TOXICITY VALUES									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		2.0E-02	p			2.0E-02	r	0.1	791-28-6	**Triphenylphosphine oxide**	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
1.4E-02	p	3.1E-01	p	1.4E-02	r	3.1E-01	r	0.1	115-96-8	**Tris(2-chloroethyl) phosphate**	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
3.2E-03	p	1.0E-01	p	3.2E-03	r	1.0E-01	r	0.1	78-42-2	**Tris(2-ethylhexyl) phosphate**	1.5E+02	ca*	5.4E+02	ca	2.1E+00	ca	2.1E+01	ca		
		2.0E-04	n						7440-61-1	Uranium (chemical toxicity only)	1.6E+01	nc	2.0E+02	nc			7.3E+00	nc		
		1.0E-03	n						7440-62-2	Vanadium and compounds	7.8E+01	nc	1.0E+03	nc			3.6E+01	nc	6.0E+03	3.0E+02
		1.0E-03	i			1.0E-03	r	0.1	1929-77-7	Vernam	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	0.1	50471-44-8	Vinclozolin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E+00	h			5.7E-02	i	y	108-05-4	Vinyl acetate	4.3E+02	nc	1.4E+03	nc	2.1E+02	nc	4.1E+02	nc	1.7E+02	8.0E+00
1.1E-01	r	8.6E-04	r	1.1E-01	h	8.6E-04	i	y	593-60-2	Vinyl bromide (bromoethene)	1.9E-01	ca*	4.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*		
1.5E+00	i	3.0E-03	i	3.1E-02	i	2.9E-02	i	y	75-01-4	Vinyl chloride (child/adult)+++	7.9E-02	ca			1.1E-01	ca	2.0E-02	ca	1.0E-02	7.0E-04
7.5E-01	i	3.0E-03	i	1.6E-02	i	2.9E-02	i	y	75-01-4	Vinyl chloride (adult)			7.5E-01	ca						
		3.0E-04	i			3.0E-04	r	0.1	81-81-2	Warfarin	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E-01	i			2.9E-02	i	y 0.1	1330-20-7	**Xylenes**	2.7E+02	nc	4.2E+02	sat	1.1E+02	nc	2.1E+02	nc	2.1E+02	1.0E+01
		3.0E-01	i						7440-66-6	Zinc	2.3E+04	nc	1.0E+05	max			1.1E+04	nc	1.2E+04	6.2E+02
		3.0E-04	i						1314-84-7	Zinc phosphide	2.3E+01	nc	3.1E+02	nc			1.1E+01	nc		
		5.0E-02	i			5.0E-02	r	0.1	12122-67-7	Zineb	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		

Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater

Volume 1: Summary Tier 1 Lookup Tables

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DISCLAIMER

This document, *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (Interim Final, May 2005), is a technical report prepared by staff of the Hawai'i Department of Health, Environmental Management Division. It is intended to serve as an update to the 1996 HIDOH document entitled *Risk-Based Corrective Action and Decision Making at Sites With Contaminated Soil and Groundwater*. This document is not intended to establish policy or regulation. The Environmental Action Levels presented in this document and the accompanying text are specifically not intended to serve as: 1) a stand-alone decision making tool, 2) guidance for the preparation of baseline ("Tier 3") environmental assessments, 3) a rule to determine if a waste is hazardous under the state or federal regulations, or 4) a rule to determine when the release of hazardous substances must be reported to the overseeing regulatory agency.

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TABLE A: GROUNDWATER IS A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER

TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
ACENAPHTHENE	1.6E+01	2.0E+01	1.6E+01	2.0E+01
ACENAPHTHYLENE	1.0E+02	2.4E+02	1.3E+01	3.0E+01
ACETONE	5.0E-01	1.5E+03	5.0E-01	1.5E+03
ALDRIN	2.9E-02	4.0E-03	2.9E-02	4.0E-03
ANTHRACENE	2.8E+00	7.3E-01	2.8E+00	7.3E-01
ANTIMONY	2.0E+01	6.0E+00	2.0E+01	6.0E+00
ARSENIC	2.2E+01	1.0E+01	2.2E+01	1.0E+01
BARIUM	7.5E+02	2.0E+03	7.5E+02	2.0E+03
BENZENE	2.2E-01	5.0E+00	2.2E-01	5.0E+00
BENZO(a)ANTHRACENE	6.2E+00	2.7E-02	6.2E+00	2.7E-02
BENZO(a)PYRENE	6.2E-01	1.4E-02	6.2E-01	1.4E-02
BENZO(b)FLUORANTHENE	6.2E+00	9.2E-02	6.2E+00	9.2E-02
BENZO(g,h,i)PERYLENE	2.7E+01	1.0E-01	2.7E+01	1.0E-01
BENZO(k)FLUORANTHENE	3.7E+01	4.0E-01	3.7E+01	4.0E-01
BERYLLIUM	4.0E+00	4.0E+00	4.0E+00	2.7E+00
BIPHENYL, 1,1-	6.5E-01	5.0E-01	6.5E-01	5.0E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	9.5E-03	1.2E-04	9.5E-03
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	2.7E-01	3.0E-03	2.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	6.0E+00	3.5E+01	6.0E+00
BORON	1.6E+00	1.6E+00	1.6E+00	1.6E+00
BROMODICHLOROMETHANE	3.4E-03	1.8E-01	3.4E-03	1.8E-01
BROMOFORM	2.2E+00	1.0E+02	2.2E+00	1.0E+02
BROMOMETHANE	3.4E-01	8.5E+00	3.4E-01	8.5E+00
CADMIUM	1.2E+01	3.0E+00	1.2E+01	3.0E+00
CARBON TETRACHLORIDE	2.7E-02	5.0E+00	2.7E-02	5.0E+00
CHLORDANE	1.6E+00	9.0E-02	1.6E+00	4.0E-03
CHLOROANILINE, p-	5.3E-02	5.0E+00	5.3E-02	5.0E+00
CHLOROBENZENE	3.0E+00	5.0E+01	1.5E+00	2.5E+01
CHLOROETHANE	2.7E-01	3.9E+00	2.7E-01	3.9E+00
CHLOROFORM	1.8E-02	6.2E+01	1.8E-02	6.2E+01
CHLOROMETHANE	1.6E+01	1.6E+02	1.6E+01	1.6E+02
CHLOROPHENOL, 2-	1.2E-02	1.8E-01	1.2E-02	1.8E-01
CHROMIUM (Total)	2.1E+02	7.4E+01	2.1E+02	7.4E+01
CHROMIUM III	7.5E+02	5.7E+02	7.5E+02	7.4E+01
CHROMIUM VI	8.0E+00	1.6E+01	8.0E+00	1.1E+01
CHRYSENE	2.3E+01	3.5E-01	2.3E+01	3.5E-01
COBALT	4.0E+01	3.0E+00	4.0E+01	3.0E+00
COPPER	2.3E+02	2.9E+00	2.3E+02	2.9E+00
CYANIDE (Free)	1.0E+02	1.0E+00	1.0E+02	1.0E+00

TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
DIBENZO(a,h)ANTHTRACENE	6.2E-01	9.2E-03	6.2E-01	9.2E-03
DIBROMO-3-CHLOROPROPANE, 1,2-	9.0E-04	4.0E-02	9.0E-04	4.0E-02
DIBROMOCHLOROMETHANE	1.1E-02	1.3E-01	1.1E-02	1.3E-01
DIBROMOETHANE, 1,2-	5.2E-05	5.6E-03	5.2E-05	5.6E-03
DICHLOROBENZENE, 1,2-	1.1E+00	1.0E+01	1.1E+00	1.0E+01
DICHLOROBENZENE, 1,3-	2.1E+01	1.8E+02	7.4E+00	6.5E+01
DICHLOROBENZENE, 1,4-	6.5E-02	5.0E+00	6.5E-02	5.0E+00
DICHLOROBENZIDINE, 3,3-	4.0E-02	1.5E-01	4.0E-02	1.5E-01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	2.8E-01	2.4E+00	1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	2.8E-01	2.4E+00	1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	1.3E-02	1.7E+00	1.0E-03
DICHLOROETHANE, 1,1-	1.9E+00	4.7E+01	1.9E+00	4.7E+01
DICHLOROETHANE, 1,2-	1.1E-03	1.2E-01	1.1E-03	1.2E-01
DICHLOROETHYLENE, 1,1-	1.2E+00	7.0E+00	1.2E+00	7.0E+00
DICHLOROETHYLENE, Cis 1,2-	2.2E+00	7.0E+01	2.2E+00	7.0E+01
DICHLOROETHYLENE, Trans 1,2-	6.7E+00	1.0E+02	6.7E+00	1.0E+02
DICHLOROPHENOL, 2,4-	3.0E-01	3.0E-01	3.0E-01	3.0E-01
DICHLOROPROPANE, 1,2-	2.1E-02	5.0E+00	2.1E-02	5.0E+00
DICHLOROPROPENE, 1,3-	4.6E-02	4.0E-01	4.6E-02	4.0E-01
DIELDRIN	5.2E-03	4.2E-03	2.3E-03	1.9E-03
DIETHYLPHTHALATE	2.2E+01	9.4E+02	3.5E-02	1.5E+00
DIMETHYLPHENOL, 2,4-	1.8E+00	2.7E+02	7.3E-01	1.1E+02
DIMETHYLPHTHALATE	2.2E+01	9.4E+02	3.5E-02	1.5E+00
DINITROPHENOL, 2,4-	2.1E-01	7.3E+01	2.1E-01	7.3E+01
DINITROTOLUENE, 2,4-	2.5E-01	3.4E+01	2.5E-01	3.4E+01
DIOXANE, 1,4-	3.7E-03	6.1E+00	3.7E-03	6.1E+00
DIOXIN (2,3,7,8-TCDD)	3.9E-06	3.0E-05	3.9E-06	5.0E-06
ENDOSULFAN	1.8E-02	3.4E-02	4.6E-03	8.7E-03
ENDRIN	1.0E-02	3.7E-02	6.5E-04	2.3E-03
ETHYLBENZENE	3.3E+00	3.0E+01	3.3E+00	3.0E+01
FLUORANTHENE	4.0E+01	4.0E+01	4.0E+01	8.0E+00
FLUORENE	1.6E+02	2.4E+02	8.9E+00	3.9E+00
HEPTACHLOR	1.1E-01	5.3E-02	1.3E-02	3.6E-03
HEPTACHLOR EPOXIDE	5.3E-02	5.3E-02	1.4E-02	3.6E-03
HEXACHLOROBENZENE	3.0E-01	1.0E+00	3.0E-01	1.0E+00
HEXACHLOROBUTADIENE	4.3E+00	8.6E-01	4.3E+00	8.6E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	9.8E-02	1.6E-01	4.9E-02	8.0E-02
HEXACHLOROETHANE	1.6E+01	4.8E+00	1.6E+01	4.8E+00
INDENO(1,2,3-cd)PYRENE	6.2E+00	9.2E-02	6.2E+00	9.2E-02

TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
LEAD[3]	2.0E+02 (4.0E+02)	1.5E+01	2.0E+02 (4.0E+02)	5.6E+00
MERCURY	1.0E+01	2.0E+00	1.0E+01	2.5E-02
METHOXYCHLOR	1.9E+01	3.0E-02	1.9E+01	3.0E-02
METHYL ETHYL KETONE	6.4E+00	7.0E+03	6.4E+00	7.0E+03
METHYL ISOBUTYL KETONE	3.9E+00	1.7E+02	3.9E+00	1.7E+02
METHYL MERCURY	6.1E+00	3.0E-03	6.1E+00	3.0E-03
METHYL TERT BUTYL ETHER	2.3E-02	5.0E+00	2.3E-02	5.0E+00
METHYLENE CHLORIDE	6.7E-02	4.3E+00	6.7E-02	4.3E+00
METHYLNAPHTHALENE (total 1- & 2-)	1.2E+00	1.0E+01	2.5E-01	2.1E+00
MOLYBDENUM	4.0E+01	1.8E+02	4.0E+01	1.8E+02
NAPHTHALENE	1.2E+00	6.2E+00	1.2E+00	6.2E+00
NICKEL	1.5E+02	5.0E+00	1.5E+02	5.0E+00
PENTACHLOROPHENOL	3.0E+00	1.0E+00	3.0E+00	1.0E+00
PERCHLORATE	7.0E-03	3.7E+00	7.0E-03	3.7E+00
PHENANTHRENE	1.8E+01	7.7E+00	1.1E+01	4.6E+00
PHENOL	7.6E-02	5.0E+00	7.6E-02	5.0E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	5.0E-01	1.1E+00	1.4E-02
PYRENE	8.5E+01	2.0E+00	8.5E+01	2.0E+00
SELENIUM	1.0E+01	2.0E+01	1.0E+01	5.0E+00
SILVER	2.0E+01	1.0E+00	2.0E+01	1.0E+00
STYRENE	1.5E+00	1.0E+01	1.5E+00	1.0E+01
tert-BUTYL ALCOHOL	2.3E-02	3.7E+00	2.3E-02	3.7E+00
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	4.3E-01	7.6E-03	4.3E-01
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	5.6E-02	9.9E-04	5.6E-02
TETRACHLOROETHYLENE	6.9E-02	5.0E+00	6.9E-02	5.0E+00
THALLIUM	5.2E+00	2.0E+00	5.2E+00	2.0E+00
TOLUENE	2.9E+00	4.0E+01	2.9E+00	4.0E+01
TOXAPHENE	4.0E-01	2.1E-01	4.2E-04	2.0E-04
TPH (gasolines)	1.0E+02 (2.0E+03)	1.0E+02	1.0E+02 (2.0E+03)	1.0E+02
TPH (middle distillates)	5.0E+02 (5.0E+03)	1.0E+02	5.0E+02 (5.0E+03)	1.0E+02
TPH (residual fuels)	5.0E+02 (5.0E+03)	1.0E+02	5.0E+02 (5.0E+03)	1.0E+02
TRICHLOROBENZENE, 1,2,4-	1.6E+00	7.0E+01	1.6E+00	2.5E+01
TRICHLOROETHANE, 1,1,1-	2.5E+01	2.0E+02	7.8E+00	6.2E+01
TRICHLOROETHANE, 1,1,2-	2.6E-02	5.0E+00	2.6E-02	5.0E+00
TRICHLOROETHYLENE	3.6E-02	5.0E+00	3.6E-02	5.0E+00
TRICHLOROPHENOL, 2,4,5-	1.6E+00	1.0E+02	1.8E-01	1.1E+01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	3.7E+00	1.2E+00	3.7E+00
VANADIUM	7.8E+01	1.9E+01	7.8E+01	1.9E+01
VINYL CHLORIDE	3.9E-02	2.0E+00	3.9E-02	2.0E+00

TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
XYLENES	2.3E+00	2.0E+01	2.3E+00	2.0E+01
ZINC	6.0E+02	2.2E+01	6.0E+02	2.2E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	not applicable	2.0	not applicable
Sodium Adsorption Ratio	5.0	not applicable	5.0	not applicable

Notes:

1. Assumes current or future residenital land use, generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.)
2. Assumes potential impacts to drinking water source and discharge of groundwater into a freshwater, marine or estuary surface water system.
3. Lead: First action level is based on ecotoxicity. Action level in parentheses is based on direct exposure to humans. Ecotoxicity action level generally not applicable to highly developed urban sites where no significant open spaces are anticipated.

Source of Soil Action Levels: Refer to Appendix 1, Tables A-1 and A-2.
Source of Groundwater Action Levels: Appendix 1, Table D-1a (≤150m to Surface Water Body) and Table D-1b (>150m to Surface Water Body).
Soil data should be reported on dry-weight basis (see Appendix 1, Section 6.2).
Soil Action Levels intended to address direct-exposure, vapor intrusion, groundwater protection (leaching), ecologic (urban areas) and nuisance concerns. Soil gas data should be collected for additional evaluation of potential indoor-air impacts at sites with significant areas of VOC-impacted soil. See also Section 2.5 and Table C.
Groundwater Action Levels intended to address surface water impacts, vapor intrusion and nuisance concerns. Use in conjunction with soil gas action levels to evaluate potential impacts to indoor-air if groundwater action levels for this concern approached or exceeded (refer to Table C-1a in Appendix 1). See also Section 2.5 and Table C.
Groundwater action levels should be compared to dissolved phase chemical concentrations unless otherwise instructed by HIDOH.
GALs >150m to Surface Water Body: Groundwater screened with respect to acute surface water goals (See Table D-1b).
GALs ≤150m to Surface Water Body: Groundwater screened with respect to chronic surface water goals (see Table D-1a).
TPH -Total Petroleum Hydrocarbons: TPH Action Levels must be used in conjunction with Action Levels for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.). See Section 2.2 in text. TPH Soil Action Levels: First Action Level based on potential nuisance concerns. Second Action Level based on potential leaching concerns. Action Levels for nuisance concerns recommended for soils exposed or potentially exposed at the ground surface (minimum three meters below ground surface for residential sites with private yards and three feet below ground surface for other land use scenarios). **More stringent TPH soil action levels for leaching concerns may be required at sites with elevated threats to drinking water resources or aquatic habitats. Refer to Section 2.2.2.3 in text.**

TABLE B: GROUNDWATER IS NOT A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
ACENAPHTHENE	1.3E+02	2.0E+02	1.9E+01	2.3E+01
ACENAPHTHYLENE	1.3E+02	3.0E+02	1.3E+01	3.0E+01
ACETONE	5.0E-01	1.5E+03	5.0E-01	1.5E+03
ALDRIN	2.9E-02	1.3E+00	2.9E-02	1.3E-01
ANTHRACENE	2.8E+00	7.3E-01	2.8E+00	7.3E-01
ANTIMONY	2.0E+01	1.5E+03	2.0E+01	3.0E+01
ARSENIC	2.2E+01	6.9E+01	2.2E+01	3.6E+01
BARIUM	7.5E+02	2.0E+03	7.5E+02	2.0E+03
BENZENE	5.3E-01	1.6E+03	5.3E-01	4.6E+01
BENZO(a)ANTHRACENE	6.2E+00	2.7E-02	6.2E+00	2.7E-02
BENZO(a)PYRENE	6.2E-01	1.4E-02	6.2E-01	1.4E-02
BENZO(b)FLUORANTHENE	6.2E+00	9.2E-02	6.2E+00	9.2E-02
BENZO(g,h,i)PERYLENE	2.7E+01	1.0E-01	2.7E+01	1.0E-01
BENZO(k)FLUORANTHENE	3.7E+01	4.0E-01	3.7E+01	4.0E-01
BERYLLIUM	4.0E+00	4.3E+01	4.0E+00	2.7E+00
BIPHENYL, 1,1-	6.5E+00	5.0E+00	6.5E+00	5.0E+00
BIS(2-CHLOROETHYL)ETHER	6.7E-03	1.0E+02	6.7E-03	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	2.9E+00	3.2E+03	6.6E-01	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	3.2E+01	3.5E+01	3.2E+01
BORON	1.6E+00	1.6E+00	1.6E+00	1.6E+00
BROMODICHLOROMETHANE	2.3E-02	2.7E+02	2.3E-02	2.7E+02
BROMOFORM	6.1E+01	5.1E+03	6.1E+01	3.2E+03
BROMOMETHANE	8.6E-01	2.3E+03	8.6E-01	1.6E+02
CADMIUM	1.2E+01	3.0E+00	1.2E+01	3.0E+00
CARBON TETRACHLORIDE	2.7E-02	2.1E+01	2.7E-02	9.8E+00
CHLORDANE	1.6E+00	9.0E-02	1.6E+00	4.0E-03
CHLOROANILINE, p-	5.3E-02	5.0E+00	5.3E-02	5.0E+00
CHLOROBENZENE	9.5E+00	1.6E+02	1.5E+00	2.5E+01
CHLOROETHANE	2.7E-01	3.9E+00	2.7E-01	3.9E+00
CHLOROFORM	1.8E-02	6.2E+01	1.8E-02	6.2E+01
CHLOROMETHANE	1.6E+01	9.5E+03	1.6E+01	3.2E+03
CHLOROPHENOL, 2-	1.2E-01	1.8E+00	1.2E-01	1.8E+00
CHROMIUM (Total)	2.1E+02	7.4E+01	2.1E+02	7.4E+01
CHROMIUM III	7.5E+02	5.7E+02	7.5E+02	7.4E+01
CHROMIUM VI	8.0E+00	1.6E+01	8.0E+00	1.1E+01
CHRYSENE	2.3E+01	3.5E-01	2.3E+01	3.5E-01
COBALT	4.0E+01	3.0E+00	4.0E+01	3.0E+00
COPPER	2.3E+02	2.9E+00	2.3E+02	2.9E+00
CYANIDE (Free)	1.0E+02	1.0E+00	1.0E+02	1.0E+00

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
DIBENZO(a,h)ANTHTRACENE	6.2E-01	2.5E-01	6.2E-01	2.5E-01
DIBROMO-3-CHLOROPROPANE, 1,2-	9.0E-04	4.0E-02	9.0E-04	4.0E-02
DIBROMOCHLOROMETHANE	1.7E-02	1.6E+02	1.7E-02	1.6E+02
DIBROMOETHANE, 1,2-	7.2E-04	1.6E+01	7.2E-04	1.6E+01
DICHLOROBENZENE, 1,2-	1.1E+01	1.0E+02	1.6E+00	1.4E+01
DICHLOROBENZENE, 1,3-	3.0E+01	3.7E+02	7.4E+00	6.5E+01
DICHLOROBENZENE, 1,4-	6.5E-02	1.1E+02	6.5E-02	1.5E+01
DICHLOROBENZIDINE, 3,3-	1.1E+00	2.5E+02	1.1E+00	2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	6.0E-01	2.4E+00	1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	1.4E+01	2.4E+00	1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	1.3E-02	1.7E+00	1.0E-03
DICHLOROETHANE, 1,1-	1.9E+00	4.7E+01	1.9E+00	4.7E+01
DICHLOROETHANE, 1,2-	1.6E-02	1.3E+02	1.6E-02	1.3E+02
DICHLOROETHYLENE, 1,1-	3.5E+01	3.9E+03	4.3E+00	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	6.2E+00	1.2E+04	6.2E+00	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	1.2E+01	2.6E+03	1.2E+01	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E+00	3.0E+00	3.0E+00	3.0E+00
DICHLOROPROPANE, 1,2-	2.1E-02	1.0E+02	2.1E-02	1.0E+02
DICHLOROPROPENE, 1,3-	1.0E-01	1.6E+02	1.0E-01	1.2E+02
DIELDRIN	3.0E-02	7.1E-01	2.3E-03	1.9E-03
DIETHYLPHTHALATE	2.2E+01	9.4E+02	3.5E-02	1.5E+00
DIMETHYLPHENOL, 2,4-	1.8E+00	2.7E+02	7.3E-01	1.1E+02
DIMETHYLPHTHALATE	2.2E+01	9.4E+02	3.5E-02	1.5E+00
DINITROPHENOL, 2,4-	6.5E-01	2.3E+02	2.1E-01	7.5E+01
DINITROTOLUENE, 2,4-	1.5E+00	2.0E+02	8.6E-01	1.2E+02
DIOXANE, 1,4-	3.0E+01	5.0E+04	3.0E+01	5.0E+04
DIOXIN (2,3,7,8-TCDD)	3.9E-06	3.0E-03	3.9E-06	5.0E-06
ENDOSULFAN	1.8E-02	3.4E-02	4.6E-03	8.7E-03
ENDRIN	1.0E-02	3.7E-02	6.5E-04	2.3E-03
ETHYLBENZENE	3.3E+01	3.0E+02	3.2E+01	2.9E+02
FLUORANTHENE	4.0E+01	4.0E+01	4.0E+01	8.0E+00
FLUORENE	1.6E+02	3.0E+02	8.9E+00	3.9E+00
HEPTACHLOR	1.1E-01	5.3E-02	1.3E-02	3.6E-03
HEPTACHLOR EPOXIDE	5.3E-02	5.3E-02	1.4E-02	3.6E-03
HEXACHLOROBENZENE	3.0E-01	6.0E+00	3.0E-01	3.7E+00
HEXACHLOROBUTADIENE	6.2E+00	1.1E+01	6.2E+00	4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	9.8E-02	1.6E-01	4.9E-02	8.0E-02
HEXACHLOROETHANE	3.5E+01	1.0E+02	3.5E+01	1.2E+01
INDENO(1,2,3-cd)PYRENE	6.2E+00	9.2E-02	6.2E+00	9.2E-02

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
LEAD[3]	2.0E+02 (4.0E+02)	2.9E+01	2.0E+02 (4.0E+02)	5.6E+00
MERCURY	1.0E+01	2.1E+00	1.0E+01	2.5E-02
METHOXYCHLOR	1.9E+01	3.0E-02	1.9E+01	3.0E-02
METHYL ETHYL KETONE	1.3E+01	1.4E+04	1.3E+01	1.4E+04
METHYL ISOBUTYL KETONE	3.9E+00	1.7E+02	3.9E+00	1.7E+02
METHYL MERCURY	6.1E+00	3.0E-03	6.1E+00	3.0E-03
METHYL TERT BUTYL ETHER	1.6E+00	1.8E+03	1.6E+00	1.8E+03
METHYLENE CHLORIDE	9.0E-01	4.2E+03	9.0E-01	2.2E+03
METHYLNAPHTHALENE (total 1- & 2-)	1.2E+01	1.0E+02	2.5E-01	2.1E+00
MOLYBDENUM	4.0E+01	2.4E+02	4.0E+01	2.4E+02
NAPHTHALENE	1.8E+01	2.1E+02	4.8E+00	2.4E+01
NICKEL	1.5E+02	5.0E+00	1.5E+02	5.0E+00
PENTACHLOROPHENOL	3.0E+00	1.3E+01	3.0E+00	7.9E+00
PERCHLORATE	1.2E+00	6.0E+02	1.2E+00	6.0E+02
PHENANTHRENE	1.8E+01	7.7E+00	1.1E+01	4.6E+00
PHENOL	4.0E+01	3.4E+03	1.9E+01	1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	2.0E+00	1.1E+00	1.4E-02
PYRENE	8.5E+01	2.0E+00	8.5E+01	2.0E+00
SELENIUM	1.0E+01	2.0E+01	1.0E+01	5.0E+00
SILVER	2.0E+01	1.0E+00	2.0E+01	1.0E+00
STYRENE	1.5E+01	1.0E+02	1.5E+01	1.0E+02
tert-BUTYL ALCOHOL	7.0E+01	5.0E+04	7.0E+01	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	3.1E+00	3.1E+03	3.1E+00	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	7.2E-03	1.5E+02	7.2E-03	1.5E+02
TETRACHLOROETHYLENE	6.9E-02	9.9E+01	6.9E-02	9.9E+01
THALLIUM	5.2E+00	4.7E+02	5.2E+00	2.0E+01
TOLUENE	2.9E+01	4.0E+02	9.3E+00	1.3E+02
TOXAPHENE	4.0E-01	2.1E-01	4.2E-04	2.0E-04
TPH (gasolines)	1.0E+02 (2.0E+03)	5.0E+03	1.0E+02 (2.0E+03)	5.0E+02
TPH (middle distillates)	5.0E+02 (5.0E+03)	2.5E+03	5.0E+02 (5.0E+03)	6.4E+02
TPH (residual fuels)	5.0E+02 (5.0E+03)	2.5E+03	5.0E+02 (5.0E+03)	6.4E+02
TRICHLOROBENZENE, 1,2,4-	1.6E+00	1.6E+02	1.6E+00	2.5E+01
TRICHLOROETHANE, 1,1,1-	3.9E+02	6.0E+03	7.8E+00	6.2E+01
TRICHLOROETHANE, 1,1,2-	2.6E-02	2.8E+02	2.6E-02	2.8E+02
TRICHLOROETHYLENE	3.6E-02	7.4E+01	3.6E-02	7.4E+01
TRICHLOROPHENOL, 2,4,5-	1.6E+00	1.0E+02	1.8E-01	1.1E+01
TRICHLOROPHENOL, 2,4,6-	6.1E+00	4.9E+02	6.1E+00	4.9E+02
VANADIUM	7.8E+01	1.9E+01	7.8E+01	1.9E+01
VINYL CHLORIDE	3.9E-02	2.2E+01	3.9E-02	2.2E+01

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
XYLENES	1.8E+02	2.0E+03	1.1E+01	1.0E+02
ZINC	6.0E+02	2.2E+01	6.0E+02	2.2E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	not applicable	2.0	not applicable
Sodium Adsorption Ratio	5.0	not applicable	5.0	not applicable

Notes:

1. Assumes current or future residenital land use, generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.)
2. Assumes potential discharge of groundwater into a freshwater, marine or estuary surface water system.
3. Lead: First action level is based on ecotoxicity. Action level in parentheses is based on direct exposure to humans. Ecotoxicity action level generally not applicable to highly developed urban sites where no significant open spaces are anticipated.

Source of Soil Action Levels: Refer to Appendix 1, Tables B-1 and B-2.
Source of Groundwater Action Levels: Appendix 1, Table D-1c (≤150m to Surface Water Body) and Table D-1d (>150m to Surface Water Body).
Soil data should be reported on dry-weight basis (see Appendix 1, Section 6.2).
Soil Action Levels intended to address direct-exposure, vapor intrusion, groundwater protection (leaching), ecologic (urban areas) and nuisance concerns. Soil gas data should be collected for additional evaluation of potential indoor-air impacts at sites with significant areas of VOC-impacted soil. See also Section 2.5 and Table C.
Groundwater Action Levels intended to be address surface water impacts, vapor intrusion and nuisance concerns. Use in conjunction with soil gas action levels to evaluate potential impacts to indoor-air if groundwater action levels for this concern approached or exceeded (refer to Table C-1a in Appendix 1). See also Section 2.5 and Table C.
Groundwater action levels should be compared to dissolved phase chemical concentrations unless otherwise instructed by HIDOH.
GALs >150m to Surface Water Body: Groundwater screened with respect to acute surface water goals (See Table D-1d).
GALs ≤150m to Surface Water Body: Groundwater screened with respect to chronic surface water goals (see Table D-1c).
TPH -Total Petroleum Hydrocarbons: TPH Action Levels must be used in conjunction with Action Levels for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.). See Section 2.2 in text. TPH Soil Action Levels: First Action Level based on potential nuisance concerns. Second Action Level based on potential leaching concerns. Action Levels for nuisance concerns recommended for soils exposed or potentially exposed at the ground surface (minimum three meters below ground surface for residential sites with private yards and three feet below ground surface for other land use scenarios. **More stringent TPH soil action levels for leaching concerns may be required at sites with elevated threats to drinking water resources or aquatic habitats. Refer to Section 2.2.2.3 in text.**

APPENDIX B

TEST AMERICA ANALYTICAL LABORATORY

QUALITY ASSURANCE PROGRAM MANUAL

QUALITY ASSURANCE / QUALITY CONTROL MANUAL

For

Test America Honolulu
99-193 Aiea Heights Dr. Suite 121
Aiea, HI 96701-3900

PH. (808) 486-5227
FAX(808) 486-2456

Effective Date: December 15, 2006
(See Table of Contents for Revision Dates of Each Section)

Prepared by:

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(828)258-3746

Laboratory Director – Aidan J. Scott — 01/29/2007 Date

Quality Assurance/ technical Director: Marvin D. Heskett III — 01/29/2007 Date

This manual is considered confidential within TestAmerica and may not be altered in any manner by other than a duly appointed representative from TestAmerica. If the document has been provided to external users or regulators, it is for the exclusive purpose of reviewing ***TestAmerica Honolulu***'s quality systems and shall not be used in any other way without the written permission of an appointed representative of TestAmerica.

Control Number _____

Assigned to _____

Section 2.0
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Section 3.0
(NELAC 5.2 and 5.3)
INTRODUCTION

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

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

3.1.2 The QAM has been prepared to assure compliance with the 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards and ISO/IEC Guide 17025 (1999). In addition, the policies and procedures outlined in this manual are compliant with the various accreditation and certification programs listed in Appendix 5.

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

3.1.3.1 EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.

3.1.3.2 EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.

3.1.3.3 EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.

3.1.3.4 EPA SW-846, *Test Methods for the Evaluation of Solid Waste, 3rd Edition,* September 1986; Update I, July 1992; Update II, September 1994; and Update III, December 1996.

3.1.3.5 Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261,

3.1.3.6 USEPA Contract Laboratory Program. *Statement of Work for Inorganics Analysis. Multi-Media, Multi-Concentration.* Document ILM04.0.

3.1.3.7 USEPA Contract Laboratory Program. *Statement of Work for Organics Analysis. Multi-Media, Multi-Concentration.* Document Number OLMO3.1, August 1994. .

3.1.3.8 Department of Defense quality assurance requirements as specified under ACOE, NFESC, AFCEE, USATHAMA and HAZWRAP programs as they apply.

3.2 TERMS AND DEFINITIONS

3.2.1 A Quality Assurance program is a company-wide system designed to ensure that data produced by TestAmerica Honolulu conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and

management policies, and at the analytical level through standard operating procedures and quality control.

3.2.2 See Appendix 6 for glossary and acronyms.

3.3 SCOPE / FIELDS OF TESTING

3.3.1 TestAmerica Honolulu analyzes Hundreds of environmental and industrial samples every month. Sample matrices vary among drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. All measurements are made using published reference methods or methods developed and validated by the laboratory.

3.3.2 The methods covered by this manual include the most frequently requested water, industrial waste, and soil methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 8. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by *TestAmerica Honolulu* shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director/Manager and the Quality Assurance Manager. In some cases QAPPs and DQOs may specify less stringent requirements. The Laboratory Director/Manager and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements. The lab must ensure that it meets the method requirements or must appropriately denote the final report if modifications were made to the reported method.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process.

3.4.1.1 The manual is reviewed annually by the Quality Assurance Manager and laboratory personnel to assure that it reflects current practices and meets the requirements of *TestAmerica Honolulu*'s clients and regulators. Occasionally the manual may need changes in order to meet new or changing regulations and operation. The Quality Assurance Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. The updates will be reviewed by the Quality Assurance Manager, Laboratory Director/Manager, Technical Director, relevant operational staff and Corporate Quality Assurance (if a change is made to the Corporate template) and then formally incorporated into the document in periodic updates. The QAM is based on a Corporate QAM template that is prepared and approved by the Executive Vice Presidents (EVP) of Operations and Corporate Quality Assurance. This template is reviewed annually by the EVPs of Operations, Corporate Quality Assurance, and each laboratory. Necessary changes are coordinated by the Vice President of Quality Assurance and distributed to each laboratory for inclusion in the laboratory specific QA Manuals.

3.4.1.2 Policies in the QAM that require immediate attention may be addressed through the use of Corporate QA/QC Policy memoranda. QA/QC Policy Memoranda are published from time to time to facilitate immediate changes to QA/QC Policy. QA/QC Policy Memoranda supersede the QAM and all other Standard Operating Procedures (see Section 5.3). All policy memoranda are dated, archived and distributed by their placement into the front of the QAM between the cover page and Section 2. At a minimum, each policy memorandum is approved by the same authorized signatories as shown on the cover page of the QA Manual. In addition, Corporate QA/QC Policy Memoranda are signed by the Executive Vice Presidents of the Eastern and Western Divisions and Corporate Quality Assurance. The QA/QC Policy memoranda are incorporated into the QAM during the periodic updates and are then removed from use. Policy memorandum may also include an expiration date if appropriate. An example format can be found in Figure 3-1. A similar procedure is followed for local laboratory changes.

3.4.2 Control

3.4.2.1 This manual is considered confidential within TestAmerica and may not be altered in any manner by other than a duly appointed representative from TestAmerica. If the document has been provided to external users or regulators, it is for the exclusive purpose of reviewing *TestAmerica Honolulu*'s quality systems and shall not be used in any other way without the written permission of an appointed representative of TestAmerica. The procedure for control of distribution is incorporated by reference to GEN045 Control of SOPs and Quality Assurance manual.

3.4.3 The order of precedence in the event of a conflict between policies is outlined in Section 5.3 of this QAM Manual.

Figure 3-1:

Example Format for a QA/QC Policy Memorandum

Corporate (or Laboratory) QA/QC Policy Memorandum # _____

Effective Date: _____ Expiration Date: When Appropriate QAM Section is Revised

Technical Director Approval Date	Quality Assurance Approval Date
Laboratory Director/Manager Approval Date	Date

1. **Purpose**

2. **Procedure**

3. **Documentation**

4. **Attachments**

5. **References/Cross References**

Section 4.0
(NELAC 5.4.1)
ORGANIZATION AND MANAGEMENT

4.1 ORGANIZATION

4.1.1 TestAmerica Honolulu is part of a national network of laboratories known as TestAmerica Analytical Testing Corp. This Quality Assurance Manual (QAM) is applicable to the *TestAmerica Honolulu* laboratory only.

Test America Honolulu

99-193 Aiea Heights Dr. Suite 121

Aiea, HI 96701-3900

Federal ID number HI00914

NELAC State ID E87907

4.1.2 The Corporate organization chart can be found in Figure 4-1 and the laboratory's organization chart can be found in Appendix 2. The locations of other TestAmerica labs are as follows:

TestAmerica Analytical Testing Corp. - Anchorage, AK
TestAmerica Analytical Testing Corp. – Phoenix, AZ
TestAmerica Analytical Testing Corp. – Irvine, CA
TestAmerica Analytical Testing Corp. – Morgan Hill, CA
TestAmerica Analytical Testing Corp. – Ontario, CA
TestAmerica Analytical Testing Corp. – Sacramento, CA
TestAmerica Analytical Testing Corp. – Colorado Springs, CO
TestAmerica Analytical Testing Corp. – Orlando, FL
TestAmerica Analytical Testing Corp. – Buffalo Grove, IL
TestAmerica Analytical Testing Corp. – Indianapolis, IN
TestAmerica Analytical Testing Corp. – Cedar Falls, IA
TestAmerica Analytical Testing Corp. – Pontiac, MI
TestAmerica Analytical Testing Corp. – Nashville, TN
TestAmerica Analytical Testing Corp. – Dayton, OH
TestAmerica Analytical Testing Corp. - Portland, OR
TestAmerica Analytical Testing Corp. – King of Prussia, PA
TestAmerica Analytical Testing Corp. – Seattle, WA
TestAmerica Analytical Testing Corp. – Spokane, WA
TestAmerica Analytical Testing Corp. – Watertown, WI

4.2 ROLES AND RESPONSIBILITIES

4.2.1 In order for the Quality Assurance program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to QA/QC. The following descriptions define each role in its relationship to the Quality Assurance program. More extensive job descriptions are maintained by laboratory management.

4.2.2 Responsibility for the Quality Assurance Program

The responsibility for quality lies with every employee of ***TestAmerica Honolulu***. All employees have access to the QAM and are responsible for knowing the content of this manual and upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs.

4.2.3 Chief Executive Officer (CEO)

The CEO reports directly to the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica Analytical Testing Corp. operations. He establishes the overall quality standard and data integrity program for the company, providing the necessary leadership and resources to assure that the standard and integrity program are met..

4.2.4 Chief Operating Officer (COO)

The COO serves as the ranking executive for all respective company operational functions and reports to the CEO of the corporation. The COO has full responsibility for the overall administrative and operational management of company operational functions. The COO participates with the CEO and the Board of Directors in formulating strategic direction for the company, being specifically accountable for the Laboratory Division. He ensures the attainment of corporate objectives through the selection, development, motivation, and evaluation of top management personnel. The COO approves all operating budgets and capital expenditures and participates in the selection and approval of banking, legal, and accounting relationships.

4.2.5 Executive Vice-President (EVP) – Eastern Division and EVP – Western Division

Each EVP reports directly to the COO. There is an EVP in the Eastern Division and an EVP in the Western Division. Each EVP has full responsibility for the overall administrative and operational management of their respective laboratories.

The EVP reviews and approves the Corporate QAM template used by each laboratory to prepare a laboratory-specific QAM. The EVP is also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.6 Vice-President – Quality Assurance (VP-QA)

The Vice-President of Quality Assurance reports directly to the CEO. With the aid of the EVPs, VPs, Laboratory Directors, Quality Assurance Director and laboratory Quality Assurance Directors, the VP-QA has the responsibility for the establishment, general overview and Corporate maintenance of the quality assurance program within TestAmerica Analytical Testing Corp. Additional responsibilities of the VP of QA include:

4.2.6.1 Review of QA/QC aspects of corporate SOPs, national projects and expansions or changes in services.

4.2.6.2 Coordination/preparation of the corporate QAM Template that is used by each laboratory to prepare its own laboratory-specific QAM.

4.2.6.3 With the assistance of the Corporate QA Director, oversight of the QA/QC programs within each laboratory. This includes a final review of each laboratory-specific QAM and receipt of each laboratory's QA monthly report.

4.2.6.4 Participation, as needed, in the hiring of laboratory Quality Assurance staff.

4.2.6.5 Maintenance of corporate Quality Policy memorandums and corporate SOPs. Maintenance of data investigation records that are reported to Corporate management.

4.2.6.6 Assistance with certification activities.

4.2.6.7 Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.

4.2.6.8 With the assistance of the Health and Safety Director, development and implementation of the TestAmerica Safety and Chemical Hygiene Program.

4.2.7 Quality Assurance Director (Corporate)

The Quality Assurance Director (QAD) reports to the VP-QA and may report data integrity issues directly to the CEO as needed. Together with the VP-QA, the QAD has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance program within TestAmerica Analytical Testing Corp.

4.2.8 Ethics and Compliance Officer (ECO)

4.2.8.1 TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – one to work primarily with the eastern locations (Vice President of Quality Assurance) and the other to work primarily with the western locations (Director of Quality Assurance). Each ECO acts as a back-up to the other ECO and both are involved in data investigations. The Vice President of Quality Assurance/ECO reports to the CEO and has a direct line of communication to the entire senior Corporate and lab management staff. The Director of Quality Assurance may report violations to the CEO or the Vice President of Quality Assurance and has a direct line of communication to the entire senior Corporate and lab management staff.

4.2.8.2 The ECO ensures that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

4.2.8.3 The ECO monitors and audits procedures to determine compliance with policies and to make recommendations for policy enhancements to the CEO, Laboratory Director or other

appropriate individuals within the laboratory. The ECO will assist the laboratory QA Director in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

4.2.8.4 The ECO will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.9 Health and Safety Director (HSD) (Corporate)

The Health and Safety Director reports directly to the VP-QA. The Health and Safety Director is responsible for the development and implementation of the TestAmerica Safety and Chemical Hygiene program. Responsibilities include:

4.2.9.1 Consolidation and tracking all safety and health-related information and reports for the company, and manages compliance activities for TestAmerica locations.

4.2.9.2 Coordination/preparation of the corporate Safety Manual / Chemical Hygiene Plan (CHP) Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.

4.2.9.3 Preparation of information and training materials for laboratory Safety Officers.

4.2.9.4 Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.

4.2.9.5 Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.

4.2.9.6 Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.10 Laboratory Director

TestAmerica Honolulu's Laboratory Director is responsible for the overall quality, financial, technical, human resource and service performance of the whole laboratory and reports to the EVP-Western Division, The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive quality assurance and data integrity program.

Specific responsibilities include, but are not limited to:

4.2.10.1 Provides one or more technical directors for the appropriate fields of testing. The name(s) of the Technical Director will be included in the national database. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.

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

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

4.2.10.4 Ensures TestAmerica's human resource policies are adhered to and maintained.

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

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

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

4.2.10.8 Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.

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

4.2.10.10 Captains the management team, consisting of the QA Director, the Technical Director, and the Operations Manager as direct reports.

4.2.11 Quality Assurance Director

The QA Director has responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.

The QA Director reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Director directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

4.2.11.1 Having functions independent from laboratory operations for which he/she has quality assurance oversight.

4.2.11.1.1 Maintaining and updating the QAM.

4.2.11.2 Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.

4.2.11.3 Monitoring and communicating regulatory changes that may affect the laboratory to management.

4.2.11.4 Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.

4.2.11.5 Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).

4.2.11.6 Arranging for or conducting internal audits on quality systems and the technical operation.

4.2.11.7 The laboratory QA Director will maintain records of all ethics-related training, including the type and proof of attendance.

4.2.11.8 Maintain, improve, and evaluate the corrective and preventive action systems (Section 13.0).

4.2.11.9 Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 13.

4.2.11.10 Monitoring standards of performance in quality control and quality assurance.

4.2.11.11 Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.

4.2.11.12 Review a percentage of all final data reports for internal consistency. Review of Chain of Custody, correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.

4.2.11.13 Review of external audit reports and data validation requests.

4.2.11.14 Follow-up with audits to ensure client QAPP requirements are met.

4.2.11.15 Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.

4.2.11.16 Development of suggestions and recommendations to improve quality systems.

4.2.11.17 Research of current state and federal requirements and guidelines.

4.2.11.18 Captains the QA team to enable communication and to distribute duties and responsibilities.

4.2.12 Technical Director

The Technical Director(s) report(s) directly to the Laboratory Director. This person is accountable for all analyses and analysts with respect to ISO 17025. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing

training and development programs for existing analysts and second- and third-generation instrumentation. Specific responsibilities include, but are not limited to:

4.2.12.1 Coordinating, writing, and reviewing preparation of all test methods, i. e., Standard Operating Procedures, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He insures that the SOPs are properly managed and adhered to at the bench. He develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.

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

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

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

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

4.2.12.6 Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.

4.2.12.7 Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.

4.2.12.8 Captains department department managers to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.

4.2.12.9 Coordinates audit responses with department managers and QA Director.

4.2.12.10 The person in this position manages the timely and thorough completion of data packages in accordance with project requirements.

4.2.13 LIMS Administrator

The LIMS Administrator reports directly to the Laboratory Director. In the pursuit of this person's duties, they:

4.2.13.1 Establishes and maintains the laboratory information system (LIMS) for tracking all samples in the laboratory.

4.2.13.2 Updates and enhances LIMS.

4.2.13.3 Develops expertise in the requirements described in Good Automated Laboratory Practices (GALP)-EPA 2185, 1995 Edition, in order to ensure compliance.

4.2.13.4 Programs and tests software modifications/changes.

4.2.13.5 Coordinates testing to ensure that all LIMS software accurately performs its intended functions. Testing is performed and documented after installation or when modifications/changes are made.

4.2.13.6 Maintains historical files of software, software operating procedures (manuals), software changes/modifications (Change Log) and software version numbers.

4.2.13.7 Develops and verifies security practices to assure the integrity of LIMS data. Identifies threats, potential threats, and future threats.

4.2.13.8 Maintains awareness of any environmental conditions of the facility housing the LIMS that may compromise LIMS Raw Data and informs management.

4.2.13.9 LIMS database back-up once daily.

4.2.14 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of

4.2.14.1 Staying current with the hazardous waste regulations.

4.2.14.2 Continuing training on hazardous waste issues.

4.2.14.3 Reviewing and updating annually the Hazardous Waste Contingency Plan in the Chemical Hygiene/Safety Manual.

4.2.14.4 Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.

4.2.14.5 Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.

4.2.15 Department managers

Department managers report to the Laboratory Director. Each one is responsible to:

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

4.2.15.2 With regard to analysts, participates in the selection, training (as documented in Section 8.1.4), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

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

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

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

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

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

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

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

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

4.2.15.11 Develop, implement, and enhance calibration programs.

4.2.15.12 Provide written responses to external and internal audit issues.

4.2.16 Laboratory Analysts

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

4.2.16.1 Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.

4.2.16.2 Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.

4.2.16.3 Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Director or member of QA staff.

4.2.16.4 Perform 100% review of the data generated prior to entering and submitting for secondary level review.

4.2.16.5 Suggest method improvements to their supervisor, the Technical Director, and the QA Director. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.

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

4.2.17 Safety Officer

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

4.2.17.1 Conduct ongoing, necessary safety training and conduct new employee safety orientation.

4.2.17.2 Assist in developing and maintaining the Chemical Hygiene/Safety Manual.

4.2.17.3 Administer dispersal of all Material Safety Data Sheet (MSDS) information.

4.2.17.4 Perform regular chemical hygiene and housekeeping instruction.

4.2.17.5 Give instruction on proper labeling and practice.

4.2.17.6 Serve as chairman of the laboratory safety committee.

4.2.17.7 Provide and train personnel on protective equipment.

4.2.17.8 Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.

4.2.17.9 Supervise and schedule fire drills and emergency evacuation drills.

4.2.17.10 Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.

4.2.17.11 When determined necessary, conduct exposure monitoring assessments.

4.2.17.12 Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.

4.2.17.13 Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.

4.2.18 Client Services Director

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

4.2.18.1 Technical training and growth of the Project Management team.

4.2.18.2 Technical liaison for the Project Management team.

4.2.18.3 Human resource management of the Project Management team.

4.2.18.4 Responsible to ensure that clients receive the proper sampling supplies.

4.2.18.5 Accountable for response to client inquiries concerning sample status.

4.2.18.6 Responsible for assistance to clients regarding the resolution of problems concerning Chains-of-Custody.

4.2.18.7 Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.

4.2.18.8 Notifying the department managers of incoming projects and sample delivery schedules.

4.2.18.9 Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.

4.2.18.10 Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.

4.2.18.11 Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.

4.2.18.12 Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.

4.2.18.13 Inform clients of data package-related problems and resolve service issues.

4.2.18.14 Coordinate requests for sample containers and other services (data packages).

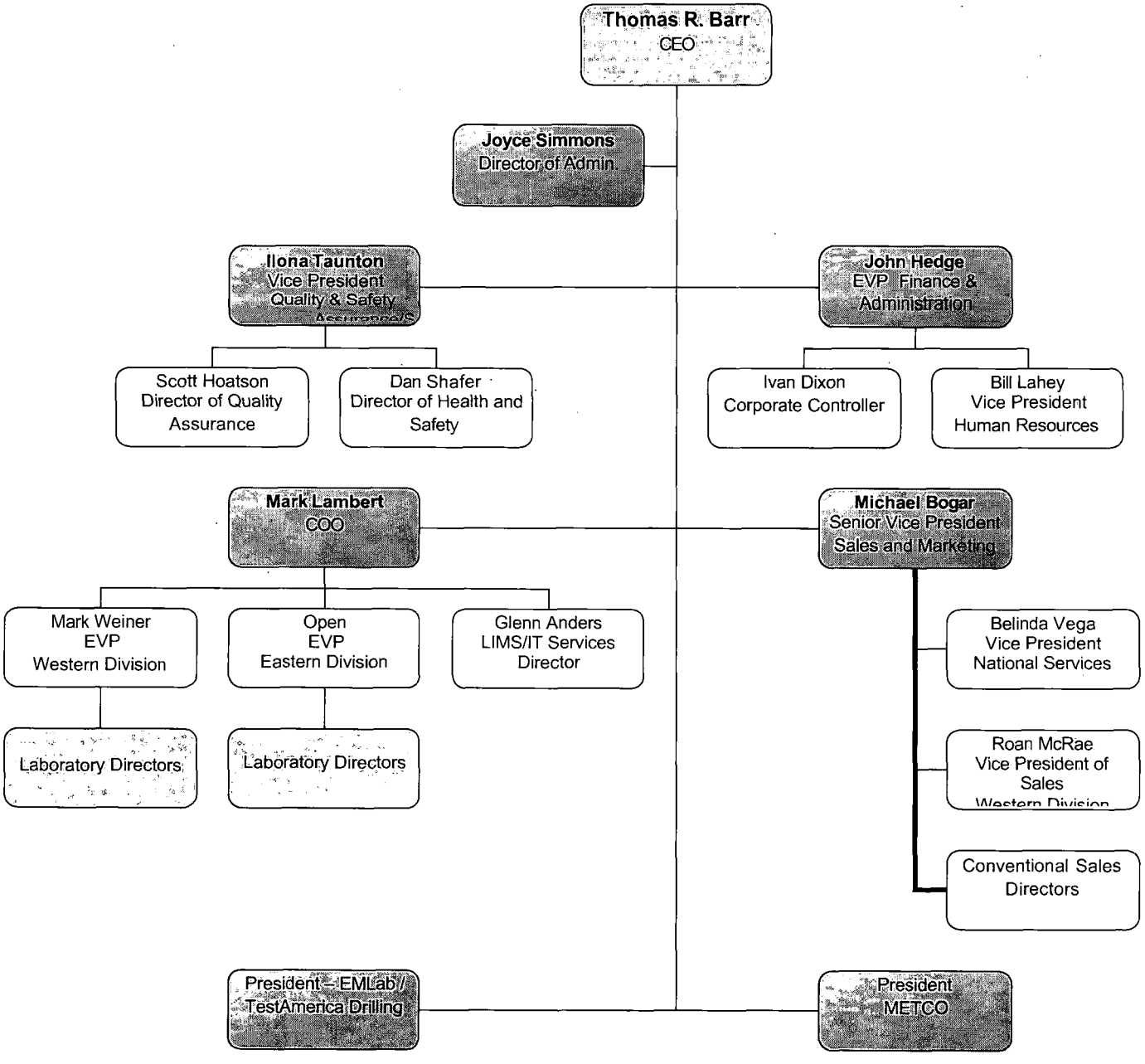
4.3 DEPUTIES

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

Key Personnel	Deputy	Comment
Laboratory Director	Technical Director	
QA Director	Laboratory Director	
Organics Manager	QA Director/ Senior analyst	
Metals/ Inorganics Manager	Laboratory Director/ Senior analyst	
Safety Officer	QA Director	
Client Service Manager	Project manager	

Figure 4-1

Corporate Organization Chart



Section 5.0
(NELAC 5.4.2)
QUALITY SYSTEM

5.1 QUALITY POLICY STATEMENT

5.1.1 The management of TestAmerica Analytical Testing Corp. and *TestAmerica Honolulu* are committed to providing quality data to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols described in this manual.

5.1.2 In all aspects of the laboratory and business operations, management is dedicated in maintaining the highest ethical standards. An Ethics Policy and Code of Ethical Conduct can be viewed in Appendix 1. Training on ethical and legal responsibilities is provided and each employee signs off on the policy annually as a condition of employment.

5.1.3 It is TestAmerica's policy to continually improve systems and provide support to quality improvement efforts. The company recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.

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

5.2 ETHICS AND DATA INTEGRITY

5.2.1 TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The seven elements of TestAmerica's ethics and data integrity program include:

5.2.1.1 An Ethics Policy and Code of Ethical Conduct (Appendix 1).

5.2.1.2 An Ethics and Compliance Officer (ECO).

5.2.1.3 A training program.

5.2.1.4 Self governance through disciplinary action for violations.

5.2.1.5 A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (SOP: GEN065

5.2.1.6 Procedures and guidance for recalling data if necessary (SOP: CP-01-06).

5.2.1.7 An effective external and internal monitoring system that includes procedures for internal audits (Section 16).

5.2.2 As an American Council of Independent Laboratories (ACIL) member, all TestAmerica laboratories adhere to the following ACIL Code of Ethics:

5.2.2.1 Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).

5.2.2.2 Present services in a confidential, honest and forthright manner.

5.2.2.3 Provide employees with guidelines and an understanding of the ethical and quality standards of our industry.

5.2.2.4 Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.

5.2.2.5 Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.

5.2.2.6 Educate clients as the extent and kinds of services available.

5.2.2.7 Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.

5.2.2.8 Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM SUPPORTING DOCUMENTATION

5.3.1 The laboratory's quality system is communicated through a variety of documents prepared by the laboratory:

5.3.1.1 Quality Assurance Manual (QAM)

5.3.1.2 Corporate Standard Operating Procedures (SOPs)

5.3.1.2.1 Corporate SOPs are developed for use by all relevant laboratories. They are approved by both Corporate and laboratory management and are then incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.

5.3.1.3 Laboratory SOPs – General and Technical

5.3.1.4 Corporate TestAmerica QA/QC Policy Memorandums (see Section 3.4)

5.3.1.5 Laboratory QA/QC Policy Memorandums (see Section 3.4)

5.3.2 Order of Precedence

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

5.3.2.1.1 TestAmerica QA/QC Policy Memorandum - Corporate
5.3.2.1.2 Laboratory QA/QC Policy Memorandum
5.3.2.1.3 Quality Assurance Manual
5.3.2.1.4 Corporate SOPs
5.3.2.1.5 Laboratory SOPs
5.3.2.1.6 Other (memos, flow charts, etc.)

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

5.4.1 Quality Assurance and Quality Control are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. It is defined as "*the total integrated program for assuring the reliability of monitoring and measuring data.*"

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

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

5.4.4 Historically, laboratories have described their QA objectives in terms of precision, accuracy, representativeness, comparability and completeness (PARCC).

5.4.4.1 Precision

The laboratory objective for precision is to meet the precision demonstrated for the analytical methods on similar samples and to meet data requirements for the analyses published by the US EPA. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike duplicate samples. The calculation of precision is described in Section 25.

5.4.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the analytical methods on similar samples and to meet the recovery data published by the US EPA. Accuracy is defined as the degree of bias in a measurement system. Accuracy is

documented on the basis of recovery of matrix spikes. Accuracy may also be documented through the use of laboratory control samples. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery. The calculation of accuracy is described in Section 25.

5.4.4.3 Representativeness

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

5.4.4.3.1 The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory can assist the client with enacting proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by *TestAmerica Honolulu*

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories, and by the degree to which approval from the US EPA or other pertinent regulatory agencies is obtained for any procedure for which significant modifications have been made.

5.4.4.5 Completeness

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

5.4.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: Extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific

retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), Specific Electrodes (separation and identification), etc.

5.4.5 Criteria for Quality Indicators

5.4.5.1 The laboratory prepares a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at *TestAmerica Honolulu*. This summary includes an effective date, is updated each time new limits are generated and is located in the QA department. Limits are derived through the LIMS system and are printed and filed for each year. The date of each study and date of implementation are easily found on the reports themselves. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, *TestAmerica Honolulu* has developed limits from evaluation of data from similar matrices. Criteria for development of limits is contained in Section 25.

5.4.6 Statistical Quality Control

5.4.6.1 Statistically derived precision and accuracy limits are required by selected methods (such as SW-846). *TestAmerica Honolulu* routinely utilizes statistically derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

5.4.6.2 If a method requires the generation of historical limits, the lab develops them from recent data in the QC database of LIMS following the guidelines described in Section 25. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project. In the case of DOD clients, limits are obtained from the most current update of the DOD-QSM or the AFCEE QAPP.

5.4.6.3 Surrogate recoveries are determined from a separate surrogate database in LIMS for a specific time period. The resulting ranges are entered in LIMS.

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

5.4.6.5 QC Charts

As the QC limits are calculated or when lab personnel changes occur, QC charts are generated showing warning and control limits for the purpose of evaluating trends. The Quality Assurance Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file.

Section 6.0
(NELAC 5.4.3)
DOCUMENT CONTROL

6.1 OVERVIEW

6.1.1 The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are taken out of use or destroyed. This library of documents consists of the QA Manual, Standard Operating Procedures, various forms and information summaries, method sources, textbooks, and regulations, corrective action reports, audit reports and responses, logbooks, standard logs, training files, MDL studies, PT studies, certifications and related correspondence, and instrument instruction books. Hard copy and electronic systems are included. Unique identification of each item is a component of the system.

6.1.1.1 The archiving of actual analytical data is discussed in Section 15, including paper records and electronic records.

6.1.1.2 The maintenance of purchasing data is discussed in Section 9.

6.1.1.3 The maintenance of sales and marketing contracts is discussed in Section 7.

6.2 DOCUMENT APPROVAL AND ISSUE

6.2.1 The pertinent elements of a control system for each document include a unique name and number, the number of pages of the item, the created/revised date, and the laboratory's name. The QA Director is responsible for the maintenance of the system and maintains the items in the QA office

6.2.2 In order to develop a new document, a Department Manager submits an electronic draft of the form to QA for suggestions and approval before use. Upon approval, QA adds the identifying version information to the document and retains the official document on file (hard copy and electronic copy). The official original is provided as needed to those using it.

6.2.3 The QA department maintains a table of contents of the official versions of the items.

6.2.4 If changes are required, the suggestions are submitted to QA by marking a copy of the existing item or submitting a revision form, QA makes the changes retaining the marked-up copy and the new version on file. All copies of the previous versions are destroyed (the original is maintained).

6.2.5 In using the documents, employees understand that the name of the document, unique identifier, page numbers/total pages, and date created/revised are always present on future copies.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

6.3.1 For changes to the QA Manual, see SOP GEN045. Only controlled copies are available inside the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the server in the QA folder for the applicable revision.

6.3.2 For changes to SOPs, see SOP GEN045. The QA Department has a complete file of all current and previous versions, showing changes, of each SOP. Additionally, there are controlled notebooks of current SOPs in the lab. These are updated by the QA department. There is a table of contents. Electronic versions of current, previous, and in-transition SOPs are maintained on the server QA folder.

6.3.3 Changes to facilities, the QA Manual, certifications, personnel, safety/health, capabilities are documented in the Management of Change log as prescribed in Section 17.

6.3.4 Forms, worksheets, miscellaneous instructions and information are organized by department electronically and stored on the server. The procedure for the care of these documents is in SOP GEN014.

6.3.5 Reference books, regulations, and other external protocols are listed, with location, in the QA office. This list is updated as needed.

6.3.6 Logbooks and preparation worksheets are initialized and stored in an archiving system described in SOP GEN014 for easy tracking and retrieval.

6.3.7 Certification correspondence, audit reports and responses, control charts, MDLs, training files, subcontractor credentials, and PT studies are stored by date in the QA office in appropriate files. These documents are not uniquely identified.

6.4 OBSOLETE DOCUMENTS

6.4.1 All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived as described in Section 15.

Section 7.0
(NELAC 5.4.4)
Review of Work Requests

7.1 REVIEW OF WORK REQUESTS - OVERVIEW

7.1.1 *TestAmerica Honolulu* has established procedures for the review of work requests and contracts. The procedures include evaluation of the laboratory's and/or network capabilities and available resources to meet the requirements within the requested time period. All requirements, including all methods and data quality must be adequately defined, documented, evaluated and understood.

7.1.2 The appropriateness of methods, and the laboratory's and/or network capability to perform must be established. Alternate test methods that are capable of meeting the clients' requirements may be proposed. The laboratory must be certified, as required, for all proposed tests and it must be able to meet the requested detection and quality control limits. A review of the lab's ability to analyze any non-routine analytes is also part of this review process

7.1.3 The offeror, in association with the Laboratory Director(s), must determine if the laboratory nominated have the necessary physical, personnel, and information resources to meet the contract. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the scope of the project, including the proposed turnaround time and deliverables will be checked for feasibility.

7.1.4 Electronic and/or hard copy deliverable requirements are evaluated against the lab's capacity for production of the requested documentation.

7.1.5 In addition to in-house capabilities, this process covers a review of any work that may need to be subcontracted by the laboratory. This discussion includes an assessment of the availability of qualified subcontracting labs and the client's acceptance of potential subcontractors. (See Section 8 for Sub-contracting procedures.)

7.1.6 The offeror reviews the findings with the client and discusses any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work as defined in the scope presented. The offeror also discusses any options or revisions that would allow the laboratory to perform the project successfully.

7.1.7 The client is advised of any deviation from the contract, and all differences between the request and the final contract are resolved and documented in writing before any work begins. It is necessary that the contract be acceptable to both the laboratory and the client.

7.1.8 When there are amendments or changes in scope to the original contract by the client, personnel affected by the changes will be given copies of the amendments for their review and approval.

REVIEW SEQUENCE AND KEY PERSONNEL

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

7.1.9 For routine projects and other simple tasks, a review by the Project Manager is considered adequate. The Project Manager confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around and deliverable requirements. In addition the Project Manager must also be aware of standard Terms and Conditions and Insurance requirements. Project Managers should contact the appropriate Regional Account Manager, Regional Inside Sales Coordinator, or Corporate Contract Administrator if any of the details are unknown, differ from what standard payment policy and insurance coverage includes, or if the task falls outside the Project Manager's job responsibilities. Payment terms exceeding 90 days must be approved. The Chief Financial Officer can be contacted for approval or forward information to the Corporate Contract Administrator. The following info will need to be provided: the payment terms requested, the projected revenue and duration of the project. If the project is a National Account, the Project Manager should notify the Director of National Accounts or the Corporate Contract Administrator.

7.1.10 Where the scope of a request is of a size where a simple review by the Laboratory Director is not feasible, the documents will be forwarded to the Regional Account Manager and/or Regional Inside Sales Coordinator. This team should review the documents and determine the person or team of persons needed to best review the scope. This team will also coordinate the response, including technical and cost proposal. When the bid opportunity includes technical and/or contractual sections, the subsets of 7.2.4 should be followed with the exception that the Regional Inside Sales Coordinator will act as the distribution source in lieu of the Corporate Contracts Administrator.

7.1.11 For complex or large projects, the proposal or contract should be directed to either the Executive Director of Sales (EDS) if regional in scope, or to the Director of National Accounts (DNA) if stemming from a national client or has the potential to be national in scope. Either the EDS or the DNA will determine the appropriate course of action.

7.1.11.1 The proposal will be forwarded to the Corporate Contracts Administrator, who distributes it to the following personnel (or whatever resources deemed appropriate):

7.1.11.1.1 The Chief Financial Officer evaluates contractual obligations, bonding issues and payment terms.

7.1.11.1.2 The laboratory Technical Director(s) reviews method capabilities, analyte lists, reporting limits and quality control limits. If the contract is national in scope, the request will be coordinated through the Vice President of National Accounts and the team of DNAs will determine the most appropriate action.

7.1.11.1.3 The Laboratory Director or Section Managers will review and agree to the proposed turnaround time or suggest a term that is more feasible.

7.1.11.1.4 The laboratory Quality Assurance Manager reviews QA/QC issues, including certification. The Vice President of Quality Assurance or the Corporate Quality Assurance Director also review QA/QC requirements of large/multi-lab contracts.

7.1.11.1.5 The Regional Accounts Manager or the Director of National Accounts will propose final pricing and review the offer with the appropriate Lab Director/Manager(s) before issuing the formal laboratory quotation. Regional Account Managers may employ the assistance of the Regional Inside Sales Coordinator for creation of the formal quote. If the quotation involves a National Account, the DNA should be brought into process before the submittal to the client.

7.1.11.1.6 The Information Systems Director evaluates the final report formatting and EDD requirements. Input from IT will be based on the scope of the program and the deliverables. If the program requires an electronic data deliverable format that is not currently in the EDD library of the laboratory or laboratories nominated for the contract, the specifications must be reviewed and approved by the Director of LIMS Support (or designee). If it is necessary for development, either time and/or cost must be considered in the program budget. Laboratory Director(s) and/or EDSs and Director of National Accounts may waive the cost of development if deemed appropriate.

7.1.11.1.7 The Laboratory Director goes over the statement of work guideline capabilities.

7.1.11.1.8 In the event that one of the above personnel is not available to review the proposal, his or her back-up will fulfill the review requirements and sign-off on the review.

7.1.11.2 The initiator of the review process, be it the Director of National Accounts or Regional Account Manager, assisted by the Corporate Contracts Administrator, Regional Inside Sales Manager, and any other appropriate resources, will then submit the technical and pricing proposal, including any variances for client approval.

7.1.11.3 The Corporate Contracts Administrator maintains copies of all signed contracts.

7.2 DOCUMENTATION

7.2.1 Appropriate records are maintained for every contract or work request. Where applicable, all stages of the contract review process are documented and stored in files in the administration office and includes records of any significant changes.

7.2.2 A Contract Summary should be completed by the primary bidder and a copy provided to every laboratory Project Manager who may be involved in the work. This summary provides an at-a-glance review of the project for questions and project references.

7.2.3 The contract will be distributed to and maintained by the appropriate sales/marketing personnel. A copy of the contract and formal quote will be filed with the laboratory Project Manager and the Lab Director/Manager. Summary contract and pricing documents may be prepared and issued. It is the responsibility of the offeror to confirm complete understanding and transfer of information to the Project Management level in each laboratory to ensure a smooth transition from proposal to activation.

7.2.4 Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The Project Manager keeps a phone log of conversations with the client. Communications between Sales and Marketing should be captured in Salesforce and pertinent information should be copied to all appropriate Project Management and technical staff.

Section 8.0
(NELAC 5.4.5)
SUBCONTRACTING OF TESTS

8.1 OVERVIEW

8.1.1 A subcontract laboratory is defined by TestAmerica Analytical Testing Corp. as a laboratory external to the TestAmerica network. However, there are some situations where a network lab must be defined as a subcontract laboratory. These situations must be identified prior to the commencement of a project to determine if client or agency notification and approval of the subcontractor is required prior to the use of a network lab on a project. The laboratory will advise the client of a subcontract arrangement in writing and when appropriate or contractually required, gain the approval of the client.

8.1.2 When subcontracting analytical services, the laboratory will assure, to the extent necessary, that the subcontract laboratory maintains a program consistent with the requirements of this document, the requirements specified in NELAC/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-NELAC accredited work. The laboratory assumes responsibility to the client for the subcontractor's work, except in the case where a client or a regulating authority specified which subcontractor is to be used.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

8.2.1 To begin the process, Projects Managers may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory is approved by the Laboratory Director/Manager. The Laboratory Director/Manager requests that the QA Manager begin the process of approving the subcontract laboratory.

8.2.2 The QA Manager will complete the Subcontracting Approval Form (Figure 8-2) and have supporting documentation on file prior to initiation of any work when deemed necessary on a project by project basis. In some cases a network laboratory or Corporate QA may have already completed an approval of a subcontracting laboratory. A listing of all approved subcontracting laboratories and supporting documentation is available on the TestAmerica intranet site. If this option is used, the laboratory must ensure that the subcontracting lab is capable of meeting the needs of the current project. A letter or e-mail is sent to the client requesting the following information. An example request letter is posted on the intranet site.

Note: The lab does not need to complete the approval form (Figure 8-2) if information on the intranet site is sufficient to meet the needs of the project.
Note: There are some instances where a subcontracting laboratory accredited by a State or Agency program may not require all elements listed below. If the accreditation is NELAC, follow the guidelines below. If the accreditation is not NELAC, contact Corporate QA to determine if the laboratory has been reviewed and approved before proceeding.

8.2.2.1 Copy of Quality Assurance Manual. Ensure data quality limits for relevant methods are acceptable and that training procedures are adequate. (Optional if Laboratory is NELAC accredited.)

8.2.2.2 SOP for method. Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable. A table of contents including effective dates may also be acceptable. The SOP can be examined if an on-site audit is performed. (Optional if Laboratory is NELAC accredited.)

8.2.2.3 The most recent 2 sets of full proficiency results relevant to the analyses of interest and any associated corrective action. These should be updated annually. (Optional if Laboratory is NELAC accredited.)

8.2.2.4 Copy of necessary certifications verifying that the required approvals are current. Ensure that all needed analytes are included; some may not be accredit-able (if so, document). Certificate and scope of International Standard accreditation are required, when applicable. Project Management requests a copy of the current certification at the start-up phase of the client's project and each subsequent project.

8.2.2.5 Example final report to confirm format is compliant and provides the necessary information. (Optional if Laboratory is NELAC accredited.)

8.2.2.6 SOQ or Summary list of Technical Staff and Qualifications – position, education and years of experience. (Optional if Laboratory is NELAC accredited.)

8.2.2.7 USDA permit if soils less than three feet deep from New York, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Texas, Oklahoma, New Mexico, Arizona, California, Hawaii, or outside the continental U. S. are to be analyzed. These samples require special shipping measures; check with the QA Department. It may be necessary to heat-treat the samples before shipping; however, some analytes/tests may be irrelevant after heat treatment.

8.2.2.8 Insurance Certificate. This is required by TestAmerica's Chief Financial Officer.

8.2.2.9 State Audit with Corrective Action Response. (Optional if Laboratory is NELAC accredited.)

8.2.2.10 Description of Business Ethics and Data Integrity Plan. (Optional if Laboratory is NELAC accredited.)

8.2.2.11 Copy of Raw Data Associated with First Project Sent to the Laboratory. The raw data is reviewed by the QA Manager and the Project Manager to ensure that the results meet the client's needs. This requirement can be skipped if an on-site visit of the laboratory is planned. (Optional if Laboratory is NELAC accredited.)

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

8.2.4 The status and performance of qualified subcontractors will be monitored periodically by the Laboratory QA Manager who originally posts a subcontracting lab to the intranet site.

8.2.4.1 Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints can be posted by any network laboratory.

8.2.4.2 An annual review of all qualified subcontractors will be conducted by the Laboratory QA Manager that originally posted the subcontract laboratory. During this review, the Quality Assurance Manager may request, as needed, updates of the subcontractor's Quality Assurance Manual and certificates with scopes. The documents, and any complaints on file, will be reviewed.

8.2.4.2.1 Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all network laboratories and Corporate QA if any laboratory is removed from the intranet site. This notification will be posted on the intranet site and e-mailed to all Lab Directors/Managers, QA Managers and Sales and Marketing Directors.

8.3 CONTINGENCY PLANNING

8.3.1 The Laboratory Director/Manager may waive the full qualification of a subcontractor process temporarily to meet emergency needs. In the event this provision is utilized, Corporate QA must be informed, and the Quality Assurance Manager will be required to verify adequacy of proficiency scores and certifications. The laboratory must also request a copy of the raw data to support the analytical results for the first project submitted to the subcontract laboratory. The raw data is reviewed by the Quality Assurance Manager and the Project Manager to ensure that the results meet the client's needs. The Quality Assurance Manager will immediately request full documentation and qualify the subcontractor under the provisions above within 30 calendar days.

8.3.2 When a laboratory needs to place work in another laboratory because of unforeseen reasons or on a continuing basis, the Project Manager will attempt to place the work in a qualified network laboratory. On those occasions when the work can't be kept in the network, the Project Manager or client will nominate a laboratory as a subcontractor. A client that specifies the use of a particular subcontractor assumes responsibility for that subcontractor's work. Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a hard copy of an e-mail from the client in the project folder.

8.3.3 When using a network laboratory, the Project Manager will determine if the laboratory needs to be classified as a subcontractor. Before using a subcontractor and unless otherwise pre-arranged in a work proposal approved by the client, the Project Manager must notify the client of the subcontract arrangement and when appropriate, obtain written approval from the client using a Client-Approved Subcontractor Form (Figure 8-1). The notification and form are retained in the project folder. *In addition to the client, some regulating agencies, such as the US Army Corps of Engineers and the USDA, require notification prior to placing such work.*

8.3.4 Prior to sending samples to the subcontracted laboratory, the Project Manager confirms their certification status to determine if it's current and scope-inclusive. The information is documented on a Subcontracted Sample Form (Figure 8-3) and the form is

retained in the project folder. For network laboratories, certifications can be viewed on the company website.

8.3.5 The Sample Control department is responsible for ensuring compliance with quality assurance requirements and applicable shipping regulations, including those of the USDA, when shipping samples to a subcontracted laboratory.

8.3.6 All subcontracted samples must be accompanied by a Chain-of-Custody (CoC). A copy of the original CoC sent by the client must be included with all samples subbed within the network.

8.4 OVERSIGHT AND REPORTING

8.4.1 The Project Manager will communicate with the subcontracted laboratory to monitor the status of the analyses, facilitate successful execution of the work and ensure the timeliness and completeness of the analytical report.

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

8.4.3 The results submitted by a subcontract laboratory are provided to the client on the subcontractor's original report paper with any accompanying documentation.

8.4.3.1 The results submitted by a network laboratory may be transferred electronically and the results reported by the network lab are identified on the final report. The final report must include a copy of the completed CoC for all subcontracted work.

Figure 8-1

Example of Client-Approved Subcontractor Form

Client Information:

Client Name & Account Number: _____

Client Contact: _____

Client Address: _____

_____

Project Information: **(Please choose all applicable.)**

- **Certification required: ? State ? NELAC ? A2LA ? Method___**

  ? Target compound_____ ? Other_____

- **Required Turn around time (method provisional)** _____

Subcontractor's Information:

Subcontractor's Name: _____

Subcontractor's Contact: _____

Subcontractor's Email: _____

Subcontractor's Address: _____

_____

Subcontractor's Phone Number: _____

Analytical Test/Compound/Method to be subcontracted: _____

Certification Statement:

I hereby give ***[Insert Lab Name]*** permission to use the above noted subcontractor for the above noted testing procedures/methods. I realize that the above subcontractor will be held liable for the validity of the above mentioned testing procedures/methods. All subcontractors shall meet the requirements as spelled out in project information and will follow all analytical holding times and turn around times for analytical reports. The subcontract laboratory, and not TestAmerica Analytical Testing Corp., will be held liable for liquidated damages for delays in subcontracted analytical reports and/or electronic data deliverables.

_____

Client Signature **Date**

Figure 8-2

Subcontracting Laboratory Approval Form (Initial / Renewal)

SUBCONTRACTING LABORATORY APPROVAL

Reference: Section 8 – Quality Assurance Manual

Date: _____
Laboratory: _____

Address: _____
_____

Contact and e-mail address: _____
Phone: Direct _____ Fax _____

Requested Item[3]	Date Received	Reviewed/ Accepted	Date
1. QA Manual[3]			
2. Copy of State Certification[1]			
3. State Audit with Corrective Action Response (or NELAC or A2LA Audit)[3]			
4. Most Recent (and relevant) 2 Sets of WP/WS Reports with Corrective Action Response[1,3]			
5. SOQ or Summary list of Technical Staff and Qualifications [3]			
6. SOPs for Methods to Be Loadshifted[2,3]			
7. USDA Soil Permit			
8. Insurance Certificate			
9. Sample Report[3]			
10. Description of Business Ethics and Data Integrity Plan[3]			

1 - Required when emergency procedures are implemented.
2 - Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable. This requirement may also be fulfilled by supplying a table of SOPs with effective dates.
3 – If the laboratory has NELAC accreditation, Item #1,3,4, 5, 6, 9 and 10 are optional.

On Site Audit Planned: YES NO If yes, Date Completed: _____ By Whom: _____

Comments:

Lab Acceptable for Subcontracting Work: YES NO Limitations: _____

QA Manager: _____ Date: _____

Figure 8-3

Example Subcontracted Sample Form

Date/Time: _____

Subcontracted Laboratory Information:

- Subcontractor's Name: _____
- Subcontractor Point of Contact: _____
- Subcontractor's Address: _____
- Subcontractor's Phone: _____
- Analyte/Method: _____
- Certified for State of Origin: _____
- NELAC Certified: Yes_____No_____
- A2LA (or ISO 17025) Certified: Yes_____No_____
- CLP-like Required: Yes_____No_____
  (Full doc required)
- Requested Sample Due Date: _____
  (Must be put on COC)

Project Manager: _____

Laboratory Sample # Range: _____
(Only of Subcontracted Samples)

Laboratory Project Number (Billing Control #): _____

All subcontracted samples are to be sent via bonded carrier and Priority Overnight. Please attach tracking number below and maintain these records in the project files.

PM Signature_____**Date**_____

Section 9.0
(NELAC 5.4.6)
Purchasing Services and Supplies

9.1 GLASSWARE

9.1.1 All volumetric glassware must be Class A. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.2 REAGENTS, STANDARDS, & SUPPLIES

9.2.1 Purchase

The nature of the analytical laboratory demands that all material used in any of the procedures is of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method Standard Operating Procedure (SOP). The Department Manager reviews each purchase order request to ensure that only items that are suitable to the quality requirements of the tests performed are ordered.

9.2.2 Receiving

It is the responsibility of the Department Managers to receive the shipment. It is the responsibility of the analyst who ordered the materials to date the material when received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to ensure that the purchase meets the quality level specified in the SOP and meets any applicable specifications described below. Material Safety Data Sheets are kept in administrative office. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.2.3 Specifications

9.2.3.1 There are many different grades of analytical reagents available to the analyst. All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

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

9.2.3.2.1 The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method.

- An expiration date can not be extended if the dry chemical is discolored or appears otherwise physically degraded, the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical is compared to an unexpired independent source in performing the method and the performance of the dry chemical is found to be satisfactory. The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained with the Department Managers.

9.2.3.3 Wherever possible, standards must be traceable to NBS/NIST standards, and records to that effect are available to the user.

9.2.3.4 Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. Gas quality must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

9.2.3.5 Water used in the preparation of standards or reagents must meet at least ASTM Type II quality criteria. It must have a conductivity (resistivity) of greater than 1.0 megaohm-cm at 25 °C. The conductivity is checked and recorded daily. If the water's conductivity is less than the specified limit, the Technical Director must be notified immediately in order to notify all departments and decide on corrective action such as purchasing De-ionized water from an outside source.

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

9.2.3.7 Prior to release to the laboratory, the lot of reagent or solvent must be analyzed by the primary method of use and found to contain no target analytes at levels at or above the method reporting limits. The following are to be tested by lot number: methylene chloride, methanol, hexane, acetone, ethyl ether, nitric acid, hydrochloric acid, and sodium sulfate.

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

9.2.3.9 Purchased VOA vials must be certified clean and the certificates must be maintained. If uncertified VOA vials are purchased, all lots must be verified clean prior to use. This verification must be maintained.

9.2.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Table 9-1 details specific storage instructions for reagents and chemicals. Section 22 discusses conditions for standard storage.

9.3 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

9.3.1 When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a request to the Technical Director and/or the Laboratory Director. If they agree with the request, the Technical Director contacts the appropriate vendors for price quotations and specifies instrument features. Based on this information and previous experience, a decision is made as to which one can best satisfy the requirements.

9.3.2 Upon receipt of a new or used piece of equipment, it is given a short name, such as HP-20, added to the equipment list described in Section 21 that is maintained by the QA Department and IT must be notified so that can be linked for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, DOCs, and other relevant criteria (see Section 20). For software, its operation must be deemed reliable and so stated in the instrument's maintenance logbook. Evidence of all verifications should be filed at the instrument and in the QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

9.4 SERVICES

9.4.1 Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 21. Service to analytical balances is performed at a minimum of an annual basis or more frequently as needed. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers/Technical Director.

9.5 SUPPLIERS

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

9.5.1.1 The laboratory must maintain a listing of all suppliers of critical consumables, supplies and services. This is done through the vendors section of LIMS

Figure 9.1 Materials Request Sheet

Order List

Week of:_____

VENDOR	CAT. #	ITEM DESCRIPTION	PKG SZ.	PRICE	PAGE	QTY.	INT.

TABLE 9-1 STORAGE OF REAGENTS AND CHEMICALS

CHEMICAL	STORAGE REQUIREMENTS
Concentrated acids and bases	1
Standards for metals analysis	2
Standards for extractable organics	3
Standards for volatile organics	4
Bulk dry chemicals	5
Working solutions containing organic compounds	6
Working solutions containing only inorganics	7
Flammable solvents	8
Non-flammable solvents	9

STORAGE REQUIREMENT KEY

1. Stored in the original containers at room temperature. All organic acids must be stored separately from inorganic acids. Acids should not be stored with bases.
2. Stored at room temperature.
3. Stored at 4°C± 2°C
4. Standards should be stored following manufacturer's instructions.
5. Bulk reagents are stored at room temperature in the reagent storage room of the laboratory.
6. Stored refrigerated at 4°C± 2°C.
7. Stored at room temperature; refrigeration is optional.
8. Stored in solvent cabinets at room temperature
9. Stored separately from the flammable solvents in cabinets at room temperature.

Section 10.0
(NELAC 5.4.7)
SERVICE TO THE CLIENT

TestAmerica Honolulu cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The laboratory has procedures to ensure confidentiality to other clients (Section 16 and 26). SOP CS001 describes internal procedures for maintaining confidentiality.

Note: ISO 17025/NELAC 2003 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

10.1 SPECIAL SERVICES

The laboratory's standard procedures for reporting data are described in Section 26. When requested the following special services are provided:

10.1.1 The laboratory will provide the client or the client's representative reasonable access to the relevant areas of the laboratory for the witnessing of tests performed for the client.

10.1.2 The laboratory will work with client specified third party data validators as specified in the client's contract.

10.1.3 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 previously agreed upon.

10.2 CLIENT COMMUNICATION

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

10.2.1 Technical Directors are available to discuss any technical questions or concerns that the client may have.

REPORTING

10.3.1 The laboratory will work with the client to produce any special communication reports required by the contract.

10.4 CLIENT SURVEYS

10.4.1 The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

10.4.1.1 TestAmerica's Sales and Marketing team periodically develops lab and client specific surveys to assess client satisfaction.

Section 11.0
(NELAC 5.4.8)
COMPLAINTS

Addressing complaints is a normal function of conducting business and a valuable tool to improve services to and relationships with clients. The concept of a complaint encompasses inquiries, concerns or issues arising from clients or other parties, including accrediting authorities and laboratory staff. The process of complaint resolution utilizes the procedures outlined in Section 13 and is documented in a Complaint form or Corrective Action Report (CAR). It is TestAmerica Honolulu's goal to provide a satisfactory resolution to complaints in a timely and professional manner.

11.1 EXTERNAL COMPLAINTS

11.1.1 Complaints related to analytical reports are generally investigated by a Project Manager. These types of complaints may include, but are not limited to: report content and/or format, potential errors, turnaround time, and compliance with project requirements. The investigation may include discussions with the analyst, QA Manager, Laboratory Director/Manager, and Technical Director, and is documented in a CAR or complaint form, depending on the type of complaint.

11.1.2 Complaints related to quality systems, accreditation issues, and audit findings shall be investigated by the QA Manager and be recorded on a CAR.

11.1.3 If the complaint and/or subsequent investigation points to a QA systems failure, the QA Manager shall initiate an internal audit of the area/department involved and document the audit findings in the CAR.

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

11.2 INTERNAL COMPLAINTS

11.2.1 Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 13. In addition, Corporate management, Sales and Marketing and Information Technology (IT) may initiate a complaint.

11.3 MANAGEMENT REVIEW

11.3.1 Complaints and associated laboratory corrective actions shall be addressed in the Quality Assurance Report to Management (Section 17).

Section 12.0
(NELAC 5.4.9)
CONTROL OF NON-CONFORMING WORK

12.1 SUMMARY

12.1.1 When data discrepancies are discovered or deviations and departures from laboratory standard procedures, policies and/or client requests have occurred, corrective action is taken promptly. First, the manager evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (see Section 13).

12.1.2 Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed.

12.1.2.1 When an analyst encounters such a situation, the problem is presented to the department manager for advice. The department manager may elect to discuss it with the Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 13. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

12.1.2.2 Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 20. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Quality Assurance Director, documented and included in the project folder. The deviation must also be noted on the final report with a statement that the compound is not reported in compliance with NELAC requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run. (See Section 20.3.2 for additional requirements.)

12.1.3 On a quarterly basis, the laboratory management team reviews the non-conformance corrective actions to determine if any trends are present. If trends are found, such as repeated occurrences, further corrective action is taken to eliminate the reoccurrences as outlined in Section 13.

12.2 RESPONSIBILITIES AND AUTHORITIES

12.2.1 SOP CP01-06 (Internal Investigation of Potential Data Discrepancies and Determination for Data Recall) outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of the company's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

12.2.2 Under certain circumstances the Laboratory Director, a Lab Manager, or the QA director may exceptionally authorize departures from documented procedures or policies. The departures may be a result of: procedural changes due to the nature of the sample, a one-time procedure for a client, QC failures with insufficient sample to reanalyze, etc. In most cases the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action system described in Section 13. This information may also need to be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

12.2.3 Any nonconforming work or data discrepancy discovered by any laboratory staff member must be reported to senior laboratory management within 24-hours. The senior management staff is compromised of the Laboratory Director, the Quality Assurance Director, and the Department The reporting of issues involving alleged violations of the company's data integrity policies or procedures or manual integration procedures must be conveyed to an Ethics and Compliance Officer (ECO) within 24 hours.

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

12.2.5 The Laboratory Director, QA Director, Executive Vice President (EVP) – Eastern Division, EVP – Western Division and the ECOs have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause.

12.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

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

12.3.2 SOP CP01-06 (Internal Investigation of Potential Data Discrepancies and Determination for Data Recall) distinguishes between situations when it would be appropriate for the laboratory QA Director and Laboratory Director (or his/her designee) to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO and Corporate management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting (Section 13) in lieu of the data recall determination form contained in SOP CP01-06.

12.4 PREVENTION OF NONCONFORMING WORK

12.4.1 If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system (Section 13).

12.5 METHOD SUSPENSION/RESTRICTION

12.5.1 In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/ restriction procedures can be initiated by any of the persons noted in Section 12.2.5 above.

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

12.5.3 The Laboratory Director/Manager shall arrange for the appropriate personnel to meet with the QA Manager. This meeting shall be held to confirm that there is a problem and that suspension/restriction of the method is required.

12.5.4 The suspension/restriction meeting will conclude with a discussion of the steps necessary to bring the method, target, or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 13. A copy of the meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate EVP and Corporate QA. This fax/e-mail acts as notification of the incident.

12.5.5 After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director/Manager to hold all reporting. Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

12.5.6 Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director/Manager, Technical Director, Quality Assurance Manager, Supervisors) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. The QA Director must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report as described in Section 13.

Section 13.0
(NELAC 5.4.10)
CORRECTIVE ACTION

A major component of the TestAmerica Quality Assurance (QA) program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Reports (NCR) and Corrective Action Reports (CAR) (see Figure 13-1).

13.1 DEFINITIONS

13.1.1 Technical Corrective Action: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific quality control and protocols as well as the associated corrective actions are contained in the method specific SOPs. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis. May or may not necessarily prevent recurrence.

13.1.2 Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence. (ISO 8402)

13.2 GENERAL

13.2.1 Problems within the quality system or within technical operations may be discovered in a variety of ways, such as quality control sample failures, internal or external audits, proficiency testing performance, client complaints, staff observation, etc.

13.2.2 The purpose of a corrective action system is to:

13.2.2.1 Identify non-conformance events and assign responsibility for investigation.

13.2.2.2 Resolve non-conformance events and assign responsibility for any required corrective action.

13.2.2.3 Identify Systematic Problems before they become serious

13.2.2.4 Identify and track Client complaints and provide resolution (see more on client complaints in Section 11).

13.2.3 A Non-Conformance Report (NCR) recorded on a laboratory Narrative form is used to document the following types of corrective actions:

13.2.3.1 Deviations from an established procedure or SOP

13.2.3.2 QC outside of limits (non matrix related)

13.2.3.3 Reporting / Calculation Errors

13.2.3.4 Health and Safety Violations

13.2.3.5 Client Complaints

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

13.2.4.1 Questionable trends that are found in the monthly review of NCRs.

13.2.4.2 Issues found while reviewing NCRs that warrant further investigation.

13.2.4.3 Internal and External Audit Findings.

13.2.4.4 Failed or Unacceptable PT results.

13.2.4.5 Corrective actions that cross multiple departments in the laboratory.

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

13.2.5.1 CAUSE ANALYSIS

13.2.5.1.1 Upon discovery of a non-conformance event, the event must be defined and documented. An NCR or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 13-1 provides some general guidelines on determining responsibility for assessment.

13.2.5.1.2 The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.

13.2.5.1.3 If the cause is not readily obvious, the Supervisor, Lab Director, or QA Manager (or QA designee) is consulted.

13.2.5.2 SELECTION AND IMPLEMENTATION OF CORRECTIVE ACTIONS

13.2.5.2.1 Where corrective action is needed the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.

13.2.5.2.2 Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.

13.2.5.2.3 Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCR or CAR is used for this documentation.

13.2.5.3 MONITORING OF THE CORRECTIVE ACTIONS

13.2.5.3.1 The Department Manager/Supervisor and QA Manager are responsible to ensure that the corrective action taken was effective.

13.2.5.3.2 The QA Manager and Laboratory Director review the monthly summary of NCRs and CARs for trends. This is part of the QA Report (see Section 17). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.

13.2.5.4 ADDITIONAL AUDITS

13.2.5.4.1 Additional audits shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements. (Section 16 includes additional information regarding internal audit procedures.)

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

13.3 TECHNICAL CORRECTIVE ACTIONS

13.3.1 In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (see Section 12 for information regarding the control of non-conforming work). The documentation of these procedures is through the use of an NCR or CAR.

13.3.2 Table 13-1 includes examples of general technical corrective actions for analytical methods that might be found in specific method SOPs.

13.3.2.1 Table 13-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, QAM Sections 20 and 21, and SOP CP01-06 (Internal Investigation of Potential Data Discrepancies and Determination for Data Recall). All corrective actions are documented using an NCR or CAR. Technical Corrective Actions are reviewed at a minimum monthly by the QA Manager, Department Supervisors/Managers and Laboratory Director/Manager through the QA Monthly Report which includes a summary of all corrective actions.

13.3.3 To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is still to be reported, all samples associated with the failed quality control measure shall be reported with an appropriate data qualifier.

13.4 BASIC CORRECTIONS

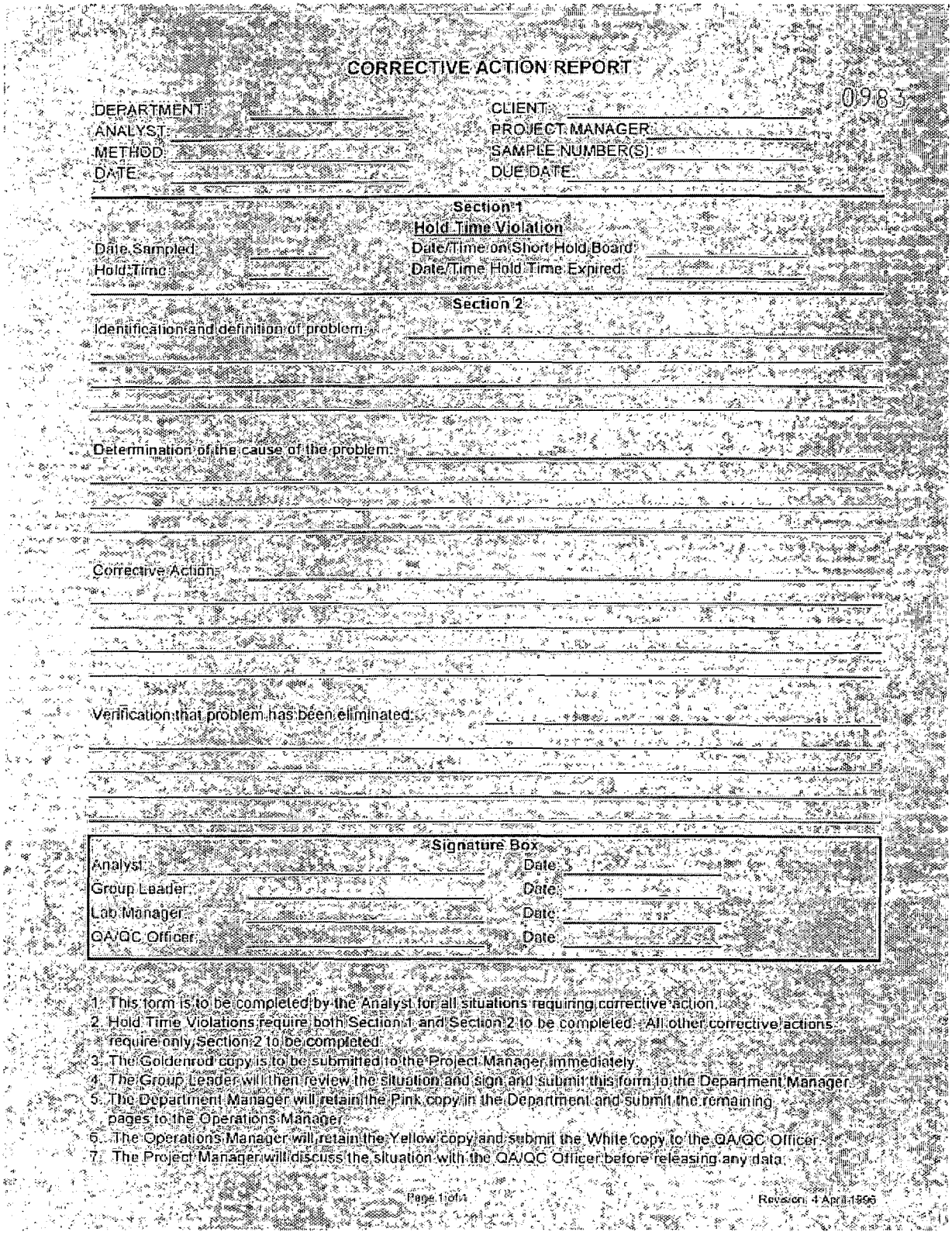
13.4.1 When mistakes occur in records, each mistake shall be crossed out, and not erased, deleted, made illegible, or otherwise obliterated (e.g. no white-out), and the correct value

entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

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

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

Figure 13-1



CORRECTIVE ACTION REPORT

0983

DEPARTMENT: CLIENT:
ANALYST: PROJECT MANAGER:
METHOD: SAMPLE NUMBER(S):
DATE: DUE DATE:

Section 1
Hold Time Violation

Date Sampled: Date/Time on Short Hold Board:
Hold Time: Date/Time Hold Time Expired:

Section 2

Identification and definition of problem:

Determination of the cause of the problem:

Corrective Action:

Verification that problem has been eliminated:

Signature Box

Analyst: Date:
Group Leader: Date:
Lab Manager: Date:
QA/QC Officer: Date:

1. This form is to be completed by the Analyst for all situations requiring corrective action.
2. Hold Time Violations require both Section 1 and Section 2 to be completed. All other corrective actions require only Section 2 to be completed.
3. The Goldenrod copy is to be submitted to the Project Manager immediately.
4. The Group Leader will then review the situation and sign and submit this form to the Department Manager.
5. The Department Manager will retain the Pink copy in the Department and submit the remaining pages to the Operations Manager.
6. The Operations Manager will retain the Yellow copy and submit the White copy to the QA/QC Officer.
7. The Project Manager will discuss the situation with the QA/QC Officer before releasing any data.

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LABORATORY NARRATIVE

DEPARTMENT: _____ CLIENT: _____

ANALYST: _____ PROJECT MANAGER: _____

METHOD: _____ SAMPLE NUMBER(S): _____

DATE: _____ DUE DATE: _____

Table 13-1

GENERAL CORRECTIVE ACTION PROCEDURES

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst))*	Instrument response < MDL. r > 0.995	Prepare another blank. If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Supervisor)*	Correlation coefficient > 0.99 or standard concentration value. Percent recovery within acceptance range. See details in Method SOP.	Reanalyze standards. If still unacceptable, remake standards.
Independent Calibration Verification (second source) *(Analyst, Supervisor)*	Percent recovery within acceptance range.	Reanalyze standard. If still unacceptable, then remake calibration standards or use new primary standards.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	Percent recovery within acceptance range.	Reanalyze standard. If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike/Matrix Spike Duplicate *(Analyst, Data Reviewer)*	Within limits documented in LIMS test code and in QA Control Chart Files	If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. If the LCS is within acceptable limits the batch is acceptable. The results of the duplicates, matrix spikes and the LCS are reported with the data set.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Laboratory Control Sample *(Analyst, Data Reviewer)*	Within limits specified in LIMS test code and in QA Control Chart Files	Batch must be re-prepared and re-analyzed. If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	Within limits of method or within three standard deviations of the historical mean	Individual sample must be repeated. Place comment in LIMS.
Method Blank *(Analyst, Data Reviewer)*	< RL[1]	Reanalyze blank. If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results.
Performance Testing (PT) Samples *(QA Manager, Department Manager/Supervisor)*	Criteria supplied by PT Supplier	Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal/External Audits *(QA Manager, Department Manager/Supervisor, Laboratory Director/Manager)*	Defined in Quality System documentation such as SOPs, QAM, etc …	Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting/Calculation Errors *(Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager/ Supervisor, QA Manager, Corporate QA, Corporate Management)*	SOP CP01-06 (Internal Investigation of Potential Data Discrepancies and Determination for Data Recall)	Corrective action is determined by type of error. Follow procedures in SOP CP-01-06.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*		Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect. Perhaps a database needs to be updated.
QA Monthly Report (See Section 17 for example.) *(QA Manager, Lab Director/Manager, Department Supervisors/Managers)*	QAM, SOPs	Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation *(Safety Officer, Lab Director/Manager, Department Supervisor/Manager)*	Chemical Hygiene Plan	Non-conformance is investigated and corrected through CAR system.

Note:

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

Section 14.0
(NELAC 5.4.11)
PREVENTIVE ACTION

Dedicating resources to an effective preventive action system emphasizes Test America's commitment to its Quality Assurance (QA) program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and satisfaction can be improved through continuous improvements to laboratory systems.

Preventive Action is a proactive process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints. Preventive action identifies negative trends and attempts to correct them before they become significant.

14.1 Opportunities for improvement may be discovered during management reviews, internal or external audits, proficiency testing performance, client complaints, staff observation, etc.

14.2 Preventive action may be initiated by any employee of the company.

14.3 Documentation of Preventive Action is required. Even when the QA Manager has no direct role in the Preventive Action, the QA Manager shall, at a minimum, serve to verify correct documentation of the process. Preventive Actions are documented with Instrument preventative maintenance logs, on laboratory logbooks and on Preventative Action forms.

14.4 The following elements are part of a Preventive Action system:

14.4.1 Identification of an Opportunity for Preventive Action. The need for preventive action is identified. Correctly defining the root cause of a potential problem is essential for a successful Preventive Action. Additionally, a rough cost benefit analysis should be undertaken at this point to assess the worst case scenario of no action compared to the resources to be spent to perform the preventive action. Resources expended in Preventive Actions should be appropriate to the magnitude of the potential problem.

14.4.2 Procedure for the Preventive Action. At this point, all of the technical resources should become involved. The Preventive Action, once correctly identified, will only be as good as the plan to investigate it.

14.4.3 Define the Control to be used to measure the effectiveness of the Plan once undertaken. Statistics or accounting principles will likely be used to define how the success of the Preventive Action will be determined.

14.4.4 Execution of the Preventive Action. A time period for evaluation is, if not already defined, determined in this step.

14.4.5 Evaluation of the plan using the defined controls. The plan is evaluated to confirm that is effective.

14.4.6 Verification of the effectiveness of the Preventive Action. This step uses the same controls as the evaluation and serves to affirm the conclusions of that evaluation.

14.4.7 Close-Out by documenting the permanent changes to the Quality System as a result of the Preventive Action.

14.5 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Review (Section 17). A highly detailed recap is not required; a simple recount of success and failure within the Preventive Action program will provide to Management a measure for evaluation.

14.6 MANAGEMENT OF CHANGE

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

14.6.1 Exemptions: Changes that do not require the application of the Management of Change System include: Maintenance, repairs and activities which are "repair or replacement in-kind", and other changes at the discretion of the Laboratory Director.

14.6.2 When it is determined that the Management of Change process is required, the Management of Change Request Form (CRF) is completed (Figure 14.1) and submitted to the Laboratory Director. Part A describes the change, Part B identifies all the reviews required, Part C shows the assigned tasks necessary to complete the change, Part D identifies the approval signatures necessary prior to making the change, and Part E documents a review to ensure that the procedures were properly implemented.

14.6.3 The QA Department is the administrator of the Management of Change System. Responsibilities include:

14.6.3.1 Maintaining copies of all initiated CRFs until they are completed

14.6.3.2 Maintaining a list of all incomplete CRFs and notifiying the Laboratory Director/Manager of all incomplete forms that are past the suggested review date. This notification is documented in the QA Report (Section 17).

14.6.3.3 Maintaining copies of all completed CRFs.

14.6.3.4 Reviewing forms for completeness.

14.6.3.5 Analyzing system to determine its effectiveness and initiating corrections as needed.

Figure 14.1 Mangement of Change Request Form

TestAmerica
ANALYTICAL TESTING CORPORATION

MANAGEMENT OF CHANGE REQUEST FORM (CRF)

Part A – Request Information *(To Be Completed by Initiator)*

- ❑ Attach any information on existing or proposed specifications if applicable.
- ❑ Check all reasons for request:

☐ Facilities	☐ Temporary	☐ Personnel
☐ Safety/Health	☐ Accreditation	☐ Other:
☐ QAM	☐ Capabilities	

- ❑ If temporary, specify date when modifications are to be removed: _____

Description and justification/impact of change:

Initiator: _____ Date: _____

Part B – Preliminary Review *(To Be Completed by Lab Director/Manager)*

Check off boxes that require a review and give to responsible person(s).

	Required Reviews	Date Reviewed	Preliminary Review Comments *(Attach any additional comments.)*	Reviewer Initials
	Lab Director/Manager			
	Technical Director			
	QA Manager			
	Project Management			
	LIMS Administrator			
	Exec VP-Operations			
	VP/QA			
	QA Director			
	Safety			
	Exec VP/Sales & Marketing			
	President/CEO			
	Other:			

Part C – Assigned Tasks, person(s), and dates necessary to complete the change are assigned by the Lab Director/Manager. Instructions for Lab Director/Manager: Fill out part C, obtain all Approval Signatures in Part D, and then give photocopy of CRF to each person assigned a task and QA Manager.

Tasks Required to complete the change:	Person(s) Assigned:	Date Task Assigned:	Target Completion Date:	Date Task Completed

Part D – Approvals: Approvals are required prior to proceeding with the tasks in Part C (see Figure 14-2 for recommended approval authorities). The Lab Director/Manager is responsible for obtaining the required signatures and for assigning a review person and suggested date of review in Part E.

Proceed with Change?		Signature and Title	Date
Yes	No		

Part E – Confirmation

Assigned person to confirm that Part C tasks were completed: _____

Suggested date of review: _____

Date review completed: _____

Review performed by:

_____ _____
Signature Date:

Comments/Recommendations:

- ❑ All assigned tasks are complete (write the date each assigned task was completed in the table in Part C)
- ❑ Some / All assigned tasks incomplete (notify Lab Director and determine a new date for review)

Figure 14.2

Management of Change Approval Authority Table

Change	Approval Authority Needed
Facility	Laboratory Director/Manager / Corporate
Accreditation	Laboratory Director/Manager / Corporate (VP of QA, Operations, Sales & Marketing)
QA Manual	Laboratory Director/Manager / QA Manager (VP of QA if change to Corporate policies or format.)
Capabilities	Laboratory Director/Manager / QA Manager/Technical Director /Sales & Marketing
Personnel	Laboratory Director/Manager
Safety/Health	Laboratory Director/Manager / Safety Officer (Director of Safety if change to corporate policies or format.)
Other	Laboratory Director/Manager determines persons who must approve the change.

Section 15.0
(NELAC 5.4.12)
CONTROL OF RECORDS

TestAmerica Honolulu maintains a record system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued See SOP GEN014.

15.1 GENERAL

15.1.1 The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. Quality records are maintained by the Quality Assurance (QA) Manager in a database and by logbook, which is backed up as part of the regular network backup. Quality records include reports from internal audits and management reviews as well as records of corrective and preventive actions, original SOPs, historical quality control limits, etc... Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the QA Director

15.1.2 All records are legible and stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement.

15.1.3 All records are held secure and in confidence. Records maintained at the laboratory are located In the QA department Filing system.

15.1.4 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. Analytical reports are maintained as electronic copies in pdf format. See Section 20.12.1 'Computer and Electronic Data Related Requirements' for more information.

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

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

15.1.5.2 All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented. The LIMS maintains an audit trail of data verification steps.

15.1.5.3 The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set See SOP GEN049 Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

15.1.5.4 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

15.1.5.5 The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", "Analyzed by" or "Analyst name".

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

15.1.5.7 Also see Section 20.12.1 'Computer and Electronic Data Related Requirements'.

15.2 TECHNICAL RECORDS

15.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless other wise specified by a client or regulatory requirement (i.e., Drinking Water and Ohio VAP – 10 years; Drinking Water Copper and Lead – 12 years). The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and checking of results.

15.2.2 Observations, data and calculations are recorded at the time they are made and are identifiable to the specific task.

15.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

15.3 RECORDS MANAGEMENT AND STORAGE

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

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

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

15.3.4 TestAmerica Honolulu has a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially within a given analysis. No analysis has more than one active notebook at a time, so all data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially and archived on the server. Standards are maintained in the LIMS and in standard logbooks.

15.3.5 All records shall be protected against fire, theft, loss, environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources. Access to the data is limited to TestAmerica employees.

15.3.6 In the event that the laboratory transfers ownership or goes out of business, TestAmerica Honolulu shall ensure that the records are maintained or transferred according to clients instructions. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the Corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

15.3.7 Laboratory sample tracking is discussed in Section 24.

15.4 SAMPLE HANDLING RECORDS

Sample handling is discussed in Section 24. Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

15.4.1 sample preservation including appropriateness of sample container and compliance with holding time requirement; these items are recorded and reported via the LIMS;

15.4.2 sample identification, receipt, acceptance or rejection and login; these items are recorded and reported via the LIMS;

15.4.3 sample storage and tracking including shipping receipts, sample transmittal / chain of custody forms; and

15.4.4 Procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

15.5 LABORATORY SUPPORT ACTIVITIES

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

15.5.1 all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);

15.5.2 a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;

15.5.3 copies of final reports;

15.5.4 archived SOPs;

15.5.5 correspondence relating to laboratory activities for a specific project;

15.5.6 all corrective action reports, audits and audit responses;

15.5.7 proficiency test results and raw data; and

15.5.8 results of data review, verification, and crosschecking procedures

15.6 ANALYTICAL RECORDS

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include (previous discussions relate where most of this information is maintained – specifics may be added below):

15.6.1 laboratory sample ID code;

15.6.2 Date of analysis and time of analysis is required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook.

15.6.3 instrumentation identification and instrument operating conditions/parameters (or reference to such data);

15.6.4 analysis type;

15.6.5 all manual calculations (e.g., manual integrations);

15.6.6 analyst's or operator's initials/signature;

15.6.7 sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations,

reagents;

15.6.8 test results;

15.6.9 standard and reagent origin, receipt, preparation, and use;

15.6.10 calibration criteria, frequency and acceptance criteria;

15.6.11 data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

15.6.12 quality control protocols and assessment;

15.6.13 electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and

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

15.7 ADMINISTRATIVE RECORDS

The laboratory also maintains the following records in either electronic or hard copy form:

15.7.1 personnel qualifications, experience and training records;

15.7.2 records of demonstration of capability for each analyst; and

15.7.3 a log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record. The initials and signatures are recorded on an annual basis in conjunction with the Corporate Ethics Policy. This allows the lab to capture changes in a person's signature or style of initialing over their time employed by the lab.

Section 16.0
(NELAC 5.4.13)
AUDITS

Audits measure laboratory performance and insure compliance with accreditation/certification and project requirements. Audits specifically provide management with an on-going assessment of the quality of results produced by the laboratory, including how well the policies and procedures of the Quality Assurance (QA) system, as well as the Ethics Policy and Data Integrity Plan, are being executed. They are also instrumental in identifying areas where improvement in the QA system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system.

16.1 INTERNAL AUDITS

16.1.1 Annually, the laboratory conducts internal audits throughout the year. These audits are intended to verify that operations continue to comply with the requirements of the laboratory QA system, ethics policies and the NELAC standard. There are various types of internal audits that occur on a regular basis.

16.1.2 It is the responsibility of the QA Manager to plan and organize audits as required by the schedule and requested by management. Personnel shall not audit their own activities except when it can be demonstrated that an effective audit will be carried out. In general, the auditor

16.1.2.1 is neither the person responsible for the process being audited nor the immediate supervisor of the person responsible for the project/process.

16.1.2.2 should be free of any conflicts of interest.

16.1.2.3 should be free from bias and influences that could affect objectivity.

16.1.2.4 should have a minimum of 4 years practical laboratory experience, at least 2 years of which should have been in quality assurance activities. If this experience criteria is not met, the audit must be reviewed by an individual that meets this criteria.

16.1.3 Technical specialists may assist with audits, performing such activities as preparing technical portions of audit checklists and conducting the technical portion of an audit.

16.1.4 Report/Data Audits

16.1.4.1 On a regular basis, the QA Manager identifies and pulls a work order that has been reported in the previous week and gathers up all associated raw data for the work order including standard and reagent logs, calibration files (initial and continuing), sequence files, maintenance logs, all instrument data and logs. All results included on the work order are audited.

16.1.4.2 The QA Manager tracks the method, matrix and analyst in order to ensure that these audits include a review of a variety of methods and analysts.

16.1.4.3 The work order information is checked against the COC and is audited for accuracy, documentation completeness and compliance with the method SOP as well as compliance to manual integration policies.

16.1.4.3.1 Included is the review of manual integrations against laboratory policies and review audit trail files and/or perform MintMiner scan on any relevant data file

16.1.4.3.2 For laboratories using Mintminer, perform Mintminer scans on archived data files to ensure tape back-up is working properly and verify data has not been changed since originally reported. Mintminer scans will be maintained in the internal audit documentation.

16.1.4.3.3 Review both hardcopy as well as electronic data.

16.1.4.3.4 Ensure that the raw data for calibrations, calculations, quality controls, chromatograms, and manual integrations are reviewed to ensure complete documentation and compliance with laboratory policies. Ensure that CARs have been completed as needed.

16.1.4.4 Compare final reported results to the original raw data.

16.1.4.5 Use the Report and Raw Data Review Checklist (Figure 16-1) to document the audit.

16.1.5 Monthly Audits

16.1.5.1 The QA Manager is responsible for a monthly technical audit to be performed. This is a detailed audit on a minimum of one analytical method/area or analyst. This audit includes comparison of the method SOP to the reference method(s).

16.1.5.1.1 Analytical Method audits must include assessment on any corresponding preparation or extraction processes as well as data review processes.

16.1.5.1.2 If the audit is of a Wet Chemistry analyst then assess their performance during a single day. With the variety of tests they may perform all tests could not be covered in a single day.

16.1.5.1.3 Audit for compliance to manual integration and ethics policies.

16.1.5.1.4 IN the event that monthly audits are missed, makeup audits must be scheduled to ensure all audit criteria mentioned are met.

16.1.6 Quarterly/Semi-Annual Audits

16.1.6.1 Typical quarterly or semi-annual audits might include: Inspection of Archiving procedures, Balance Calibration Logbooks, Thermometer Logs, Maintenance Logbooks, Pipet Calibration Logbooks, Reagent and Standard Documentation, Resistivity/Conductivity Logbooks and Micro logbooks. Generally these audits are performed quarterly, but may be extended to semi-annually if previous audits showed no deficiencies.

16.1.7 Other Audits

16.1.7.1 The following items may require an additional technical and/or performance audit. The depth of the audit will depend on the severity of the deficiency:

16.1.7.1.1 Failure of a PT sample.

16.1.7.1.2 Multiple Corrective Action Reports (CARs) in weekly data audits for Documentation issues.

16.1.7.1.3 QC failures discovered during data audits.

16.1.7.1.4 Suspected ethical improprieties.

16.1.7.2 Systematic problems identified during the corrective action process (Section 13).

16.1.7.3 Investigation of client complaints. (Sections 11 and 13)

16.2 EXTERNAL AUDITS

16.2.1 External audits are performed when certifying agencies or clients submit samples for analysis and/or conduct on-site inspections. It is TestAmerica's policy to cooperate fully with certifying agencies. It is also TestAmerica's policy to comply fully with system audits conducted by regulatory agencies and clients. The QA Manager is responsible to coordinate with the laboratory staff to identify corrective actions should any deficiencies be discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit.

NELAC: If the audit response report is not acceptable to the primary accrediting authority after second submittal, the lab shall have accreditation revoked for all or any portion of its scope of a accreditation for any or all fields of testing, a method, or analyte within a field of testing.

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

16.2.3 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 must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or

other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in Section 3.4.5 within the 2001 NELAC standards.

16.3 AUDIT FINDINGS

16.3.1.1 Internal or External Audit findings should be documented using the corrective action process (see Section 13).

16.3.1.2 If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. All efforts are made to notify the client within 2 weeks after completion of the investigation. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

16.3.1.2.1 The procedures must be in accordance to SOP CP-01-06 "Internal Investigations of Data Discrepancies and Determination of Data Recall".

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

16.4 PERFORMANCE AUDITS

16.4.1 The laboratory is involved in performance audits conducted semi-annually through the analysis of Proficiency Testing (PT) samples provided by a third party. In the past, these EPA proficiency testing studies have been referred to as Water Pollution Study (WP) and Water Supply Study (WS). Additional PTs (including soil studies) are analyzed as required by clients and state certifying agencies.

16.4.1.1 It is TestAmerica's policy that PT samples be treated as typical samples in the normal production process where this is possible. Further, where PT samples present special or unique problems in the normal production process they need to be treated differently, as would any special or unique request submitted by any client.

16.4.1.2 Holding time begins when the vial is opened. Full volume PTs follow normal hold time procedures and storage requirements.

16.4.1.3 Login will obtain the normal COC information from the documentation provided with the PTs with review by QA or other designated staff.

16.4.1.4 Vials will be prepared as required in the instruction set provided with the samples. After preparation to full volume the sample may be spiked, digested, concentrated, etc., as would be done for any normal sample requiring similar analysis.

16.4.1.5 PT samples will not undergo multiple preps, multiple runs, multiple methods (unless being used to evaluate multiple methods), multiple dilutions, UNLESS this is what would be done to a normal client sample (e.g. if a client requests, as PT clients do, that we split VOA coeluters, than dual analysis IS normal practice).

16.4.1.6 The type, composition, concentration and frequency of quality control samples analyzed with the PT samples shall be the same as with routine environmental samples.

16.4.1.7 Instructions are included in the laboratory's SOPs for how low level samples are analyzed, including concentration of the sample or adjustment of the normality of titrant. When a PT sample falls below the range of the routine analytical method, the low-level procedure may be used.

16.4.1.8 No special reviews shall be performed by operation and QA, UNLESS this is what would be done to a normal client sample. To the degree that special report forms or login procedures are required by the PT supplier, it is reasonable that the laboratory WOULD apply special review procedures, as would be done for any client requesting unusual reporting or login processes.

16.4.2 Corporate QA may arrange for double blind PT studies to be performed in the laboratories. Results are given to Management and Corrective actions of any findings are implemented at each facility by the QA Managers and Laboratory Directors/Managers. The Double Blind PT studies are used to evaluate the entire laboratory process from initial proposals through to the final invoicing process. These are not done more frequently than annually.

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

16.5 SYSTEM AUDITS

16.5.1 An annual systems audit is required to ensure compliance to analytical methods and SOPs, the laboratory's Data Integrity and Business Ethics Plan (DIBEP) and Ethics Policies, NELAC quality systems, client and State requirements. This audit can be performed in portions throughout the year, but a schedule must show that all aspects are reviewed annually. The semi-annual, quarterly and monthly internal audits may be used for parts of the systems audits if they are scheduled as such.

16.5.2 It is the responsibility of the QA Manager to plan and organize the audits as required.

16.5.3 Such audits shall be carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited.

16.5.4 System audits evaluate procedures and documentation in the laboratory. Example audit checklists can be found in Figure 16-2.

Figure 16-1

Example Report and Raw Data Review Checklist

Work Order # :_____
Received:_____
Due Date:_____

Client: _____
PM: _____

Method:									
1. Instrument ID									
2. Data Analyzed									
3. Sample holding time met									
4. Instrument Calibration met criteria:									
a) Tuning / Std points / Linearity									
b) Initial Cal. Check List included (if applic)									
5. All samples met QC criteria									
a) BLK compliant									
b) LCS / LCSD or SRM compliant									
c) MS / MSD or DUP as required									
d) Surrogate(s) compliant (if applic)									
e) Results within calibration range									
f) Manual calculation verified									
g) Manual Integration properly documented									
h) ICV/CCV (& CCB) compliant									
i) Prep batch properly documented									
j) Run log properly documented									
k) Mint Miner run & reviewed (if applic)									
l) Data logbook reviewed (if applic)									
m) Daily Check List included (if applic)									
6. Data correctly transposed to Elmnt									
a) Dates									
b) Instrument ID / Sample ID									
c) Results, DF, Batches									
d) Correct Qualifiers									
7. Standards:									
a) Traceable									
b) Shelf life OK									
8. All Logbook(s) properly documented									
9. Corrective Action Needed (and CAR#)									

Comments / Errors found: _____

Reviewed By:_____

Date Reviewed: _____

Figure 16-2

Example Internal Audit Checklists

INTERNAL AUDIT

TestAmerica Analytical Testing Corp. – *[Insert lab name]*

Date(s):	
Area Audited	Archiving (Example 1) or Method (Example 2)
Persons Contacted During Audit:	
Auditor	

Date Reported to Supervisor or Manager of Audited Area:	
Reported To:	
Department Supervisor/Manager Signature and Date:	
Date reported to Laboratory Director/Manager:	

Department Supervisor/Manager: Please review the checklist and comments attached. Comments are identified by the item number in the checklist. Please submit response to comments within one week of the "Date Reported to Supervisor." Once supervisor review is complete, please return all internal audit (IA) documentation to the auditor.

Date auditor submitted IA report to QA:_____
SOP update initiated – No_____ Yes_____
CAR initiated – No_____ Yes_____ CAR #_____

Audit complete and accepted by QA (including acceptance of response):

Date: _____ QA Signature: _____

Scheduled Date for Follow-up Audit: _____ Who: _____

Follow-up Audit completed and reported to management:

Date: _____ QA Signature: _____

AUDIT CHECKLIST: Archiving

		Yes	No
1.	The archive log(s) include: ❑ A unique box identifier. ❑ A description of the contents of the box. ❑ The location of the box. ❑ The date of disposal.		
2.	Access to archived information is documented with an access log (either per archive area or per box). The log contains the date/time, initials and description of items removed, reviewed or returned.		
3.	Archive boxes are labeled with a unique box identifier and a means for identifying the time for disposal. This would also apply to electronic records.		
4.	Archive locations are protected against fire, theft, loss, environmental deterioration and vermin. In addition, electronic records are protected against electronic or magnetic sources.		
5.	Instructions for the retrieval of electronic records are archived with the electronic records when necessary to facilitate retrieval.		
6.	The laboratory has identified a time period to maintain data records? (_____ years).		
7.	Records that are stored by computers or personal computers (PCS) have hard copy or write-protected back-up copies.		
8.	Records stored only on electronic media, are supported by the hardware and software necessary for their retrieval.		
9.	The LIMS is backed up a minimum of once per day.		
10.	All information necessary for the historical reconstruction of data are maintained by the laboratory. Examples: ❑ Copy of COC. ❑ Log-in Record. ❑ Internal Chain Record (where applicable). ❑ Worksheets/Logbooks/Notebooks ❑ Standard Preparation Log ❑ Calibration Logs – Balance, instrument, pipet, thermometers, ... ❑ Run Logs ❑ Raw Data ❑ Final Report ❑ QA Manual/SOPs ❑ MDLs ❑ QC Limits		

Comments (may add additional page(s)):

AUDIT CHECKLIST: Method Audit (xxxx)

	Yes	No
1. Does method have written SOP? Note: An SOP is a written procedure that has been numbered and approved by QA and management.		
2. Compare SOP to original published method. Are there any discrepancies? Note: List any discrepancies using table format below. A2LA or State method audit checklists may be helpful.		
3. Examine worksheets/benchsheets and runlogs. Do worksheets/benchsheets and runlogs have all required information as per published method and written SOP? Is method number included on worksheet?		
4. Observe method. Are procedures in compliance with written SOP? Note: List any discrepancies using table format below. Compare to published method if SOP is unavailable.		

Comments:

Section 17.0
(NELAC 5.4.14)
MANAGEMENT REVIEWS

17.1 QUALITY ASSURANCE REPORT

17.1.1 A comprehensive Quality Assurance (QA) Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director/Manager for review and comments. The reviewed report shall then be submitted to the Technical Directors and Laboratory Director as well as corporate Quality Assurance. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures.

17.1.2 The TestAmerica QA Report template is comprised of a discussion of three QA issues facing the laboratory and eleven specific sections (Figure 17-1):

17.1.2.1 SOPs: Report SOPs that have been finalized, SOPs that are in QA for review, SOPs that are due to QA for review and the number of SOPs that need to be written.

17.1.2.2 Corrective Action Reports: This section includes discussion on items that are tracked through the CAR system. Report the total number of CARs, the number of unresolved CARs and their highlights, discuss and attach a non-conformance summary, remark on missed holding times, client feedback and complaints, and reissue reports. Summarize any data recall decisions that were made following SOP: CP01-06.

17.1.2.3 MDLs and Control Limits: Report which MDLs/ MDL verifications have been completed, those in QA for review, and those due. Report the same for Control Limits.

17.1.2.4 Audits: Report Internal audits completed and External Audits conducted. Include all relevant information such as which methods, by whom, corrective actions needed by when and discuss unresolved audit findings.

17.1.2.5 Performance Evaluation Tests: Report the PT tests that are currently being tested with their due dates, report recent PT results by study, acceptable, total reported and the month and year (including Corporate double blind when applicable).

17.1.2.6 Certifications: Report on any certification programs being worked on by due date, packages completed, new methods, dropped methods, etc.

17.1.2.7 Training: Report on any training that has been conducted, training that is needed and issues relating to Analyst Demonstration of Capability.

17.1.2.8 Regulatory Updates: Include information on new state or federal regulations that may impact the laboratory. Report new methods that require new instrumentation, deletion of methods, changes in sampling requirements and frequencies etc…

17.1.2.9 Ethics Policy Compliance: Compliance to the Ethics Policy and Data Integrity and Business Ethics Plan (DIBEP): Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

17.1.2.10 Miscellaneous: Include any issues that may impact quality within the laboratory. This section is also used to communicate the status on any Management of Change Request Forms (CRFs) that have missed targeted due dates. Some other items that should be included in this section are:

17.1.2.10.1 Adequacy of staff, equipment and facility resources.
17.1.2.10.2 Adequacy of policies and procedures.
17.1.2.10.3 Future plans for resources and testing capability and capacity
17.1.2.10.4 Review of ACIL Seal of Excellence program performance.

17.1.2.11 Next Month: Report on plans for the upcoming month.

17.1.2.12 Lab Director Comments Section: This section gives the Laboratory Director/Manager the opportunity to comment on issues discussed in the report and to document plans to resolve these issues. Unresolved issues that reappear in subsequent monthly reports must be commented on by the Laboratory Director/Manager. (This is in addition to the action item list.)

17.2 MANAGEMENT REVIEW

17.2.1 On a monthly basis, the senior lab management team (Laboratory Director, Department Managers, at least one Project Manager, and the QA Manager) conducts a review of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director/Manager.

17.2.2 Each month, the Laboratory Director and management generate a report from the meeting. The report is distributed to Senior Management and the V.P. of Quality Assurance and/or the Quality Assurance Director. The report includes, but is not limited to:

17.2.2.1 The date of the review and the names and titles of participants.

17.2.2.2 A reference to the existing data quality related documents and topics that were reviewed.

17.2.2.3 Quality system or operational changes or improvements that will be made as a result of the review.

- An implementation schedule including assigned responsibilities for the changes. (Action Table). This action table is a 'running' list of items (Items that are closed remain on the list) so they can be continuously reviewed for trends on an ongoing basis.

17.2.3 One monthly meeting per year is used to recap the previous year to assess the "big picture" and highlight any open action items. This helps ensure that routine quality actions taken and reviewed on a monthly basis are not components of larger systematic concerns. Significant issues from the following documentation are compiled or summarized by the QA

Manager prior to the review meeting (**note:** all items may not be covered if they have been well addressed in the regular monthly meetings):

17.2.3.1 Matters arising from the previous reviews.

17.2.3.2 Prior Monthly QA Reports (summarizing items such as SOPs, CARs, MDLs, audits (internal and external), Proficiency Testing results, certification and training issues).

17.2.3.3 Review of report reissue requests.

17.2.3.4 Review of client feedback and complaints.

17.2.3.5 Issues arising from any prior management or staff meetings.

17.2.3.6 Minutes from prior Senior Management team meetings. Issues that may be raised from these meetings include:
17.2.3.6.1 Adequacy of staff, equipment and facility resources.
17.2.3.6.2 Adequacy of policies and procedures.
17.2.3.6.3 Future plans for resources and testing capability and capacity..

17.2.3.7 Compliance to the Ethics Policy and Data Integrity and Business Ethics Plan (DIBEP): Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

17.2.3.8 The QA Manual is reviewed at this time and revised to reflect any significant changes made to the quality systems.

17.2.3.9 The annual review includes the previous 12 months. Based on the annual review, a report is generated by the QA Manager and management. The report is available to Senior Management and the V.P. of Quality Assurance and/or the Quality Assurance Director upon request.

17.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

17.3.1 Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. SOP CP-01-06 "Internal Investigations of Data Discrepancies and Determination of Data Recall" shall be followed.

17.3.2 All investigations that result in finding of inappropriate activity shall be documented and shall include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. All documentation of these investigations and actions taken shall be maintained for five years or the life of the affected raw data storage whichever is greater.

Figure 17-1

Example QA Monthly Report to Management

LABORATORY: x
PERIOD COVERED:
PREPARED BY: DATE:
TO: x, Division/Laboratory Manager/Director
CC: x, Operations Manager (or Technical Directors)
X, Quality Assurance - Corporate

THREE KEY ISSUES:

1.
2.
3.

---

1. **SOPs**
   - 1.1 The following SOPs were finalized (or reviewed for accuracy) (Include updated SOP Summary):
   - 1.2 The following SOPs are in QA for review:
   - 1.3 The following SOPs are due to QA:
   - 1.4 Number of SOPs that need to be written:

2. **Corrective Action Reports**
   - 2.1 Total Number of CARs (*Include category breakdown if available*):
   - 2.2 Number of Unresolved CARs:
   - 2.3 Highlights:
     - 2.3.1
   - 2.4 Attach Non-Conformance Summary
     - 2.4.1 Discussion
   - 2.5 Number of Data Investigations/Recalls (SOP: CP01-06)
     - 2.5.1 Discussion
   - 2.6 Client Feedback and Complaints
     - 2.6.1 Discussion
   - 2.7 Re-Issue Reports
     - 2.7.1 Discussion

3. **MDLs and Control Limits**
   - 3.1 MDLs/Verifications Completed:
   - 3.2 MDLs/Verifications in for QA Review:
   - 3.2 MDLs Due:
   - 3.3 Control Limits Completed:
   - 3.4 Control Limits under QA Review:
   - 3.2 Control Limits Due:

4. **AUDITS**
   - 4.1 <u>INTERNAL AUDITS (Attach a copy of Schedule)</u>
     The following internal audits were performed (include raw data, method and general):
     4.1.1 Report/Data Audit

Date of Audit	Work Order #	Method	Matrix	Analyst(s)	Corrective Action (Due Date or Completed)

4.1.2 Method / General Audits

4.2 EXTERNAL AUDITS
(Include source, date, highlights, date Corrective Action Package is due, Progress on Corrective Action Packages, ...)

4.3 Unresolved Audit Findings:

5. **PT SAMPLES**

5.1 The following PT samples are now in house (Due Dates):

5.2 The following PT results have been received:

Study	# Acceptable	# Reported	Month/Year

5.3 Corporate Double Blind PT (when applicable):

6. **CERTIFICATIONS**

6.1 Certification Packages Being Worked On (Include Due Date):

6.2 Certification Packages Completed (Send any new Certificates):

6.3 Methods Added/Dropped:

7. **TRAINING**

7.1 Training Courses Conducted:

7.2 Training Performed:

7.3 Training Needed:

8. **REGULATORY UPDATE**

8.1 Include information on new state or federal regulations that may impact the laboratory – new methods that require new instrumentation, deletion of methods, changes in sampling requirements or frequencies, ...

9. **ETHICS POLICY COMPLIANCE**

9.1 Training

9.2 Notification of ECO (when applicable) on recall determinations

9.3 Ethics related Items from audits.

10. **MISCELLANEOUS**

10.1 (Include any issues that may impact quality within the laboratory. Also include information regarding the status of any Management of Change Request Forms (CRFs) that have missed targeted due dates.)

Items for Discussion as needed:

- Adequacy of staff, equipment and facility resources
- Adequacy of policies and procedures
- Future plans for resources and testing capability and capacity
- Review of Seal of Excellence Program Performance.

11. **NEXT MONTH**
(Items planned for next month)

LAB DIRECTOR COMMENTS AND PLANNED CORRECTIVE ACTIONS:	
LAB DIRECTOR REVIEW:	DATE:

Management Team Reviewed and Approved on: _____(date)

QA Manager: _____

Organics Manager: _____

Inorganics Manager _____

Project Manager _____

Section 18.0
(NELAC 5.5.2)
PERSONNEL

18.1 OVERVIEW

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

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

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

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

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

18.1.6 The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. (Also see Section 4 for position descriptions/responsibilities).

18.1.7 Job descriptions define the minimal level of qualifications, experience and skills necessary to perform responsibilities.

18.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

The following are the education/experience requirements for laboratory technical personnel. Records of relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory

18.4.2.1 **Laboratory Director** – A bachelor's degree in science is required. If a bachelor's degree is in a field other than chemistry, the individual should have the number of credit hours in chemistry equivalent to a minor in chemistry or

10 years experience in the environmental laboratory industry with proven track record of accomplishments.

18.4.2.2 **Technical Director, Operations Manager** – A bachelor's degree in the chemical, environmental, biological sciences or engineering, with at least 24 college semester credit hours in chemistry and at least two years of experience in the environmental analysis of representative inorganic and organic analytes for which the laboratory seeks or maintains accreditation. A masters or doctoral degree in one of the above disciplines may be substituted for one year of experience.

18.4.2.3 **Quality Assurance Director/Officer** – A bachelor's degree in a basic or applied science and at least 1 year of nonacademic analytical chemistry, or in lieu of a degree, 4 years of nonacademic analytical chemistry experience. In addition, documented training in statistics or quality control procedures is required. The QAO must be knowledgeable in quality systems as defined under NELAC

18.4.2.4 **Data Package Coordinator, Hazardous Waste Coordinator, Director of Project Management** – A bachelor's degree in the chemical, environmental, biological sciences, physical sciences or engineering is required, with at least two years of experience in environmental laboratory analysis or operation. For the Director of Project Management, a bachelor's degree in business or marketing along with environmental laboratory experience is acceptable.

18.4.2.5 **LIMS Administrator** -- A bachelor's degree in the chemical, environmental, biological sciences, physical sciences, information systems, or engineering is required.

18.4.2.6 **Supervisor** – A Bachelor of Science degree in a relevant scientific field (chemistry, with some business management preferred) or equivalent experience, with at least three years of non-academic experience in relevant analysis. Successful training in specific methods used in the department shall have been verified and documented as performance evaluations using reference/control materials of the matrices of concern. Proficiency testing results must be documented.

18.4.2.7 **Analyst** – An analyst must possess a high school diploma or equivalent. A Bachelor of Science degree in chemistry or biology is preferred. A non-degreed individual must demonstrate basic lab operational proficiency. Formal In house training on the major instruments including ICL, GC and GC/MS is mandatory minimum experience requirement for the independent operation of AA, ICP and GC is six months; 1 year for GC/MS equipment. The analyst must follow training and documentation as summarized in Section 20.

18.3 The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also see "Demonstration of Capability" in Section 20

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

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the Standard Operating Procedures in their area of responsibility. This documentation is updated as SOPs are updated. Several general SOPs are administered electronically to each analyst. These include general good lab techniques that are not present in the method SOPs. A list of these SOPs that are required by department is included in appendix 9

- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.

- Documentation of continued proficiency by at least one of the following once per year:

  - Acceptable performance of a blind sample (single blind to the analyst). Note: successful analysis of a blind performance sample on a similar test method using the same technology (e.g. GCMS volatiles by purge and trap for methods 524.2, 624, or 5030/8260 would only require the documentation for one of the test methods). The laboratory determines the acceptance limits prior to analysis.

  - another demonstration of capability (see Section 20)

  - at least 4 consecutive laboratory control samples with acceptable levels of precision and accuracy.

  - If the above 3 items cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

18.5 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica Honolulu. It is a formal part of the initial employee orientation and is also required annually for all employees at all levels and departments throughout the laboratory. Senior management at each facility performs the ethics training to their staff.

18.5.1 Key Topics covered in the presentation include:

- organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy and Code of Ethical Conduct (Appendix 1)
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.

- Specific examples breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient

18.5.2 All training is documented by signature on the signed Ethics Policy and Code of Ethical Conduct demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity. An attendance sheet is recommended for larger group trainings to assist in tracking training needs.

18.5.2.1 New employees who are hired after the annual training view the PowerPoint slides in the "Normal" slide setting so that they can read the notes down below the slides. The new employee then meets with the QA Manager to ask any questions, review their presentation and to sign a copy of the Ethics Policy and Code of Ethical Conduct.

PERSONNEL QUALIFICATIONS

Name: _____

Title: _____

Education

Month/Year From - To	Degree	Major	College/University
Number of Hours of Chemistry:			

Month/Year	Training Course Name	Training Provider	Brief Description of Course

Laboratory Experience

Number years/months analytical chemistry experience: _____

Number years/months experience in current field: _____

Professional Experience

Month/Year From - To	Job Title	Employer - Name and Address

Description

Briefly describe your relevant experience

_____ _____

Signature Date

TRAINING SUMMARY

Analyst Training
General Lab Equipment

Analyst: _____ **Department:** _____

Equipment	Training Given by	Date Completed	Analyst Initials	Dept. Manager Initials
Autopipettor				
Balance (Analytical)				
Balance (Top Loader)				
BOD Incubators				
Centrifuges				
Fume Hoods				
Hot Plates/ Stirrers				
Manual Pipets (glass)				
Oven				
pH Meter / DO Probe				
Graduated Repipettor				
Vacuum Pumps				
Volumetric glassware				
Water Baths				
Ultrasonic Baths				
Gastight Syringes				
Vortex				
Sonicator/Sonic Dismembrator				
Analytical Nitrogen Evaporator				
Turbo-Vap Evaporator				
Milli-Q Water Filtration System				
TCLP Extractor and Rotation Setup				
Flashpoint Tester				
Spectrophotometer				
Others (Pls. specify):				

Note: *All applicable items MUST be signed by the analyst and Dept. Manager and returned to the QA Director for inclusion in the training files.*

Comments: _____

Standard Operating Procedures - Sign-Off

Acknowledgment of Training

I have read and understand the requirements for performing _____ (method description) (Method _____ (Method No.)) as described in SOP OAL-_____ (SOP No.) (rev._____ (revision no.)). I will comply with its requirements as evidenced by my signature.

Print Name	Signature	Date
_____	_____	_____

Presented by: _____

Date: _____

Demonstration of Capability
Certification Statement

Date Analyzed: _____ Work Order: _____

Oceanic Analytical Laboratory, Inc.

99-193 Aiea Heights Dr. Suite 121

Aiea, HI 96701-3900

Analyst Name: _____

Matrix: _____ _____

(examples: laboratory pure water, soil, air, solid, biological tissue)

Method Number: _____ _____

SOP # _____ ***Revision #***_____

Parameter or Analyte: _____

(examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under NELAP, have met the Demonstration of Capability.
2. The test method(s) was performed by the analyst(s) identified on this certification.
3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete, and self-explanatory (1).
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

_____	_____	_____
Technical Director's Name (Title): Laboratory Director	Signature	Date
_____	_____	_____
Quality Assurance Director Name	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.

Section 19.0
(NELAC 5.5.3)
ACCOMODATION AND ENVIRONMENTAL CONDITIONS

TestAmerica Honolulu is designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded. Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis and administrative functions. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis.

19.1 ENVIRONMENT

19.1.1 Laboratory accommodation, test areas, energy sources, lighting, heating and ventilation are adequate to facilitate proper performance of tests.

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

19.1.3 The laboratory provides for the effective monitoring, control and recording of environmental conditions that may effect the results of environmental tests. Such environmental conditions include humidity and temperature.

19.1.3.1 In instances where monitoring or control of any of the above-mentioned items are specified in a test method or by regulation, the laboratory meets and documents adherence to the laboratory facility requirements.

19.1.3.2 When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels (see Section 12).

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

19.2 WORK AREAS

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

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

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

19.2.3 Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular janitorial service to control dirt, dust, and cobwebs within the laboratory.

19.2.4 Work areas are available to ensure an unencumbered work area. Work areas include:

19.2.4.1 Access and entryways to the laboratory.

19.2.4.2 Sample receipt areas.

19.2.4.3 Sample storage areas.

19.2.4.4 Chemical and waste storage areas.

19.2.4.5 Data handling and storage areas.

19.2.4.6 Sample processing areas.

19.2.4.7 Sample analysis areas.

19.3 FLOOR PLAN

19.3.1 A floor plan can be found in Appendix 3.

19.4 BUILDING SECURITY

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

19.4.2 Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of TestAmerica Honolulu.

19.4.3 Visitors (with the exception of TestAmerica employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

19.4.4 Signs are posted in the laboratory designating employee only areas - "Authorized employees beyond this point".

Section 20.0
(NELAC 5.5.4)
TEST METHODS AND METHOD VALIDATION

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

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

20.1 STANDARD OPERATING PROCEDURES (SOPs)

20.1.1 TestAmerica Honolulu maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory *(See Section 6 on Document Control)*:

20.1.2 All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.

20.1.3 Procedures for preparation, review, revision and control are incorporated by reference to SOPs: GEN026

20.1.4 SOPs are reviewed at a minimum of every 2 years, and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

20.2 LABORATORY METHOD MANUAL(S)

20.2.1 For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP. Each test method contains or references the following (where applicable and not necessarily in this order).

20.2.1.1 Identification of the test method
20.2.1.2 Applicable matrices
20.2.1.3 Detection and/or reporting limit
20.2.1.4 Scope and application, including the analyte list
20.2.1.5 Summary of the method
20.2.1.6 Definitions
20.2.1.7 Interferences

20.2.1.8 Safety
20.2.1.9 Equipment and supplies
20.2.1.10 Reagents and standards
20.2.1.11 Sample collection, preservation, shipment and storage
20.2.1.12 Quality control
20.2.1.13 Calibration and standardization
20.2.1.14 Procedure
20.2.1.15 Data analysis and calculations
20.2.1.16 Method performance
20.2.1.17 Pollution prevention
20.2.1.18 Data assessment and acceptance criteria
20.2.1.19 Corrective actions for out of control data
20.2.1.20 Contingencies for handling-out-of control or unacceptable data
20.2.1.21 Waste management
20.2.1.22 References
20.2.1.23 Any tables, diagrams, flowcharts and validation data

> **Note**:
> If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed.

20.2.2 General SOPs (non-technical) must contain scope/application, definitions, safety issues, procedure, documentation, contingencies, attachments, and references.

20.3 SELECTION OF METHODS

Appropriate test and sampling methods are chosen to meet our clients' requirements and analytical data quality objectives. The methods should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

20.3.1 Sources of Methods

20.3.1.1 In general TestAmerica Honolulu follows procedures from the referenced methods shown below in 20.3.1.3. In all cases, the laboratory must follow specific project or regulatory program required methodologies. When specified, such requirements will be followed.

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

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

- Methods for Chemical Analysis of Water and Wastes (MCAWW) - EPA/600/4-79-020 - Revised March 1983
- Code of Federal Regulations (CFR) 40, Parts 136 - Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)
- Test Methods for Evaluating Solid Waste, Physical Chemical Methods EPA SW-846 3rd Edition, September 1986, Update I, July 1992, Update II, September 1994, Update III, December 1996
- Methods for the Determination of Organic Compounds in Drinking Water - Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series)
- Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994
- EPA Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100) August 1993
- EPA Methods for the Determination of Metals in Environmental Samples (EPA/600/R-94/111), May 1994
- Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005) ***(DW labs only)***
- Standard Methods for the Examination of Water and Wastewater, (APHA, AWWA, WEF 19th and 20th Editions)
- Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261

20.3.1.4 Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

20.3.1.5 The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been so informed, the client shall have the final say on what method is used.

20.3.2 Demonstration of Capability

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

20.3.2.1 A demonstration of capability is performed whenever there is a change in instrument type, method or personnel.

20.3.2.2 The demonstration of capability must be thoroughly documented and approved by the Technical Director and QA Manager prior to analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures (see Section 15, Control of Records).

20.3.2.3 The laboratory must write a SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

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

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method).
- The reporting limit is set at or above the first standard of the curve for the analyte.
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: Reporting Limit based on the low standard of the calibration curve.
- See Section 12.1.2.2 (Control of Non-Conforming Work).

20.3.2.4 General Initial Demonstration of Capability (IDOC) procedures

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

20.3.2.4.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or if unspecified to a concentration approximately 10 times the method stated or laboratory calculated method detection limit.

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

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

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

20.3.2.4.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria

established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

20.3.2.4.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 20.3.2.4.7.1 or 20.3.2.4.7.2:

20.3.2.4.7.1 Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 20.3.2.4.3 above.

20.3.2.4.7.2 Beginning with 20.3.2.4.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with C) above.

20.3.2.5 A certification statement (see Figure 20-1) shall be used to document the completion of each demonstration of capability. A copy of the certification is archived in the analyst's training folder.

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

20.4 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP/Methods Manual (Section 20.2) and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). Client must also be in agreement to the use of the non-standard method. The information included in the checklist below (Figure 20-2) is needed before samples are accepted for analysis by a new method.

20.5 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled. (From 2003 NELAC Standard)

20.5.1 All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

20.6 METHOD DETECTION LIMITS

Method detection limits (MDL) are determined in accordance with 40 CFR part 136, Appendix B. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the value is not zero. The method detection limit is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a

significant change in the procedure or equipment, or based on project specific requirements. The Analyst prepares seven or eight replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates are analyzed over 2-4 days to provide a more realistic MDL.

20.6.1 MDL's are performed for each individual instrument and non-microbiological method analysis. Unless there are requirements to the contrary, the laboratory will use the highest calculated MDL for all instruments used for a given method as the MDL for reporting purposes.

20.6.2 MDL's must be run against acceptable instrument QC, including ICV's and Tunes. This is to insure that the instrument is in proper working condition and falsely high or low MDL's are not calculated.

20.6.3 Use only clean matrix which is free of target analytes (e.g.: Nanopure water, Ottawa Sand) unless a project specific MDL is required in a real life matrix.

20.6.4 The Reporting Limit (also may be referred to as Limit of Quantitation or LOQ) should generally be between 2 and 5 times the MDL. If the MDL is being performed during method development, use this guideline to determine the Reporting Limit for the analysis. If a sample is diluted, the reported MDL is adjusted according to the dilution factor.

20.6.5 If the MDL is < 1/10 of the spike concentration the MDL must be repeated (including extraction or digestion) using a lower spike level unless the % recovery is < 50% or > 150% of the "true value". Note: The concentration of the spike will be at a level below the calibration range.

20.6.6 The calculated MDL cannot be not greater than the spike amount.

20.6.7 If the most recent calculated MDL does not permit qualitative identification of the analyte then the laboratory may use technical judgment for establishing the MDL. (e.g. calculate what level would give a qualitative ID, compare with IDL (20.6.12), spike at a level where qualitative ID is determined and assign that value as MDL, minimum sensitivity requirements, etc.). The rationale must be documented and the QA Manager must approve any adjustments made based on judgment.

20.6.8 Each of the 7 spikes must be qualitatively identifiable (e.g. appear in both columns for dual column methods, 2 mass ions for GCMS mass spectra, etc). Manual integrations are not allowed for compound identification (cannot force the baseline to detect).

20.6.9 The method detection limit is calculated as follows:

$$\text{Method Detection Limit} = t_{(n-1,\ 1-a\ =\ 0.99)} \times (\text{Standard Deviation of replicates})$$

where $t_{(n-1,\ 1-a\ =\ 0.99)} = 3.143$ for seven replicates.

20.6.10 Because of the inherent variability in results outside of the calibration range, TestAmerica does not recommend the reporting of results below the lowest calibration point in a curve however, it is recognized that some projects and agencies require the reporting of results below the RL. Any result that falls between the MDL and the Reporting limit, when reported, will be qualified as an estimated value.

20.6.11 Detections reported down to the MDL must be qualitatively identified.

20.7 INSTRUMENT DETECTION LIMITS (IDL):

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

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

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

20.8 VERIFICATION OF DETECTION AND REPORTING LIMITS

20.8.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a Quality Control sample (prepared as a sample) at 2-3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and 1-4 times the calculated MDL for multiple analyte methods (e.g GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL or redevelop their MDL. MDLs must be verified at least annually

20.8.2 When a Reporting limit is established, it must be initially verified by the analysis of a Low level QC sample (LCS at 1-2 the reporting limit) and annually thereafter. *The annual requirement is waved for methods that have an annually verified MDL.*

20.9 RETENTION TIME WINDOWS

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

20.9.2 There must be sufficient separation between analyte peaks so as to not misidentify analytes. The valley between two peaks should not be less than 20% of the peak heights of the analytes.

20.9.2.1 Some analytes do not separate sufficiently to be able to identify or quantitate them as separate analytes (e.g. m-xylene and p-xylene) and are quantitated and reported as a single analyte (e.g. m,p-xylenes).

20.9.3 Once the analyst has determined that the instrument is in optimum working condition through calibration and calibration verification procedures, he or she uses a mid-range calibration or calibration verification standard to establish the retention times for each of the individual analytes in a method. The Analyst makes three injections of the same standard over a 72-hour period, tabulating the retention times for each analyte for each of the three injections. The retention time window is defined as the average retention time ± 3 Standard Deviations. A peak outside the retention time window will not be identified by the computer as a positive match of the analyte of interest.

20.9.4 There may be instances where method default retention time windows may be used. The same concept is applied, any peak outside of that window will not be identified by the computer as a positive match.

20.9.5 The calibration verification standard at the beginning of a daily run may be used to adjust the retention time for an analyte. This is essentially re-centering the window but the size of the window remains the same.

20.10 EVALUATION OF SELECTIVITY

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

20.11 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

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

20.11.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

20.11.3 The uncertainty associated with results generated at TestAmerica Honolulu can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated a given test over time (except for variability associated with the sampling). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

20.11.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the, and multiply the result by the decimal of the upper end of the LCS range percent value. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is

1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l.

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

20.11.6 Uncertainty may be calculated by adding the individual uncertainties of any method if formally requested by a client or regulator. The method is based on ISO/IEC 17025-1999 Standard: General Requirements for the Competence of Testing and Calibration Laboratories, based on the general rules outlined in Guide to the Expression of Uncertainty in Measurement (GUM) created by William Ingersoll. TestAmerica Honolulu is willing to participate in such an activity but may require additional charges, as several hours of administrative time will be needed to perform the task.

20.12 CONTROL OF DATA

TestAmerica Honolulu has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

20.12.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below.

20.12.1.1 Maintain the database integrity: Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use.

  Note: "Commercial off-the-shelf software in use within the designed application range is considered to be sufficiently validated." *From NELAC 2003 Standard.* However, laboratory specific configurations or modifications are validated prior to use.
- In order to assure accuracy, all data entered or transferred into the LIMS data system goes through a minimum of two levels of review.
- The QA department performs random data audits to ensure the correct information has been reported.
- Changes to reports are performed in completion and narrated on the report. The modified report is stored in the file with the original.
- Analytical data file security is provided through three policies.
  - The first policy forbids unauthorized personnel from using laboratory data acquisition computers.
  - The second policy is the implementation of network passwords and login names that restrict directory access.

- The third layer is maintained through our LIMS and includes the use of username/password combinations to gain access to the LIMS system, the fact that all data in the LIMS is associated with the user to added/reviewed the data, and the restriction of review authority of data.

- All software installations will be in accordance with any relevant copyright licensing regulations.
- The Information Technology Department must approve all software installed on any computer within the laboratory. Shrink-wrapped or otherwise sealed OEM software that is directly related to instrument usage does not need approval but the Information Technology department must be notified of the installation.
- Anti-virus software shall be installed on all servers and workstations. The anti-virus software shall be configured to check for virus signature file and program updates on a daily basis and these updates will be pushed to all servers and workstations. The anti-virus software will be configured to clean any virus-infected file if possible, otherwise the file will be deleted. Floppy disks brought from any outside source that are not OEM software must be scanned for viruses before being accessed.
- **Interlab (TestAmerica Labs) LIMS Permissions Policy**

  - PURPOSE

    The purpose of this policy is to provide a mechanism for maintaining the integrity of information contained in each laboratory's LIMS database while providing the necessary access for information sharing to staff at other laboratory facilities.

  - DEFINITIONS

    Home Laboratory: The laboratory facility that owns the LIMS system.

  - POLICIES

    (a) All permissions for the laboratory's LIMS system must only be granted by a representative of that laboratory.

    - If someone outside of the home lab needs permissions for Project Management or other uses, they must go through the Lab Director or his/her designated representative.
    - Permissions must never be granted without the knowledge of the home laboratory.

    (b) Only laboratory analytical or QA staff from the home laboratory may have edit permissions for laboratory analysis data.

    (c) Any changes made in laboratory's LIMS system:

    - Must be documented and traceable.
    - If made by staff of an affiliate lab, written permission from the home lab to make the changes (email approval is sufficient) is required.

- No corrections may be made in another laboratories system without their knowledge.

(d) Data qualifiers in laboratory reports must only be corrected, edited, etc. by the staff at the home laboratory.

(e) Full analytical data "View" only permissions may be granted to outside Project Management and Sales staff. Query permissions may also be granted so status may be checked.

(f) All qualifiers must be approved by QA staff before adding to Static Tables in LIMS.

(g) Please contact Corporate QA or IT staff if you have any questions regarding implementation or interpretation of this policy.

20.12.1.2 Ensure information availability: Protection against loss of information or service through scheduled back-ups, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

- Insured by timely backup procedures on reliable backup media, stable file server network architecture, and UPS protection
- UPS Protection:
  - Each fileserver is protected by an APC power protection/backup unit. In the event of a power outage, there is approximately 15-30 minutes of up-time for the servers prior to shutdown. This allows for proper shutdown procedures to be followed with the fileservers.
- File Server Architecture
  - All files are maintained on multiple Windows servers which are secured physically in the Information Technology area. Access to these servers is limited to members of the Information Technology staff.
  - All supporting software is maintained for at least 5 years from the last raw data generated using that software.
- System Back-up Overview and Procedures
  - Data from both servers and instrument attached PC's are backed up and purged via a custom program located on a server at each location.
  - A daily archive of all data within the LIMS database to a backup location.
  - A SQL Server Database Maintenance Plan has been defined to create a daily archive of all data within the LIMS database to a backup location. This backup is initiated automatically by the database management system.
  - On a weekly basis a complete set of backup DVDs will be stored in a fire safe located in each lab. These tapes must not be purged or reused until the monthly tape has been made and forwarded to the corporate office.

- On a monthly basis: A complete set of backup DVDs will be placed in the lab fire safe for long term storage. In addition, a complete set of backup tapes will be stored offsite in a fire safe.
- Instrument data back-ups are verified on a periodic basis by the QA department when performing electronic data audits. The audit takes place on data that has been moved to a back-up location ensuring that it has been moved.

20.12.1.3 Maintain confidentiality: Ensure data confidentiality through physical access controls, and encryption of when electronically transmitting data.

- All servers are located in a secure area of the IT department offices. Access to the servers is limited to IT staff members, lab directors, the President and Vice President of Operations.
- The company website contains SSL (Secure Socket Layer) encryption for secure website sessions and data transfers.
- The reporting portion of the LIMS system requires a project manager to enter their unique password anytime they create a report that displays a signature on it (.PDF).
- Electronic documents such as PDF files and electronic data deliverables will be made available to clients via the secure web site. The logon page for this web site contains an agreement that the customer must accept before they will be logged on which states that the customer agrees not to alter any electronic data made available to them.
- If electronic documents are made available outside of the web site, the customer must sign an agreement in advance that states they will not alter the data in any way.

20.12.2 Data Reduction

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. If the formulas outlined in this section are not used, the correct formula can be found in the appropriate method SOP.

20.12.2.1 All raw data must be retained in the original folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. In addition, a response of the values entered into LIMS must be verified and retained. At the time the observations or calculations are made, the documentation must be signed or initialed and dated (month/day/year) in an easily identifiable and clear reference to the task performed.

20.12.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. The units "mg/l" and "mg/kg" are the same as "parts per million (ppm)". The units "µg/l" and "µg/kg" are the same as "parts per billion (ppb)." For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1%.

- Several environmental methods, such as color, turbidity, conductivity, use very specific, non-concentration units to report results (e.g., NTU, umhos/cm etc).

- Occasionally, the client requests that results be reported in units which take into account the measured flow of water or air during the collection of the sample. When they provide this information, the calculations can be performed and reported.

20.12.2.3 The rounding rule is: round up if the digit to be discarded is larger than 5; round down if the digit to be discarded is less than 5. If the digit is exactly 5, round down if the preceding digit is even; round up if the preceding digit is odd.

20.12.2.4 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the result should be reported to three significant figures. In general, results are reported to 3 significant figures on the final report.

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

20.12.2.6 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server.

20.12.3 Logbook / Worksheet Use Guidelines

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

20.12.3.2 Corrections are made following the procedures outlined in Section 13.4.

20.12.3.3 Logbooks are controlled by the QA department at each facility. A record is maintained of all logbooks in the lab.

20.12.3.4 Unused portions of pages must be "Z"'d, signed and dated.

20.12.3.5 Worksheets are created with the approval of the QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

20.12.4 Review / Verification Procedures

Review procedures are out lined in several SOPs [e.g. Sample Control, Data Review, Project Management; GEN001, GEN050, CS001, GEN044& GEN046] to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data GEN044. The general review concepts are discussed below, more specific information can be found in the SOPs.

20.12.4.1 The data review process at TestAmerica Honolulu starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Control Supervisor reviews the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information.

20.12.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and adds data qualifiers if applicable (see Appendix 7 for list of common data qualifiers). To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Approximately 15% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

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

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

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

20.12.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The following are some examples of chemical relationships that are reviewed (if data is available):

- Total Results are $\geq$ Dissolved results (e.g. metals)
- Total Solids (TS) $\geq$ TDS or TSS

- TKN ≥ Ammonia
- Total Phosphorus ≥ Orthophosphate
- COD ≥ TOC
- Total cyanide ≥ Amenable Cyanide
- TDS ≥ individual anions

20.12.4.6 Any identified analytical problems are brought to the attention of both the Laboratory Director and the Quality Assurance Director/Manager for corrective action. Furthermore, any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final, typed report. (*Also see section 26 on Reporting Results*). The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

20.12.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 20-3.

20.12.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, the technique can be used improperly to make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, TestAmerica Honolulu trains all analytical staff on proper manual integration techniques using SOP GEN044 as the guidelines.

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

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

20.12.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

20.12.5.4 ALL manual integrations are documented by printing before and after chromatograms/spectra with a brief explanation of why the integration was performed. All manual integrations receive a second level review. Some exceptions may be made such as the case with the surrogate in a diesel run.

Figure 20-1 Demonstration of Capability Documentation

Demonstration of Capability Certification Statement

Date Analyzed: _____ Work Order:

_____

TestAmerica Honolulu

99-193 Aiea Heights Dr. Suite 121

Aiea, HI 96701-3900

Analyst Name:

_____

Matrix: _____

_____
(examples: laboratory pure water, soil, air, solid, biological tissue)

Method Number: _____

_____

SOP # _____ Revision #_____

Parameter or Analyte:

_____
(examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under NELAP, have met the Demonstration of Capability.
2. The test method(s) was performed by the analyst(s) identified on this certification.
3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete, and self-explanatory (1).
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

_____ _____ _____
Technical Director's Name Signature Date
(Title): Laboratory Director

Figure 20-2

New Method / Additional Analyte Checklist

The following items are **required** to be completed prior to the acceptance of client samples. Fill in any blanks that do not apply with "NA". Provide associated instrument QC when samples or QC samples are analyzed (includes run log).

New Method _____ Added Analytes _____

1_____ Standard Operating Procedure
- Note: For additional analytes, a **form** can be used to add the analytes, include RL and matrix.
  - _____ Analysis SOP
  - _____ Preparation SOP
  - _____ SOP for any other relevant process
  - _____ Pages from any applicable logbooks (instrument, standards, etc)

2_____Evaluation of Selectivity. As applicable: e.g. Retention Time Window Study, second column confirmation, Interelement correction checks, spectral or fluorescence profiles, etc.

3_____ Initial Calibration Curve (Include Tune verification or similar (e.g. degradation checks) if applicable)

4_____ Method Detection Limit (MDL) Study (summary and raw data)
- _____ Water
- _____ Soil
- _____ Other

5_____ Real Sample and MS, MSD
- Tap Water for water only methods
- Local Soil sample for SW-846 methods (if applying for soil or soil/water)
- Local water sample may be used in lieu of tap water if it is a non- drinking water method
- Does not have to contain the target analytes

6_____ Reporting Limit Verification standard
- Spike a blank matrix at the RL and process through the entire method. MDL study should be able to be used if recovery is good. Note the spike level(s) and recovery(~~ies~~)

7_____ Demonstration of Capability (DOC) per analyst (Precision and Accuracy (P&A) verification)
- 4 LCS for each matrix – most acceptance criteria are in the methods. The MDL study may be used if DOC criteria is met.
- Non-Standard methods – 3 x (1 LCS at LOQ-25%, 50%, 75% of the calibration range + Blank) prepared each day. (see NELAC Chpt 5, appedx C.3.3 (b))

8_____ Acceptable PT sample(s) if available

Notes: PT sample required for all new methods
PT sample required for all new analytes under NELAP

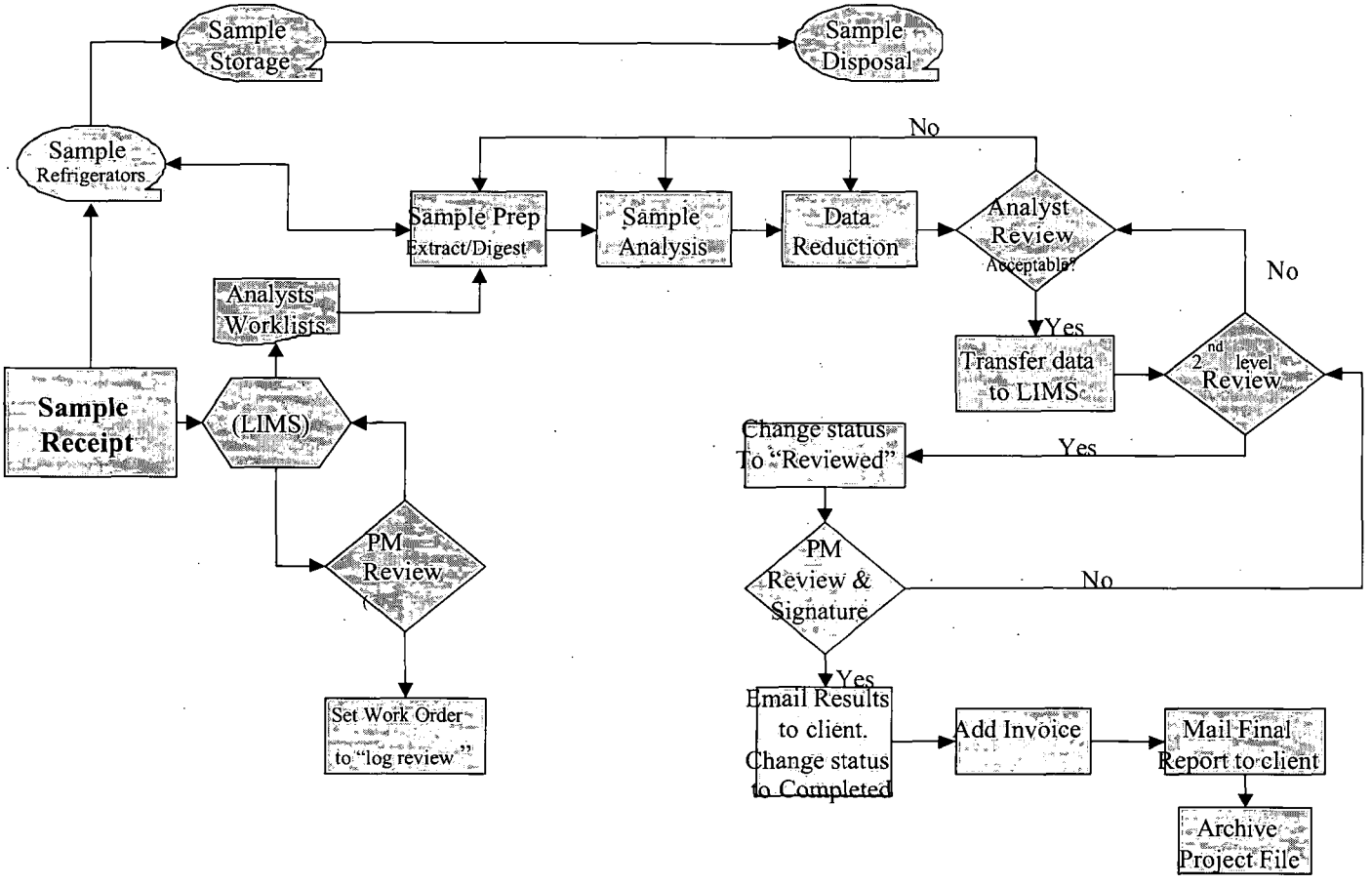
Submitted by _____ Date _____

9_____ Certification/Approval from Regulatory Agency where available.

QA Review / Acceptance _____ **Date** _____

Figure 20-3

Work Flow



Section 21
(NELAC 5.5.5)
EQUIPMENT (AND CALIBRATIONS)

Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment or software is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. See Appendix IV for list of lab SOPs. A list of the major laboratory equipment and instrumentation is presented in Table 21-1.

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

21.2 PREVENTIVE MAINTENANCE

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

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

21.2.2.1 Calibrations, routine maintenance, and adjustments are part of the analysts' and Department Managers' responsibilities. However, service contracts may be in place for some instruments to cover any major repairs.

21.2.2.2 High purity gases, reagents, and spare parts are kept on hand to minimize repair time and optimize instrument performance.

21.2.3 Table 21-2 summarize the schedule for routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals.

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

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

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

21.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed is stored by the manager of the lab and describes the maintenance performed.

21.2.4.4 In addition, the maintenance log contains:

21.2.4.4.1 The identification of the instrument/equipment (instrument's Serial Number and Model Number)
21.2.4.4.2 The date the instrument/equipment was put into use.
21.2.4.4.3 If available, the condition when the instrument was received (e.g. new, used, reconditioned).
21.2.4.4.4 Any maintenance procedures and frequency or a reference to their location.

21.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses (see Sections 12 and 13).

21.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted using the procedures outlined in Section 8.

21.2.6.1 If an instrument is sent out for service, it must be recalibrated and verified (including new MDL) prior to return to lab operations.

21.3 SUPPORT EQUIPMENT

21.3.1 This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

21.3.2 Weights and Balances

21.3.2.1 The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

21.3.2.2 Each balance is checked daily with at least two certified ASTM type 1 weights spanning its range of use. The weights are recalibrated/recertified annually to NIST standards and are used for no other purpose.

21.3.2.3 All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

21.3.2.4 All of this information is recorded in logbooks, and the recalibration/recertification certificates are kept on file. See SOP GEN022 for more details.

21.3.3 pH, Conductivity, and Turbidity Meters

21.3.3.1 The pH meters used in the laboratory are accurate to $\pm$ 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

21.3.3.2 Conductivity meters are also calibrated before each use with a standard that reflects the sample conductivity. These meters do not exceed an error of 1% or one umhos/cm.

21.3.3.3 Turbidity meters are also calibrated before each use. All of this information is documented in logbooks. Consult pH and Conductivity SOPs for further information.

21.3.4 Thermometers

21.3.4.1 All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers are calibrated quarterly

21.3.4.2 The NIST thermometer is recalibrated every three years by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer has increments of 0.2 °C, and has a range applicable to all method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

21.3.4.3 All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP GEN022

21.3.5 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

21.3.5.1 The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

21.3.5.2 Ovens, waterbaths and incubators are monitored on days of use.

21.3.5.3 All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

21.3.5.4 Sample storage refrigerator temperatures are kept between 4 $\pm$ 2°C.

21.3.5.5 Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

21.3.5.6 All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

21.3.6 Autopipettors, Dilutors, and Syringes

21.3.6.1 Mechanical volumetric dispensing devices including burettes (except Class A Glassware) are checked for accuracy at least quarterly. Glass micro-syringes are considered the same as Class A glassware.

21.3.6.2 The laboratory maintains a sufficient inventory of autopipettors, and dilutors of differing capacities that fulfill all method requirements.

21.3.6.3 These devices are given unique identification numbers, and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

21.3.6.4 For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any measurements. See SOP GEN034

21.3.6.5 Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an "Accuracy and Precision Statement of Conformance" from Hamilton attesting established accuracy.

21.4 INSTRUMENT CALIBRATIONS

21.4.1 Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

21.4.2 Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

21.4.3 Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

21.4.4 If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (see Section 13).

21.4.5 CALIBRATION STANDARDS

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. However, the general procedures are described below.

21.4.5.1 For each analyte and surrogate (if applicable) of interest, prepare calibration standards at the minimum number of concentrations as stated in the analytical methods. If a reference or mandated method does not specify the number of calibration standards, the minimum number is three, not including blanks or a zero standard. All of the standard solutions are prepared using Class A volumetric glassware and/or microsyringes and appropriate laboratory quality solvents and stock standards.

21.4.5.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to NIST whenever possible. Dilution standards are prepared from stock standards purchased from commercial suppliers. A standard log is maintained for each department, containing concentration, date of receipt, date of standard preparation, any dilutions made, lot number, supplier, type of solvent and a unique code number to identify the standard. Standards are also recorded in LIMS.

21.4.5.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

21.4.5.4 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The lowest calibration standard must be at or above the detection limit. The exception to these rules is ICP methods or other methods where the referenced method does not specify two or more standards.

21.4.5.5 Given the number of target compounds addressed by some of the organic methods, it may be necessary to prepare several sets of calibration standards, each set consisting of the appropriate number of solutions at different concentrations. The initial calibration will then involve the analysis of each of these sets of the appropriate number of standards.

21.4.5.6 All initial calibrations are verified with a standard obtained from a second source (or different lot if a second source is not available) and traceable to a national standard, when

available. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

21.4.6 CALIBRATION FOR ORGANIC METHODS (GC, GCMS)

21.4.6.1 Many of the organic analytical methods utilize an internal standard calibration (GCMS and some GC). Because of the complex nature of the multipeak chromatograms produced by the method, some instruments necessitate the use of external standard calibration (most GC). Surrogate compounds are included in the calibration processes for all appropriate organic analyses.

21.4.6.2 Once the operating parameters have been established according to the method, each instrument is calibrated for the appropriate method. The Analyst prepares five or more standard solutions at various concentrations containing all of the analytes of interest, internal standards, and surrogates that are appropriate for the method.

21.4.6.3 The standard solutions are introduced into the instrument in the same manner as samples are; whether it be by direct injection, by headspace analysis, or by purge and trap. The calibration factor (CF) for methods that use external standards, and the response factor (RF) for methods that use internal standards are calculated for the five standards.

21.4.6.3.1 External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards. The ratio of the response to the amount of analyte in the calibration standard is defined as the Calibration factor

21.4.6.3.2 Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to the responses of specific standards added to the sample or sample extract prior to injection. The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard. The ratio is termed the response factor (RF), and may also be known as a relative response factor in other methods.

- In many cases, internal standards are recommended. These recommended internal standards are often brominated, fluorinated, or stable isotopically labeled analogs of specific target compounds, or are closely related compounds whose presence in environmental samples is highly unlikely. The use of specific internal standards is available in the method SOP.
- Whichever internal standards are employed, the analyst needs to demonstrate that the measurement of the internal standard is not affected by method analytes and surrogates or by matrix interferences. In general, internal standard calibration is not as useful for GC methods with non-MS detectors because of the inability to chromatographically resolve many internal standards from the target compounds. The use of MS detectors makes internal standard calibration practical because the masses of the internal standards can be resolved from those of the target compounds even when chromatographic resolution cannot be achieved.

- When preparing calibration standards for use with internal standard calibration, add the same amount of the internal standard solution to each calibration standard, such that the concentration of each internal standard is constant across all of the calibration standards, whereas the concentrations of the target analytes will vary. The internal standard solution will contain one or more internal standards and the concentration of the individual internal standards may differ within the spiking solution (e.g., not all internal standards need to be at the same concentration in this solution). The mass of each internal standard added to each sample extract immediately prior to injection into the instrument or to each sample prior to purging must be the same as the mass of the internal standard in each calibration standard. The volume of the solution spiked into sample extracts should be such that minimal dilution of the extract occurs (e.g., 10 uL of solution added to a 1 mL final extract results in only a negligible 1% change in the final extract volume which can be ignored in the calculations).
- An ideal internal standard concentration would yield a response factor of 1 for each analyte. However, this is not practical when dealing with more than a few target analytes. Therefore, as a general rule, the amount of internal standard should produce an instrument response (e.g., area counts) that is no more than 100 times that produced by the lowest concentration of the least responsive target analyte associated with the internal standard. This should result in a minimum response factor of approximately 0.01 for the least responsive target compound.

Calibration Factors and Response Factors for each analyte are calculated as follows:

$$\textbf{Calibration Factor (CF)} = \frac{A(s)}{C(s)}$$

$$\textbf{Response Factor (RF)} = \frac{A(s) \times C(is)}{A(is) \times C(s)}$$

Where:
A(s) = Peak area (or height) of the analyte or surrogate.
A(is) = Peak area (or height) of the internal standard.
C(s) = Concentration of the analyte or surrogate, in ug/L.
C(is) = Concentration of the internal standard, in ug/L.

Note: In the equation above, RF is unitless, i.e., the units from the two area terms and the two concentration terms cancel out. Therefore, units other than ug/L may be used for the concentrations of the analyte, surrogate, and internal standard, provided that both C(s) and C(is) are expressed in the same units. The mass of the analyte and internal standard may also be used in calculating the RF value.

21.4.6.4 The CF or RF for each analyte at each concentration is tabulated to determine the graphical linearity of concentration versus response factor or calibration factor. The five CFs or RFs for each analyte in the initial calibration must have an acceptable Percent Relative Standard Deviation (% RSD) that is determined by each analytical method. If the RSD of the calibration or

response factors is less than or equal to the acceptance limit stated in the published method over the calibration range, then linearity through the origin may be assumed, and the average calibration response factor may be used to determine sample concentrations. The CFs or RFs for each compound are calculated and kept in the calibration files.

The % Relative Standard Deviation is calculated as follows:

$$\%RSD = (SD / \overline{x_i}) \times 100$$

Where SD = Standard Deviation of initial 5 CFs or RFs for each compound calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{n} \frac{\left(x_i - \overline{x_i}\right)^2}{n-1}}$$

Where:

$\overline{x_i}$ = Mean (Average) of initial 5 CFs or RFs for each compound.

n = number of standards

x_i = individual CF or RF

21.4.6.5 Policies regarding the use of calibration standard results for creating the calibration curve are as follows:

21.4.6.5.1 A low calibration standard may be excluded from the calibration if the signal-to-noise ratio or spectral criteria are not suitable. The reporting level must be elevated to be the lowest calibration standard used for calibration.

21.4.6.5.2 The upper calibration standard may be excluded if it saturates the detector or is obviously becoming non-linear. Any sample exceeding the upper standard used in the calibration must be diluted and re-analyzed.

21.4.6.5.3 Mid-calibration standards may not be excluded unless an obvious reason is found, i.e., cracked vial, incorrectly made, etc. The failed standard should be re-run immediately and inserted into the initial calibration. If not useful, recalibration is required.

21.4.6.6 Percent RSD Corrective Action

Given the potentially large numbers of analytes that may be analyzed in some methods, it is likely that some analytes may exceed the acceptance limit for the RSD for a given calibration. In those instances, the following steps are recommended, but not required.

21.4.6.6.1 The first step is generally to check the instrument operating conditions. This option will apply in those instances where a linear instrument response is expected. It may involve some trade-offs to optimize performance across all target analytes. For

instance, changes to the operating conditions necessary to achieve linearity for problem compounds may cause the RSD for other compounds to increase, but as long as all analytes meet the RSD limits for linearity, the calibration is acceptable.

21.4.6.6.2 If the RSD for any analyte is greater than the applicable acceptance criteria in the applicable analytical method, the analyst may wish to review the results (area counts, calibration or response factors, and RSD) for those analytes to ensure that the problem is not associated with just one of the initial calibration standards. If the problem appears to be associated with a single standard, that one standard may be reanalyzed and the RSD recalculated. Replacing the standard may be necessary in some cases.

21.4.6.6.3 A third alternative is to narrow the calibration range by replacing one or more of the calibration standards with standards that cover a narrower range. If linearity can be achieved using a narrower calibration range, document the calibration linearity, and proceed with analyses. The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end of the range.

NOTE: When the purpose of the analysis is to demonstrate compliance with a specific regulatory limit or action level, the laboratory must ensure that the method quantitation limit is at least as low as the regulatory limit or action level.

21.4.6.7 Alternatively, the least squares regression may be used to determine linearity. A five point line must result in a correlation coefficient (r) of 0.99 or better using the least squares method to be considered acceptable. In many cases it may be preferred that the curves be forced through zero (not to be confused with including the origin as an additional data point, which is not allowed). **Note:** EPA method 8000B does not allow forcing through zero however the agency has revaluated this position and has since changed this stance to allow forcing through zero. In addition, from EPA Method 8000C: "However, the use of a linear regression or forcing the regression through zero may NOT be used as a rationale for reporting results below the calibration range demonstrated by the analysis of the standards.").

21.4.6.8 Instead of a linear curve model (either Average RF or least squares regression), a second order curve (Quadratic) may be used (and preferred) as long as it contains at least six data points. As a rule of thumb, if there is a consistent trend in RFs (or CFs) in the calibration curve, either up or down, then quadratic curve fit may be indicated as the preferred calibration routine for that analyte. The coefficient of determination (COD or r^2) for the quadratic curve must be at least 0.99 for it to be considered acceptable. Some limitations on the use of Quadratic Curve fits:

21.4.6.8.1 Care MUST be exercised to assure that the results from this equation are real, positive, and fit the range of the initial calibration.

21.4.6.8.2 They **may not** be used to mask instrument problems that can be corrected by maintenance. (Not to be used where the analyte is normally found to be linear in a properly maintained instrument).

21.4.6.8.3 They **may not** be used to compensate for detector saturation. If it is suspected that the detector is being saturated at the high end of the curve, remove the higher concentration standards from the curve and try a 1^{st} order fit or average RF.

Coefficient of Determination

$$r^2 = \frac{\left(\sum xy\right)^2}{\sum x^2 \sum y^2}$$

Correlation Coefficient

$$r = \frac{\left(\sum xy\right)}{\sqrt{\sum x^2 \sum y^2}}$$

Where:

y = Response or Response ratio (see below)

x = Concentration

Linear Regression / Least Squares Curve fit:

The calibration curve if defined by the equation:

$$y = mx+b$$

The sample concentration is determined by using the formula

$$x = (y-b) / m$$

Where:

y = Response or Response ratio (see below)

x = Concentration

m = slope

b = y intercept

Quadratic Curve Fits

The calibration curve is defined by the equation

$$y = ax^2 + bx + c$$

The sample concentration is determined using the formula :

$$x = \frac{-b \pm \sqrt{b^2 - 4a(c-y)}}{2a}$$

Where:

y = Response or Response Ratio (see below)

x = Concentration

a = variable to define the curvature

b = variable similar to the slope

c = y intercept.

Response Ratio (y) = $\frac{R_S * C_{IS}}{R_{IS}}$

Where:

R_S = Reponse of Sample or Standard

C_{IS} = Concentration of Internal Standard

R_{IS} = Response of Internal Standard

21.4.7 Calibration for Inorganic Analyses

21.4.7.1 EPA Method 7000 from EPA SW-846 is a general introduction to the quality control requirements for metals analysis. For inorganic methods, quality control measures set out in the individual methods and in the *Standard Methods for the Examination of Water and Wastewater* (20th Edition) may also be included. Standard Operating Procedures for the analysis and the quality control documentation measures are kept in the analysts' reference binders or in SOP PDFs and Laboratory Department assigned SOPs

21.4.7.2 In general, inorganic instrumentation is calibrated with external standards. Some exceptions would be Inductively Coupled Plasma (ICP), Inductively Coupled Plasma Mass Spec (ICPMS). These analyses may use an internal standard to compensate for viscosity or other matrix effects. While the calibration procedures are much the same for inorganics as they are for organics, CF's or RF's are not used. The calibration model in 21.4.7.7 is generally used for most methods, however in some instances the model from section 21.4.7.8 may be used. A correlation coefficient (r) of 0.995 or greater must be used to accept a calibration curve generated for an inorganic procedure. Correlation coefficients are determined by hand-held scientific calculators or by computer programs and written on the calibration curves. Curves are not allowed to be stored in calculator memories and must be written on the raw data for the purposes of data validation.

21.4.7.3 "Calibrations" for titrimetric analyses are performed by standardizing the titrants against a primary standard solution. See specific methods in *Standard Methods for the Examination of Water and Wastewater* (20th Edition) for more information.

21.4.7.4 Spreadsheets that are used for general chemistry calculations must have all cells containing calculations locked to prevent accidental changes to the calculations.

21.4.7.5 Instrument technologies (e.g. ICP) with validated techniques from the instrument manufacturer or other methods using a zero point and single point calibration require the following:

21.4.7.5.1 The instrument is calibrated using a zero point and a single point calibration standard.

21.4.7.5.2 The linear range is established by analyzing a series of standards, one at the reporting limit (RL).

21.4.7.5.3 Sample results within the established linear range do not need to be qualified.

21.4.7.5.4 The zero point and single standard is run daily with each analytical batch.

21.4.7.5.5 A standard at the RL is analyzed daily with each analytical batch and must meet established acceptance criteria.

21.4.7.5.6 The linearity is verified at a frequency established by the manufacturer or method.

21.4.8 Calibration Verification

21.4.8.1 The calibration relationship established during the initial calibration must be verified at periodic intervals as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

NOTE: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration, and is not appropriate nor permitted in SW-846 chromatographic procedures for trace environmental analyses.

21.4.8.2 Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift.

21.4.8.3 A continuing instrument calibration verification (CCV) must be repeated at the beginning and end of each analytical batch for non-GC/MS methods. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples.

21.4.8.4 The acceptance limits for calibration verifications can be found in each method SOP. As a rule of thumb: GCMS $\pm$ 20%, GC $\pm$ 15%, Inorganics: $\pm$ 10 or 15%. Actual methods may have wider or tighter limits; see the method SOP for specifics.

21.4.8.5 If the response (or calculated concentration) for an analyte is within the acceptance limits of the response obtained during the initial calibration, then the initial calibration is

considered still valid, and the analyst may continue to use the CF, RF or % drift values from the initial calibration to quantitate sample results.

21.4.8.6 If the response (or calculated concentration) for any analyte varies from the mean response obtained during the initial calibration by more than the acceptance criteria, then the initial calibration relationship may no longer be valid. If routine corrective action procedures fail to produce a second consecutive (immediate) calibration verification within acceptance criteria, then either the laboratory has to demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new initial instrument calibration must be performed. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

21.4.8.6.1 When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

21.4.8.6.2 When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

21.4.8.7 *Verification of Linear Calibrations*

Calibration verification for linear calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. Use the equations below to calculate % Drift or % Difference, depending on the procedure specified in the method SOP. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

The Percent Difference is calculated as follows:

$$\% \text{ Difference} = \frac{(\text{CF(v) or RF(v)}) - (\text{Avg. CF or RF})}{(\text{Avg. CF or RF})} \times 100$$

Where:

CF(v) or RF(v) = CF or RF from verification standard

Avg. CF or RF = Average CF or RF from Initial Calibration.

The Percent Drift is calculated as follows:

$$\% \text{ Drift} = \frac{\text{Result - True Value}}{\text{True Value}} \times 100$$

The Percent Recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Result}}{\text{True Value}} \times 100$$

21.4.8.8 Verification of a Non-Linear Calibration

Calibration verification of a non-linear calibration is performed using the percent drift or percent recovery calculations described in 21.4.9.51 above.

21.4.8.9 Regardless of whether a linear or non-linear calibration model is used, if verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

21.4.8.10 All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met.

21.4.8.11 All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

21.4.8.11.1 If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

21.5 POLICY ON TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GCMS ANALYSIS

21.5.1.1 For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

21.5.1.2 For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. Use the following guidelines for making tentative identifications:

21.5.1.2.1 Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

21.5.1.2.2 The relative intensities of the major ions should agree within ± 20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%).

21.5.1.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

21.5.1.2.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

21.5.1.2.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

21.5.1.3 The concentration of any non-target analytes identified in the sample (Sec. 21.5.1.2) should be estimated. The same formulae as calibrated analytes should be used with the following modifications: The areas A_x and A_{is} should be from the total ion chromatograms, and the RF for the compound should be assumed to be 1.

21.5.1.4 The resulting concentration should be reported indicating: (1) that the value is an estimate, and (2) which internal standard was used to determine concentration. Use the nearest internal standard free of interferences.

Note: The above guidelines above are from EPA SW846 III edition, method 8260B.

21.5.1.5 For general reporting if TICs are requested, the ten (10), largest non-target analyte peaks whose area count exceeds 10% of the nearest internal standard will be termed "Tentatively Identified Compounds" (TICs). More or fewer TICs may be identified based on client requirements.

21.5.1.6 TIC Reporting Limits

21.5.1.6.1 In general Reporting limits cannot be specified because of the unknown nature of the TIC. Any reporting limit that is reported can only be evaluated as an estimate as the quantitation is based on the assumption that the TIC responds exactly as the IS responds which is most likely not the case. In general, it is not recommended to set a Reporting limit at too low of a concentration as it gives a false impression.

21.5.1.6.2 TICs that meet the above identification criteria (21.5.1.1-5) at 10% area of the IS: The RL would be 10% of the concentration of the internal standard used for quantitation. (e.g. 2.5 ug/L for 8260B, 4.0 ug/L for 8270C). In general, if the 10% area criteria is not met, the TIC RLs should be set at a level approximately 5x the level of the poorest performer in the analysis.

21.5.1.6.3 If a compound meets the TIC criteria, the reporting limit will reflect the ratio between the TIC and the IS or 5x the level of the poorest performer whichever is lower.

21.6 POLICY ON GC/MS TUNING

21.6.1 Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

21.6.2 Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

21.6.3 The concentration of the BFB or DFTPP must be at or below the concentrations that are referenced in the analytical methods. Part of the purpose of the tune is to demonstrate sensitivity and analyzing solutions at higher concentrations does not support this purpose. Tune failures may be due to saturation and a lower BFB/DFTPP concentration may be warranted.

21.6.4 Tune evaluations usually utilize the "Autofind" function and are set up to look at the apex +/- 1 scan and average the three scans. Background correction is required prior to the start of the peak but no more than 20 scans before. Background correction cannot include any part of the target peak.

21.6.5 Other Options or if Auto Tune Fails

21.6.5.1 Sometimes the instrument does not always correctly identify the apex on some peaks when the peak is not perfectly shaped. In this case, manually identify and average the apex peak +/- 1 scan and background correct as in 21.6.4 above. This is consistent with EPA 8260 and 8270.

21.6.5.2 Or the scan across the peak at one half peak height may be averaged and background corrected. This is consistent with Standard Methods 6200, EPA 624 and EPA 625.

21.6.5.3 Adjustments such as adjustments to the repeller and ion focus lenses, adjusting the EM Voltage, etc. may be made prior to tune verification as long as all of the subsequent injections in the 12 hour tune cycle are analyzed under the same MS tune settings and it is documented in the run sequence log and/or maintenance log that an adjustment was made. Excessive adjusting (more than 2 tries) without clear documentation is not allowed. Necessary maintenance is performed and documented in instrument log.

21.6.5.4 A single scan at the Apex (only) may also be used for the evaluation of the tune. For SW 846 and EPA 600 series methods, background correction is still required.

21.6.5.5 Cleaning the source or other maintenance may be performed and then follow steps for tune evaluation above. The maintenance must be documented in the maintenance log and should be noted in the sequence run log. Note: If significant maintenance was performed, see methods 8000B or 8000C then the instrument may require automatic recalibration prior to proceeding.

21.6.6 Tune evaluation printouts must include the chromatogram and spectra as well as the Tune evaluation information. In addition, the verifications must be sent directly to the printer (no screen Prints). This ability should be built into the instrument software.

21.6.7 Since the limits are expressed in whole percentages, the results may be rounded to whole percentage before comparing to criteria when assessing the tune verification against the tune requirements. However, the comparison to the criteria is usually done automatically by the software and if the printout says "Fail" then there would have to be documentation of the hand calculation on the raw data and comparison to the criteria if the lab intends to still accept the tune. In most cases the analyst is better off performing an adjustment and rerunning the tune standard.

21.6.8 All MS tune settings must remain constant between running the tune check and all other samples. It is recommended that a separate tune method not be used, however a separate method may be used as long as the MS conditions between the methods are the same

as the sample analysis method and tracked so any changes that are made to the analysis method are also made to the tune method.

Table 21-1

Equipment List

Table 21-1
Laboratory Equipment and Instrumentation

Department: Digestion/Wet Chemistry

Equipment Name	Model Name/#	Serial #	Year/Condition
Automated Ion Analyzer	Lachat QuickChem	AE2000-0659	2006/Used
Automated Block Digestor	Lachat BD46	1800-190	1993/New
Analytical Balance	Mettler AE163	FNR 38500	1995/Used
Top-loading Balance	Mettler P3	43328	1995/Used
Top-loading Balance	Mettler P3N	50001	1995/Used
Top-loading Balance	Mettler PC220	B93966	1987/New
BOD Incubator	LabLine 3554B	282T	1995/Used
Drying Oven	Baxter, DX-61	A12090	1995/New
Flash Point Tester	Boeckel 152800 (PM)	1165	1995/Used
Fume Hood	Labconco, 6+12ft.	NA	1992/New
Fume Hood	Labconco, 6 ft.	NA	1995/Used
Hotplate	Thermolyne	411920685505	1992/New
Hotplate	Thermolyne	411950145906	1995/New
Hotplate	Thermolyne	611950473205	1995/New
Microwave Digester	CEM Mars 5		
pH/ISE Meter	Orion	0010102	1992/New
pH/ISE Meter	Orion	005770	1995/New
pH/ISE Meter	Fisher Accumet 50	10016174	1995/New
TCLP Extractor	Millipore	NA	1987/New
TCLP Extractor	Environmental Express	NA	1994/New
TCLP Extractor	Associated Design	NA	1995/Used
TCLP Extractor	AT&C	NA	1995/Used
Temperature-Controlled Shaker/Water Bath	Exacal Ex89AM1	92220-15	1987/New
Temperature-Controlled Shaker/Water Bath	Blue M	M5-18534	1987/New
Water Purifier	Millipore	FINM 72753 0	1991/New
Water Purifier	Barnstead/Easypure UV	740950365881	1995/New

Department: Spectroscopy Laboratory

Equipment Name	Model Name/#	Serial#	Year/Condition
ICP/AES	IRIS	418590	2004/New
Mercury Analyzer	CETAC	2492	2002/New
Turbidimeter	HACH	93060000	1993/New
Turbidimeter	HF Scientific DRT-15CE	NA	1995/New
UV-VIS Spectrophotometer	Milton-Roy 401	3815014003	1993/New

Department: GC - Gas/BTEX

Instrument Identifier: GC4 Year purchased 1993

Equipment Name	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II	NA/ 3203A41936/New
PID	OI Photoionization Detector	OI4430REVD/ 91-1308/New
FID	OI Flame Ionization Detector	NA/ New
Autosampler (16 port)	OI DPM16	NA/C421411319/New
Purge and Trap	Tekmar LSC2000	LSC2000/ 91190012/ New
Autosampler (5035 compliant)	Tekmar multimatrix vial autosampler	Solatek72/ 2266006/New
Software	HP Enviroquant for GC	G1045A Version C.01.00
	HP Chemstation for GC	G1034C Version C.03.00

Instrument Identifier: GC7 Year purchased 1993

Equipment Name	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II	2950A26679/New
PID	OI Photoionization Detector	NA
FID	OI Flame Ionization Detector	NA
Autosampler (16 port)	Tekmar	ALS 2016NA/ 91190012/Used
Sample Heaters (16 jackets)	OI MHC	NA / D420464197/New
Purge and Trap	Tekmar	LSC 2000/ 91190012/Used
Software	HP Enviroquant for GC	G1045A Version C.01.00
	HP Chemstation for GC	G1034C Version C.03.00

Department: GC/MS - Volatiles

Instrument Identifier: MSD1 Year purchased 1993

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II w/EPC	II /3336A57688/New
Mass Spectrometer	HP5971 MSD	5971/3435A02001/New

Equipment Name:	Description	Model #/Serial #/Condition
on Gauge Controller	Ion Gauge Controller	59822B/NA/New
Autosampler	Tekmar	Solatek72/ USO1198018/ New
Purge and Trap	Tekmar	LCS3000/95142005/New
Printer	HP	LaserJet 4/J2PFK018913
/New		
Software	HP Enviroquant for GCMS	G1032C Version C.01.00
	HP Chemstation for GCMS	G1034C Version C.03.00

Instrument Identifier: MSD4 Year purchased 2006

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II w/EPC	II /3235A45418/used
Mass Spectrometer	HP5972 MSD	5971/3234A04217/used
Autosampler	Archon	5100/ A226161/ used
Purge and Trap	Tekmar	LCS3000/95142005/New
Software	HP Enviroquant for GCMS	G1701AA.03.00
	HP Chemstation for GCMS	B.02.05

Department: GC/MS - Semivolatiles

Instrument Identifier: MSD3 Year purchased 1993

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II w/EPC	II/3203A41749/New
Mass Spectrometer	HP5972 MSD	5972/ 3188A03611/New
Autosampler	HP7673 Autosampler Arm	18596B/3217A28387/New
	HP7673 Autosampler Tower	18593B/33240A32580/New
	HP7673 Autosampler Controller	18594B/3528A02315/New
Software	HP Enviroquant for GC/MS	G1032C Version C.01.00
	HP Chemstation for GC/MS	G1034C Version C.03.00

Instrument Identifier: MSD2 Year purchased 2002

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	Shimadzu	GC17A/ 6263056140SA/ NEw
Mass Spectrometer	GCMSQP5000v2	QP5000/C70173800083SA/New
Autosampler	AOC-20i	C11144006405KG/new
	AOC-20s	C11153902688KG/new

Department: GC - Semivolatiles

Instrument Identifier: GC1 - Pesticides/PCBs Year purchased 1993

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II	NA/3336A54304/New
ECD	HP Electron Capture Detector	G1223A/K0984/New
ECD	HP Electron Capture Detector	G1223A/F7926/New
Autosampler	HP7673 Autosampler Arm	18596B/3422A35575/New
	HP7673 Autosampler Tower	18393B / 3240A32580/New
	HP7673 Autosampler Tower	18593A/2704A07946/New
	HP7673 Autosampler Controller	18594B / 3421A33688/New
Software	HP Enviroquant for GC	G1045A Version C.01.00
	HP Chemstation for GC	G1034C Version C.03.00
	Target	Version 3.0

Instrument Identifier: GC2 – Diesel Year purchased 1993

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II	NA / 3033A31075/New
FID/FID	HP Flame Ionization Detector	NA/New
Autosampler	HP7673 Autosampler Arm	18596B /3239A30015/New
	HP7673 Autosampler Tower	18593B /3421A38982/New
HP7673	Autosampler Tower	18593B /3218A30569/New
	HP7673 Autosampler Controller	18594B /3420A30161/New
Software	HP Enviroquant for GC	G1045A Version C.01.00
	HP Chemstation for GC	G1034C Version C.03.00
	Target	Version 3.0

Instrument Identifier: GC3 - Pesticides/PCBs, Year purchased 1993

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II	NA / 3310A49409/New
ECD/NPD	HP Electron Capture Detector	K1094 / New
Autosampler	HP7673 Autosampler Arm	18596B / 3422A35574/New
	HP7673 Autosampler Tower	18593B / 3250A33384/New
	HP7673 Autosampler Controller	18594B / 3420A30161/New
Software	HP Enviroquant for GC	G1045A Version C.01.00
	HP Chemstation for GC	G1034C Version C.03.00
	Target	Version 3.0

Instrument Identifier: GC6 - Herbicides, Pesticides/PCBs Year purchased 1993

Equipment Name:	Description	Model #/Serial #/Condition
Gas Chromatograph	HP 5890 Series II	II / 2921A24192 /Used

Equipment Name:	Description	Model #/Serial #/Condition
ECD/ECD	HP Electron Capture Detector	F6734 / KL6550 /New
Autosampler	HP7673 Autosampler Arm	18596B / 3250A30805 /New
	HP7673 Autosampler Tower	18593B / 3421A38994 /New
	HP7673 Autosampler Controller	18594B / 3218A28458/New
Software	HP Enviroquant for GC	G1045A Version C.01.00
	HP Chemstation for GC	G1034C Version C.03.00
	Target	Version 3.0

Department: Organic Preparation Laboratory

Equipment Name	Description	Model #/Serial #/Condition
Analytical Balance	Ohaus	TS4000 / 4398 /New
Analytical Balance	Sartorius Analytical balance	Silver Edition/3410299/New
Centrifuge	Fisher Marathon Centrifuge	Marathon 6K/ 12910542/New
Centrifuge	Centrifuge	90800166New
Dual horn sonicator	Fisher sonic dismembrator	Model 550/F1455/New
Extraction Heaters	LabLine Multiunit Extraction Heater	NA / 06950144/New
		NA / 0982129/New
Hot plate/Stirrer	Thermolyne Hot plate/Stirrer	MIRAK / 732950920327/New
Fume Hood	Hemco, 8ft.	NA/Used
Fume Hood	Labconco, 6 +12ft.	NA/New
IR Spectrophotometer	Brucker Scientific	HC 404/20RW/Used
Nitrogen Evaporator	Organomation Nitrogen Evaporator	N-EVAP/15023/New

Equipment Name	Description	Model #/Serial #/Condition
Sonicator	Heat Systems	W-380/Used
Sonic Bath	Fisher Solid State Sonicator	FS-14 / 182402 / New
Top-loading Balance	Denver Instruments scale	XS-2100 / 0073848/New
Turbovap	Zymark Turbovap	TURBOVAP II/New
		TV9424104100/New
RapidVap	Labconco	990691639A/ 2006/ used
Water Bath	Precision Scientific Water bath	NA / 9503403/New

21-2

Schedule of Routine Maintenance

Table 21-2 (Version 1)

Inductively Coupled Plasma

DAILY OR AS NEEDED

- Wavelength and refractor calibration
- Replace pump tubing when worn
- Check the autosampler arm for alignment

QUARTERLY TO YEARLY

- Clean optical windows for maximum wavelength intensity
- Replace water recirculator cartridge and oil motor
- Check instrument for signs of wear or corrosion from fumes
- Evaluate present and past detection limit studies for instrument performance

SPARE PARTS

- Sample pump tubing
- Quartz back-torch
- Glass concentric nebulizer
-

Semivolatile Gas Chromatograph

DAILY

- Test for leaks (is the head pressure stable?)
- Refill solvent rinse vials and empty solvent waste vials
- All gas cylinders are checked and changed if the pressure is less than 500 psi
- Check disk space delete old files if necessary
- Ensure proper peak shape,(gaussian, minimal tailing,no splitting,proper baseline)

WEEKLY

- Injector inlets are removed, cleaned and replaced if necessary. (as needed for DRO GCs).
- Guard columns are removed, cut, (1 cm) and re-inserted
- Inlet seals, ferrules and o-rings are checked and if necessary replaced
- Replace injector septa for each inlet

MONTHLY OR AS NEEDED

- FID jet is removed and cleaned
- ECD, Are many negative peaks present?, if so and the signal for the detectors is > 50 consider sending the detector in for cleaning or refoiling.

6 MONTHS

- Wipe test ECD detectors
- Change gas tank filters traps

- Pressure test injection port EPC unit

SPARE PARTS

- Graphite ferrules
- Injector Septa
- Glass Inlets
- O-rings
- Gold Seals
- Wipe Test Kits
- Column Cutter
- Flow measurement devices
- GC Tools and wrenches
- Snoop Leak detection liquid
- Gas Purifier

Volatile Gas Chromatograph

DAILY

- Check disk space delete old files if necessary
- All gas cylinders are checked and changed if the pressure is less than 500 psi
- Ensure proper peak shape,(gaussian, minimal tailing,no splitting,proper baseline)
- Verify DI water reservoir for autosamplers is full, fill if necessary
- Empty autosampler waste water container
- Test for leaks , GC (is the head pressure stable?)

TWICE A WEEK

- Replace standards in autosampler standard reservoirs

MONTHLY

- Wipe Archon drive rods clean with Isopropanol.
- Calibrate robotics, Archon and Solatek 72
- Verify correct purge flow on concentrator vent, both water and soil mode
- Recondition trap
- Inspect autosampler probes for hardness build-up, clean if necessary

ANNUALLY (MINIMUM), BEFORE A CALIBRATION OR AS NEEDED

- Apply oil to robotics drive assembly rod on Solatek 72
- Clean FID jet
- PID bulb windows are cleaned
- Perform injection port mainetnence,replace o-ring, liner, gold seal washer, clip column
- Leak test concentrator
- Verify correct purge flow all ports
- Back flush sample path up to injection port with Methanol, water and then air
- Replace in-line filters and traps
- Verify correct column flow or linear velocity
- Pressure test injection port EPC unit

SPARE PARTS

- Graphite ferrules
- PID Lamps
- Injector Septa
- Glass Inlets
- O-rings
- Gold Seals
- Column Cutter
- Flow measurement devices
- GC Tools and wrenches
- Snoop Leak detection liquid
- Universal and Hydrocarbon traps
- Methanol
- Machine Oil
- Electronic leak detector

Property of TestAmerica Honolulu

Gas Chromatograph/Mass Spectrometer

In addition to the Gas Chromatography maintenance identified in the previous section, the following maintenance must be scheduled for the Mass Spectrometry systems:

DAILY

- Record the source pressure
- Print out PFTBA spectra, confirm peak widths and ion ratios are normal
- Verify no leaks are present using the air/h2o,PFTBA ratio

6 MONTHS (MINIMUM)

- Change rough vacuum pump oil and molecular sieve
- Clean ion source
- Check diff pump fluid level, change if necessary

SPARE PARTS

- Pump Oil and Filters
- Column Cutter
- GC Tools and wrenches
- Snoop Leak detection liquid
- Electronic leak detector

Table 21-2 (Version 2)
Table 21-2

Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	***Activity***	***Frequency***
Gas chromatograph	*Change septum*	*As needed - record*
	Check gases	*Daily – record*
	Replace or clip column	*As needed – record. Rerun calibration/RT study*
	Clean detector	*As needed – record*
	Check autosampler seals	*Daily*
	Clean injectors; replace liners	*As needed – record*
	Clean or replace PID lamp	*As needed -- record*
	Vendor repair	*As needed –record work order*
GC/MS	*Change Merlin (SVOC only)*	*As needed – record*
	Bake trap (VOC only)	*Daily*
	Clean source	*As needed – record*
	Change vacuum pump oil	*Biannually – record*
	Clean injector; replace liner (SVOC only)	*Daily*
	Replace column	*As needed – record. Rerun calibration/RT study*
	Vendor repair	*As needed –record work order*
ICP	*Torch inspection*	*Each use*
	Clean torch and nebulizer	*As needed – record*
	Inspect filters	*Daily*
	Change filters	*As needed – record*
	Inspect pump tubing	*Daily*
	Change pump tubing	*As needed – record*
	Vendor repair	*As needed –record work order*
UV/VIS	*Check paper*	*Daily*
	Clean sample compartment	*As needed*
	Auto-check calibration	*Daily at start-up*
	Wavelength calibration	*Six months-record*
	Vendor repair	*As needed –record work order*
Mercury Analyzer	*Inspect tubes and reagents*	*Daily*
	Vendor repair	*As needed –record work order*
Turbidimeter	*Check lamp*	*Each use*
	Clean sample holder	*Each use*
	Vendor repair	*As needed –record work order*
pH Meter	*Clean electrode*	*Each use*
	Inspect electrode	*Each use*
	Vendor repair	*As needed –record work order*

Table 21-2 (Version 2)
Table 21-2

Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	***Activity***	***Frequency***
Temperature Devices: refrigerators, incubators, evaporators, flash point tester, COD reactor, water circulator, drying ovens	*Monitor temperature*	*Daily or when used (refrigerators 2 times per day) -- record*
	Vendor repair	*As needed –record work order*
Weighing Balances	*Clean pan*	*Each use*
	Check calibration	*Daily – record*
	Vendor repair	*As needed –record work order*
Ultrasonic Disruptors	*Clean, Tune by depressing tuning button while adjusting % output knob until lowest reading is obtained. For dual head, disconnect one horn at a time.*	*Each use – record*
	Vendor repair	*As needed –record work order*
Zero Headspace Extractors	*Verify rotation speed*	*Each use – record*
	Check for leakage	*Each use*
	Vendor repair	*As needed –record work order*
TCLP Extractors	*Verify rotation speed*	*Each use– record*
	Check for leakage	*Each use*
	Vendor repair	*As needed –record work order*
Microwave	*Check power output*	*Weekly*
	Check cleanliness and rotation	*Each use*
	Vendor repair	*As needed –record work order*
Discrete Analyzer	*Check water and waste container*	*Daily*
	Check cuvette bin	*Weekly*
	Wash procedure	*Daily*
	Perform "start-up"	*Daily*
	Run water blank	*Daily*
	Replace syringe	*6 months*
	Replace lamp	*6 months*

Table 21-3

Periodic Calibration

Table 21-3: Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually. A second annual inspection and calibration by same firm.	Daily	± 0.2%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually. A second annual inspection and calibration by same firm.	Daily	± 0.5%	Clean. Replace.
A2LA-accredited NIST Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
NIST-Traceable Thermometer	Accuracy determined by A2LA-accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 1.2°C	Replace

Table 21-3: Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 1.5°C	Replace
InfraRed Temperature Guns	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily. If out of range, check again in two hours.	2.7 ± 1.7°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10)-(-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Incubator	Temperature checked using NIST-traceable thermometer.	When in use. For microbiology, twice daily when in use.	BOD: 20 ± 1.0°C Micro: 35 ± 0.5°C	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number.	Monthly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.

Table 21-3: Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Glass Microliter Syringes	None	Accuracy must be initially de-monstrated if syringe was not received with a certifi-cate attesting to established accuracy.	± 1%	Not applicable.
Conductivity Meter	Cell impedance calibrated with three KCl standards.	Each use.	$r^2 = 0.99$	Recalibrate.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Inorganics Department.	Weekly	<10 µmhos/cm^2	Record on log. Report discrepancies to QA Director.

Table 21-2 (Version 2)
Preventive Maintenance Procedures
For Field Equipment

Instrument/ Equipment Type	Activity	Frequency	Maintenance
Bailers – Miscellaneous sizes	Check ball valve for overall condition	Prior to use	Clean/replace accordingly
	Check rope	Before, during and after use	Retie or replace as necessary
	Clean inside and out	Before and after use	---
Residual Chlorine – HACH Kit	Check battery	Before and after use	Replace batteries when necessary
	Inspect glass cells	Before and after use	Replace as necessary
	Clean glass cells	Prior to use	---
Residual Chlorine – HACH Kit	Inspect cell holder	Before and after use	Remove obstructions, if present
	Check expiration dates of reagents	Prior to use	Remove and reorder as necessary
	Inspect ampules for cracks	Before and after use	Replace as necessary

Table 21-2
Preventive Maintenance Procedures
For Laboratory Equipment

Instrument/ Equipment Type	Maintenance	Frequency
Gas Chromatograph	Replace Gas line dryers and filters	As needed*
	Replace Gas cylinders	As needed*
	Check or adjust column gas flow and/or detector make-up flow	As needed*
	Replace Injection port Septa	Daily*
	Replace Injection port liners/re-silonize liners	GC, As needed; GC/MS, Daily*
	Replace injection port liner o-ring	GC, As needed; GC/MS, Daily*
	Replace inlet seal and ring	GC, As needed, GC/MS, Daily*
	Replace column ferrules	GC, As needed; *
	Clip column (injector and detector end)	GC, As needed; GC/MS, Daily*
	Replace syringes on autosamplers	As needed*
	Replace heated-zones heaters and sensors	As needed*
	Replace inlet assembly	As needed*
	Empty solvent rinse and solvent rinse-waste vials (on autosampler tower)	Daily or as needed
	Replace column	As needed*
Flame Ionization Detector (FID)	Clean/replace jet	As needed*
	Clean collector	As needed*
	Check and/or adjust gas flows	As needed*
	Replace graphite ferrule	After each cleaning (OI detectors only)
Photoionization Detector (PID)	Clean window	As needed*
	Replace o-ring seat	As needed*
	Replace Lamp	As needed*
	Check and/or adjust gas flows	As needed*
	Adjust Lamp power supply intensity	As needed*
Mass Spectrometer (MS)	Clean source, replace source parts, replace filaments	As needed*
	Clean analyzer	As needed*
	Replace electron multiplier	As needed*
	Clean or replace glass jet separator, replace transfer line from jet separator to MS	As needed*
	Change rough pump oil	After each source cleaning
	Refill calibration compound (PFTBA) vial	As needed
Purge and Trap Equipment	Refill rinse water supply/Empty rinse water waste	Weekly or as needed
	Refill spiking solutions vials	As needed
	Rinse sparge tubes	Daily
	Clean or replace 6-port valve	As needed*
	Replace Transfer lines (from Autosampler to LSC and from LSC to GC)	As needed*
	Adjust gas flows and pressures	As needed
	Perform leak check	As needed

Table 21-3
Preventive Maintenance Procedures
For Laboratory Equipment
(cont.)

Instrument/ Equipment Type	Maintenance	Frequency
Inductively Coupled Plasma, Atomic Emission Spectrometer (ICP-AES)	Replace Peristaltic pump tubing	As needed*
	Clean autosampler, change tubing	As needed*
	Clean nebulizer and torch assembly	As needed*
	Replace nitrogen and argon tanks	As needed*
	Refill rinse water receptacle	Daily
	Empty waste receptacle	Daily
	Check for internal standard and sample flow through peristaltic pump tubing	As often as possible
	Replace internal standard solution receptacle	As needed
	Operate and check vents	Daily
	Perform Hg alignment	Daily*
	Check water level and water filter on recirculating-cooling unit, refill and replace filter	Check daily, refill and replace as needed
	Check purge windows	Daily, replace as needed
	Replace nebulizer and o-rings	As needed*
	Replace torch	As needed*
	Drain air compressor	Weekly
	Replace mixing chambers	As needed*
	Clean or replace air filters	Weekly
	Check pneumatic filters	Weekly, replace as needed
	Perform wave calibration (UV and Vis)	Quarterly*
	Calibrate Detector	Quarterly*
pH Meters	Clean or replace electrode	As needed
	Refill electrode electrolyte	As needed

Table 21-3
Preventive Maintenance Procedures
For Laboratory Equipment
(cont.)

Instrument/ Equipment Type	Maintenance	Frequency
Balance	Clean pan and platform	After each use
	Check Level bubble	Daily
	Check calibration	Daily
	Check sensitivity	Weekly
	Cleaning and calibration by authorized service	Annually
Conductivity Meter	Clean probe	As needed
Dissolved Oxygen Meter	Replace membrane	As needed
	Clean probe	As needed
ZHE vessels	Replace o-rings and screens	As needed
ZHE and TCLP Tumblers	Check Rotation Rate	Monthly
Spectrophotometers	Clean and check tubing	As needed
Burettes and Pipets	Clean and check calibration	Quarterly*
Thermometers	Check calibration	Annually, Quarterly for Digitals and IR Thermometer*
Ovens	Check and/or adjust temperature, record temperature on log sheet	Daily
Refrigerators and Freezers	Check and/or adjust temperature, record temperature on log sheet	Daily
	Defrost freezers	As needed
Lachat, Flow Injection Analyzer	Replace tubes on autodilutor	As needed*
	Clean autosample surfaces	As needed
	Spray silicone on cloth and rub on pump rollers	As needed
	Clean or replace o-rings and ports on valves	As needed*
	Clean union and T's on manifold and replace o-rings on manifold	As needed
	Dry and clean detector surfaces	As needed
	Replace flow cell o-rings and flares	As needed*
	Replace manifold tubing	As needed*
	Adjust pump timing	As needed

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

Section 22
(NELAC 5.5.6)
MEASUREMENT TRACEABILITY

22.1 GENERAL

The following definitions are provided by the American Association for Laboratory Accreditation:

22.1.1 "Traceability is the property of a measurement result whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, each step in the chain having stated uncertainties." There are six essential elements:

- An unbroken chain of comparison
- A calculated measurement uncertainty for each step in the chain to allow for an overall uncertainty calculation
- Documentation of each step in each calibration report
- All steps in the chain are performed by individuals with evidence of technical competence and accredited by a recognized accreditation body
- Reference to International Standard (SI) units
- Recalibration at appropriate intervals to preserve traceability

22.1.2 Calibration is defined as "determining and documenting the deviation of the indication of a measuring instrument (or the stated value of a material measure) from the conventional 'true' value of the measurand."

22.1.3 Uncertainty is defined as "a parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measurand." Measurement of Uncertainty is discussed is Section 20 of this QA Manual.

22.2 TRACEABILITY

22.2.1 NIST-Traceable Weights and Thermometers

22.2.1.1 Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

22.2.1.2 For NIST-traceable weights and thermometers, TestAmerica Honolulu requires the following:

22.2.1.2.1 All calibrations must be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

22.2.2 Reference Standards/Materials

22.2.2.1 Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, etc.. (See Section 9 and Table 20-1 for additional information on purchasing).

22.2.2.2 All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

22.2.2.3 All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. See Table 9-1 in Section 9 for general storage requirements and SOPGEN006 for additional storage information. For safety requirements, please refer to method SOPs and the laboratory Chemical Hygiene Plan.

22.3 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

22.3.1 All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These are records are maintained in each laboratory section close to where the standards are stored. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection.

22.3.1.1 Commercial materials purchased for preparation of calibration solutions, spike solutions, etc. are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

22.3.2 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged the Laboratory Information Management System (LIMS), and are assigned a unique identification number. The following information is typically recorded in the electronic database

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date

- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

22.3.3 Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

22.3.4 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date
- Standard ID

22.3.4.1 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Special Health/Safety warnings if applicable
- Initials of analyst preparing standard or opening container

22.3.4.2 All containers of prepared reagents must include a preparation date, expiration date and an ID number to trace back to preparation.

22.3.4.2.1 Procedures for preparation of reagents can be found in the Method SOPs.

22.3.5 To maintain traceability, standard ID numbers must be noted on all associated logbooks, worksheets and raw data.

22.3.6 All reagents and standards must be stored in accordance to the following priority: 1-with the manufacturer's recommendations; 2-with requirements in the specific analytical methods.

Section 23.0
(NELAC 5.5.7)
SAMPLING

23.1 SAMPLING

TestAmerica – Honolulu provides sampling services. Sampling procedures are described in the following SOP: CS002

23.2 SAMPLING CONTAINERS

TestAmerica Honolulu offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required (Specifications and Guidance for Contaminant-Free Sample Containers OSWER Directive #9240.0-05A Dec 92). One certificate of cleanliness per batch of containers that are provided by the supplier is maintained at the laboratory.

23.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

23.2.2 Preparing Container Orders

23.2.2.1 Upon request, the containers are then sent to clients for use in collecting samples. When a client requests containers, a client services representative creates a container request in a database; it is then stored permanently in the database. Bottle request forms are used for jobs requiring complicated or large numbers of tests.

23.2.2.2 The laboratory also provides EnCore sampling devices when requested.

23.2.2.3 If containers are provided directly to the client from the manufacturer or from other sources, TestAmerica Honolulu will not be responsible for any of the above records.

23.3 FIELD QUALITY CONTROL (QC)

Common field quality control samples are defined in the following paragraphs. The frequency of field quality control samples should be specified in the site specific Quality Assurance Project Plan (QAPP) or by the client. TestAmerica provides trip blanks for VOC analysis with the sample containers for all volatile organic analyses. All blanks generated in the field will be analyzed in the analytical sequence along with the field samples.

23.3.1 Equipment Blank / Rinseate Blank - The equipment blank, sometimes referred to as a rinseate blank, is a sample of the water used to decontaminate sampling equipment. The source water should be as free of target analytes as possible. An aliquot of this water is poured over or through the sample collection device after decontamination, collected in a sample container, preserved with appropriate reagents, and returned to the laboratory. This serves as a check on sampling device cleanliness, and will also be affected by the site and sample handling conditions evaluated by the other types of blanks.

23.3.2 Field Blank - The field blank is water that is as free of target analytes as possible and from the same source as the equipment blank. The water is poured into a sampling container at the sampling site, preserved with the appropriate reagents, and returned to the laboratory. This serves as a check on reagent and environmental contamination.

23.3.3 Trip Blank - The trip blank pertains to volatile analysis only. This serves as a check on sample contamination originating from sample transport, sample container contamination, shipping and storage, or from certain site conditions. Trip blanks are often referred to as travel blanks. They are prepared using pre-cleaned sample containers. They are filled with organic-free water (the source of the organic free water is the same source of water used to prepare volatile standards, method blanks, LCS and sample dilutions), sealed and taken into the field with the empty containers which will be used for sampling. The recommended frequency is one trip blank per cooler (in duplicate or triplicate), per volatiles method.

23.3.4 Field Duplicates - Field duplicates are replicate samples collected from the same sampling point or location during a field collection event. This control sample is used to demonstrate the ability of both the sampling and analytical process to generate data of acceptable precision.

23.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the following tables are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. "Analyze immediately" is an EPA designation reserved for tests which, for compliance monitoring projects, should be performed by field instrumentation or a laboratory "generally within 15 minutes" of sampling (Federal Register, Vol. 48, No. 209, p 11). TestAmerica will qualify data for these parameters if analysis cannot be performed within 15 minutes of sampling. "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

Tables 23-1 to 23-7 detail holding times, preservation and container requirements, and sample volumes.

23.5 DEFINITION OF HOLDING TIME

23.5.1 The date and time of sampling documented on the chain-of-custody (COC) form establishes the day and time zero. When the maximum allowable holding time is expressed in days, the holding time is based on day measured. Holding times expressed in 72 hours or less are measured from date and time zero. Exceptions to this rule will be applied when work is performed by a specific client requirement such as the case for DOD-QSM work. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis.

23.5.2 Semi-Volatile - Holding times for sample preparation for semi-volatile organics are measured from the date and time of sampling until the solvent contacts the sample. If a sample is to be extracted on the day of expiration, the actual time of extraction must be recorded on the sample preparation worksheet. Holding times for analysis are measured from the date and time of initiation of extraction to the time of injection into the gas chromatograph.

23.5.3 Volatiles - Holding times for volatile organics are measured from the date and time of sampling to the date and time of injection into the gas chromatograph. The time of initiation of purging is considered the injection time, but data systems record the start of the chromatographic run rather than the start of purging. Hence, if a sample is so near expiration that the start-of-purging time rather than the chromatographic run time is needed to document the integrity of the sample; the analyst must record the start-of-purging time in the instrument log. Extractions, e.g. for high level soils, must be completed in time to allow for analysis to be initiated within the maximum allowable holding time.

23.5.4 Inorganic - For inorganic and metals analysis, the preparation/digestion/distillation must be started within the maximum holding time as measured from the sampling date and time.

23.6 SAMPLE ALIQUOTS / SUBSAMPLING

23.6.1.1 TestAmerica Honolulu provides quality multi-incremental sub-sampling (based on EPA/600/R-03/027) at an extra cost to the client. TestAmerica Honolulu recommends this process to obtain well represented samples. SOP OAL-IN-031 describes this process in full. For all other samples TestAmerica Honolulu follows SOP GEN036 which exlains methods to try to minimize variance due to sample heterogeneity.

23.2.2 For solid samples, when volatile organics analysis is requested, the sample should be manipulated as little as possible. In most cases, the sample will arrive already preserved or in an EnCore™ sampler of the correct mass (requiring quick preservation of the entire amount). If the client requests volatiles on a solid sample which has been collected in a jar and is in a common container from which aliquots for other test methods must be taken, See SOP CS001 for handling of containers for volatiles and other special conditions. for preparing a proper aliquot prior to any other aliquots being taken out.

23.2.3 For multiphasic samples, the client should instruct the laboratory as to the intent of the testing and how to handle the sample. If the entire sample is to be accounted for, and the phases do not mix easily with inversion/stirring, such that a representative aliquot can be taken, the analyst should record the percent by volume of each phase. The analysis must be conducted on each phase separately; the final results are combined mathematically, weighting the individual phase results by volume. One exception to this procedure is the situation addressed in the TCLP and SPLP methods for wastes containing free liquids. However, if the leachate and final filtrate are not miscible, it is necessary to combine mathematically the concentrations of the two (or more) solutions by volume.

Table 23-1 Drinking Water (SDWA)

PARAMETER	CONTAINER	PRESERVATION[1,2] Temp.	PRESERVATION[1,2] Chemical	HOLDING TIME[3]	SAMPLE VOLUME
Asbestos	Plastic/Glass	4°C	None	48 hours[5]	1 L
Coliforms (Total and Fecal)	Plastic/Glass[20]	10°C	$Na_2S_2O_3$	30 hours[21]	120 mL
Cyanide	Plastic/Glass	4°C	NaOH to pH >12	14 days	500 mL
Fluoride	Plastic/Glass	None	None	None	250 mL
Heterotrophic Plate Count	Plastic/Glass[20]	10°C	$Na_2S_2O_3$	8-24 hours[22]	120 mL
Mercury	Plastic/Glass	None	HNO_3 to pH<2	28 days	250 mL
Metals[4]	Plastic/Glass	None	HNO_3 to pH<2	6 months	250 mL
Nitrate	Plastic/Glass	4°C	None	48 hours[6]	250 mL
Nitrate-Nitrite	Plastic/Glass	None	H_2SO_4 to pH<2	28 days	250 mL
Nitrite	Plastic/Glass	4°C	None	48 hours	250 mL
THMs Only	Glass[8]	4°C	$Na_2S_2O_3$	14 days	3 X 40 mL
Volatile Organic Compounds	Glass[8]	4°C	HCl to pH <2 $Na_2S_2O_3$ or Ascorbic acid [9]	14 days	3 X 40 mL

PARAMETER	CONTAINER	PRESERVATION[1,2] Temp.	Chemical	HOLDING TIME[3]	SAMPLE VOLUME
EDB, DBCP, 1,2,3-TCP (EPA 504.1)	Glass[8]	4°C	$Na_2S_2O_3$	14 days	3 X 40 mL
Organochlorine Pesticides/PCBs (EPA 505)[10]	Glass[8]	4°C	$Na_2S_2O_3$	14 days[11]	3 X 40 mL
Nitrogen and Phos. Pesticides (EPA 507)	Glass-Amber[8]	4°C	$Na_2S_2O_3$	14 days[12]	1 L
Total PCBs (EPA 508A)	Glass-Amber[8]	4°C	None	14 days[13]	1 L
Pesticides and PCBs (EPA 508.1)[14]	Glass-Amber[8]	4°C	HCl to pH <2 $Na_2S_2O_3$[9]	14 days[13]	1 L
Chlorinated Acids (EPA 515.1)	Glass-Amber[8]	4°C	$Na_2S_2O_3$	14 days[12]	1 L
Semivolatiles (EPA 525.2)	Glass-Amber[8]	4°C	HCl to pH <2 $Na_2S_2O_3$[9]	14 days[13]	1 L
N-Methylcarbamoyloxamines and N-Methcarbamates (EPA 531.1)	Glass[8]	4°C	$Na_2S_2O_3$, Monochloroacetic Acid buffer to pH<3	28 days	3 X 60 mL
Glyphosate (EPA 547)	Glass[8]	4°C	$Na_2S_2O_3$	14 days	3 X 60 mL
Endothall (EPA 548)	$Na_2S_2O_3$	4°C	None	7 days[15]	1 L
Diquat/Parquat (EPA 549.1)	Glass-Amber[8] (Silanized or PVC amber)	4°C	H_2SO_4 to PH <2 $Na_2S_2O_3$[9]	7 days[16]	1 L
Chlorinated Disinfection Byproducts, Chlorinated Solvents, and Halogenated Pesticides/Herbicides (EPA 551)	Glass[8]	4°C	Phosphate Buffer and Ammonium Chloride[19]	14 days[17]	3 X 60 mL
Haloacetic Acids (EPA 552.1)	Glass-Amber[8]	4°C	Ammonium Chloride	28 days[18]	250 mL

Key to Table

1. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
2. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

Key to Table

3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
4. All metals except Hg.
5. Instructions for containers, preservation procedures and holding times as specified in Method 100.2 must bed adhered to for all compliance analysis including those conducted with Method 100.1.
6. If the sample is chlorinated, the holding time for an un-acidified sample kept at 4°C is extended to 14 days.
7. Nitrate-Nitrite refers to a measurement of total nitrite.
8. With Teflon lined septum.
9. If chlorinated add $Na_2S_2O_3$ prior to acidification.
10. Heptaclor has a 7 day hold time
11. 14 days until extraction. 24 hours after extraction.
12. 14 days until extraction. 28 days after extraction.
13. 14 days until extraction. 30 days after extraction.
14. For cyanazine, cool to 4°C only.
15. 7 days until derivitation. 1 day after derivatation.
16. 7 days until extraction. 21 days after extraction.
17. 14 days until extraction. 14 days after extraction.
18. 28 days until extraction. 48 hours after extraction.
19. Sodium Sulfite may be used as a dechlorinating agent in some instances. Verify with laboratory prior to sampling.
20. Sterilized. Plastic must be Polypropylene.
21. 40 CFR part 141.74 regulations to avoid filtration or disinfection state 8 hours (DW compliance testing). Most facilities are using either disinfection or filtration so the 8 would not apply in most cases.
22. 40 CFR part 141.74 regulations for Disinfection By-Product rule state 8 hours (DW compliance testing) where SM 9215 allows up to 24 hours if sample is stored between > 0 and $\leq 4^{\circ}$ C

Table 23-2 NPDES – Bacteria, Protozoa, Toxicity Tests

PARAMETER	CONTAINER [1]	PRESERVATION[2,3] Temp.	PRESERVATION[2,3] Chemical	HOLDING TIME[4]	SAMPLE VOLUME
Total, Fecal, and E.coli Coliforms	Plastic/Glass	10°C	0.0008 % $Na_2S_2O_3$[5]	6 hours	100 mL
Fecal Steptococci	Plastic/Glass	10°C	0.0008 % $Na_2S_2O_3$[5]	6 hours	100 mL
Enterococci	Plastic/Glass	10°C	0.0008 % $Na_2S_2O_3$[5]	6 hours	100 mL
Cryptosporidium	LPDE Plastic	0-8°C	None	96 Hours	500 mL
Giardia	LPDE Plastic	0-8°C	None	96 Hours	500 mL
Toxicity – Acute/Chronic	Plastic/Glass	4°C[5]	None	36 Hours	2 L

Key to Table

1. Plastic should be Polypropylene or other sterilizable plastic.
2. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

Key to Table

4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
5. Sufficient ice should be placed with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present, when samples arrive, it is necessary to measure the temperature of the samples and confirm that the 4°C temperature maximum has not been exceeded.
6. Should only be used in the presence of residual chlorine.

Table 23-3 NPDES - Inorganic

PARAMETER	CONTAINER [1]	PRESERVATION [2,3] Temp.	Chemical	HOLDING TIME [4]	SAMPLE VOLUME
Acidity	Plastic/Glass	4°C	None	14 days	100 mL
Alkalinity	Plastic/Glass	4°C	None	14 days	100 mL
Ammonia	Plastic/Glass	4°C	H_2SO_4 to pH<2	28 days	400 mL
BOD 5 Day	Plastic/Glass	4°C	None	48 hours	1000 mL
Boron	Plastic [5]	None	HNO_3 to pH<2	6 months	200 mL
Bromide	Plastic/Glass	None	None	28 days	100 mL
CBOD 5 Day	Plastic/Glass	4°C	None	48 hours	1000 mL
COD	Plastic/Glass	4°C	H_2SO_4 to pH<2	25 days	100 mL
Chloride	Plastic/Glass	None	None	28 days	50 mL
Chlorine, Residual	Plastic/Glass	None	None	15 min. [6]	200 mL
Color	Plastic/Glass	4°C	None	48 hours	50 mL
Cyanide -Total	Plastic/Glass	4°C	NaOH to pH >12, 0.6 g ascorbic Acid [7]	14 days	100 mL
Cyanide -Amenable	Plastic/Glass	4°C	NaOH to pH >12, 0.6 g ascorbic Acid [7]	14 days	100 mL
Fluoride	Plastic	None	None	28 days	300 mL
Hardness	Plastic/Glass	None	HNO_3 to pH<2 [8]	6 months	100 mL
Hexavalent, Chromium	Plastic/Glass	4°C	HNO_3 to pH<2 [10]	24 hours	200 mL
Hydrogen Ion (pH)	Plastic/Glass	None	None	15 min. [6]	200 mL
Kjeldahl and organic Nitrogen	Plastic/Glass	4°C	H_2SO_4 to pH <2	28 days	500 mL
Mercury [11]	Plastic/Glass	None	HNO_3 to pH<2	28 days	200 mL
Metals [9,10]	Plastic/Glass	None	HNO_3 to pH<2	6 months	200 mL

PARAMETER	CONTAINER [1]	PRESERVATION[2,3] Temp.	Chemical	HOLDING TIME[4]	SAMPLE VOLUME
Nitrate	Plastic/Glass	4°C	None	48 hours	100 mL
Nitrate-Nitrite	Plastic/Glass	4°C	H_2SO_4 to pH <2	28 days	100 mL
Nitrite	Plastic/Glass	4°C	None	48 hours	100 mL
Oil and Grease	Glass	4°C	H_2SO_4 to pH <2[12]	28 days	1 L
Organic Carbon (TOC)	Plastic/Glass	4°C	H_2SO_4 to pH <2[12]	28 days	250 mL
Orthophosphate	Plastic/Glass	4°C	Filter immediately.	48 hours	250 mL
Oxygen, Dissolved Probe	Glass[13]	None	None	15 min.[6]	200 mL
Oxygen, Winkler	Glass[13]	None	Fix on site and store in dark.	8 hours	300 mL
Phenols	Glass	4°C	H_2SO_4 to pH <2	28 days	500 mL
Phosphorus, Elemental	Glass	4°C	None	48 hours	250 mL
Phosphorus, Total	Plastic/Glass	4°C	H_2SO_4 to pH <2	28 days	250 mL
Residue, Total	Plastic/Glass	4°C	None	7 days	1 L
Residue, Filterable	Plastic/Glass	4°C	None	7 days	1 L
Residue, Non-Filterable	Plastic/Glass	4°C	None	7 days	1 L
Residue, Settleable	Plastic/Glass	4°C	None	48 hours	1 L
Residue, Volatile	Plastic/Glass	4°C	None	7 days	1 L
Silica	Plastic[5]	4°C	None	28 days	250 mL
Specific Conductance	Plastic/Glass	4°C	None	28 days	250 mL
Sulfate	Plastic/Glass	4°C	None	28 days	250 mL
Sulfide	Plastic/Glass	4°C	Zinc acetate plus NaOH to pH>9	7 days	500 mL
Sulfite	Plastic/Glass	None	None	15 min.[6]	200 mL
Surfactants	Plastic/Glass	4°C	None	48 hours	1 L
Temperature	Plastic/Glass	None	None	N/A	100 mL
Turbidity	Plastic/Glass	4°C	None	48 hours	1 L

Key to Table

1. Plastic should be Polyethylene.
2. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
5. May also be collected in quartz or PFTE Plastic.
6. 40 CFR Part 136 requires this analyte to be analyzed immediately after collection. Collection is defined as within 15 minutes of collection.
7. Should only be used in the presence of residual chlorine.
8. H_2SO_4 to a pH <2 is also acceptable.
9. Except Mercury and Hexavalent Chromium.
10. Samples should be filtered on site before adding HNO_3 preservative for dissolved metals.
11. Samples collected for determination of trace level mercury (100 ng/L) using EPA 1631 must be collected in tightly capped fluoropolymer or glad bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. Samples collected for dissolved trace level mercury should be filtered in the laboratory. However, if circumstances prevent overnight shipping, samples should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. Samples that been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.
12. HCl to a pH <2 is also acceptable.
13. Should have glass lid or top.

Table 23-4 NPDES - Organic

PARAMETER	CONTAINER	PRESERVATION[1,2] Temp.	PRESERVATION[1,2] Chemical	HOLDING TIME[3]	SAMPLE VOLUME
Purgeable Halocarbons	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5]	14 days	40 mL
Purgeable Aromatic Hydrocarbons	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5], HCl to pH<2[6]	14 days	40 mL
Acrolein and Acrylonitrile	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5], adjust pH to 4-5[7]	14 days	40 mL
Phenols[9]	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5]	7 days[8]	1 L
Benzidines[9]	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5]	7 days[8, 11]	1 L
Phthalate esters[9]	Glass[4]	4°C	None	7 days[8]	1 L
Nitosamines[9,12]	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5,13]	7 days[8]	1 L
PCBs[9]	Glass[4]	4°C	None	7 days[8]	1 L
Nitroaromatics and Isophorone[9]	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5,13]	7 days[8]	1 L
Polynuclear Aromatic Hydrocarbons[9]	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5,13]	7 days[8]	1 L
Haloethers[9]	Glass[4]	4°C	0.0008 % $Na_2S_2O_3$[5]	7 days[8]	1 L
Chlorinated Hydrocarbons[9]	Glass[4]	4°C	None	7 days[8]	1 L
CDD/CDFs[9] – Aqueous: Field/Lab Preservation	Glass	0-4°C	pH <9, 0.0008 % $Na_2S_2O_3$[5]	1 year	1 L
CDD/CDFs[9] – Solids/Mixed Phase/Tissue - Field Preservation	Glass	4°C	None	7 days	1 L
CDD/CDFs[9] – Solids/Mixed Phase/Tissue - Lab Preservation	Glass	< -10°C	None	1 year	1 L
Pesticides[9]	Glass	4°C	pH 5-9 [14]	7 days[8]	1 L

Key to Table

1. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
2. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
4. With Teflon lined septum.
5. Should only be used in the presence of residual chlorine.
6. Samples receiving no pH adjustments must be analyzed within 7 days. If 2-chlorovinylethylether is a target analyte, the sample should not be acidified.
7. The pH adjustment is not required if acrolein is not being measured. Samples for acrolein receiving no pH adjustment must be analyze within three days of sampling.
8. 7 days until extraction, 40 days after extraction.
9. When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more categories, the sample may be preserved by cooling to 4°C reducing residual chlorine with 0.0008 % sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9. Samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine) and footnotes 10 and 11(re the analysis of Benzidine).
10. If 1,2-diphenylhydrazine is likely to be present, adjust pH to of the sample to 4.0 $\pm$ 0.2 to prevent rearrangement to benzidine.
11. Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
12. For the analysis of diphenylnitrosamine, add 0.008 % $Na_2S_2O_3$ and ajust pH to 7-10 with NaOH within 24 hours of sampling.
13. Store in dark.
14. The pH adjustment may be performed upon receipt in the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin , add 0.0008 % $Na_2S_2O_3$.

Table 23-5 NPDES - Radiological

PARAMETER	CONTAINER	PRESERVATION[1,2] Temp.	Chemical	HOLDING TIME[3]	SAMPLE VOLUME
Alpha, Beta, Radium	Plastic/Glass	None	HNO_3 to pH<2	6 months	1 L

1. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
2. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater).
3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.

Table 23-6 RCRA - Aqueous

PARAMETER	CONTAINER [1]	PRESERVATION[2,3] Temp.	Chemical	HOLDING TIME[4]	SAMPLE VOLUME
Chloride	Plastic/Glass	4ºC	None	28 days	100 mL
Cyanide -Total	Plastic/Glass	4ºC	NaOH to pH >12[5]	14 days	250 mL
Cyanide -Amenable	Plastic/Glass	4ºC	NaOH to pH >12[5]	14 days	250 mL
Hydrogen Ion (pH)	Plastic/Glass	None	None	24 hours	100 mL
Nitrate	Plastic/Glass	4ºC	None	48 hours	28 days
Oil and Grease	Glass	4ºC	HCl	28 days	1 L
Organic carbon (TOC)	Plastic/Glass	4ºC	pH to <2[6] Store in dark	28 days	28 days
Sulfate	Plastic/Glass	4ºC	None	28 days	400 mL
Sulfide	Plastic/Glass	4ºC	Add Zn Acetate	7 days	400 mL
Chromium VI	Plastic/Glass	4ºC	None	24 hours	250 mL
Mercury	Plastic/Glass	None	HNO_3 to pH<2	28 days	250 mL
Other Metals	Plastic/Glass	None	HNO_3 to pH<2	6 months	250 mL
Acrolein and Acrylonitrile	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7]	14 days	1 L
Benzidines	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7]	7 days[8]	1 L
Chlorinated Hydrocarbons	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7]	7 days[8]	1 L
Dioxins and Furans	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7]	7 days[8]	1 L
Haloethers	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7]	7 days[8]	1 L
Nitroaromatics and cyclic ketones	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7], store in dark	7 days[8]	1 L
Nitrosomines	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7], store in dark	7 days[8]	1 L
Organochlorine Pesticides	Glass[10]	4ºC	None	7 days[8]	1 L
Organophosphorus Pesticides	Glass[10]	4ºC	Adjust pH[9]	7 days[8]	1 L
PCBs	Glass[10]	4ºC	None	7 days[8]	1 L
Phenols	Glass[10]	4ºC	0.0008 % $Na_2S_2O_3$[7]	7 days[8]	1 L
Phthalate Esters	Glass[10]	4ºC	None	7 days[8]	1 L

PARAMETER	CONTAINER [1]	PRESERVATION[2,3] Temp.	Chemical	HOLDING TIME[4]	SAMPLE VOLUME
Polynuclear Aromatic Hydrocarbons	Glass[10]	4°C	0.0008 % $Na_2S_2O_3$[7], store in dark	7 days[8]	1 L
Purgeable Hydrocarbons	Glass[10]	4°C	0.0008 % $Na_2S_2O_3$[7] Adjust pH <2[2]	14 days	40 mL
Purgeable Halocarbons	Glass[10]	4°C	0.0008 % $Na_2S_2O_3$[7]	14 days	40 mL
Total Organic Halides (TOX)	Glass[10]	4°C	Adjust pH to <2 with H_2SO_4	28 days	1 L
Radiological Tests (Alpha, Beta, Radium)	Plastic/Glass	None	HNO_3 to pH<2	6 months	250 mL

Key to Table

1. Plastic should be Polyethylene.
2. Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. For the preservation requirements of Table 6-8, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
5. If oxidizing agents are present, add 5 mL 0.1 N $NaAsO_2$ or 0.06 g of ascorbic acid per L. See Cyanide SOP for additional information about other interferences.
6. Adjust pH to <2 with H_2SO_4, HCl, or solid $NaHSO_4$. Free Chlorine must be removed prior to adjustment.
7. Free Chlorine must be removed by the appropriate addition of $Na_2S_2O_3$.
8. 7 days until extraction. 40 days after extraction.
9. Adjust pH to 5-8 using NaOH or H_2SO_4.
10. With Teflon lined septum.

Table 23-7 RCRA – Non-Aqueous

PARAMETER	CONTAINER [1]	PRESERVATION Temp.	PRESERVATION Chemical	HOLDING TIME[2]	SAMPLE WEIGHT
Chloride	Glass	4°C	None	28 days	50 g
Cyanide -Total	Glass	4°C	None	14 days	50 g
Cyanide -Amenable	Glass	4°C	None	14 days	50 g
Hydrogen Ion (pH)	Glass	4°C	None	24 hours	50 g
Nitrate	Glass	4°C	None	N/A	50 g
Oil and Grease	Glass	4°C	None	28 days	50 g
Sulfide	Glass	4°C	Add Zn Acetate, zero headspace	7 days	50 g
Chromium VI	Glass	4°C	None	24 hours	50 g
Mercury	Plastic/Glass	None	None	28 days	50 g
Other Metals	Plastic/Glass	None	None	6 months	50 g
Acrolein and Acrylonitrile	Glass[4]	4°C	None	14 days	50 g
Benzidines	Glass[4]	4°C	None	14 days[3]	50 g
Chlorinated Hydrocarbons	Glass[4]	4°C	None	14 days[3]	50 g
Dioxins and Furans	Glass[4]	4°C	None	14 days[3]	50 g
Haloethers	Glass[4]	4°C	None	14 days[3]	50 g
Nitroaromatics and cyclic ketones	Glass[4]	4°C	None	14 days[3]	50 g
Nitrosomines	Glass[4]	4°C	None	14 days[3]	50 g
Organochlorine Pesticides	Glass[4]	4°C	None	14 days[3]	50 g
Organophosphorus Pesticides	Glass[4]	4°C	None	14 days[3]	50 g
PCBs	Glass[4]	4°C	None	14 days[3]	50 g
Phenols	Glass[4]	4°C	None	14 days[3]	50 g
Phthalate Esters	Glass[4]	4°C	None	14 days[3]	50 g
Polynuclear Aromatic Hydrocarbons	Glass[4]	4°C	None	14 days[3]	50 g
Purgeable Hydrocarbons	Glass[4]	4°C	None	14 days[5]	50 g

PARAMETER	CONTAINER [1]	PRESERVATION		HOLDING TIME[2]	SAMPLE WEIGHT
		Temp.	Chemical		
Purgeable Halocarbons	Glass[4]	4°C	None	14 days[5]	50 g
Total Organic Halides (TOX)	Glass[4]	4°C	None	28 days	50 g

Key to Table

1. Plastic should be Polyethylene.
2. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
3. 14 days until extraction. 40 days after extraction.
4. With Teflon Lined Septum
5. See Volatile SOP for more detailed preservation requirements.

Table 23-8 Air Samples

PARAMETER	CONTAINER [1]	PRESERVATION Temp.	PRESERVATION Chemical	HOLDING TIME[2]	SAMPLE WEIGHT
Volatile Organics	Tedlar Bag	None	None	72 hrs[3,4]	1 L

Key to Table

1. Plastic should be Polyethylene.
2. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
3. Holding Time is based on SW 846 Method 0040 "SAMPLING OF PRINCIPAL ORGANIC HAZARDOUS CONSTITUENTS FROM COMBUSTION SOURCES USING TEDLAR® BAGS". Some states specifically enforce this holding time (e.g. Florida, New Jersey) and others have not specified this information in their regulatory requirements.
4. The holding time is 72 hours unless the laboratory has a documented validation study that indicates a longer HT is acceptable for the analytes of interest.

Section 24
(NELAC 5.5.8)
HANDLING OF SAMPLES

Sample management procedures at TestAmerica Honolulu ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

24.1 SAMPLE HANDLING

24.1.1 Chain of Custody

The chain-of-custody form is the written documented history of any sample. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the chain–of-custody (COC) form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 24-1.

24.1.2 Field Documentation

At the sampling site, each sample is labeled with the following information:

- client's sample identification
- date and time of sampling
- name of the client
- name of the sampler
- sampling procedure used
- and any other pertinent information

During the sampling process, the chain-of-custody form is completed. This form includes information such as the address and phone number of the client, the analyses requested, the containers and preservatives used, and the sampling date and time (see Figure 24-1). The samples are stored in a cooler with ice and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier.

NOTE: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

24.1.3 Legal/Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal (Figure 24-2), retain the shipping record with the COC, and initiate an internal COC (Figure 24-3) for laboratory use by analysts and a sample disposal record (Figure 24-4).

24.2 SAMPLE RECEIPT

Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

24.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any problems or deviations are recorded on a sample checklist form. See figure 24-5

24.2.1.1 Inspection of samples include a check for:

- Complete documentation to include sample identification, location, date and time of collection, collector's name, preservation type, sample type and any additional comments concerning the samples.
- Complete sample labels to include unique identification in indelible ink.
- Use of appropriate sample containers (see Section 23)
- Adherence to holding times as specified in the test method and/or summarized in Section 23.
- Adequate sample volume for required analyses (see Section 23).
- Damage or signs of contamination to sample container. Volatile vials are also inspected for headspace

24.2.1.2 Check and record the temperature of the samples that require thermal preservation.

24.2.1.2.1 Samples shall be deemed acceptable if arrival temperature is just above freezing and less than or equal to 6° C. Samples requiring volatiles only may be frozen as per method 5035A. Samples that are hand-delivered immediately after collection may not be at the required temperatures; however, if there is evidence that the chilling process has begun, such as the arrival on ice, the samples shall be considered acceptable. This will be documented on the chain of custody.

24.2.1.2.2 If the samples were shipped in ice and solid ice is still present and in direct contact with samples, report the samples as "received on ice." Direct contact means samples must be surrounded by ice cubes or crushed ice. Ice present in a plastic bottle or other container does not constitute direct contact. Samples shipped with only "blue ice" may not be reported as "received on ice".

24.2.1.3 Verify sample preservation as specified in the test method. Check for correct pH as specified in the test method. The results are documented. In the case of volatiles it is recorded after analysis when samples are to be analyzed before 7 days on the sample prep sheet. Chlorine is checked on samples requiring extractable organics, BOD, TOX, cyanide, fluoride, ammonia, TKN, CBOD and Nitrate; presence or absence is recorded in the laboratory before testing.

24.2.1.4 After inspecting the samples, the sample control personnel sign and date the chain-of-custody form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators.

24.2.1.5 If samples are received without a chain-of-custody form, TestAmerica will provide a generic chain-of-custody form to be completed by the client when the samples are brought to the laboratory. The client is always provided with a copy of the completed chain-of-custody form for their records.

24.2.1.6 If analyses with short holding times are requested, the dates are inspected to ensure that holding times have not been already violated.

24.2.1.7 Any deviations from the checks described in section 24.2.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance criteria (Section 24.3) are not met, the laboratory shall either.

24.2.1.7.1 Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

24.2.1.7.2 Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

24.2.2 Sample Log-in

24.2.2.1 All samples that are received by the laboratory are logged into the LIMS to allow the laboratory to track and evaluate sample progress. Each group of samples that are logged in together (typically one project from a given client/sampling event) is assigned a unique job number. Within each job, each sampling point (or sample) receives a unique number. Sample numbers are generated sequentially over time, and are not re-assigned. A sample may be composed of more than one bottle since different preservatives may be required to perform all analyses requested. Even if multiple containers are received for a single sample, each container is uniquely identified with an alphabetic letter added to the sample number. The LIMS generates sample labels that are attached to each bottle for a given sample.

24.2.2.2 Each job/set of samples is logged into LIMS with a minimum of the following information:

- Client Name, Project Name, Address, Phone, Fax, Report to information, invoice to information (most of this information is "default information" that is stored in the LIMS).
- Date and time sampled;
- Date and time received;
- Job description, sample description;
- Sample matrix, special sample remarks;
- Reporting requirements (i.e., QC level, report format, invoicing format);
- Turn-around-time requirements;
- Parameters (methods and reporting limits or MDLs are default information for a given parameter)

24.3 SAMPLE ACCEPTANCE POLICY

24.3.1 The laboratory has a written sample acceptance policy (Figure 24-4) that clearly outlines the circumstances under which samples shall be accepted. These include:

- a chain of custody filled out completely;

- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method;
- sample holding times must be adhered to;
- all samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time;
- the project manager will be notified if any sample is received in damaged condition.

24.3.2 Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined. A copy of the sample acceptance policy is provided with all laboratory-supplied container shipments.

24.4 SAMPLE STORAGE

24.4.1 In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed at a regular interval. See SOP GEN060. Samples are not stored in refrigeration units containing standards or reagents.

24.4.2 Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. This 6 week holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

24.4.3 Access to the laboratory is controlled such that sample storage needs to be locked at all times. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

24.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. For any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, a Hazardous Sample Notice must be completed by the analyst. This form may be completed by Sample Control, Project Managers, or analysts and must be attached to the report. The sample itself is clearly marked with a red stamp, stamped on the sample label reading "HAZARDOUS" or "FOREIGN SOIL" and placed in a colored and/or marked bag to easily identify the sample. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all

hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

24.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6°C during transit. The samples are carefully surrounded by packing material to avoid breakage, and a trip blank is enclosed for those samples requiring volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice.

24.7 SAMPLE DISPOSAL

24.7.1 Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures SOP GEN030 Waste Handling. All procedures in the laboratory Chemical Hygiene Plan/Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than 6 weeks from receipt unless otherwise requested.

24.7.2 If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. A Waste Disposal Record can be produced from LIMS.

Figure 24-1

Chain of Custody

TestAmerica
ANALYTICAL TESTING CORPORATION

99-193 Aiea Heights Dr Ste 121 • Aiea, HI 96701-3900
808-486-LABS (5227) • FAX: 808-486-2456

LABORATORY USE ONLY
LAB JOB NO.
LOCATION
CONTAINERS

Chain of Custody / Analysis Request Form

Report To:
Company Name
Address
City State ZIP
Phone Fax
Sampler # of Samples in Shipment

Project Identification
Job Name
Job Number
P.O. Number
Contact email address
Date Results Needed

Indicate Analysis Requested

Item No	Client Sample I.D.	COM	GRA	Matrix: Water, Soil, Wastewater, Drinking water, Sludge, Liquid, Solid, Oil, Other	Preservation Method	Sampling: Date	Sampling: Time	Number of containers	Laboratory No.
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Released by (Print/Signature)	Date / Time Released	Delivery Method	Received by (Print/Signature)	Company / Agency Affiliation	Date / Time Received	Condition Noted
	/				/	
	/				/	
	/				/	

Comments:

Please Check Box
☐ Dispose by Lab
☐ Return to Client
☐ Archive

White - OAL Yellow - OAL Pink - Client

Page_____ of _____

Figure 24-2

Example Custody Seal

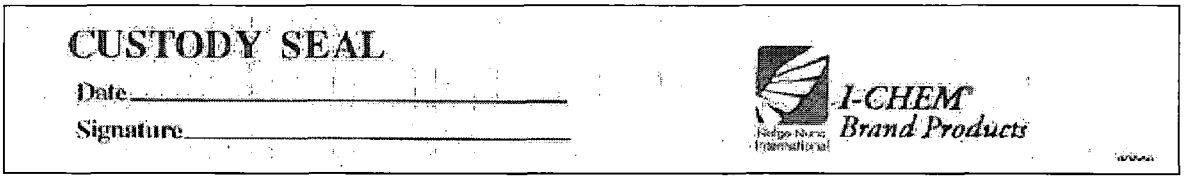


Figure 24-3

Example Internal Chain of Custody

VOLATILES

Client ID	Lab Number
Influent	03-A114050
Midfluent	03-A114051
MID-BAC 1	03-A114052
MID-GAC 2	03-A114053
MID-GAC3	03-A114054
Effluent	03-A114055

Relinquished by	Received by	Reason	Date	Time

Figure 24-4 Sample Acceptance Policy

TestAmerica Honolulu

Sample Receipt Checklist

Client Name: OAL — Date and Time Received: 06/25/2001 15:24

Work Order Number: 0106139 — Received by: MDH

Checklist completed by: _____ Reviewed by: _____
Initials Date Initials Date

Matrix: Aqueous Carrier name: FedEx Airbill #: 461977653502

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑ Custody Seal #:
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑ Custody Seal #:
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Check ☑

Adjusted? _____ Checked by _____

Sample Container/Blank Temperature Range (Minimum 3 sample containers if available). 25 °C to 25 °C

Any "No" response must be detailed in the comments section below.

Client contacted: _____ Date contacted: _____ Contacted by: _____

Regarding: _____

Comments: _____

Corrective Action: _____

Section 25.0
(NELAC 5.5.9)
ASSURING THE QUALITY OF TEST RESULTS

In order to assure our clients of the validity of their data, TestAmerica Honolulu continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 21, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DU), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

25.1 NEGATIVE CONTROLS

25.1.1 **Method Blanks** are used to assess preparation and analysis for possible contamination during the preparation and processing steps.

25.1.1.1 The Method Blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water or Ottawa sand) and is processed along with and under the same conditions as the associated samples.

25.1.1.2 The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).

25.1.1.3 The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis however it is generally 1 for each batch of samples; not to exceed 20 environmental samples.

25.1.1.4 Evaluation criteria and corrective action for method blanks is defined in the specific standard operating procedure for each analysis however, in general if the concentration of a target analyte in the blank is at or above the reporting limit as established by the method or regulation:

- The source of contamination is investigated
- Measures are taken to minimize or eliminate the source of the contamination
- Affected samples are reprocessed or the results are qualified on the final report.

25.1.2 **Calibration Blanks** are prepared and analyzed along with calibration standards. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

25.1.3 **Instrument Blanks** are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

25.1.4 **Trip Blanks** are required to be submitted by the client with each shipment of samples requiring volatiles analyses. A trip blank is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples. Trip Blanks are also

25.2 POSITIVE CONTROLS

25.2.1 Laboratory Control Sample (LCS)

25.2.1.1 The LCS is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

25.2.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water or Ottawa sand) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS.

25.2.1.3 Certified pre-made reference material purchased from an NIST accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.)

25.2.1.4 The LCS goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).

25.2.1.5 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis however it is generally 1 for each batch of samples; not to exceed 20 environmental samples.

25.2.1.6 If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

25.2.1.6.1 For methods that have 1-10 target analytes, spike all components

25.2.1.6.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

25.2.1.6.3 For methods with more than 20 target analytes, spike at least 16 components.

25.2.1.6.4 Exception: Due to analyte incompatibility in pesticides Toxaphene and Chlordane are only spiked at client request based on specific project needs.

25.2.1.7 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

25.3 SAMPLE SPECIFIC CONTOLS

25.3.1 Matrix Spikes (MS) and Matrix Spike Duplicates (MSD)

25.3.1.1 The Matrix spike is used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used.

25.3.1.2 An MS is essentially a sample fortified with a known amount of the test analyte(s). At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.

25.3.1.3 If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number of the listed components (see LCS analytes 25.2.1.6 above) may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

25.3.2 Surrogate Spikes

25.3.2.1 Surrogate Spikes are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.

25.3.2.2 Surrogate compounds are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method (also see section 25.4 below). Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.

25.3.3 Duplicates and triplicates

25.3.3.1 For a measure of analytical precision, with each matrix-specific batch of samples processed, a duplicate sample, matrix spike duplicate, triplicate or LCS duplicate is carried through the complete analytical procedure. Duplicate samples are usually analyzed with methods that do not require matrix spike analysis. Duplicate LCS samples are usually analyzed when insufficient sample volume is supplied for the LIMS specified matrix spike sample. The recoveries for the spiked duplicate samples should meet the same laboratory established recovery limits as the accuracy QC samples. Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling. It may also be caused by low

concentrations of the analyte in the sample. RPDs are concentration dependent and may not represent precision for small numbers. Incremental procedures may employ triplicates as a better indication of sample homogeneity as triplicate results are not biased by the concentration of the analyte being compared.

25.4 INTERNAL STANDARDS

25.4.1 In most organic analyses, internal standards are spiked into all environmental and quality control samples (including the initial calibration standards). An internal standard is also used with some metals analyses. It is added to sample extracts after the extraction (post-prep). The acceptance criteria in most methods are 50% to 200% of the responses in the mid-point of the corresponding calibration curve. Consult the method-specific SOPs for details on the internal standard compounds and calculations.

25.4.2 When the internal standard recoveries fall outside these limits, if there are not obvious chromatographic interferences, one sample from each affected project is reprocessed and reanalyzed to confirm a possible matrix effect. If the recoveries confirm or there is obvious interference, results are reported from the original analysis and a qualifier is added. If the internal standard recoveries from the reprocessed sample fulfill criteria, all affected samples are reprocessed and results from the re-analyses are reported.

25.5 ACCEPTANCE CRITERIA (CONTROL LIMITS)

25.5.1 Each individual analyte in the LCS, MS, or Surrogate Spike are evaluated against the control limits as published in the test method. Where there are no established acceptance criteria, the laboratory calculates control limits with the use of control charts or, in some cases, utilizes client project specific or regulatory mandated control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

25.5.1.1 For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

25.5.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating (e.g. EPA SW846 8000 series methods). Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

25.5.2.1 The lab should consider the effects of the spiking concentration on matrix spike control limits, and to avoid censoring of data. The acceptance criteria for matrix spike recovery and precision are often a function of the spike concentration used. Therefore, caution must be used when pooling matrix spike/matrix spike duplicate data to generate control limits. For this reason TestAmerica Honolulu uses limits established by LCSs only.

25.5.2.2 Not only should the results all be from a similar matrix, but the spiking levels should also be approximately the same (within a factor of 2). Similarly, the matrix spike and surrogate results should all be generated using the same set of extraction, cleanup and analysis techniques. For example, results from solid samples extracted by ultrasonic extraction are not mixed with those extracted by Soxhlet.

25.5.2.3 The laboratory should try and avoid discarding data that do not meet a preconceived notion of acceptable performance. This results in a censored data set, which, when used to develop acceptance criteria, will lead to unrealistically narrow criteria. For a 99% confidence interval, 1 out of every 100 observations likely will still fall outside the limits. For methods with long analyte lists this may mean occasional failures every batch or two. While professional judgment is important in evaluating data to be used to develop acceptance criteria, specific results are not discarded simply because they do not meet one's expectations. However, data points shall be discarded if they were the result of human or mechanical error or sample concentration exceeded spike level by > 4x. (Right clicking on the control chart and selecting View Data from the drop down menu allows the QA Manager to view a table of all the charted points with any qualifiers. This assists the QA Manager in determining if any points should be discarded prior to limit generation.)

25.5.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of at least 20-30 data points. The system defaults to collecting the previous 3 months data. This time frame should be shortened if there are more than 200 points since the system slows down tremendously. The time frame should be extended if there are not 20-30 points.

25.5.3.1 Regardless of the calculated limit, the limit should be no tighter than the Initial Calibration Verification (CCV). (Unless the analytical method specifies a tighter limit).

25.5.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method.

25.5.3.3 The lowest acceptable recovery limit will be 5% (the analyte must be detectable).

25.5.3.4 The maximum acceptable recovery limit will be 150%.

25.5.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

25.5.3.6 If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

25.5.4 The laboratory prepares a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Honolulu. This summary includes an effective date, is updated each time new limits are generated and is located in the QA department. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

25.5.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for

samples within the same batch must be qualified when reported. The internal corrective action process (see Section 13) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

25.5.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

25.5.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

25.5.5.3 Or, for NELAC and Departement Of Defense (DOD) work, there are an allowable number of Marginal Exceedances (ME):

- <11 analytes – 0 marginal exceedances are allowed.
- 11 – 30 Analytes – 1 marginal exceedance is allowed
- 31-50 Analytes – 2 marginal exceedances are allowed
- 51-70 Analytes – 3 marginal exceedances are allowed
- 71-90 Analytes – 4 marginal exceedances are allowed
- > 90 Analytes – 5 marginal exceedances are allowed

25.5.5.3.1 Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (NELAC).

25.5.5.3.2 Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

25.5.5.3.3 Though marginal exceedances may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

25.5.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in Appendix 4 and in Section 13.

25.5.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, one sample from each affected project is reprocessed and reanalyzed to confirm a possible matrix effect. If the recoveries confirm or there is obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the surrogate recoveries from the reprocessed sample fulfill criteria, all affected samples are reprocessed and results from the re-analyses are reported.

25.6 METHOD DETECTION LIMITS (MDLs)

25.6.1 MDLs , calculated as described in Section 20.6, are updated annually, or more often if required by the method. Once values are approved, they are distributed to the analysts, entered in LIMS analyte by analyte, and stored in the QA deparment.

25.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

25.7.1 The laboratory has written procedures to assure the accuracy of the test method including calibration (see Section 21), use of certified reference materials (see Section 22) and use of PT samples (see Section 16).

25.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 20.

25.7.3 Use of formulae to reduce data is discussed in the method standard operating procedures and in Section 21.

25.7.4 Selection of appropriate reagents and standards is included in Section 9 and 22.

25.7.5 A discussion on selectivity of the test is included in Section 5.

25.7.6 Constant and consistent test conditions are discussed in Section 19.

25.7.7 The laboratories sample acceptance policy is included in Section 24.

25.7.8 A listing of the type of test result correlations that are looked at during report review (e.g. Total Chromium should be greater or equal to Hexavalent Chromium) is included in Section 26.

Section 26.0
(NELAC 5.5.10)
REPORTING RESULTS

26.1 GENERAL

26.1.1 The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is a conflict between the client requested formats and accreditation requirements or data usability information, accreditation requirements and data usability information will take precedence over client requests. A variety of report formats are available to meet specific needs.

26.1.2 In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

26.1.3 Review of reported data is included in Section 20.

26.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

26.2.1 A report title (e.g. Analytical Report For Samples) with a "sample results" column header.

26.2.2 Each report page printed on company letterhead, which includes the laboratory name.

26.2.3 A unique identification of the report (e.g. work order number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

26.2.3.1 Page numbers of the report are represented as page # and are ordered by their individual section where data and QA are numbered separately. The total number of pages are tabulated on the cover page.

26.2.4 A copy of the chain of custody (COC)

26.2.4.1 Any COCs involved with Subcontracting are included

26.2.4.2 In most cases the applicable COC is not paginated but is an integral part of the report. The extra number of pages caused by the COC to the total report will be accounted for on the cover page.

26.2.4.3 Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information).

26.2.5 The name and address of client and a project name/number, if applicable.

26.2.6 Client project manager or other contact

26.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

26.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

26.2.9 Date reported or date of revision, if applicable.

26.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

26.2.11 Practical quantitation limits or reporting limit.

26.2.12 Method detection limits (if requested)

26.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

26.2.14 Sample results.

26.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

26.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets and or the Chain of Custody. (see 26.2.4.3 regarding additional addenda).

26.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

26.2.18 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director. For applying an electronic signature see the Electronic Signature Policy (section 26.3).

26.2.19 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not.

26.2.20 The laboratory includes a cover letter.

26.2.21 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

26.2.22 When Soil samples are analyzed, a specific identification as to whether soils are reported on a "dry weight" basis. Results not labeled as such assume a wet weight.

26.2.23 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

26.2.24 If the report is a "Partial" report (client requests some results before all of it is complete), it must state that it is "Partial" on the report and that a complete report will follow once all of the work has been completed.

26.2.25 Any out of network subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All in-network subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

26.3 Reporting Levels

26.3.1 TestAmerica Honolulu offers three levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

26.3.1.1 Level II is a basic data report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.

26.3.1.2 Level III contains all the information supplied in Level II, but presented on summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.

26.3.1.3 Level IV is the same as Level III with the addition of all raw supporting data.

26.3.2 In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 26.7.

26.4 ELECTRONIC REPORTING AND SIGNATURE POLICY

Following the lead of the Federal Paperwork Reduction Act, TestAmerica Analytical Testing Corp. has implemented policies and procedures to help reduce paper usage. One of these procedures is to generate final reports and provide them to clients in pdf format.

Laboratory Director/Manager appointed representatives approve final reports using an electronic signature that is applied to the report at the time of generation. This policy is prepared to state that the electronically applied signatures on TestAmerica Analytical Testing

Corp. reports are as legally binding as a handwritten "wet signature". This policy is intended to prevent the possibility of non-repudiation (denial that an individual signed the document) and to insure authenticity and security. In order to ensure the electronic signatures are valid and unequivocally represent the identity of the signer, TestAmerica uses 21 CFR Part 11 "Electronic Records; Electronic Signatures" from the FDA as well as EPA's procurement policy (EPS 00-01) as the guidance document for this policy.

In order to ensure authenticity of the reports, the following conditions must be met:

26.4.1 Report Content

26.4.1.1 State that the report was electronically signed.

26.4.1.2 The printed name and title of the signer must be underneath the signature

26.4.1.3 The date when the signature was executed is represented in the "Report Issued" entry on the cover page of the report.

26.4.1.4 The meaning of the signature: (e.g. reviewed and approved)

In order to insure the integrity of the signatures the following security features have been implemented.

26.4.2 General requirements

26.4.2.1 The identity of the signatory must be verified before an electronic signature can be created for that person.

26.4.2.2 Each electronic signature shall be unique to a single individual and shall not be reused by or assigned to another individual

26.4.2.3 Persons using an electronic signature shall certify that the electronic signatures in the system are intended to be the legally binding equivalent to their traditional handwritten signature. On this certification, the signatory will state that their passwords are to remain completely confidential and can only be used by the genuine owner of the password and the sign-off may not take place until each page has been viewed. See Figure 26-1.

26.4.3 Components and Controls

26.4.3.1 Two distinct identification components are utilized for each individual. The components are a) user name b) password

26.4.3.2 Each signing will require the entry of the username and the password must be reentered.

26.4.3.3 The signatures may not be copied, excised or transferred from the report by ordinary means.

26.4.3.4 The report may not be changed once the signature has been applied and the pdf files are stored on the file server with security as well as password protected to ensure no changes may be made to the file.

26.4.3.4.1 In the case where a client requests that the pdf be unsecure so that the report may be inserted into their reports, the client must sign an agreement stating that they will not alter the report. This can be achieved by requiring agreement each time it is accessed on the web or by signing off on an agreement (see Figure 26-2).

26.4.3.4.2 Pdf reports must be backed up on a Magnetic tape or other durable storage media (e.g. DVD) and maintained secure for up to 5 years.

26.5 SUPPLEMENTAL INFORMATION FOR TEST

26.5.1 The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report. See Appendix 7 for a list of the laboratory's standard footnotes and qualifiers.

26.5.2 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

26.5.3 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature.

26.5.4 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

26.5.5 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

26.5.5.1 When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment that if the client may want verify with their regulator may be warranted.

26.6 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

26.6.1 If TestAmerica Honolulu is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in Section 8.

26.6.2 Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of the TestAmerica network are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

26.7 CLIENT CONFIDENTIALITY

26.7.1 In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

26.7.2 TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

26.7.3 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet that includes a confidentiality statement similar to the following:

This transmission contains information that may be legally confidential. The information is intended solely for the individual or entity named above and access by anyone else is unauthorized. If you are not the intended recipient, any disclosure, copying, distribution, or use of the contents of this information is prohibited and may be unlawful. If you have received this transmission in error, please reply immediately to the sender that you have received the message in error. Because access to receiving equipment is not under our control, TestAmerica Honolulu cannot be responsible for the confidentiality of electronically transmitted data.

26.8 FORMAT OF REPORTS

The format of reports are designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

26.9 AMENDMENTS TO TEST REPORTS

26.9.1 Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (see Section 13).

26.9.2 The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "R" The revised report will have the word "revised" or "amended" next to the date rather than the word "reported".

26.9.3 When the report is re-issued, a notation of "Revised Report" is placed on the cover/signature page of the report with a brief explanation of reason for the re-issue.

26.10 POLICIES ON CLIENT REQUESTS FOR AMMENDMENTS

26.10.1 Sample Reanalysis Policy RECALL SOP – Section 6

Because there is a certain level of uncertainty with any analytical measurement a sample reanalysis may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g. sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats.

26.10.1.1 Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported and the client will be charged for a second analysis. At the client's request, both results may be reported on the same report but not on two separate reports.

26.10.1.2 If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation and report the confirmed result at no additional cost.

26.10.1.3 Charges may be dropped based upon Laboratory Director approval.

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

26.10.2 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

26.10.2.1 Laboratory Error.

26.10.2.2 Sample identification is indeterminate (confusion between COC and sample labels).

26.10.2.3 An incorrect analysis (not analyte) was requested (e.g. COC said 8315 but client wanted 8310). A written request for the change is required.

26.10.2.4 Incorrect limits reported based on regulatory requirements.

26.10.2.5 The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

26.10.3 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report. (This does not refer to copies of the same report.)

Figure 26-1.

Read and Understand Memo for
Electronic Reporting and Electronic Signatures Policy

I have read and understand the TestAmerica Policy on Electronic Reporting and Electronic Signatures and agree to follow procedures stated in this document. Futhermore, I agree to maintain my password secure and confidential and will not divulge this password to anyone. I am aware that my electronic signature is as legally binding as that of my signature signed with a pen. I will not apply my signature until I have reviewed each page.

Employee: _____

Signature: _____

Date: _____

Return this signed form to HR within 5 days for filing in your Personnel File

Figure 26-2

AGREEMENT FOR ELECTRONIC REPORTS

TestAmerica Analytical Testing Corp. provides laboratory services and certified lab reports ("Reports") to the undersigned client ("Client"). Client desires to receive the Reports in both written hard copy and electronic format. Both TestAmerica and the Client desire to protect and preserve the integrity of the Reports.

TestAmerica agrees to provide Client with the Reports in both hard copy and electronic format. Client agrees to accept all responsibility for and indemnify and hold TestAmerica harmless from all claims or demands from third parties, including attorneys' fees and costs incurred by TestAmerica, due to alterations or deletions to the Reports by Client, or the use of incomplete Reports by Client.

Client agrees not to alter any Reports whether in the hard copy or electronic format and to use reasonable efforts to preserve the Reports in the form and substance originally provided by TestAmerica.

Date: _____ **Company Name:** _____

Completed By: _____

Title/Position: _____

Client Signature: _____

Date: _____ Company Name: TestAmerica - Honolulu

Received By: _____

Title/Position: _____

Signature: _____

Please sign and FAX to (808) 486-2456

Appendix 1

TESTAMERICA ETHICS POLICY AND CODE OF ETHICAL CONDUCT

It is the policy of TestAmerica that every employee shall at all times and in all ways comply with federal, state and local laws, and that every employee shall adhere to the highest standards of ethics, morality, honesty and decency in the performance of the duties of his or her job. TestAmerica strives to create an ethical "culture" through top-down example with an emphasis on doing things the "right way" for the "right reasons". The consequences of non-compliance can be severe to both the environment and the company. The actions of one employee can jeopardize the entire company. The company has a zero tolerance policy for illegal, unethical and improper practices that affect the integrity of all data the company produces.

1.1 TestAmerica Code of Ethical Conduct

TestAmerica has adopted a Code of Ethical Conduct, to which each employee must adhere, as follows:

a) To serve human health and environmental interests by performing analytical and testing responsibilities in a manner that justifies the public trust.

b) To present services in a confidential, honest, and candid manner. Facility/location procedures, client names and their results are not discussed outside of the company except with an approved client agent.

c) To produce results that are both accurate and defensible.

d) To comply with all written procedures (i.e., Quality Assurance (QA) Manual, Standard Operating Procedures (SOPs), Safety Manual, Human Resources Manual, etc.). Members of management must comply with all applicable federal, state, and local laws and regulations consistent with accepted professional and analytical practices.

e) To understand and adhere to the guidelines of ethical and quality work that meet the standards required by the environmental testing industry.

1.2 Data Quality Assurance Program

TestAmerica wants to ensure a national standard of quality at all TestAmerica locations.

Each TestAmerica laboratory has a Quality Assurance Manual that focuses on quality related test specifications performed by that laboratory. Documented quality systems are designed to insure that work performed in the laboratory is accurate, precise, complete, comprehensive, and reflects the needs of the customer/client.

1.3 Ethics Quality Commitment, Objective, and Policy

TestAmerica wants to ensure quality analytical and data management services to meet the needs of customers/clients while satisfying the requirements of appropriate state and federal regulations. This enables the customer/client to make rational, confident, cost-effective decisions on the assessment and resolution of environmental problems. Protocols and procedures utilized by laboratories, with emphasis on the Quality Assurance/Quality Control (QA/QC) requirements, are based on EPA guidelines.

It is the policy of TestAmerica to incorporate quality into all analytical programs by adhering to the following practices:

a) TestAmerica will not offer any analysis for which we cannot demonstrate consistent quality and defensible analyses;

b) Employees who are aware of falsification or misrepresentation of facts regarding analytical results or the manipulation of data are required to immediately inform the appropriate member of Management;

c) TestAmerica has "Open Door" and "Open Line" Policies which enable every TestAmerica employee to have free access to the respective Manager and Corporate Officers. Such Open Door Policies are intended to foster two-way communications and provide each employee with access to Laboratory and Corporate Management. Such Policies are also intended to encourage each employee to consider it his or her duty and responsibility to "come forward". Any employee who disagrees with or has a concern or question about any Company practice, process, procedure, or policy, or about any Supervisory/Managerial request, instruction, or directive should come forward. This includes concerns about any undue pressures placed upon an employee which adversely affects the quality of work produced. Such contact should be made to members of Laboratory or Corporate Management. Any contacts with a Manager or representative of Corporate shall be treated as "confidential", within the confines of any legal requirements placed upon the Company, if the employee so requests. The employee may also contact their Human Resources representative.

d) No employee of TestAmerica will compare or disclose results for any Performance Testing (PT) sample, or other similar QA or QC requirements, with any employee of any other laboratory, including any other TestAmerica laboratory, prior to the required submission date of the results to the person, organization, or entity supplying the PT sample.

1.4 TestAmerica Code of Ethical Conduct Agreement

I. I understand that I am charged with meeting ethical standards in performing all of my duties and responsibilities;

II. I have been formally instructed to consider quality as an important aspect of my job responsibilities. The provisions of the "Ethics Policy and Code of Ethical Conduct" have also been reviewed with me. In as much, it is understood that ethical performance and data integrity must supersede any other operational objective.

III. I also agree to the following:

a) I shall not report data inconsistent with actual values observed or measured.

b) I shall not modify data (either sample or QC data) unless the modification can be technically justified through a measurable analytical process, such as one deemed acceptable to the

laboratory's Standard Operating Procedures, Quality Assurance Manual or Technical Director. All such modifications must be clearly and thoroughly documented in the appropriate laboratory notebooks/worksheets and/or raw data and include my initials or signature and date.

c) I shall not intentionally report dates and times of analyses that do not represent the true and actual dates and times the analyses were conducted.

d) I shall not intentionally represent another individual's work as my own or represent my work as someone else's.

e) I shall not make false statements to, or seek to otherwise deceive, members of Management or their representatives, agents, or clients/customers. I will not, through acts of commission, omission, erasure, or destruction, improperly report measurement standards, quality control data, test results or conclusions.

f) I shall not condone any accidental or intentional reporting of inauthentic data by other employees and will immediately report its occurrence. If I have actual knowledge of such acts committed by any other employees, and I do not report such information to designated members of Management, it shall be considered as serious as if I personally committed the offense. Accordingly, in that event, I understand that I may be subject to immediate termination of employment.

g) I shall immediately inform my supervisor or other member of management regarding any intentional or unintentional reporting of my own inauthentic data. Such report shall be given both orally and in writing to the supervisor or other member of management contacted and to the local Quality Assurance Officer/Manager. The Quality Assurance Officer/Manager will initial and date the information and return a copy to me.

h) I shall not accept gifts of a value that would adversely influence judgment.

i) I shall avoid conflicts of interest and report any potential conflicts to the management (e.g. employment or consulting with competitors, clients, or vendors)

j) I shall not participate in unfair competition practices (e.g. slandering competitors, collusion with other labs to restrict others from bidding on projects)

k) I shall not misrepresent certifications and status of certifications to clients or regulators

l) I shall not intentionally discharge wastes illegally down the drain or onto the ground.

m) I shall protect confidential client information, business information and trade secrets that are vital to the interests and the success of TestAmerica. Such confidential information includes, but is not limited to the following: Client lists, client contact representatives, specific client/project information, pending projects and proposals, scientific data, SOPs, financial information and marketing strategies.

n) I understand that any attempt by management or an employee to circumvent these policies will be subject to disciplinary action.

I understand the critical importance of accurately reporting data, measurements, and results, whether initially requested by a client, or retained by TestAmerica and submitted to a client at a later date, or retained by TestAmerica for subsequent internal use.

I understand that if any supervisor, manager, or representative of management instructs, requests, or directs me to perform any of the aforementioned improper laboratory practices, or if I am in doubt or uncertain as to whether or not such laboratory practices are proper, I will not comply. In fact, I must report such event to all appropriate members of Management including, but not limited to, the Manager, all supervisors and managers with direct line reporting relationship between me and the Manager, and the local Quality Assurance representative, excluding such individuals who participated in such perceived improper instruction, request, or directive. In addition, I may contact Corporate Quality Assurance / Ethics Compliance Officer(s) for assistance.

The Ethics and Compliance Officers are:

- Ilona Taunton: ITaunton@TestAmericaInc.com (Located in Asheville, NC)

  Office: (828) 258-3746

  Cell: (828) 712-9242

- Scott Hoatson: SHoatson@TestAmericaInc.com (Located in Portland, OR)

  Office: (503) 906-9200

  Cell: (206) 714-2171

I should obtain a ruling, in writing, as to whether such practice is or is not improper and will abide by such ruling. However, if I have not received a timely ruling, or if I believe such ruling is incorrect, I may appeal to the Division Exec VP/COO or President/CEO and will abide by such written ruling.

I understand that if my job includes supervisory responsibilities, I shall not instruct, request, or direct any subordinate to perform any laboratory practice which is unethical or improper. Also, I shall not discourage, intimidate, or inhibit an employee who may choose to appropriately appeal my supervisory instruction, request, or directive which the employee perceives to be improper, nor retaliate against those who do.

I have read and fully understand all provisions of the "Ethics Policy and Code of Ethical Conduct" and realize that even one instance of variance from the above Code of Ethical Conduct will result in discipline, up to and including termination of employment. I have also viewed the 2005/2006 Ethics Presentation.

_____ _____

(Dated) (Employee's Signature)

_____

(Print Name)

_____

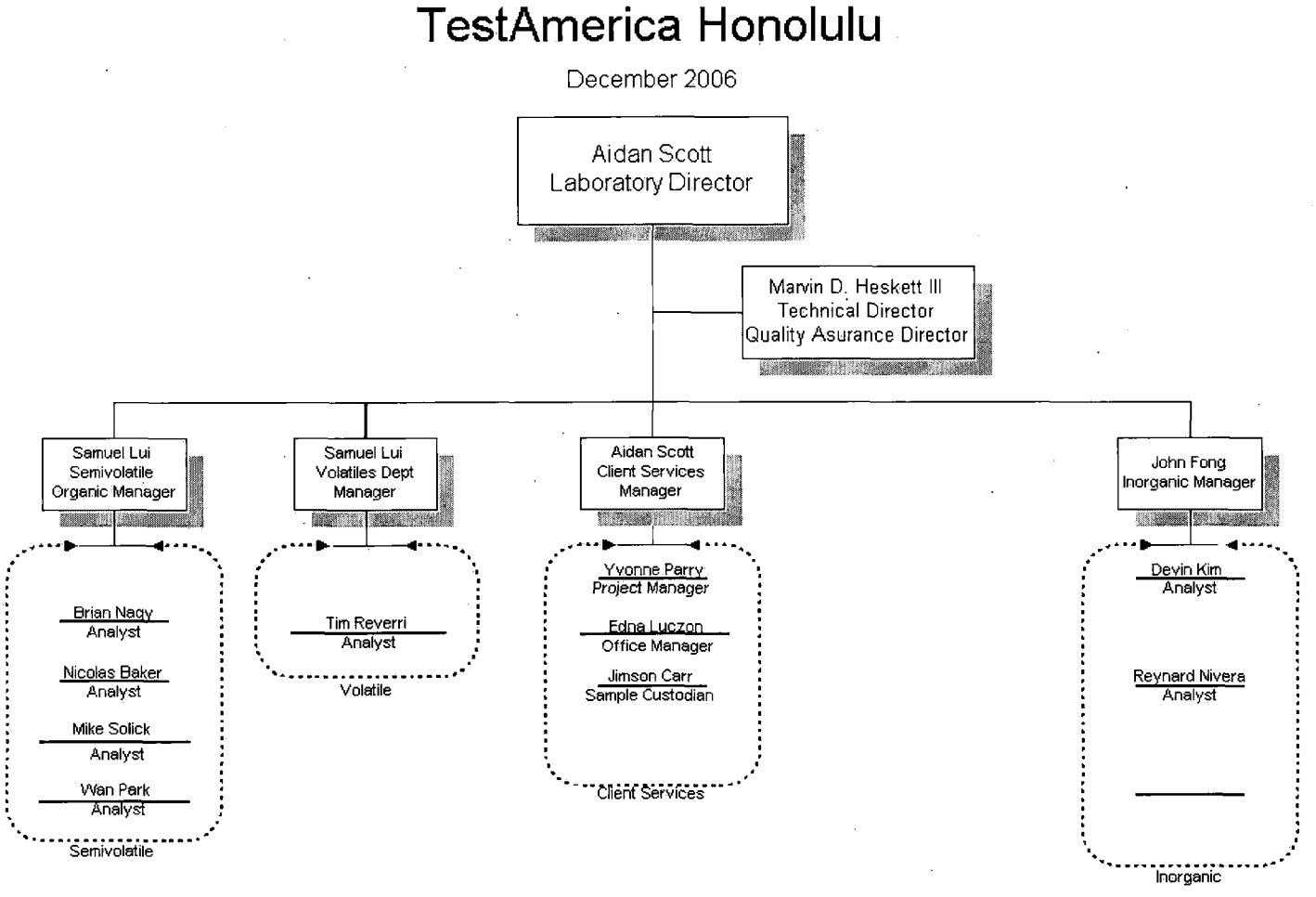
(If applicable, Employee ID Number)

NOTE: This Ethics Policy and Code of Ethical Conduct must be signed at the time of hire (or within 2 weeks of an employee's initial receipt of this Policy, if later) and re-signed annually. Such signature is a condition of continued employment. Failure to sign will result in immediate termination of employment.

2/06

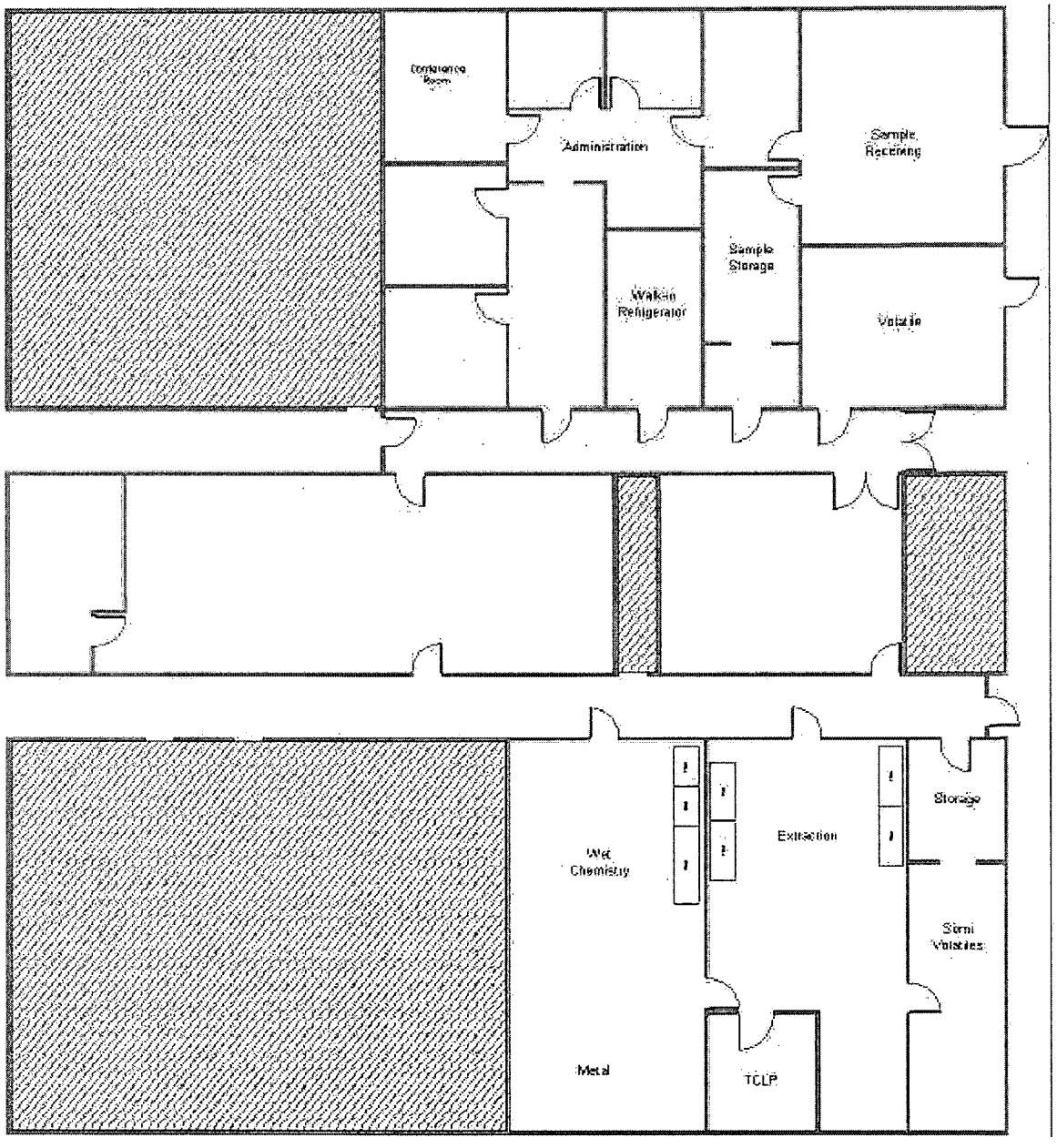
Appendix 2

Laboratory Organization Chart



Appendix 3

Laboratory Floor Plan



Appendix 4

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[3]	Corrective Action[4]
SW8081 SW8082	Minimum five-point initial calibration for all target analytes[2]	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	Linear regression correlation coefficient $r^2 \geq 0.99$, r = 0.995. RSD of CF = 20%	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source	Once immediately following initial calibration	All target analytes within 15% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RT Window[7].	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Breakdown check (Endrin and DDT)[1]	Before sample analysis	Degradation ≤15% for either Endrin or DDT.	Inlet/column maintenance; repeat breakdown check and re-analyze all samples since last successful breakdown check.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ ½ RL or MDL, whichever is greater[5]	Correct problem then re-prep[6] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes, must be from a 2nd source.	One per prep batch, not to exceed 20 samples in a batch.	See QC Limit Summary	Re-prep[6] and analyze the LCS and all samples in the affected analytical batch
	Surrogate(s)	Every sample, spike, standard, and method blank	See QC Limit Summary	Check system, re-inject, re-extract[6]
	MS/MSD, must be from a 2nd source. Rotate Aroclors each quarter.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See QC Limit Summary	None (LCS is used to determine if data is acceptable).
	Second-column confirmation	100% for all positive results for Pest compounds except Chlordane and Toxaphene. Aroclors when analyzed by DOD-QSM	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 20 for how to calculate RTW's).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW at the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. If questions, see the supervisor or technical director.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 --8081A only
2 – Method 8082, a five-point calibration is only analyzed for Aroclors 1016 and 1260.
3 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
4 - All abnormalities must be noted on the data in LIMS.
5 - Report all target compounds identified in the method blank above the MDL.

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6 - If unable to re-extract the samples because of insufficient sample volume or holding time has expired, then place a comment in LIMS.
7 - The mean of all calibrated compounds may be used, but all compounds above the 15% must be noted in LIMS on each sample.

Appendix 4: Summary of Calibration and QC Procedures for GC/MS Organics

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
SW8260 SW8270	Check of mass spectral ion intensities[1], i.e., Tune	Prior to initial calibration or Continuing calibration verification, every 12 hours	Refer to criteria listed in the method SOP for Tune criteria, including DDT, Benzidene and Pentachlorophenol requirements for 8270.	Retune the instrument and verify (instrument maintenance may be needed).
SW8260	Minimum five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	SPCCs average RF ≥ 0.30 or 0.1 depending on the compound and %RSD for RFs for CCCs ≤ 30% and all other target analytes %RSD for RF ≤ 15%.	Correct problem then repeat initial calibration
SW8270			SPCCs average RF ≥ 0.050 and %RSD for RFs for CCCs ≤ 30% and all other target analytes %RSD for RF ≤ 15%.	Correct problem then repeat initial calibration
SW8260 SW8270			*option (if %RSD is > 15%)*–linear regression $r^2 \geq 0.99$, r = 0.995.	If the calibration is not considered linear by either %RSD or linear regression, then correct the problem and re-calibrate.
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following five-point initial calibration	All analytes within 20% of expected value	Correct problem then repeat initial calibration
	Relative Retention time window	Each sample	Relative retention time (RRT) of the analyte within 0.06 RRT units of the RRT of the internal standard	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
SW8260	Continuing calibration verification (CCV)	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF ≥ 0.30 or 0.1 depending on the compound; and	Correct problem then repeat initial calibration and re-analyze all samples since last successful CCV.
SW8270			SPCCs average RF ≥ 0.050; and	
SW8260 SW8270	Continuing calibration check		CCCs: ≤20% difference (when using RFs) or drift (when using least squares regression). **All other target compounds ≤20%, up to 5 non-CCC target compounds, may fail this requirement provided the % difference is = 40%.**	

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Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
SW8260 SW8270	Method blank	One per analytical prep batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[4]	Correct problem then re-prep[5] and analyze method blank and all samples processed with the contaminated blank
SW8260 SW8270	Internal Standards	Every sample/standard and blank	Retention time ±30 seconds from retention time of the mid-point std. in the CCV/ICAL (sample/standard). EICP area within -50% to +100% of ICAL mid-point std for the CCV and –50% to +100% of the prior CCV for the samples.	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning (dilution of the sample may be required, see the supervisor or the technical director for advice).
	LCS for all analytes, must be from a 2nd source.	One per prep batch, not to exceed the 20 samples in a batch.	See QC Limit Summary	Correct problem then re-prep[5] and analyze the LCS and all samples in the affected analytical batch
	MS/MSD, must be from a 2nd source.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See QC Limit Summary	None (the LCS is used to evaluate to determine if the batch is acceptable).
	Surrogate(s)	Every sample, spike, standard, and blank	See QC Limit Summary	Check system, re-analyze, re-prep[5]
SW8260	pH check	All 8260 water samples.	PH =2.	If the pH is > 2, then comment the data, in the LIMS.
SW8260	Residual chlorine check (North Carolina samples only)	Each sample.	Residual chlorine should be negative.	If the residual chlorine is positive, then comment the data, in the LIMS.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 – SW8260B requires BFB; SW8270C requires DFTPP
2 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
3 - All abnormalities must be noted on the data and in LIMS.
4 - Report all target compounds identified in the method blank above the MDL.
5 - If unable to re-prep samples because of insufficient sample volume or the holding time has expired, then place a comment in LIMS.

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Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
SW8021 SW8015[5]	Five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF </= 20% Linear – least squares regression $r^2 \geq 0.99$, r = 0.995	Correct problem then repeat initial calibration
	Initial calibration verification (ICV), must be from a 2nd source.	Immediately following five-point initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	LCS for all analytes, must be from a 2nd source.	One per prep batch, not to exceed 20 samples in a batch.	See QC Limit Summary	Re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RTW.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ ½ RL or MDL, whichever is greater[3]	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	Surrogate	Every sample, spiked sample, standard, and method blank	See QC Limit Summary	Check system, re-analyze, re-prep[4]
	MS/MSD, must be from a 2nd source.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See QC Limit Summary	None (LCS is used to determine if data is acceptable).
	GC/MS confirmation.	At the clients request or analyst judgement.		
	Retention time window calculated for each analyte (see section 20 for how to calculate RTW's).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
8021	pH Check	All water samples after analysis.	pH should be less than 2.	If pH is > 2, then place a comment on the worklist and in LIMS.
8021	Residual chlorine check (North Carolina samples only)	All water samples after analysis.	Residual chlorine should be negative.	If residual chlorine is positive, place comment on the worklist, on in the PIPE database, and in LIMS.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information. 2 - All abnormalities must be noted on the data in LIMS. 3 - Report all target compounds identified in the method blank above the MDL.
4 - If unable to re-prep the samples because of insufficient sample volume or holding time has expired, then place a comment in LIMS.
5 - For GRO and DRO, see state specific SOP/Method for acceptance criteria. If there is not a specific method for that state, then follow the acceptance criteria in this table.

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Appendix 4: Summary of Calibration and QC Procedures for Method SW6010B

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW6010B	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	N/A	N/A
	Second-source calibration verification (ICV)	Daily after initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	Calibration blank (CB)	After every continuing calibration verification	Must be <3 times the IDL or the average of 3 CB must be <3 times the IDL.	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10% of expected value and RSD of replicate integrations <5%	Repeat calibration and re-analyze all samples since last successful calibration
	Method blank	One per prep batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[1]	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICS)	At the beginning of an analytical run	Within 20% of expected value	Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	LCS	One per prep batch	See QC Limit Summary	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	MS/MSD	One per batch per matrix	See QC Limit Summary	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	Dilution test	Each new sample matrix	1:5 dilution must agree within 10% of the original determination	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails	Recovery within 25% of expected results	Correct problem then re-analyze post digestion spike addition

1 – Report all targets identified in the method blank above the MDL.

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Appendix 4: Summary of Calibration and QC Procedures for Method SW7196A

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW7196A	Initial calibration (minimum three standards and a blank)	Initial calibration prior to sample analysis.	$r^2 = 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Immediately following initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Beginning and after every 10 samples and at the end of the analysis sequence	All analytes within 20% of expected value	Correct problem then repeat initial calibration and re-analyze all samples since last successful calibration
	Verification check to ensure lack of reducing condition and/or interference	Once for every sample matrix analyzed	Spike recovery between 85-115%	If check indicates interference, dilute and re-analyze sample persistent interference indicates the need to use and alternate method
	Method blank	One per prep batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[1]	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	MS/MSD	One per 20 samples per matrix	See QC Limit Summary	none
	LCS	One per batch	See QC Limit Summary	Re-prep, re-analyze all affected samples.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

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Appendix 4: Summary of Calibration and QC Procedures for Method SW7470A/SW7471A

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW7470A SW7471A	Initial calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 = 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Immediately following initial daily calibration	Analytes within 10% of expected value	Correct problem then repeat initial calibration
	Calibration blank	Once per initial daily calibration	No analytes detected ≥ MDL	Correct problem then re-analyze calibration blank and all samples associated with blank
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	Analytes within 20% of expected value	Correct problem then repeat calibration and re-analyze all samples since last successful calibration
	Method blank	One per prep batch	No analytes detected ≥ ½ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	LCS	One per prep batch	See QC Limit Summary	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	Dilution test; five-fold dilution test	Each preparatory batch	Five times dilution sample result must be ±10% of the undiluted sample result	Perform post digestion spike addition
	Recovery test	When dilution test fails	Recovery within 85-115% of expected results	Dilute the sample; re-analyze post digestion spike addition
	MS/MSD	One per batch per matrix	See QC Limit Summary	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

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Appendix 4: Summary of Calibration and QC Procedures for Gravimetric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA160.1 (TDS) SM2540 C (TDS) EPA160.2 (TSS)	Verification standard– single standard (if available)	Each batch	±10%	Repeat
EPA160.3 (TS) EPA160.4 (TVS) ASTM D482-87 (Ash) SW1110 (Corrosivity) ASTM D2974-87D (FOM) SM2540 G (Moisture) ASTM D1475 (Density)	Method blank	Each batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[1]	Repeat, rerun
	Duplicate	Each batch, less than 20	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Summary of Calibration and QC Procedures for Titrimetric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA305.1: Acidity.	Verification standard– single standard (if available)	Each batch	±10%	Repeat, check
EPA310.1: Alkalinity. SM2320: HCO_3-, CO_3^{-2}. SM4500-CO_2 C: CO_2.	Method blank	Each batch	No analyte detected = ½ report limit or MDL, whichever is greater[1]	Repeat batch
	Duplicate	Each batch	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Spectrophotometric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA350.1: NH_3.	Calibration curve – minimum 5 point	Initial. Perform re-calibration once per year minimum.	RSD <10%, $r^2 \geq 0.99$, r = 0.995	Recalibrate
EPA410.4: COD. EPA325.1/325.2: Cl^- SW9250/ 9251: Cl^-. EPA330.5: Cl_2 Res.	Independent calibration verification – mid-level, second-source required (ICV)	Immediately following initial calibration.	±10%	Recalibrate
EPA218.4/SW7196A: Cr^{+6}.	Continuing calibration verification (CCV)	Beginning, every 10 samples, and at end of sequence	±10%	Correct, recalibrate
EPA375.4: SO_4^{-2}. SW9038: SO_4^{-2}. EPA376.2: S^{-2}.	MS/MSD	Each batch, less than 20	RSD < ±20%	None
	LCS	Each batch	± 10%	Rerun
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Electrometric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA405.1: BOD[1], CBOD[1]. EPA120.1: Cond. SW9050A: Cond. EPA360.1: DO[1].	Calibration Curve – minimum of 5 standards	Initial Calibration. Perform re-calibration once per year minimum	±10%, r^2 = 0.99, r = 0.995.	Recalibrate
EPA340.2: F^-.	Independent calibration verification (second source) (ICV)	Immediately after initial calibration	±10%	Recalibrate
SW9214: F^-. EPA150.1: pH. SW9040B, 9045C:pH.SM2580: ORP[1].	Continuing calibration verification (CCV)	Beginning, every 10 samples, and end of batch	±10%	Rerun
EPA180.1: Turbidity.	Method blank	Each batch	No analyte detected = ½ report limit or MDL, whichever is greater[2]	Reprep
	LCS	Each batch	±10%	Rerun batch
	MS/MSD	Each batch	± 20%	None
	Duplicate	When spike not available	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

[1]Calibration curve does not apply.
2 - Report all targets identified in the method blank above the MDL.

Summary of Calibration and QC Procedures for Oil & Grease Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA1664A SW9070. SW9071A.	Verification standard	Single standard	±10% PAR standard	Rerun
	Method blank	Each batch	No analyte detected = ½ report limit or MDL, whichever is greater[1]	Repeat batch
	LCS	Each batch	See QC Limit Summary	Repeat batch
	MS/MSD	Each batch	See QC Limit Summary	None, use LCS
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

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Appendix 4: Summary of Calibration and QC Procedures for Physical Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW1010: Flash Point. ASTM E711, D3286: BTU. EPA110.2: Color (Pt/Co). ASTM D4982B: Solids Ignt. EPA140.1: Odor. SW9095A: Paint Filter. EPA160.5: Settleable Solids.	Method blank	Each batch	No analyte detected = ½ report limit or MDL, whichever is greater[1]	Repeat, rerun
	Two standards for Flash Point One standard for BTU 1 Known for Settleable Solids Method-specific standards for Color.	Each batch	±10%	Rerun batch
	Duplicate	Each batch	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

[1]Report all targets identified in the method blank above the MDL.

Appendix 5

Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analytical Detection Limit:
The smallest amount of an analyte that can be distinguished in a sample by a given measurement procedure throughout a given (e.g., 0.95) confidence interval. (applicable only to radiochemistry)

Assessor Body:
The organization that actually executes the accreditation process, i.e., receives and reviews accreditation applications, reviews QA documents, reviews proficiency testing results, performs on-site assessments, etc., whether EPA, the State, or contracted private party. (NELAC)

Accrediting Authority Review Board (AARD):
Five representatives from the Territories, States, EPA, and/or other Federal Agencies, appointed by the NELAP Director, in consultation with the NELAC Board of Directors, for the purpose of reviewing the processes and procedures used by EPA to approve accrediting authorities in accordance with NELAC standards. (NELAC) [1.6.3]

Analyst:
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Assessment:
The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Assessment Criteria:
The measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)

Assessment Team:
The group of people authorized to perform the on-site inspection and proficiency testing data evaluation required to establish whether an applicant meets the criteria for NELAP accreditation. (NELAC)

Assessor:
One who performs on-site assessments of accrediting authorities and laboratories' capability and capacity for meeting NELAC requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested. (NELAC)

Audit:
A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch:
See Section 11. (NELAC Quality Systems Committee)

Blank:
See Section 11. (ASQC)

Blind Sample:
See Section 11. (NELAC)

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

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

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
See Section 11. Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures

(NELAC)

Conformance:
An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Contributor:
A participant in NELAC who is not a Voting Member. Contributors include representatives of laboratories, manufacturers, industry, business, consumers, academia, laboratory associations, laboratory accreditation associations, counties, municipalities, and other political subdivisions,

other federal officials not engaged in environmental activities, and other persons who are interested in the objectives and activities of NELAC> (NELAC) [Art III, Const]

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Detection Limit:
See Section 11. (NELAC)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
See Section 11. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA):
The enabling legislation under 7 U.S.C. 135 et seq., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides. (NELAC)

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Finding:
An assessment conclusion that identifies a condition having a significant effect on an item or activity. As assessment finding is normally a deficiency and is normally accompanied by specific examples of the observed condition. (NELAC)

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Inspection:
An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Interdependent Analytes:
Analytes analyzed using methods in which the ability to correctly identify and quantitate a series of analytes is indicative of the laboratory's ability to correctly determine the presence or absence of similar analytes. (NELAC) [2.C5.1]

Internal Standard:
See Section 11. (NELAC)

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory:
A defined facility performing environmental analyses in a controlled and scientific manner. (NELAC)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
See Section 11. (NELAC)

Laboratory Duplicate:
See Section 11. (NELAC)

Limit of Detection (LOD):
See Section 11. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

LIMS Raw Data (LRD):
LRD are original observations recorded by the LIMS that are needed to verify, calculate or derive data that are or may be reported. Original observations mean the first occurrence of human-readable information. The media to which the LRD are first recorded is the LRD storage media. The media may be paper, magnetic or optical storage media.

As an example: *Person A* places a sample into a laboratory instrument that analyzes the sample and transmits signals to a personal computer (PC). The PC software captures the signals, analyzes them and displays a graphical representation of the analyzed signals on the monitor. *Person B* examines the graphic, concludes it is realistic and then issues a command to the PC software to record the analyzed data on a disk. The data stored on the disk are the LRD and the disk is the LRD storage medium. The instrument, communications components, PC, PC software, monitor, recording device and disk are a LIMS. Alternatively, *Person B* could issue a command to first record the analyzed signal to paper before it is recorded to disk. In this case, the paper is the LRD storage medium.

Manager (however named):
The individual designed as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with ,15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with .15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):
See Section 11. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
See Section 11. (QAMS)

Method Blank:
See Section 11. (NELAC)

Method Detection Limit:
See Section 11. (40 CFR Part 136, Appendix B)

National Environmental Laboratory Accreditation Conference (NELAC):
A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP):
The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards:
The plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

Non-interdependent Analytes:
Analytes that are analyzed using methods in which the ability to correctly identify and quantitate a series of analytes in a sample is not indicative of the laboratory's ability to correctly identify and quantitate similar analytes. (NELAC) [2.C.5.2]

Objective Evidence:
Any documented statement of fact, other information, or records, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measures, or tests that can be verified. (ASQC)

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Primary Accrediting Authority:
The agency or department designated at the Territory, State, or Federal level as the recognized authority with responsibility and accountability for granting NELAC accreditation for a specified field of testing. (NELAC) [1.5.2.3]

PT Fields of Testing:
NELAC's approach to offering proficiency testing by regulatory or environmental program, matrix type, and analyte. (NELAC)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol:
A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (EPA-QAD)

Pure Reagent Water:
Shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:
See Section 11. (EPA-QAD)

Reagent Blank (method reagent blank):
See Section 11. (QAMS)

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method:
A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement:
Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal. (NELAC)

Resume:
The summary (usually written) of an individual's relevant technical and management experience, including training. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Secondary Accrediting Authority:
The Territorial, State, or Federal Agency that grants NELAC accreditation to laboratories, based upon their accreditation by a NELAP-recognized Primary Accrediting Authority. See also Reciprocity and Primary Accrediting Authority. (NELAC) [1.5.2.3]

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike:
See Section 11. (NELAC)

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named):
The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties, and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate:
See Section 11. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director:
Individuals(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)
Test:
A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process, or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method:
An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Testing Laboratory:
A laboratory that performs tests. (ISO/IEC Guide 2-12.4)

Test Sensitivity/Power:
The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the

selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Toxic Substances Control Act (TSCA):
The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

United States Environmental Protection Agency (EPA):
The Federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation:
The process of substantiating specified performance criteria. (EPA-QAD)

Verification:
Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)
NOTE:
In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell:
A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Acronyms:

CAR – Corrective Action Report
CCV – Calibration Verification
CF – Calibration Factor
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry

HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QAO – Quality Assurance Officer
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

21.1.1 Definitions

21.1.1.1 Traceability: The property of a measurement result whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons. (*NELAC June 2003*) It is characterized by six essential elements:(1) an unbroken chain of comparison); (2) a calculated measurement uncertainty for each step in the chain to allow for an overall uncertainty calculation; (3) documentation of each step in each calibration report; (4) all steps in the chain performed by individuals with evidence of technical competence and accredited by a recognized accreditation body; (5) reference to International Standard (SI) units; and (6) recalibration at appropriate intervals to preserve traceability.

21.1.1.2 Calibration: Determining and documenting the deviation of the indication of a measuring instrument (or the stated value of a material measure) from the conventional 'true' value of the measured value.

21.1.1.3 Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

21.1.1.4 External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

21.1.1.5 Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

21.1.1.6 Instrument Response: Instrument response is normally expressed as either peak area or peak height however it may also reflect a numerical representation of some type of count on a detector (e.g. Photomultiplier tube, or Diode array detector) and is used in this SOP to represent all types.

21.1.1.7 Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

2nd Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99

Appendix 6

Laboratory Certification/Recognition

Laboratory Certifications, Accreditations, Validations

TestAmerica Honolulu maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number	Organization	Certificate Number
NELAC	E87907-04		
State of Hawaii DOH	HI00914		

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, the final report review table, and in the following offices: QA, marketing, and project management.

Claims of Accreditation Status

TestAmerica Honolulu has agreed to make only valid claims as to its accreditation/certification status by any authority by ensuring that the expiration dates are not exceeded and the method-specific scope or parameter lists are supportable, as required by each. Any false claims would be reported to that authority. The agreement covers the use of the authority's name, such as "Authority-Accredited," logo, or certificate number. The only valid proof of accreditation/certification is the current certificate and scope of the authority. It is the responsibility of the laboratory to make

these documents available to all staff, and it is the staff's duty to reference only the current documents.

A report with scope and non-scope analytes may only be presented on the same report if the non-accredited results are clearly and unambiguously identified. No report with non-scope analytes may be associated with the logo, "Authority accredited" phrase, or the certificate number. Only the analytes specified by a unique method are valid within the scope. There shall be no intentional misleading of the users of the laboratory's services in this regard.

No opinions and/or interpretations based on results outside the laboratory's scope may be presented on a document referenced by "Authority-accredited, the logo, or the certificate number. If these are made, they must be written in a separate letter which is not endorsed by the authority.

The "Authority-accredited" logo may only be affixed to equipment calibrated by a laboratory that is accredited by the authority. If calibration labels contain the logo, they must also show the calibration laboratory's name or its certificate number, the instrument's unique identification, the date of the last calibration, and a cross-reference to the last calibration certificate.

Should the company decide to use the "Authority-accredited" logo in marketing activities, no misrepresentation may occur. Only reference to the accredited scope at a specific laboratory site is allowed. If any "Authority-accredited" language is used in proposals or quotations, any non-scope analytes must be clearly denoted as not accredited by that authority. The same is true for any use of laboratory letterhead with the "Authority-accredited" wording or logo. The logo may not be affixed to any material, item, product, part, or packaging, thereby implying accreditation status to that piece. In literature, any use of the logo must be positioned adjacent to the accredited laboratory's name and clearly state that the presence of the logo does not imply certification/approval of the products tested. At no time may the logo appear to suggest that a person is accredited. Misrepresentation of accreditation status is never allowed and must be reported if it occurs. If in doubt, the idea of the logo's use may be presented to the authority for approval.

If accreditation is terminated or suspended, the laboratory will immediately cease to use the "Authority-accredited" wording, the logo, or the certificate number reference in any way and inform clients impacted by the change.

Appendix 7

Data Qualifiers

B	Analyte was detected in the associated Method Blank.
B1	Analyte was detected in the associated method blank. Analyte concentration in the sample is greater than 10x the concentration found in the method blank.
B2	Non-target analyte detected in method blank and sample, producing interference.
B3	Target analyte detected in calibration blank at or above the method reporting limit.
B4	Target analyte detected in blank at/above method acceptance criteria.
B5	Target analyte detected in method blank at or above the method reporting limit, but below the trigger level or MCL.
B6	Target analyte detected in calibration blank at or above the method reporting limit, but below the trigger level or MCL.
BQC	Reported for batch QC purposes only. See re-analysis (RE) for final result.
BQC1	Reported for batch QC purposes only. See original analysis for final result.
C	Calibration Verification recovery was above the method control limit for this analyte. Analyte not detected, data not impacted.
C1	Calibration Verification recovery was above the method control limit for this analyte, however the average % difference for all analytes met method criteria. See Calibration Summary form. [Custom Value]
C2	Calibration Verification recovery was below the method control limit for this analyte, however the average % difference for all analytes met method criteria. See Calibration Summary form. [Custom Value]
C4	Calibration Verification recovery was below the method control limit for this analyte.
C5	Calibration Verification recovery was below the method control limit for this analyte. An additional check standard was analyzed at the reporting limit to ensure instrument sensitivity at the reporting limit. Samples ND.
C6	CCV recovery was below method acceptance limits. The sample could not be reanalyzed due to insufficient sample.
C7	Calibration Verification recovery was below the method control limit due to matrix interference carried over from analytical samples. The matrix interference was confirmed by reanalysis with the same result.
C8	Calibration Verification recovery was above the method control limit for this analyte. A high bias may be indicated.
CBP	Calibration verification recovery for this analyte is outside of limits as stated in BP-GCLN Technical Requirements however the calibration verification meets the requirements as stated in the analytical method.
CIG	The % RSD for this compound was above 20%. The average % RSD for all compounds in the calibration met the 20% criteria specified in EPA method 8000B. See the attached Initial Calibration Criteria form.
CIN	The % RSD for this compound was above 15%. The average % RSD for all compounds in the calibration met the 15% criteria specified in EPA methods 8260B/8270C. See the attached Initial Calibration Criteria form.
CF1	Confirmatory analysis not performed as required by the method.
CF2	Confirmatory analysis was past holding time.
CF5	The sample was originally analyzed with a positive result, however the reanalysis did not confirm the presence of the analyte.
CF6	Results confirmed by reanalysis.
cl	Compound reported based on total Chlordane result being less than the reporting limit.

CN1	The cyanide value was greater after chlorination than before chlorination due to the sample matrix. An additional Weak Acid Dissociable Cyanide analysis was performed.
CN2	The cyanide value was greater after chlorination than before chlorination due to the sample matrix.
CN3	Reactive cyanide results reported from total determination method.
CN4	Amenable cyanide results reported from total determination method.
CR	The carbon range of the fuel found in the sample = [Custom Value]
CSTM	[Custom Value]
DNQ	Detected but not quantified.
DR	Sample dried prior to screening.
E	Concentration exceeds the calibration range and therefore result is semi-quantitative.
E1	Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.
E3	Concentration estimated. Analyte exceeded calibration range. Reanalysis not peformed due to holding time requirements.
FT	This analysis was performed in the field by the sampler whose name appears on the attached Chain of Custody form.
H	Sample analysis performed past method-specified holding time.
H1	Sample analysis performed past the method-specified holding time per client's approval.
H2	Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
H3	Sample was received and analyzed past holding time.
H4	Sample was extracted past holding time, but analyzed within analysis holding time.
H5	The sample was prepared outside of the required 8 hour holding time, however it was stored at >0° and <4°C and prepared within the method allowed 24 hour holding time.
H6	The sample was received at the laboratory either past, or with insufficient time remaining on, the required 8 hour holding time. However, it was stored at >0° and <4°C and prepared within the method allowed 24 hour hold time.
H8	The sample was extracted past the holding time.
H9	Sample analysis performed past the EPA recommended holding time.
HTI	The holding time for this test is immediate. The laboratory measurement, therefore, may not be suitable for compliance purposes.
I	Internal Standard recovery was outside of method limits. Matrix interference was confirmed by reanalysis.
ID	Due to the low levels of analyte found in the sample, the analyte was qualitatively identified based on the compound's retention time and the presence of a single mass ion.
ID2	Secondary ion abundance outside of method requirements. Identificaiton based on analytical judgment
ID3	Due to matrix unable to resolve Benzofluoranthene isomers. Value reported only in Benzo(b) category represents Total Benzo(b+k)fluoranthene.
ID4	Benzo(j)fluoranthene coelutes with Benzo(k)fluoranthene. The reported result is a summation of the isomers and the concentration is based on the response factor of Benzo(k)fluoranthene
ID5	Benzo(e)pyrene concentration is based on the response factor of Benzo(a)pyrene, and has not been calibrated independently.
J	Estimated value. Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). The user of this data should be aware that this data is of limited reliability.
J1	Due to matrix interference, estimated data below the PQL can not be determined.

K	The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criteria of at least 2 mg/l. Therefore the reported result is an estimated value only.
K1	The sample dilutions set up for the BOD analysis failed to meet the criteria of a residual dissolved oxygen of at least 1 mg/L. Therefore the reported result is an estimated value only.
K2	The seed depletion was outside the method acceptance limits. Therefore, the reported result is an estimated value only.
K3	The dilution water D.O. depletion was > 0.2 mg/L.
K4	The seed depletion was not within method recommended limits. The LCS, which is a means of checking dilution water quality and seed effectiveness, was within acceptance limits. The acceptable LCS demonstrates that the data is valid.
K5	Residual chlorine detected. Sample dechlorinated prior to analysis.
L	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was above the acceptance limits. Analyte not detected, data not impacted.
L1	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was above acceptance limits.
L2	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was below acceptance limits.
L4	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was below the acceptance limits. A low bias to sample results is indicated.
L5	Analyte recovery outside of specified criteria. Individual analyte criteria exceedences allowed for multi-component analyses without disqualification of data per NELAC Standard, DOD QSM and/or AFCEE QAPP.
L6	Per the EPA methods, benzidine is known to be subject to oxidative losses during solvent concentration.
M1	The MS and/or MSD were above the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
M3	Results exceeded the linear range in the MS/MSD and therefore are not available for reporting. The batch was accepted based on acceptable recovery in the Blank Spike (LCS).
M4	The sample required a dilution due to matrix interference. Because of this dilution, the matrix spike concentrations in the sample were reduced to a level where the recovery calculation does not provide useful information. See Blank Spike (LCS).
M5	Due to CCV failure, the MS/MSD results were not available for reporting. The batch was accepted based on acceptable recovery in the Blank Spike (LCS).
M6	Any analyte not run due to matrix
M7	The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
M9	Matrix Spike recovery was high. Data Reported per ADEQ policy 0154.000
M10	Matrix Spike recovery was low. Data Reported per ADEQ policy 0154.000
M11	The MS and/or MSD were above the acceptance limits. See calibration verification (CCV)
M12	The MS and/or MSD were below the acceptance limits. See calibration verification (CCV)
M13	The sample spiked had a pH of less than 2. 2-Chloroethylvinylether degrades under acidic conditions.
MCP	No results were reported for the MS and/or MSD due to a clogged autosampler port. Batch was accepted based on Blank Spike (LCS) recoveries.

MEN	Unspiked sample results were determined from the sample portion received in an Encore sampler. The sample portions used for the MS/MSD were taken from an additional sample sleeve due to an insufficient number of Encore samplers supplied.
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).
MNR	No results were reported for the MS/MSD. The sample used for the MS/MSD required dilution due to the sample matrix. Because of this, the spike compounds were diluted below the detection limit.
MNR1	There was no MS/MSD analyzed with this batch due to insufficient sample volume. See Blank Spike/Blank Spike Duplicate.
MNR2	Insufficient sample received to meet method QC requirements. See case narrative.
MNR3	Insufficient sample received to meet method QC requirements.
N1	See case narrative.
N2	See corrective action report.
Neg	The reported result is a negative value.
NFP	Non-fuel pattern present.
P	The sample, as received, was not preserved in accordance to the referenced analytical method.
P1	Sample received and analyzed without chemical preservation.
P2	Sample received without chemical preservation, but preserved by the laboratory.
P3	Sample was received above recommended temperature.
P4	Sample received in inappropriate sample container.
P5	Insufficient sample received to meet method QC requirements.
P6	Sample received unpreserved, however the sample was analyzed within 7 days per EPA recommendation.
P7	Sample filtered in lab.
P8	Sample unable to be adjusted to correct pH due to matrix.
P9	This analyte has been shown to degrade upon preservation with HCl and cannot accurately be quantitated.
P-HS	Sample container contained headspace.
pH	pH = [Custom Value]
PassY	Pass
PassN	Not Pass
Q1	Does not match typical pattern
Q2	Typical pattern for diesel
Q3	The chromatographic pattern is not consistent with diesel fuel.
Q4	The hydrocarbons present are a complex mixture of diesel range and heavy oil range organics.
Q5	Results in the diesel organics range are primarily due to overlap from a gasoline range product.
Q6	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
Q7	The heavy oil range organics present are due to hydrocarbons eluting primarily in the diesel range.
Q8	Detected hydrocarbons in the gasoline range appear to be due to overlap of diesel range hydrocarbons.
Q9	Hydrocarbon pattern most closely resembles [Custom Value].
Q10	Hydrocarbon pattern most closely resembles a blend of [Custom Value].

Q11	Detected hydrocarbons in the diesel range do not have a distinct diesel pattern and may be due to heavily weathered diesel.
Q12	Detected hydrocarbons in the diesel range do not have a distinct diesel pattern and may be due to heavily weathered diesel or possibly biogenic interference.
Q13	Detected hydrocarbons do not have pattern and range consistent with typical petroleum products and may be due to biogenic interference.
QB	Quantitated against a Bunker C Oil standard.
QC4	Quantitation begun immediately before the retention time of tert-Butanol (TBA).
QCM	Quantitation begun immediately following the methanol peak.
QD	Quantitated against a diesel fuel standard.
QG	Carbon range C6-C12 quantitated against a gasoline standard.
QG1	Quantitated against a gasoline standard.
QJ	Quantitated against a jet fuel standard.
QM	Quantitated against a motor oil standard.
QMS	Quantitated against a mineral spirits standard.
QP	Hydrocarbon result partly due to individual peak(s) in quantitation range.
qr	Qualitative result based on chromatographic comparison with a known standard.
QS	Quantitated against a Stoddard solvent standard.
QSG	Silica Gel clean-up performed on extracts.
QT	Quantitated against a therminol standard.
QU	Unquantitated hydrocarbons present in the sample outside of the reported carbon range.
QV	The molecular weight of 100 was used to convert Volatile Fuel Hydrocarbons from mg/m3 to ppm by volume (ppmv).
R	The RPD exceeded the method control limit due to sample matrix effects. The individual analyte QA/QC recoveries, however, were within acceptance limits.
R1	The RPD between the primary and confirmatory analysis exceeded 40%. Per method 8000B, the higher value was reported.
R2	The RPD exceeded the acceptance limit.
R3	The RPD exceeded the acceptance limit due to sample matrix effects.
R4	Due to the low levels of analyte in the sample, the duplicate RPD calculation does not provide useful information.
R6	The RPD calculation does not provide useful information due to varying sample weights when Encore samplers are used.
R7	LFB/LFBD RPD exceeded the acceptance limit. Recovery met acceptance criteria.
R9	Sample RPD exceeded the laboratory control limit.
R10	The RPD between the primary and confirmatory analysis exceeded 40%. Per method 8000B, the lower value was reported due to apparent chromatographic problems.
R11	RPD exceeded the laboratory control limit. See case narrative.
RL1	Reporting limit raised due to sample matrix effects.
RL2	Reporting limit raised due to high concentrations of hydrocarbons.
RL3	Reporting limit raised due to high concentrations of non-target analytes.
RL4	Reporting limit raised due to insufficient sample volume.
RL5	Reporting limit raised due to high single peak analyte.
RL6	Reporting limit raised due to high toxaphene concentrations.
RL7	Sample required dilution due to high concentrations of target analyte.
S	Analyzed by standard addition.
S1	The correlation coefficient (r) from MSA for this analyte is less than 0.995.
S2	Compound is a common lab solvent and contaminant.
S3	Post digestion spike is out of acceptance limits for this analyte

S4	Sample was received by the laboratory with moisture in the charcoal tube. Sample results may be biased low.
S5	The fineness factor used to calculate the ECCE was determined by Servi-Tech Laboratories.
S6	Sediment present.
S7	Sample breakthrough to 2nd section is > 10%. Results may be biased low.
S8	Acid concentration not matched
S9	Unable to digest full amount of sample due to matrix problem.
S10	Insufficient sample available for reanalysis.
SB	Sustained burning when exposed to open flame.
SC	Analytical results not reliable due to potential sample container contamination.
SF	Reactive sulfide results reported from total determination method.
SR	Rogers Ratio is not applicable for this sample. Concentrations of Dissolved Gasses do not exceed PGE specified limits.
T1	Method approved by EPA, but not yet licensed by ADHS.
T3	Method not promulgated either by EPA or ADHS.
T4	The cited licensed method does not contain this analyte as part of the method compound list.
T5	Less than the prescribed sample amount was available to perform the leachate extraction. The volume of extraction fluid was adjusted proportionately based on the method prescribed ratio of extraction fluid to sample weight.
T6	The temperature during the 18 hour TCLP extraction exceeded the 21-25 degrees C range stated in EPA Method 1311. The temperature range during the extraction was [Custom Value] degrees C.
T7	Tentatively identified compound. Concentration is estimated based on the closest internal standard.
TMP	Temperature taken in the field at the time of sampling.
TRM	Per client request, the sample was digested according to section 4.1.4 of "Methods for the Chemical Analysis of Water and Wastes 1983". The sample was subsequently prepared and analyzed by EPA Method 245.1.
TVO	Based on the sum of the concentrations of the compounds in the EPA 8010/8020 list.
X	Exceeds regulatory limit.
X1	Exceeds specified permit limit.
Z	Due to sample matrix effects, the surrogate recovery was below the acceptance limits.
Z1	Surrogate recovery was above acceptance limits.
Z2	Surrogate recovery was above the acceptance limits. Data not impacted.
Z3	The sample required a dilution due to the nature of the sample matrix. Because of this dilution, the surrogate spike concentration in the sample was reduced to a level where the recovery calculation does not provide useful information.
Z5	Due to sample matrix effects, the surrogate recovery was outside acceptance limits. Secondary surrogate recovery was within the acceptance limits.
Z6	Surrogate recovery was below acceptance limits.
Z7	Surrogate recovery was high. Data reported per ADEQ policy 0154.000.
Z8	Surrogate recovery was low. Data reported per ADEQ policy 0154.000.
Z9	Unable to calculate surrogate recovery due to matrix interference.
ZX	Due to sample matrix effects, the surrogate recovery was outside the acceptance limits.

Appendix 8

Methods Performed

SOP ID	Title	Method
OAL-OR-002	TPH Diesel (EPA 8015M)	SW8015M
OAL-OR-004	BTEX (EPA 8020)	SW8021B
OAL-OR-005	TPH Gasoline (EPA 8015M)	SW8015B
OAL-OR-006	Organic Extraction of Water (EPA 3510)	SW3510C
OAL-OR-007	Organic Extraction of Soil (EPA 3550)	SW3550B
OAL-OR-008	Organic Extraction of Non-aqueous Waste Samples (EPA 3580)	SW3580A
OAL-OR-009	Methanol Extraction of Medium Level Soils for Volatiles Analyses	SW5030B
OAL-OR-010	Acid Clean-Up (EPA	SW3665A
OAL-OR-011	EPA 5030	SW5030B, SW5035
OAL-OR-012	GC/MS Volatiles (EPA 8260)	SW8260B
OAL-OR-013	GC/MS Semivolatiles (EPA 8270)	SW8270C
OAL-OR-014A	Organochlorine Pesticides and PCB's (EPA 8081)	SW8081A
OAL-OR-014B	Organochlorine Pesticides and PCB's (EPA 8082)	SW8082
OAL-OR-016	Fluorosil by 3620	SW3620B
OAL-OR-017	GC/MS Gas Range Organics (EPA 8260)	SW8015M
Inorganics Methods		
OAL-IN-001	Determination of Sulfate in Water (EPA 375.4)	E375.4
OAL-IN-002A	Acid Digestion of Aqueous Samples for GFAAS, ICP, FLAAS (EPA 3005)	SW3005A
OAL-IN-002B	Acid Digestion of Aqueous Samples for FLAAS, GFAAS, ICP (3010)	SW3010A
OAL-IN-002C	Acid Digestion of Sediments for FLAAS, GFAAS, ICP (EPA 3050)	SW3050B
OAL-IN-002D	Extraction of Soluble Ions from Soils, Sediments,and Sludges	SW9045CM
OAL-IN-002E	Acid Digestion of Aqueous Samples for Analysis by GFAAS (EPA 3020)	SW3020A
OAL-IN-003	Determination of Mercury by CVAAS	SW7470A/ SW7471A
OAL-IN-004	ammonia by ISE	E350.3
OAL-IN-005	Hardness by Calculation	SM2340B
OAL-IN-006	Chloride (EPA 325.2)	E325.2
OAL-IN-007	Acidity	E305.1
OAL-IN-008	Specific Conductance	E120.1
OAL-IN-009	Alkalinity	SM2320B
OAL-IN-010	Hexavalent Chromium	SW7196A
OAL-IN-011	Nitrite	E354.1
OAL-IN-012	Salinity by Calculation	SM2520B

OAL-IN-013	pH Determination of Soil and Water and Meter Calibration	E150.1
OAL-IN-014	Paint Filter Liquids Test	SW9095
OAL-IN-015	Determination of Sulfate in Water by Latchat Method	E375.2
OAL-IN-016	Metals Analysis by ICP byEPA 200.7 - Drinking Water	E200.7
OAL-IN-017	Metals by Inductively Coupled Plasma - SW-846 Method	SW6010B
OAL-IN-018	Chloride (automated)	E325.2
OAL-IN-019	Ammonia (automated)	E350.1, E350.3
OAL-IN-020	Total Kjeldahl Nitrogen (automated)	E351.2
OAL-IN-021	Nitrate/Nitrite, Nitrite Determination (automated)	E353.2, E350.3
OAL-IN-022	Total Phosphorus (automated)	E365.4
OAL-IN-023	Fluoride (ISE)	SM4500-F-, -C
OAL-IN-024	Chemical Oxygen Demand (EPA 410.4)	E410.4
OAL-IN-025	Iodometric Determination of Sulfide (EPA 376.1)	E376.1
OAL-IN-026	Dissolved Oxygen	E360.1
OAL-IN-027	Biochemical Oxygen Demand	E405.1
OAL-IN-028	Total Residual Chlorine (HACH 8167)	SM4500-Cl G
OAL-IN-029	Percent Solids Determination	SM2540G
OAL-IN-030A	Residue, Filterable (Total Dissolved Solids at 180 Celsius)	E160.1
OAL-IN-030B	Residue, Non-Filterable (Total Suspended Solids at 103-105 Celsius)	E160.2
OAL-IN-030C	Residue, Filterable (Total Solids at 103-105 Celsius)	SM2450C
OAL-IN-030D	Setteable Solids	E160.5
OAL-IN-030E	Volatile/Fixed Solids	E160.4
OAL-IN-031	Incremental subsampling	EPA /600/R-03/027
OAL-IN-032	Methylene Blue Active Substances as Surfactants (EPA 425.1)	E425.1
OAL-IN-033	Ortho-phosphate	E365.2
OAL-IN-034	Dissolved Silica	E370.1
OAL-IN-035	Toxicity Characteristic Leaching Procedure (TCLP) EPA1311	SW1311
OAL-IN-036	Turbidity	E180.1
OAL-IN-037	Flashpoint (EPA 1010)	SW1010
OAL-IN-038	Reactivity Screen	
OAL-IN-039	Ignitability Screen	SW1010
OAL-IN-040	EPA Method 413.1	E413.1
OAL-IN-041	EPA Method 413.2	E413.2
OAL-IN-043	Total Petroleum Hydrocarbons - Oil (EPA 418.1)	E418.1
OAL-IN-044	Determination of Ferrous Iron by HACH Method 8146	HACH 8146
OAL-IN-045	N-Hexane Extractable Material (HEM; Oil & Grease)	E1664A
OAL-IN-046	HEM/ SGT-HEM by SPE	E1664A

Appendix 9

General SOPs

1. Client Services

GEN001	Sample Control
GEN002	Internal COC Procedures Managerial
GEN004	Sample Cold Storage Temperature Requirements
GEN004A	Sample Cold Storage Temperature Requirements HI-LO Therm
GEN015	Good Laboratory Documentation
GEN036	Sample Sub-sampling Protocol
GEN037	Soil Compositing
GEN050	Data review for completeness by operations
GEN056	Technical review of Data for DOD projects
GEN060	Volatile Sample Storage Monitoring

2. Wet Lab

GEN005	Instrument Maintenance and Calibration
GEN006	Receiving/Storage/Disposing of Standards and Reagents
GEN009	Detection Limits
GEN013B	Precision and Accuracy Study
GEN 016	Glassware Cleaning
GEN021	Preventative Maintenance Program
GEN022	Daily Calibration of Balances Using Class P Weights
GEN034	Autopipette/ Repipettor Use and Precision and Accuracy
GEN038	Preparation of Dilutions
GEN044	Computerized Data Review/ Manual Integration
GEN046	Quality Control Frequency Requirements

3. Organics

GEN005	Instrument Maintenance and Calibration
GEN006	Receiving/Storage/Disposing of Standards and Reagents
GEN009	Detection Limits
GEN013B	Precision and Accuracy Study
GEN016	Glassware Cleaning
GEN021	Preventative Maintenance Program
GEN022	Daily Calibration of Balances Using Class P Weights
GEN034	Autopipette/ Repipettor Use and Precision and Accuracy
GEN038	Preparation of Dilutions
GEN044	Computerized Data Review/ Manual Integration
GEN046	Quality Control Frequency Requirements
GEN060	Volatile Sample Storage Monitoring
GEN062	5 Point initial Cal for AFCEE Samples

4. General Laboratory

GEN003	Sample Maximum Holding Times
GEN008	Ordering Supplies
GEN011	Security Procedure for Laboratory Samples
GEN012	Procedures to Prevent Sample Contamination
GEN019	Corrective Action Reports
GEN020	Open Spaces in Logbooks
GEN028	Calibration of +B63 Thermometers
GEN029	Run Log Documentation
GEN030	Waste Disposal

GEN039	Logbook Review
GEN041	Missing Sample Notification
GEN049	Archiving Hardcopy Data
GEN050	Data Review for Completeness
GEN052	Accuracy and Precision Calculations
GEN053	Internal Audits
GEN054	Identification and Documentation of Methods
GEN055	Control Charts
GEN057	DOD Client Specific requirements
GEN064	Data Integrity and Ethical Practices Policy
GEN065	Internal Investigations of Potential Data Discrepencies

5. Managerial

GEN013	General Analyst training
GEN013A	Training Levels
GEN014	Logbook, Issuing, Labeling and archiving
GEN026	Preparation of SOPs
GEN033	Spill Kit Inspection
GEN045	Control of SOPs and Quality Assurance Documentation
GEN053	Internal Audits
GEN058	Quality Assurance Reports to Management
GEN059	Tracking and Monitoring Audit Deficiencies

Title: Determination of Bioaccessibility: a Physiologically Based Extraction Technique (PBET)

Approvals (Signature/Date):

2008.03.24 12:45:05 -10'00'	2008.04.10 13:28:03 -10'00'
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2008.03.20 09:16:37 -10'00'	2008.03.24 12:45:15 -10'00'
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This SOP was previously identified as SOP No. OAL-IN-010

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1.0 Scope and Application

1.1 This SOP describes an in vitro laboratory procedure to determine bioaccessibility values for lead and/or arsenic in soils and soil waste materials. This method addresses the risk of indigested soils contaminated with lead and/or arsenic. The application of bioaccessibility is then used to determine the potential for lead and/or arsenic to be absorbed with in the human body.

2.0 Analytes, Matrix(s), and Reporting Limits

2.1 This method is used to determine lead and/or arsenic concentration in soils or soil waste matrix. Reagent blanks must not contain more than 5 μg/L arsenic or 25μg/L lead. Bottle blanks must not contain arsenic and/or lead concentrations greater than 10 μg/L and 50 μg/L, respectively. The reporting limits for arsenic and lead are both at 1 mg/kg.

3.0 Summary of Method

3.1 This in vitro test is to measure the fraction of a chemical from a soil sample under simulated gastrointestinal conditions. This measurement is referred to as bioaccessibility. Bioaccessibility is thought to be an important determinant of bioavailability based on laboratory and animal studies. The in vitro procedure consists of an extraction fluid being introduced to soils thereby leaching lead and arsenic. The container in which the fluid and soil are mixed are then placed in an apparatus that simulates gastric conditions. The extract produced is refer to as the bioaccessible fraction. Once completed, the solution is analyzed for lead and/or arsenic. The concentrations of lead and/or arsenic found in the extract is then compared to the concentration of the total metal representative. Thereby producing a bioavailable value.

4.0 Definitions

4.1 Associate - TA employee. This term replaces personnel in all SOPs.
4.2 Analyst - an associate performing sample preparation or analysis. This term replaces technician, chemist, etc.
4.3 Inorganic Department Manager - supervisor in charge of a specific department within the laboratory.
4.4 ICP- Inductively Coupled Plasma
4.5 Reagent blank –Extraction fluid only
4.6 Bottle blank- Extraction fluid ran with batch
4.7 Standard Reference material (SRM)-National Institute of Standards and Technology (NIST) material 2711 (Montana Soil) used as Laboratory Control Sample

5.0 Interferences

5.1 Chemical Interference
5.1.1 Samples may contain highly caustic compounds(eg. $CaCO_3$, $NaHCO_3$) and it could lead to problems lowering the pH on samples thereby diluting samples further.
5.2 There is possible contamination of reagents, water, or equipment. Blank spikes should be within 15% of their true value. If recovery of any blank spike is outside this range, possible error in preparation, contamination, or instrument problems should be suspected. In the case of a blank spike outside specified limits, the problems must be investigated and corrected before continuing sample analysis.

6.0 Safety

6.1 Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

6.2 This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

7.0 Equipment and Supplies

7.1 Supplies

7.1.1 2 L Class A Volumetric flasks
7.1.2 100 mL graduated cylinder
7.1.3 Beakers
7.1.4 Funnels
7.1.5 Analytical balance
7.1.6 125-mL wide-mouth HDPE (Fisher Cat. No. 02-893-5C)
7.1.7 2.5 L plastic container
7.1.8 Disposable 20-cc syringe with a Luer-Lok attachment
7.1.9 0.45-μm cellulose acetate disk filter (25 mm diameter)
7.1.10 50-mL polypropylene centrifuge tube or appropriate sample vial

7.2 Equipment

7.2.1 Inductively coupled plasma (ICP)
7.2.2 PBET rotator (30 ± 2 RPM) with water bath capable of maintaining 37± 2ºC
7.2.3 pH meter
7.2.4 Refrigerator capable of maintaining 4 ºC

8.0 Reagents and Standards

8.1 ASTM Type II de-ionized (DI) water
8.2 Glycine (High purity and heavy metal free)
8.3 Concentrated Hydrochloric Acid (12.1N)
8.4 Montana Soil (NIST material 2711) or standard reference material (SRM)
8.5 Extraction Fluid Preparation (0.4 M glycine) – To 1.9 L of DI water, add 60.06 g glycine (free base, Sigma Ultra or equivalent). Place the mixture in a water bath at 37 ºC until the extraction fluid reaches 37 ºC. Add concentrated hydrochloric acid (12.1 N, Trace Metal grade) until the solution pH reaches a value of 1.5 ± 0.05(approximately 60 mL) Bring the solution to a final volume of 2 L.

9.0 Sample Collection, Preservation, Shipment and Storage

9.1 All soil/material samples should be prepared for testing by oven drying (<40 ºC) and sieving to <250 μm. The <250 μm size fraction is used because this particle size is representative of that which

adheres to children's hands.

9.2 All the samples follow the leaching procedure using a buffered extraction fluid at a pH of 1.5, and store filtered samples in a refrigerator at 4 °C until they are analyzed.

10.0 Quality Control

QC Sample	Minimum frequency of Analysis	Control Limits
Reagent Blank*	Once per batch (min. 5%)	<25 ug/L lead <5 ug/L arsenic
Bottle Blank	Once per batch (min. 5%)	<50 ug/L Lead <10 ug/L arsenic
Blank Spike	Once per batch (min. 5%)	85-115% recovery
Duplicate	10%	± 20% RPD
SRM (NIST 2711)	2%	9.22 ± 1.5 mg/L Pb 0.59 ± 0.09 mg/L As

* Reagent blank is not to be rotated and should be analyzed straight from the reagent container.

11.0 Procedure

11.1 Leaching Procedure

11.1.1 Measure 100 ± 0.5 mL of the extraction fluid, using a graduate cylinder, and transfer to a 125-mL wide mouth HDPE bottle.

11.1.2 Add 1.00 ± 0.05 g of test substrate (<250 μm) to the bottle.

11.1.3 Record the volume of the solution and mass of soil added to the bottle on the extraction test checklist.

11.1.4 Hand-tighten each bottle top, and shake/invert to ensure that no leakage occurs, and that no soil is caked on the bottom of the bottle.

11.1.5 Place the bottles into the PBET rotator (also including the Quality Control Samples; bottle blank, blank spikes, duplicate, SRM).

11.1.5.1 Reagent blank does not get rotated with the rest of the QC samples.

11.1.6 Record the temperature of the water bath at the beginning and end of extraction batch and ensure the temperature of watch bath must be 37 ± 2 °C.

11.1.7 Rotate the extractor at 30 ± 2 RMP for 1 hour and record start time of rotation.

11.1.8 Immediately remove bottles and wipe dry when extraction is complete.

11.1.9 Filter the extraction using disposable 20-cc syringe and 0.45 μm cellulose acetate disk filter into a 50-mL centrifuge tube and store filtered samples in a refrigerator at 4 °C until they are analyzed.

11.1.10 Record the time that the extract is filtered. If the total elapsed time is greater than 1 hour 30 minutes, the test must be repeated.

11.2 Measuring Remaining Extraction Procedure

11.2.1 Measure the record the pH of fluid remaining in the extraction bottle.

11.2.2 If the fluid pH is not within ± 0.5 pH units of the starting pH, the test must be discarded and the sample needed to be reanalyzed.

11.2.3 If the pH has dropped by 0.5 or more pH units, the test will be re-run in an identical fashion.

11.2.4 If the second test also result, in a decrease in pH of greater than s.u., the pH will be recorded, and the extract filtered for analysis.

11.2.5 If the pH has increased by 0.5 or more units, the test must be repeated, but extractor must be stopped at specific intervals and the pH menually adjusted down to pH 1.5 with dropwise addition of HCl (adjustments at 5, 10, 15, 30 minutes into the extraction, and upon final removal from the water bath up to 60 minutes.

11.2.6 Samples with rising pH values must be run in a separate extraction, and must not to combined with samples being extracted by the standard method.

11.3 Analyzing Procedure

11.3.1 Use inductively coupled plasma (ICP) to analyze arsenic and/or lead concentration following 6010B method.

12.0 Calculations / Data Reduction

12.1 Bioaccessibility

$$\text{Bioaccessibility value} = \frac{\text{(concentration in extract, mg/L) (0.1L)}}{\text{(concentration in solid, mg/kg) (0.001kg)}} \times 100$$

12.2 Accuracy

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

$$\text{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

12.3 Precision (RPD)

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

12.4 Concentration

$$L = \frac{C \times V \times D}{W}$$

Where:
C = sample concentration in extract (ppm)
V = Volume of extract (mL)
D = Dilution Factor
W = Weight/Volume of sample aliquot extracted (grams or mLs)

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

13.0 Method Performance

13.1 Method Detection Limit Study (MDL) :The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. Please use GEN009 (method Detection Limits) for reference.

13.2 Demonstration of Capabilities and Training Requirements

13.2.1 The Department Manager has the responsibility to ensure that an analyst who has been properly trained in its use and has the required experience performs this procedure. The Department Manager must document the training, PE, P&A performance and document of capability shall be submitted to the QA Director for inclusion in associate training files.

13.2.2 Analyst training shall be considered up to date if an employee training file contains a SOP Acknowledgement of training form, a Demonstration of Capability and documentation of continued proficiency by at least one of the following at least once per year:

13.2.2.1 Acceptable performance of a blind sample
13.2.2.2 Another demonstration of capability
13.2.2.3 Successful analysis of a blind performance sample on a similar test method using the same technology.
13.2.2.4 At least 4 consecutive LCSs which pass P& A criteria.
13.2.2.5 Analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst

14.0 Pollution Control

14.1 It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

15.0 Waste Management

15.1 Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SOP No. HO-SCO-030, Rev. 0.

16.0 References / Cross-References

16.1 SOP No.: M004: (Preparation of Standards/Spikes)
16.2 SOP No.: GEN006: (RECEIVING/STORAGE/DISPOSING OF STD AND REAGENTS)
16.3 SOP No.: GEN019: (Nonconformance and Corrective Action)
16.4 SOP No.: GEN057 (DOD requirements)
16.5 SOP No.: GEN009 (method Detection Limits)
16.6 SOP No.: GEN016 (Glassware Cleaning)
16.7 SOP No.: GEN034 (Autopipettor/ repipettor use)

17.0 Attachments

Attachment 1: < EXTRACTION LOG >
Attachment 2: < EXTRACTION FLUID PREP >

18.0 Revision History

18.1 Revision 1, March 12, 2008
18.1.1 Original SOP development.

Attachment 1.

EXTRACTION LOG:

Date of Extraction:_____

Extraction Fluid Lot#:_____
As LCS Lot#:_____

Analyst:_____

As Spike Amount:_____

Sample ID	Amount (g) or (mL)	Start Time	End Time	Initial pH	Final pH	Δ pH	Initial Temp (°C)	Final Temp (°C)	Start Time –End Time Filtration
MB									
LCS									
LCS-SRM									

Attachment 2

EXTRACTION FLUID PREP:

Date:_____

Prepared by:_____

Extraction Fluid Lot#:_____

Component	Lot#	Actual Quantity
Glycine (60.06 ± 0.5g)		
HCl (Conc. 12.1N) 60mL approx.		
Extraction Fluid pH value @ 37°C	-----	

*Add glycine to approximately 1.9L of DI water. Add approximately 60 mL of concentrated HCl until solution reaches a pH between 1.45 and 1.55. Dilute to 2L.