State of Hawaii Department of Health
Hazardous Waste Section
QUALITY ASSURANCE PROJECT PLAN

(HW QAPP)

State of Hawaii Department of Health
Environmental Management Division
Solid and Hazardous Waste Branch

November 30, 2021

A. Program Management

A1. Title and Approval Sheet

State of Hawaii Department of Health Hazardous Waste Section
Quality Assurance Project Plan (HW QAPP)

Approved By:
State of Hawaii Department of Health

Joanna L. Seto Date: 08.22.2022
Joanna L. Seto, P.E., Environmental Management Division Chief

_____ Date: _____
(position vacant) Environmental Management Division Quality Assurance Manager

_____ Date: 8/16/22
Lene Ichinotsubo, P.E., Acting Solid and Hazardous Waste Branch Chief

_____ Date: 8/5/2022
Thomas Brand, Hazardous Waste Section Supervisor

U.S. Environmental Protection Agency

DANI ALLEN-WILLIAMS Digitally signed by DANI ALLEN-WILLIAMS Date: 2022.11.29 11:12:56 -08'00' Date: _____
Dani A. Allen-Williams, US EPA Region IX Project Officer

Audrey L Johnson Digitally signed by Audrey L Johnson Date: 2022.11.29 10:44:40 -08'00' Date: _____
Audrey L. Johnson, US EPA Region IX Quality Assurance Manager

A2. Table of Contents

LIST OF FIGURES

A3. Distribution List

U.S. Environmental Protection Agency:

EPA Region IX Land Division Project Officer

State of Hawaii Department of Health:

EMD Quality Assurance Manager

Solid & Hazardous Waste Branch Chief

Solid & Hazardous Waste Branch Quality Assurance Officer

Hazardous Waste Section Supervisor

All Hazardous Waste Section Staff

Contractor Distribution List

To Be Determined

Laboratory Distribution List

To Be Determined

A4.1. Program/Task Organization

The goal of the Environmental Protection Agency (EPA)'s Resource Conservation and Recovery Act (RCRA) Subtitle C program is to protect human health and the environment from the improper management of hazardous waste. Through the State Authorization process, EPA delegates the primary responsibility for implementing RCRA Subtitle C regulations to individual states. As the authorized agency in Hawaii, the State of Hawaii Department of Health (HDOH) has a continuing obligation to maintain a hazardous waste program equivalent to and consistent with the federal hazardous waste program. Specifically, this responsibility falls on the Hazardous Waste (HW) Section of the Solid and Hazardous Waste Branch (SHWB) under the Environmental Management Division (EMD) within HDOH.

In order to effectively accomplish program objectives, the HW Section is divided into four separate units, each one tasked with different activities and responsibilities. The four units are: Compliance Monitoring & Enforcement, Permitting & Corrective Action, Outreach, and Planning. Each Unit is comprised of staff who report to a Section Supervisor. The Section Supervisor in turn reports to the SHWB Chief. See Figure 1 for the organizational structure and Table 1 for a listing of HW Section and related quality assurance (QA) staff positions and responsibilities.

Figure 1. Organizational Structure

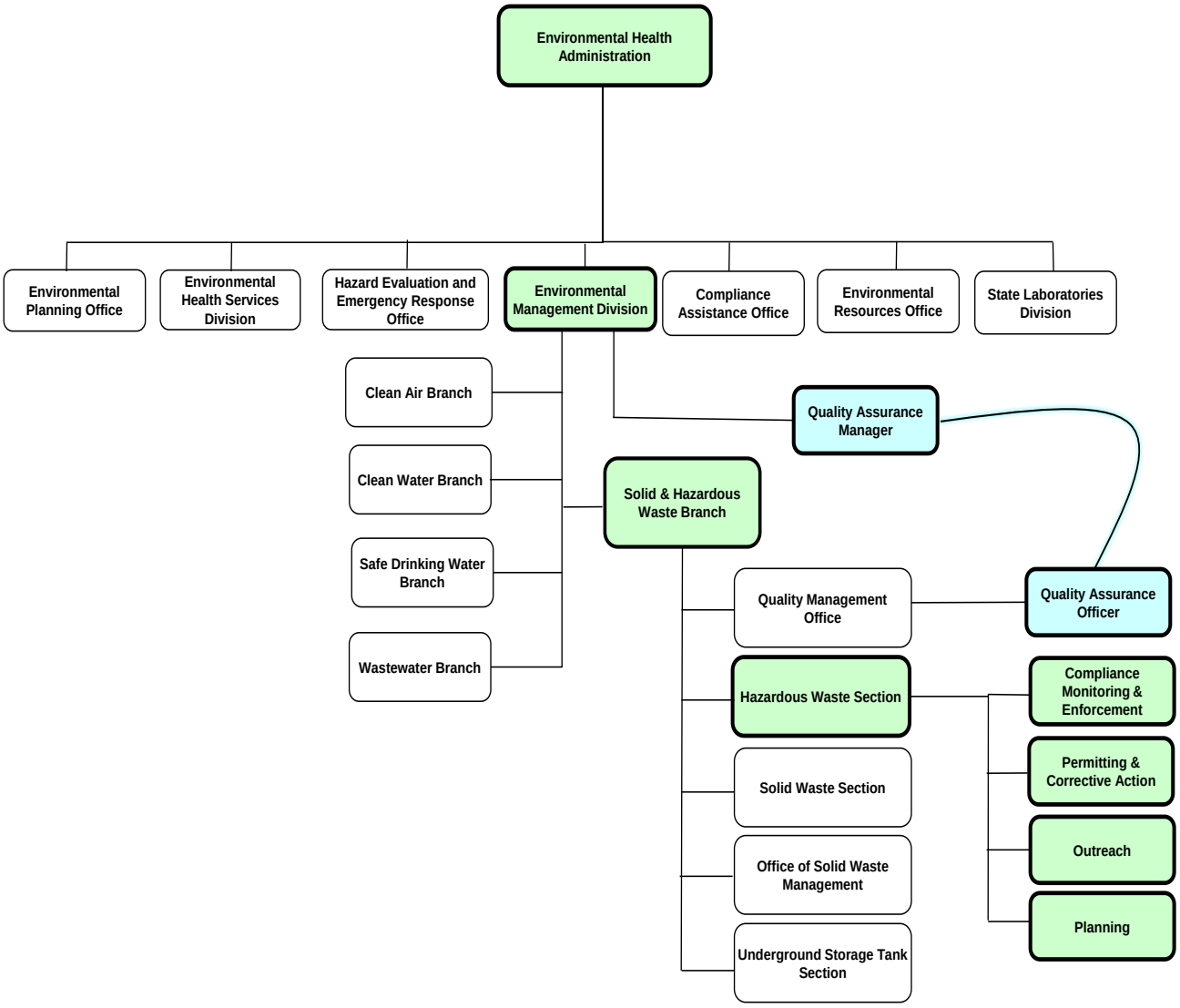

Table 1. HW Section Positions and Responsibilities

Position	Responsibilities
QUALITY ASSURANCE	
Quality Assurance Manager (EMD)	Review and approve HW QAPP; submit HW QAPP to EPA Region 9 for approval; maintain on file a copy of the official, approved version of this QAPP; address quality-related disputes or challenges; participate in QA system assessments. Is not involved in data generation activities.
Quality Assurance Officer (SHWB)	Oversee review of all data generated by and submitted to HW Section; administer HW QA/QC activities; prepare and annually review HW QAPP; maintain on file the official, approved version of this QAPP; assess effectiveness of program quality systems; review and approve external quality assurance documents for conformance with QAPP; maintain and distribute all HW quality documents, including external documents. Is not involved in data generation activities.
HW SECTION	
Section Supervisor	Coordinate Section activities; manage Section staff; prepare reports; manage EPA grant funding and obligations; review and approve Section documents, including inspection reports and enforcement notices; arrange corrective action hearings; budgeting and administration.
PLANNING	
Planner	Collect information through issuance of EPA Identification Numbers to HW generators, transporters, and treatment, storage, and disposal (TSD) facilities; manage and maintain State data in national RCRAInfo database; compile Hazardous Waste Biennial Reports; draft and adopt administrative rule changes and prepare state authorization packages.

Position	Responsibilities
PERMITTING & CORRECTIVE ACTION	
Permit Writer & Corrective Action Project Manager	Review environmental data provided in permit applications of treatment, storage, and disposal (TSD) facilities; write HW and used oil permits; review environmental data submitted by permitted facilities pursuant to permit requirements to determine compliance with permit conditions; complete technical reviews of compliance documents. Review and approve closure reports and corrective action management plans; review environmental data submitted by permitted facilities to verify that contamination is remediated at levels that protect human health and the environment, verify that facilities are closed properly, and facilitate revitalization of contaminated properties.
COMPLIANCE MONITORING & ENFORCEMENT	
Inspector and Enforcement Officer	Investigate hazardous waste generators, transporters, TSD facilities, and other regulated facilities to ensure that they are properly managing hazardous waste; collect waste samples and review and evaluate laboratory analytical data to determine proper waste characterizations; develop enforcement action for violations identified during investigations; review investigation progress and monitoring reports made by waste handling facilities, including laboratory analytical data, for RCRA regulatory compliance and classification and to determine appropriate enforcement action; draft warning letters and notice of violation and orders; enter compliance and enforcement data in RCRAInfo database.
OUTREACH	
Waste Minimization Coordinator	Review Green Business Checklist and derive performance measurements; conduct site visits to provide compliance and pollution prevention assistance to regulated businesses; update public information listings (such as used oil transporter list) and guidance documents.

Data generation and key users

Compliance Monitoring & Enforcement (CM&E) and Permitting & Corrective Action staff are the principal data users, reviewing and evaluating laboratory data generated from the analysis of waste samples taken by regulated facilities, their contractors, and occasionally by the CM&E staff (see section A6 for more information). CM&E staff are the only HW Section staff who engage in data generation activities, and they are managed by the Section Supervisor. Samples taken by regulated facilities, their contractors, and CM&E staff are all analyzed by independent analytical laboratories.

Key decision makers

CM&E and Permitting & Corrective Action staff are primary decision makers, along with the HW Section Supervisor, SHWB Chief, HDOH executive staff, and EPA Region 9 partners. All of these parties use environmental data to determine applicability of regulations, regulatory compliance, and appropriate enforcement actions. Permitting & Corrective Action staff also use the data to determine active facility, closure, and post-closure permit approval, denial, and conditions, including corrective action requirements.

Quality Assurance

The SHWB Quality Assurance Officer (QAO) provides support for the HW Section, administering the quality assurance/quality control (QA/QC) activities of the Section to ensure that they are consistent with the EMD's and the Section's policies, goals, and objectives. The QAO is responsible for preparing and annually updating this HW Quality Assurance Project Plan (QAPP), maintaining on file the official, approved version of this QAPP, reviewing Section procedures to assure accountability for data quality and data management, reviewing and approving all quality assurance documents produced and used by the Section, working with Permitting staff to ensure submission and approval of all required QA documents by permit holders and applicants, overseeing all data review and assessment activities, and conducting periodic evaluations of the QA program. The QAO also reviews and approves quality assurance documentation submitted by regulated facilities and independent laboratories for conformance with the requirements of this QAPP and maintains and distributes all HW Section quality documents, including external documents.

The QAO works in tandem with EMD's Quality Assurance Manager (QAM), who is responsible for reviewing and approving this QAPP, submitting this QAPP to EPA Region 9 for approval, maintaining on file a copy of the official, approved version of this QAPP, and addressing quality-related disputes or challenges. Neither the QAO nor the QAM are involved in data generation activities.

In case of a conflict between data generators (CM&E staff) and the QAO regarding data quality, the QAO will consult the HW Section Supervisor and SHWB Chief. If the problem is not resolved at this level, the QAO is authorized to bring the issue directly to the QAM for settlement.

A4.2. Planning Documentation

Quality Assurance (QA) planning ensures valid and defensible program decisions by documenting standard procedures for producing high quality environmental data on which these decisions are based. All data generation activities (sampling and analysis) encompassed by the HDOH Hazardous Waste regulatory program must use appropriate QA planning documents, whether these activities are carried out by regulated facilities, their contractors, HW program staff, or external support organizations (independent laboratories). Any major change to procedures covered by the QA planning documents described below must be reflected in an updated document. When such a document requires approval (see below), the updated version must be submitted and approved prior to implementation of new procedures. For further information on documentation, see section A9.

QA planning for sampling

In order to generate laboratory analytical data of predictable and appropriate quality for decision-making, appropriate samples first must be collected. There are three different circumstances relative to QA planning for sampling under the HW program:

1. Facilities applying for a new or renewed active Treatment, Storage, and Disposal (TSD) facility, closure, post-closure, or other permit (such as a research and development permit) must provide a Waste Analysis Plan (WAP) and closure or post-closure plan, as appropriate, to Permitting & Corrective Action staff as part of their permit application. All TSD facilities must submit WAPs and closure plans. Title 40 section (§) 264.110(b) of the Code of Federal Regulations (CFR), as incorporated and amended in chapter 11-264.1, Hawaii Administrative Rules (HAR), lists those facilities which must submit post-closure plans. The WAP must include the components outlined in 40 CFR §264.13, as incorporated and amended in chapter 11-264.1, HAR. Guidance for writing WAPs is available in the EPA document "Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Waste – Final" (EPA 530-R-12-001, April 2015). Closure and post-closure plans include sampling plans to monitor environmental media (soil, sediment, surface water, and groundwater) for contamination and must meet the requirements of 40 CFR §§264.112 and 264.118, as incorporated and amended in chapter 11-264.1, HAR, respectively. Sampling plans to monitor environmental media must follow the Hazardous Evaluation and Emergency Response (HEER) Office Technical Guidance Manual (TGM), which can be found at https://health.hawaii.gov/heer/tgm/. All waste analysis, closure, and post-closure plans must be reviewed and approved by the QAO and Permitting & Corrective Action staff prior to data collection. These plans become permit conditions when a permit is issued and any revisions require that the facility make a request for permit modification, following the procedures of chapter 11-270.1, HAR.
2. Regulated facilities, their contractors, and CM&E staff sampling homogenous waste in order to make a hazardous waste determination must use widely recognized standard methods for taking random samples, such as those published by EPA or ASTM (see section B2), and follow procedures outlined in this QAPP. In this case, they are not required to write a Sampling and Analysis Plan (SAP). Sampling method must be

recorded on the field data sheet. Regulated facilities are ultimately responsible for the action or inaction of their contractors with regard to data quality.

3. Regulated facilities or their contractors must complete a written SAP indicating sampling design and methods prior to initiating sampling of complex waste or environmental media, ~~(~~unless covered by a more comprehensive WAP~~)~~. This SAP should follow the format ~~and guidance~~ provided in "Sampling and Analysis Plan Guidance and Template Version 4, General Projects" (R9QA/009.1, May 2014) and must follow sampling guidance in this QAPP and the HEER TGM, which can be found at https://health.hawaii.gov/heer/tgm/. Note that ~~Not~~ not all sections of the template will be applicable to a particular sampling event. Regulated facilities are required by 40 CFR §262.11, as incorporated and amended in chapter 11-262.1, HAR, to make a determination of whether or not their waste meets the regulatory definition of hazardous waste and then must manage the waste in accordance with applicable regulations. Making a correct waste determination (i.e., using appropriate sampling and analytical methods) is the responsibility of the regulated facility, is time-sensitive, and is subject to HW Section oversight as an after-the-fact compliance determination. 40 CFR §262.11(f), as incorporated and amended in chapter 11-262.1, HAR, specifies recordkeeping requirements for waste determinations, and HW inspectors may request these records as part of a compliance evaluation inspection. Regulated facilities submitting laboratory analyses to CM&E staff must submit a copy of the corresponding SAP (unless covered by scenario 1 or 2 above). The QAO will review and approve the SAP. If the SAP is not approved, the data will not be accepted as valid and the facility may be deemed in violation of 40 CFR §262.11, as incorporated and amended in chapter 11-262.1, HAR, by CM&E staff. Regulated facilities and contractors for regulated facilities who plan to take samples of complex waste or environmental media may also submit their SAP to the QAO for review and approval prior to initiating sampling. Regulated facilities are ultimately responsible for the action or inaction of their contractors with regard to data quality.

QA planning for laboratory analysis

Prior to the acceptance of analytical reports, independent laboratories that analyze samples collected by CM&E staff must submit copies of their Quality Assurance Manual and record(s) of accreditation for the relevant analyte(s) through the National Environmental Laboratory Accreditation Program (NELAP) of the National Environmental Laboratory Accreditation Conference Institute (The NELAC Institute or TNI) or The American Association for Laboratory Accreditation (A2LA) to the SHWB QAO for review. These same laboratory QA documents must be submitted to the SHWB QAO by regulated facilities when they submit laboratory analytical reports for samples collected by the facilities or their contractors.

Quality Assurance Manuals must include detailed quality control (QC) information including: types of QC samples run; frequency with which they are run; sources and concentrations of spiking solutions that are used in preparing surrogate spikes, matrix spikes, and/or laboratory control sample mixtures; acceptance criteria associated with each type of QC check (analyte-

specific); and corrective actions taken when these criteria are not met. QC procedures must meet the standards specified in section B5.

A5. Problem Definition/Background

The first RCRA Subtitle C regulations, published in the Federal Register on February 26 and May 19, 1980 (45 FR 12722, 45 FR 33066), established the basic "cradle to grave" approach to hazardous waste management that exists today. RCRA Subtitle C mandates strict controls over the treatment, storage, and disposal of hazardous waste in the United States. HDOH was originally authorized by EPA as the primary implementer of the RCRA Subtitle C program in Hawaii in 2001, with reauthorization for its updated program effective August 28, 2018, and has a continuing obligation to maintain a hazardous waste program equivalent to and consistent with the federal program.

In regulatory terms, a hazardous waste is a waste that appears on one of four hazardous waste lists in chapter 11-261.1, HAR, or exhibits any of the characteristics of ignitability, corrosivity, reactivity, or toxicity. The four lists found in 40 CFR §§261.31 to 261.33, as incorporated and amended in chapter 11-261.1, HAR, are the F-list, K-list, P-list, and U-list. The F-list identifies wastes from common manufacturing and industrial processes, also known as wastes from non-specific sources. The K-list includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing. The P-list and the U-list are discarded commercial chemical products, and also include products whose sole active ingredient is a chemical on either the P- or U-list. A waste not contained in the F-, K-, P-, and U-lists may still be considered a hazardous waste if it exhibits one or more of the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined in 40 CFR §§261.21 to 261.24, as incorporated and amended in chapter 11-261.1, HAR.

The purpose of HDOH's hazardous waste program is to protect human health and the environment by ensuring the proper management of hazardous waste in accordance with chapters 11-260.1 to 11-279.1, Hawaii Administrative Rules. Critical to this mission is the proper identification of waste meeting the regulatory definition of hazardous waste. The Compliance Monitoring & Enforcement Unit of the HW Section, as well as the regulated and potentially regulated community, rely heavily on environmental data to determine whether or not particular wastes are hazardous, and therefore subject to regulation. This decision, in turn, allows HW Section staff and businesses to determine whether or not a facility is part of the HW Section's regulated universe, and, if so, which specific regulations apply based on the quantity of waste generated and how it is managed.

Further, HW Section staff use the same data that characterize the waste, along with observations and documentation of how the waste is being handled, to classify waste handler's activities as compliant or non-compliant with applicable regulations and to determine what type of enforcement HDOH should initiate, whether to issue or renew a permit, and what permit conditions to require, including corrective actions. In order for these program decisions to be

sound, the environmental data generated, collected, and evaluated by HW Section staff must be of known quality, scientifically valid, and appropriate for their intended uses.

This QAPP provides guidance for hazardous waste program staff, regulated facilities, their contractors, and independent laboratories to ensure that their quality assurance and quality control planning and documentation meet the HDOH hazardous waste program's standards. This document is considered a guidance document that articulates with the regulations cited herein and is intended to clarify how regulated entities and their contractors may meet regulatory requirements relating to data quality. It does not itself impose additional regulatory requirements.

A6. Program/Task Description

The two HW program activities involving environmental data are the collection of samples and the review of laboratory analytical data.

Sample collection and laboratory analysis

Environmental data used to make program decisions are generated by the collection of waste, soil, sediment, surface water, and groundwater samples which are then analyzed by an independent laboratory. Samples may be collected by CM&E Unit staff or by regulated facilities and their contractors. CM&E staff occasionally collect waste samples during the course of a compliance evaluation inspection (CEI).

While the completion of CEIs is routine, sampling by CM&E staff is not. This is because regulations restrict the storage, treatment, and disposal of hazardous waste and require that all regulated or potentially regulated facilities make a hazardous waste determination for all waste that they generate. This determination can often be made using knowledge of the materials and processes that produce the waste, but sometimes it requires sampling and laboratory analysis of the waste for its contents and characteristics. In cases where waste may or may not be hazardous and testing is required to make this determination, the waste-generating facility must have records of the data that support their decisions about how and where to send the waste for treatment or disposal (as hazardous waste or as non-hazardous waste) and these records must be made available to CM&E staff upon request. Therefore, most waste samples are collected by regulated facilities and their contractors and laboratory data are submitted to CM&E staff as part of a CEI or when CM&E staff make a separate request for information as part of another compliance monitoring activity such as a non-financial record review. The RCRA permit process requires permitted facilities to take environmental samples regularly to monitor for contamination, so almost all of the laboratory data submitted to the Permitting & Corrective Action is generated this way.

Whether the sample is collected by a regulated facility, a contractor, or CM&E staff, it is analyzed by a private laboratory and the report of laboratory analyses constitutes the data received by HW Section staff. Since the baseline questions to be answered by the data are whether waste meets the RCRA definition of hazardous waste (see section A5) and whether soil,

sediment, surface water, or groundwater are unacceptably contaminated with hazardous waste, the laboratory analyses conducted will provide such data as leachable levels of toxic contaminants and information about how ignitable, corrosive, and reactive the sample is. For example, the regulatory criteria for waste to be defined as hazardous because of the characteristic of ignitability is a flash point below 60º C, so laboratory data to be used for making a hazardous waste determination may include the sample's flash point. Part B of this QAPP provides more detail about sampling and laboratory analysis.

Review of laboratory data

Laboratory analytical data are used primarily by HW program staff in the CM&E and Permitting & Corrective Action Units in making numerous decisions. These regulatory decisions are at the core of the RCRA Subtitle C program, which relies heavily on compliance monitoring inspections to ensure the proper handling of hazardous waste by facilities that generate and transport it and on the permitting process and inspections to ensure proper handling by facilities that treat, store, and dispose of hazardous waste. Former TSD facilities are also subject to closure and post-closure requirements mandating environmental clean-up and monitoring and restricting future uses of contaminated land. The enforcement of all of these regulations relies on evaluation of laboratory data by program staff.

CM&E staff compare laboratory data with regulatory definitions to characterize waste as hazardous waste or not, which in turn allows them to determine the applicability of regulations and a facility's regulatory compliance or non-compliance. If evaluation of the data indicate that a waste is hazardous and observations by CM&E staff during a CEI or review of facility records indicate that this waste has been improperly stored, transported, or disposed, CM&E staff and management will determine appropriate enforcement actions. These enforcement action determinations, including penalty amounts, may depend on the severity of the threat to human health and the environment posed by the facility's mishandling of the waste. Specific characteristics of the waste revealed by laboratory analyses are important in determining the level of threat presented.

Permitting & Corrective Action staff use laboratory data to characterize soil, sediment, surface water, and groundwater as potentially contaminated or not, to determine appropriate active facility, closure, and post-closure permit approval, denial, and conditions, including corrective action requirements, and to determine facility compliance or non-compliance with closure and post-closure regulations and permit conditions, including corrective action requirements. Permitting & Corrective Action staff, CM&E staff, and managers also use this data to determine appropriate enforcement actions if closure or post-closure regulations and permit conditions are violated. To ensure sound program decisions, all laboratory data reviewed by Section staff must meet the data acceptance criteria described in section B5.

A7. Quality Objectives and Criteria for Measurement Data

Adherence to data quality objectives (DQOs) ensures that data are of known and consistent quality and are appropriate and sufficient for their intended use in decision making. In the case of the HW program, environmental data are used by staff in making key regulatory decisions (described briefly in section A6) for implementing the HW Section's mission to protect human health and the environment from the mismanagement of hazardous waste. To ensure appropriate and defensible program actions, the data upon which these decisions are based must be of known and acceptable quality. For this reason, all data evaluated by HW staff, including data based on samples taken by regulated facilities and their contractors, are subject to the same DQOs. Regulated facilities are ultimately responsible for the action or inaction of their contractors with regard to data quality. To reiterate, HW program decisions based on environmental data include:

- Characterization of a waste as RCRA hazardous waste
- Characterization of environmental media as potentially contaminated
- Characterization of facility compliance status
- Determination of appropriate enforcement actions
- Determination of appropriate permit actions and conditions, including corrective action requirements

The criteria for accepting data as valid for use in making these decisions are described in detail in Section B5 and the process of data quality review is discussed in Part D. This section will discuss the quantitative decision criteria used by the HW program once data are deemed valid.

The primary decisions made based on environmental data are characterization of waste as hazardous waste (explained in Section A5) and characterization of environmental media (soil, sediment, surface water, or groundwater) as potentially contaminated. Characterization of facility compliance status and determination of enforcement and permit actions rely, first of all, on the characterization of specific wastes as hazardous or environmental media as potentially contaminated.

Characterization of a waste as RCRA hazardous waste

The definition of hazardous waste is a regulatory definition, set out in great detail in chapter 11-261.1, HAR. There are many cases in which a hazardous waste determination can be made without recourse to environmental data. Chapter 11-261.1, HAR, specifies when laboratory testing of waste samples may be necessary, certain required analytical procedures, and action levels for waste characterization. Action levels can be understood as "if-then" statements by which alternative program actions are selected based on quantitative values for analyzed samples of waste.

When a waste sample is tested for hazardous waste characterization, the testing procedures and action levels are defined in 40 CFR Part 261 subpart C, as incorporated and amended in chapter 11-261.1, HAR. For example, 40 CFR §261.21(a), as incorporated and amended in chapter 11-261.1, HAR, states, in part, that "a solid waste exhibits the characteristic of ignitability *if* a representative sample of the waste…has a flash point less than 60º C (140º F)". The regulations

define testing methods for determining the flash point of the sample (40 CFR §261.21(a)(1), as incorporated and amended in chapter 11-261.1, HAR), which are standard methods published by the American Society for Testing and Materials (ASTM). So in this case, using the appropriate standard analytical method to measure the representative sample's flashpoint, the action level is 60º C. *If* the flashpoint is equal to or more than 60º C, *then* the waste is not defined as hazardous waste due to the ignitability characteristic. *If* the flashpoint is less than 60º C, *then* the waste is defined as hazardous waste due to the ignitability characteristic. If this action level is met (FP < 60º C), then a characterization of facility compliance can then be made based upon whether the waste was handled properly *as a hazardous waste*. If the facility's handling of the waste does not align with regulations, then HDOH will initiate enforcement action. The type and degree of non-compliance is used to determine what type of enforcement action to initiate (informal or formal) and is a factor in determining the proposed penalty amount in formal enforcement cases. These are complex decisions relying on a great deal of qualitative input, but they are grounded in the first decision to characterize waste as hazardous waste based on quantitative environmental data.

To take another example, sampling and testing are often required to decide whether the waste is hazardous due to the toxicity characteristic defined in 40 CFR §261.24, as incorporated and amended in chapter 11-261.1, HAR. The use of the Toxicity Characteristic Leaching Procedure (TCLP) test method 1311 in EPA Publication SW-846 (*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*; hereafter referred to as SW-846), is mandated by 40 CFR §261.24(a) and (b), as incorporated and amended in chapter 11-261.1, HAR. 40 CFR §261.24, as incorporated and amended in chapter 11-261.1, HAR, sets regulatory levels (action levels for hazardous waste characterization) for the results of the TCLP test for a variety of listed contaminants based on the toxicity of each contaminant, as shown in Table 2. *If* a representative sample's TCLP results exceed a regulatory level for one or more listed contaminants, *then* the waste is defined as hazardous waste due to the characteristic of toxicity.

The required analytical methods and action levels are specified for the corrosivity characteristic in 40 CFR §261.22, as incorporated and amended in chapter 11-261.1, HAR, and the reactivity characteristic in 40 CFR §261.23, as incorporated and amended in chapter 11-261.1, HAR.

Table 2. Maximum Concentration of Contaminants for the Toxicity Characteristic

EPA HW No.	Contaminant	Regulatory Level (mg/L)
D004	Arsenic	5.0
D005	Barium	100.0
D018	Benzene	0.5
D006	Cadmium	1.0
D019	Carbon Tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100.0
D022	Chloroform	6.0
D007	Chromium	5.0
D023	o-Cresol	200.0[2]
D024	m-Cresol	200.0[2]
D025	p-Cresol	200.0[2]
D026	Cresol	200.0[2]
D016	2,4-D	10.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13[1]
D012	Endrin	0.02
D031	Heptachlor (and its epoxide)	0.008
D032	Hexachlorobenzene	0.13[1]
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D008	Lead	5.0
D013	Lindane	0.4
D009	Mercury	0.2
D014	Methoxychlor	10.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0[1]
D010	Selenium	1.0
D011	Silver	5.0
D039	Tetrachloroethylene	0.7
D015	Toxaphene	0.5
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D017	2,4,5-TP (Silvex)	1.0
D043	Vinyl chloride	0.2

[1] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

[2] If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.

Characterization of media as potentially contaminated

In addition to characterizing the wastes they take in and the wastes they generate, hazardous waste treatment, storage, and disposal (TSD) facilities regulated by the HW Section are required to sample environmental media (soil, sediment, groundwater and/or surface water) to test for potential hazardous contaminants in three circumstances:

1. All newly permitted TSD facilities are required, as a condition of their permit, to undertake a comprehensive corrective action investigation to identify sources of known or unknown releases of solid or hazardous waste to the environment. In the event that possible environmental contaminants are discovered in soil, sediment, groundwater or surface water, further assessment and corrective action are required.
2. Operating TSD facilities are required to test for environmental contamination when any unpermitted release of hazardous waste occurs and may be required under their permit to conduct groundwater monitoring or routine testing of soil, sediment, and/or surface water, depending on the type of storage and treatment activities permitted (see chapter 11-264.1, HAR).
3. Plans for closure and post-closure care required under 40 CFR §§264.112 and 264.118, as incorporated and amended in chapter 11-264.1, HAR, include environmental testing to ensure that the site is properly decontaminated once the regulated facility ceases operation and before alternative land use can commence. These plans must be approved by Permitting & Corrective Action staff.

Characterization of the tested media as potentially contaminated is based on action levels for contaminants of concern specified in the HDOH Environmental Action Levels (EAL) Surfer, which is a searchable, electronic EAL lookup table managed by Dr. Roger Brewer, a toxicologist in the Hazard Evaluation and Emergency Response (HEER) Office under the Environmental Health Administration (see Figure 1). The EAL Surfer incorporates but goes beyond the May 2008 EPA Regional Screening Level models. The EAL Surfer and guidance on its use in Environmental Hazard Evaluation (EHE) can be accessed on the HEER Office's webpage at https://health.hawaii.gov/heer/guidance/ehe-and-eals/.

The EALs displayed by the quick lookup function in EAL Surfer are called Tier 1 EALs. They represent concentrations of contaminants in soil, soil gas, and groundwater below which the contaminants are assumed to not pose a significant threat to human health or the environment. The Tier 1 EAL is selected by comparing action levels for individual environmental hazards (i.e. direct exposure, vapor intrusion, groundwater leaching) for the same contaminant and selecting the lowest of the individual action levels. Exceeding the Tier 1 EAL does not necessarily indicate that contamination at the site poses environmental hazards because the EALs incorporate conservative, risk-based exposure assumptions that may not be applicable under all site conditions. If the Tier 1 EAL is exceeded, site data should be compared to the detailed action levels used to develop the Tier 1 EAL.

Exceeding the Tier 1 EAL for any contaminant is an indication that additional evaluation and/or remedial action is warranted. This can include additional site investigation and a more detailed evaluation of the tentatively identified environmental hazards. *If* laboratory data reveal a

concentration of a contaminant of concern above the Tier 1 action level, *then* Permitting & Corrective Action staff will work with the facility to address the situation. A detailed review of specific hazards and preparation of clean-up action levels can be carried out, including the preparation of a detailed human health or ecological risk assessment, although this level of effort will rarely be required for typical sites. In many cases it is more cost-effective to remediate the site to the Tier 1 EALs than to conduct an advanced evaluation.

A8. Special Training/Certification

All HW Section personnel must complete the hazardous waste operations and emergency response (HAZWOPER) training requirement defined in 29 CFR §1910.120 before engaging in field activities. All new Hazardous Waste Section staff are required to complete the 40-hour HAZWOPER training upon hire and all staff attend an 8-hour annual refresher class to maintain current certification. These trainings are provided through a third-party environmental consultant or emergency response contractor and include an assessment component. Instructors must meet the Occupational Safety and Health Administration (OSHA) qualifications for trainers found in 29 CFR §1910.120(e)(5). The Section Supervisor is responsible for ensuring that all staff maintain current certification at all times, which is accomplished by scheduling all staff to receive annual refresher training as a group. This ensures that all staff members have current HAZWOPER certification at the time of their participation in any field operations, including sample collection. Training certifications are reviewed by the Section Supervisor and filed in each individual staff member's personnel record by the Branch Secretary. Regulated facilities that collect samples are responsible for ensuring that their personnel (or contractors) are properly trained to perform their respective tasks and training should be included in the regulated facility's planning documentation.

All HW CM&E staff have completed the Basic RCRA Inspector Training course and Basic RCRA Enforcement Training course (two weeks of training) through EPA and the Western States Project. The HW Section Supervisor has completed multi-day training courses on sampling and analysis. Further training of new CM&E staff in writing Sampling and Analysis Plans, taking field samples, and completing associated procedures and paperwork as described in this QAPP is given as on-the-job training by staff members with more training and experience who are also participating in the sample collection, including the Section Supervisor.

Additional special training specific to each of the Units (i.e. inspections, enforcement, drafting permits, corrective action standards, database management) may be completed online or via webinar; opportunities for in-person trainings are sporadic and such trainings may be unofficial. For example, new HW Section staff treat opportunities to co-inspect with EPA Region 9 inspectors, to observe EPA inspections, and to review CM&E cases with EPA staff as important training opportunities. Review of laboratory analytical data and, rarely, sample collection may be involved in these cases. Documentation of all official staff training is kept in individual personnel files.

A9. Documentation and Records

The records with which the HW Section documents the quality of environmental data used to make program decisions include the following:

- QAPP
- Waste Analysis Plans (WAP), closure plans, and post-closure plans
- Sampling and Analysis Plans (SAP)
- Field data sheets and Chain of Custody (COC) records
- Laboratory QA packages and analytical data reports

QAPP

This HW Quality Assurance Project Plan follows "EPA Region 9 Guidance for Quality Assurance Program Plans" (R9QA/03.2, March 2012) and complies with the EMD's requirements for QA Project Plans (section 7.3 of the EMD QMP). The QAPP will be maintained as an electronic file on the shared network drive by the SHWB QAO. The folder containing this document will be labeled "Quality Assurance" and will be accessible to all program staff.

The QAPP is reviewed annually by all HW Section staff to revise procedures and identify any necessary changes that the QAO should make to the document. If major changes are made, the QAPP must be re-reviewed and approved by EPA Region 9 Quality Assurance. This QAPP must be approved by the EPA Region 9 Quality Assurance Office every five years but may be re-approved/re-issued if no changes are necessary. When updated or re-issued, this QAPP will be re-distributed to all parties on the distribution list in section A3.

The HW QAPP will be labeled using the document control system described in Section 8 of the EMD's QMP. The official, signed paper copy of the approved QAPP will be maintained by the QAO and a copy of the official, signed version will be retained by the EMD QAM. Obsolete versions will be clearly marked and maintained, at a minimum, as offline electronic copies by the QAO.

Waste Analysis Plans, closure plans, and post-closure plans

WAPs, closure plans, and post closure plans approved as described in section A4.2 are filed as permanent records as part of the permit in the file of the facility submitting the plan. The facility file includes all notifications, permits, inspection reports, responses to requests for information, correspondence, etc. pertaining to one regulated facility, as "facility" is defined in 40 CFR §260.10, as incorporated and amended in chapter 11-260.1, HAR.

Sampling and Analysis Plans

SAPs are required when sampling and analysis methods are neither standard (widely recognized, EPA/ASTM standard operating procedures (SOPs) and methods mandated by regulations; see sections A4.2 and A7) nor covered by a more comprehensive plan (waste analysis, closure, or post-closure plan). SAPs are filed as permanent records in the facility file as part of the report for

a particular evaluation (CEI, non-financial record review, etc.) when the sample was taken or laboratory data were requested from the regulated facility.

Field data sheets and COC records

All field activities must be documented using the procedures described in this section. CM&E staff use field data sheets and Chain of Custody records to document all aspects of sample collection (see Appendices C and D and section B3). Both forms are retained permanently as part of the inspection report in the facility file. In order to ensure that samples are clearly identified and traceable, the following information is always documented:

- Site information (site name, description, EPA ID number)
- Sample identification information number
- Media/matrix description
- Location
- Date and time of collection
- Number of samples, including QC samples
- Sampling equipment used, if any
- Sample preservation information, if applicable
- Sampler's name and contact information
- Shipping arrangements and name of receiving laboratory
- Analyses requested
- Corrective actions taken

In most cases, CM&E staff will follow sampling procedures published by EPA or ASTM (see section B2) and an SAP will not be required. If the situation is more complex and requires planning, the SAP will specify additional documentation to be included on the field data sheet, such as:

- Field measurements (water temperature, pH, dissolved oxygen, etc.) and units
- Field observations and details related to analysis or integrity of samples (weather conditions, noticeable odors or colors, etc.)
- Designation of sample as composite or grab
- Sampling equipment information (serial no., model no., manufacturer, etc.)
- Calibration data for field instrumentation

All entries to the field data sheet and chain of custody form are made in permanent waterproof ink and any necessary corrections must be lined out, initialed, and dated. Regulated facilities and their contractors should follow the same procedures and may use the forms included in Appendices C and D or their own comparable forms but must record all the information required by this QAPP.

Laboratory QA packages and analytical data reports

As discussed in section A4.2, independent analytical laboratories reporting data to the HW Section must submit a QA Manual and be either NELAP or A2LA accredited for all analyses (analyte/matrix combinations) that will be reported to the HW Section. Laboratory QA Manuals must include detailed QC information (see section A4.2) and the laboratory's standard QA/QC

procedures must meet the requirements for data reporting, data acceptance criteria, and data review and verification outlined in Parts B and D (see especially sections B5, D1, and D2). Laboratory QA Manuals reviewed and approved by the QAO and copies of proof of accreditation are retained by the QAO for at least five years as electronic files in the "Quality Assurance" folder on the shared network drive.

Regulated facilities using laboratory data to make a hazardous waste determination are required to retain a copy of the laboratory's QA Manual, relevant NELAP or A2LA accreditation(s), and the complete laboratory report package for three years from the date the waste was last sent offsite and submit these records to the HW Section upon request (40 CFR §262.11(f), as incorporated and amended in chapter 11-262.1, HAR). Laboratory reports and associated QA/QC information submitted to HW staff are maintained permanently in the facility file; if laboratory reports are submitted as part of a CEI, they are maintained as part of the inspection report.

All laboratory data reports submitted to the HW Section must include an acknowledgement signed by the laboratory manager stating that:

- All procedures of the laboratory's Quality Assurance Manual have been followed;
- Data being reported have been verified and validated using the QC procedures described in the Quality Assurance Manual; and
- QC results are acceptable unless otherwise stated.

Regulated facilities are responsible for ensuring that they (and their contractors) use an accredited laboratory, maintaining a copy of the laboratory's QA Manual and current accreditation on file, and ensuring that the certification statement above is included in all laboratory reports submitted to the HW Section.

B. Data Generation and Acquisition

B1. Sampling Design

Simple random sampling of a homogenous waste is the most common sampling design used to produce data that will be used by the HW program. As described in section A4.2, CM&E staff, regulated facilities, and their contractors must prepare an SAP prior to sampling complex waste for which simple random sampling is not appropriate or feasible. Sampling design for hazardous waste characterization must produce a sample fitting the regulatory definition of "representative sample" (40 CFR §260.10, as incorporated and amended in chapter 11-260.1, HAR) and should be described in the SAP. For complex environmental media such as soil, the HW program requires the use of multi-incremental sampling, as described in the HEER Office TGM.

TSD facilities applying for a permit are required to submit waste analysis plans and closure and post-closure plans for environmental monitoring (see section A4.2 for more information). These plans include sampling design and must conform to applicable regulatory requirements. For example, sampling design for WAPs must allow for the production of analytical data that

"contain all the information which must be known to treat, store, or dispose of the waste in accordance with this part [chapter 11-264.1, HAR] and part 268 [chapter 11-268.1, HAR]" (40 CFR §264.13(a)(1), as incorporated and amended in chapter 11-264.1, HAR). The sampling design for this task is limited by the definition of a representative sample (40 CFR §264.13(b)(3), as incorporated and amended in chapter 11-264.1, HAR, and 40 CFR §260.10, as incorporated and amended in chapter 11-260.1, HAR) and the specification of analytical methods for action levels of certain hazardous constituents/contaminants (40 CFR §§268.40 and 268.48, as incorporated and amended in chapter 11-268.1, HAR). These regulatory levels define whether a waste can be disposed as is or must first be subjected to further treatment. Thus, a specific sampling design may be mandated by the regulations for a particular waste stream based upon a rather complex set of regulatory references. Minimum frequency and duration for ongoing sampling are also set in the regulations, as applicable (see 40 CFR §§264.13, 264.112, and 264.118, as incorporated and amended in chapter 11-264.1, HAR).

Sampling designs for environmental monitoring at TSD facilities are individual and vary based on a range of factors including the type of facility, type of waste, treatment process, type of storage and/or treatment unit (container, tank system, surface impoundment, etc.), and site geology. When developing a sampling design is necessary, regulated facilities and their contractors should follow guidance in ~~"Guidance on Choosing a Sampling Design for Environmental Data Collection" (EPA/QA-G5S, December 2002)~~ the HEER Office TGM and consider the following factors:

- The media or wastes to be sampled
- The physical characteristics of the medium to be sampled
- The steps within a treatment process to sample
- The physical locations to sample
- The number and types of control samples that must be collected (field duplicates, field blanks, equipment blanks)
- Regulatory requirements affecting the type and number of samples needed for analysis

Sampling design descriptions must be included in all plans submitted as part of permit applications or permit modification requests and are subject to approval by Permitting & Corrective Action staff and the HDOH Director.

B2. Sampling Methods

All sampling methods used to generate data for the HW program must be widely recognized standard methods, such as those published by EPA (in SW-846 at https://www.epa.gov/hw-sw846 and the EPA Emergency Response Team (ERT) SOPs at http://www.epaosc.org/site/site_profile.aspx?site_id=2107) and ASTM. The requirements discussed in this QAPP apply to sampling carried out by CM&E staff, regulated facilities, and their contractors. In the case of most waste sampling, regulations specify a method of analysis to be carried out on a "representative sample" of waste, as representative sample is defined in 40

CFR §260.10, as incorporated and amended in chapter 11-260.1, HAR. 40 CFR Part 261 Appendix I, as incorporated and amended in chapter 11-261.1, HAR, provides a list of ASTM methods for sampling waste in various physical states and situations where the HW program "will consider a sample obtained using any of the applicable sampling methods specified…to be a representative sample" (40 CFR §261.20(c), as incorporated and amended in chapter 11-261.1, HAR). Some of the listed methods are out of date; the HW program considers current versions of those same methods representative as well. For example, for containerized liquid waste, the ASTM Standard Practice for Sampling with a Composite Liquid Waste Sampler (COLIWASA) is listed. The current version of this standard (ASTM D5495-03 (2011)) is followed by CM&E staff when sampling containerized liquid waste. The HW program requires the use of widely recognized standard methods for sampling in order to ensure the representativeness of samples used to produce the laboratory data on which regulatory decisions rely.

In cases of ongoing waste sampling, non-homogenous waste, and environmental monitoring for closure and post-closure, sampling methods are discussed in the SAP, WAP, closure plan, or post-closure plan prepared by CM&E staff, the regulated facility, or its contractor (see section A4.2). Waste analysis, closure, and post-closure plans become part of the facility's permit conditions and sampling must be carried out according to the methods specified in these plans.

Sampling equipment and containers

Sampling methods vary widely because the material being sampled is diverse. These media and wastes can be complex, multi-phase mixtures of liquids, semi-solids, sludges, and solids. The liquid and semi-solid mixtures vary greatly in viscosity, corrosivity, volatility, explosivity, and flammability. The solid wastes can range from powders to granules to large lumps. The wastes may be in drums, barrels, sacks, bins, vacuum trucks, ponds, or other conditions. Sampling these diverse types of media and wastes requires different types of sampling equipment. Specific sample collection devices and procedures for preparing, using, and decontaminating the sample collection devices are described in SW-846, ~~and~~ ERT SOPs, and the HEER Office TGM.

In general, sampling requires the collection of representative samples of wastes or potentially contaminated media of adequate size for all analytical needs. The concentration of the contaminant, type of analysis, and sample medium determine the required sample volume. SW-846, ~~and~~ ERT sampling procedures, and the HEER TGM give general guidelines for volume requirements. The type of equipment used for sample collection and containment vary and must be compatible with the sample. Contamination can occur if collection equipment or containers are made of incompatible material that reacts with the sample. For example, when sampling for organics, one should not use equipment or containers made of plastic or PVC, as these could contaminate the sample. Tables 3 and 4 show some typical required volumes and container types for different kinds of samples. The sample collection equipment used and sample volumes collected must be recorded on the field data sheet and, if applicable, specified in the SAP or other planning document.

Table 3. Volume and Container Type for Aqueous Solution Samples

Analysis	Required Volume	Container Type
Volatile organics	80 mL	Two 40-mL volatile organic analysis (VOA) glass vials
Semi-volatile organics Pesticides PCBs	4 liters	Two 80-ounce or four 1-liter amber glass bottles w/Teflon lined lid
Metals Inorganics (non-metal) Cyanides and sulfides	1 liter	One 1-liter polyethylene bottle

Table 4. Volume and Container Type for Soil and Sediment Samples

Analysis	Required Volume	Container Type
Volatile organics	5 grams/sample	Three 40 ml VOA glass vials sealed after sample is added from sample coring device or three hermetically-sealed sample vials
Semi-volatile organics Pesticides PCBs Metals Inorganics (non-metal) Cyanides and sulfides	6 ounces	One 8-ounce or two 4-ounce wide-mouthed glass jars w/Teflon lined lid

Reusable sampling equipment and containers should be decontaminated by the following standard procedure, unless specified otherwise in an SAP, WAP, closure plan, or post-closure plan.

1. Non-phosphate detergent wash
2. Tap water rinse
3. 10% nitric acid rinse, when cross-contamination from metals is a concern (testing for metals)
4. Distilled/deionized water rinse
5. Pesticide grade solvent rinse, when semi-volatile and non-volatile organic contamination may be present
6. Air dry to ensure solvent evaporation
7. Distilled/deionized water rinse

Unless environmental media samples appear very unlikely to be contaminated based on the evaluation described in section B3, all decontamination rinsate must be managed as hazardous waste, following applicable regulations in chapters 11-260.1 to 11-268.1, HAR.

Quality Control samples

At least one blank sample should be collected in the field, as appropriate and in the following order of preference: equipment blank, field blank, VOA (volatile organic analysis) travel blank.

When sampling equipment or containers are decontaminated and reused in the field, an equipment blank should always be collected by running water over/through the equipment after decontamination. Organic-free water should be used to collect blanks targeted for organics analysis, deionized/distilled water should be used for blanks targeted for inorganics analysis. If single-use sample collection equipment and containers are used, a field blank rather than an equipment blank should be collected. The number and type of blanks collected must be recorded on the field data sheet and, if applicable, specified in the SAP or other planning document.

Collection of field duplicates is encouraged, and field splits may also be taken by CM&E staff and regulated facility staff when sampling is done as part of a CEI. In the event of a sampling failure when CM&E staff are conducting sampling, staff will resample whenever possible. All sampling failures and corrective action responses must be documented. Regulated facilities are responsible for maintaining records of properly validated laboratory analyses to document regulatory compliance; the regular practice of taking field duplicates and field splits is recommended to minimize the possibility of sampling failure. If data documenting compliance are not available due to sampling failure, regulated facilities may be subject to enforcement action. See Table 9 for recommended minimum QC samples.

Sample preservation and holding time

Guidelines for maximum holding times for different types of samples are published by EPA in chapter 2 of SW-846 (Tables 2-40A and 2-40B) and by the HEER Office in section 11 of the TGM (Appendix 11-A and Appendix 11-B). Holding times can be extended if preservation techniques are employed to reduce biodegradation, volatilization, oxidation, sorption, precipitation, and other physical and chemical processes. Tables 5 and 6 summarize the applicable preservation methods and holding times for the common types of analyses performed on waste and media samples to generate data for the HW program. Preservation methods used are documented on the field data sheet and COC form and, if applicable, specified in the SAP or other planning document. Holding times are documented by the laboratory based on receipt date/time and the collection date/time recorded on the COC form.

Table 5. Holding Times[1] and Preservation for Aqueous Samples

Analysis	Maximum Holding Time	Preservation Method[2]
Volatile organic compounds	14 days	HCl~~, H_2SO_4, or $NaHSO_4$~~ to pH < 2, cool to ≤ 6º C
Reactive volatile organics (e.g., vinyl chloride, styrene, and ethers)	7 days	cool to ≤ 6º C
Semi-volatile Organics Pesticides Herbicides	Extracted within 7 days and analyzed within 40 days after extraction	cool to ≤ 6º C
PCBs	None	cool to ≤ 6º C
Metals	6 months	HNO_3 to pH < 2
Mercury	28 days	HNO_3 to pH < 2, cool to ≤ 6° C
Hexavalent Chromium[3]	24 hours[3]	cool to ≤ 6º C
Alkalinity	14 days	cool to ≤ 6º C
Chlorides	28 days	None
Conductivity	14 days	cool to ≤ 6º C
Cyanides	14 days	NaOH to pH > 12, cool to ≤ 6º C
Nitrate nitrogen	48 hours	cool to ≤ 6º C
Sulfates and fluorides	28 days	cool to ≤ 6º C
Sulfides	7 days	NaOH to pH > 12, cool to ≤ 6º C
Total Dissolved Solids	14 days	cool to ≤ 6º C

[1] Holding times begins at the time of collection
[2] Some waters may effervesce. If this occurs, perform no pH adjustment, cool and have analyzed immediately. Refer to Chapter 4 of SW-846 for more detailed guidance regarding preservation of aqueous samples.
[3] If hexavalent chromium is preserved with ammonium sulfate and analyzed by EPA method 218.6, the holding time can be extended to 28 days.

Table 6. Holding Times[1] and Preservation for Soil and Sediment Samples

Analysis	Maximum Holding Time	Preservation Method
Volatile Organic Compounds	14 days	Methanol or Na_2SO_4 in reagent water, cool to ≤ 6º C~~,~~; see individual methods for ~~preservatives~~other methods
Reactive volatile organics (e.g., vinyl chloride, styrene, and ethers)	7 days	Methanol or Na_2SO_4 in reagent water, cool to ≤ 6º C
Semi-volatile Organics Pesticides Herbicides	Extracted within 14 days and analyzed within 40 days after extraction	cool to ≤ 6º C
PCBs	None	cool to ≤ 6º C
Metals	6 months	None
Mercury	28 days	cool to ≤ 6º C
Hexavalent Chromium	Extracted within 30 days and analyzed within 7 days after extraction	cool to ≤ 6º C
Cyanides	14 days	cool to ≤ 6º C
Sulfates and fluorides	28 days	cool to ≤ 6º C
Sulfides	7 days	cool to ≤ 6º C

[1] Holding times begins at the time of collection

B3. Sample Handling and Custody

All samples collected in support of HW Section activities must be handled using a Chain of Custody (COC) procedure and form to ensure sample integrity. The COC form is included as Appendix D. An unbroken chain of sample custody, both in the field and in the laboratory, is an important consideration in legal proceedings where laboratory data are used as evidence. Because HW program decisions based on environmental data are regulatory decisions, all sampling events produce data that may need to withstand legal scrutiny. The handling and custody procedures for samples collected by CM&E staff are detailed below. Samples collected by regulated facilities and their contractors must be handled following the same procedures or comparable procedures documented in an SAP, WAP, closure plan, or post-closure plan.

Sample containers must be labeled by hand in indelible ink at the time of sampling. A sample identification number will be assigned by the sampler and recorded on the container label, the field data sheet, and the COC form. If space allows, additional information such as date, time, location, and sampler name should also be recorded on the container label. All of this information is also recorded on the field data sheet and COC form (see section A9). The sampler

is personally responsible for the care and custody of samples until they are transferred or shipped. As few people as possible should handle samples.

A sample is in your custody when:

- It is in your physical possession
- It is in your view, after being in your physical possession
- It was in your physical possession and then you personally locked it in a car or room to prevent tampering
- You have placed it in a designated and identified secured area

Samples must be accompanied by a COC record at all times. The COC form includes the following information used to identify and track continuous custody of samples:

- Location, date, and time of collection
- Number of containers
- For each sample container:
  - Sample identification numbers
  - Analyses requested
  - Custody seal number if individually sealed
- Name and signature of sampler(s) who signed custody seals
- Airbill number
- Custody seal number on cooler
- Signature in "relinquished by" matching one of the samplers' signatures
- Signature and shipping company name in "received by"
- Signature in "received for laboratory by"
- Date and time of each custody transfer

The COC form is completed in the field with permanent waterproof ink and any corrections made to the COCs are lined out, initialed, and dated. When transferring custody of samples, the individuals relinquishing and receiving samples will sign and write the date and time of transfer in the appropriate sections of the form. Each cooler containing samples will have its own accompanying COC document, placed in a sealed plastic bag and taped in the inner top of the cooler lid. The last person to have custody of the samples prior to shipping will retain a copy of the COC record. Coolers should be secured with duct tape or strapping tape and labeled with two signed and dated COC seals on the front and two on the back. A copy of the airbill or other shipping paper should also be retained as documentation.

Samples must be transported in a manner that will ensure their integrity, prevent leakage or breakage, and protect the health and safety of shipping/receiving personnel. Waste samples should be assumed to be hazardous and environmental samples should be evaluated to determine if the sampled matrix should be considered hazardous based on all available information, including:

- Proximity of the sampling location to the suspected source of contamination
- Field screening results

- Environmental indicators such as living biota (vegetation, fish, etc.), staining, matrix characteristics (i.e., does the soil or water appear "normal"?)
- Historic sampling and analytical results
- Type of site and activities conducted on the site

Department of Transportation and International Air Transport Association regulations for the transport of hazardous materials must be followed with waste samples and should be followed for environmental samples, unless samples appear very unlikely to be contaminated based on the above evaluation.

Sample jars should be prepared for shipping as follows, then placed in a sturdy cooler:

- Closed tightly/sealed
- Placed in an individual zip-lock bag
- Wrapped in bubble wrap and tape
- Small containers such as 40 mL vials for VOA may be secured in a test tube rack
- Large glass containers may be kept in place with pieces of carved out plastic foam

The cooler should be prepared in the following manner:

- The drain plug at the bottom of the cooler should be taped closed with strong packing tape (duct tape, nylon, or fiber glass strapping tape) to ensure that water from melting ice will not leak from the cooler
- The interior should be double lined with large plastic bags
- Ice added to the cooler to maintain sample temperature should be double bagged
- Empty spaces in the cooler should be filled with noncombustible, absorbent, cushioning material to minimize the possibility of sample jar breakage and to absorb any material that may have leaked
- There must be sufficient cushioning material between multiple sample jars to prevent breakage if the shipping container is dropped
- "This end up" and "fragile" labels on the outside of the cooler are recommended, in addition to any required labels if the samples are likely to be hazardous

Additional shipping and handling precautions and procedures may be necessary based on the nature of the samples. For example, soil samples shipped from Hawaii to the US mainland are subject to United States Department of Agriculture (USDA) inspection and regulation. The receiving laboratory must obtain a USDA Soil Import Permit certifying their ability to receive and properly dispose of soil. Coolers containing soil samples must be inspected by a USDA representative at the airport and properly labeled and documented following USDA requirements.

Upon receipt at the laboratory, the sample custodian (receiver) will inspect the contents of the cooler, verifying that they agree with the COC form, and sign the COC form to indicate receipt of the samples. After samples have been received by the laboratory, the laboratory will retain a copy of the COC form and return the original form to the sampler.

B4. Analytical Methods

A wide variety of laboratory analyses are carried out on samples with very different properties in order to generate data on many analytes of interest. The analytical methods chosen may depend on the following:

- Analytes of concern
- Sample media
- Detection requirements
- Type, quality, and quantity of data needed for the decision
- Permit requirements
- Regulatory requirements

Rather than attempting to list or discuss every method used, this QAPP will outline HW program policy more generally.

In many cases, the analytical method is specified in a method-defined parameter. For example, the regulatory definition of a liquid waste possessing the characteristic of ignitability is a liquid (other than a solution of <24% alcohol) that "has a flash point of less than 60º C (140º F), *as determined by* a Pensky-Martens Closed Cup Tester, *using the test method specified* in ASTM Standard D 93-79 or D 93-80…or a Setaflash Closed Cup Tester, *using the method specified* in ASTM Standard D 3278-78" (italics added; 40 CFR §261.21(a)(1), as incorporated and amended in chapter 11-261.1, HAR). In this and other cases "where the analytical result is wholly dependent on the process used to make the measurement," the regulations specify what process must be used, as explained in chapter 8 of SW-846. The toxicity characteristic leaching procedure (TCLP) used to prepare a leachate for further testing (EPA test method 1311) and the tests for the characteristic of corrosivity (EPA test methods 9040C and 1110A) are other examples (see 40 CFR §§261.22 and 261.24, as incorporated and amended in chapter 11-261.1, HAR). Any change made to the specific analytical methods could change the results and incorrectly identify a waste as hazardous or non-hazardous. The parameters (such as "less than 60º C") for defining waste as exhibiting these characteristics are known as "method-defined" parameters ("less than 60º C…*as determined by...using the test method specified*"). For method-defined parameters, analytical methods used must be as specified in the regulations.

In other cases, a specific method is not required by the regulations. When analytical method is not specified, CM&E staff, regulated facilities, and their contractors may choose an appropriate method. For example, after using TCLP to generate an extract, the method used to measure the concentration of each hazardous constituent it contains is not specified. CM&E staff select analytical methods published by EPA in SW-846 and by ASTM, and methods from these sources are also recommended for analysis of samples taken by regulated facilities and their contractors. If EPA or ASTM methods are not available or appropriate for project-specific requirements, other recognized standard analytical methods may be used; if other methods are used, a SAP or other project-specific planning document is required.

SAPs, WAPs, closure plans, and post-closure plans must specify the analytical methods to be used for all samples collected. WAPs, closure plans, and post-closure plans become part of

facility permits, so use of the particular analytical methods specified in these plans becomes a permit condition and deviation is not permissible. As discussed in section A4.2, these plans must be approved prior to implementation; proposed analytical methods are reviewed by Permitting & Corrective Action staff prior to permit approval.

Tables 7 and 8 list some common methods used to analyze samples for the HW program. The presence of a letter in a SW-846 method number indicates that EPA has updated the method; the number after the hyphen in an ASTM method number indicates the last update. The most recent published version of a method should be used unless regulations set a method-defined parameter.

Table 7. Sample Preparation Procedures

Analyte of Interest	SW-846 Methods
Organics	
Volatile organics	5021A, 5030B, 5031, 5035, 5041A
Semi-volatile organics	3510C, 3520C, 3540C, 3541, 3550C, 3542
Pesticides PCBs	3510C, 3520C, 3540C, 3541, 3550C
Inorganics	
Metals	3005A, 3010A, 3020A, 3050B, 3015A, 3051A

Table 8. Analytical Procedures

Parameters	SW-846 method	ASTM method
Organics		
Volatile organics	8260B	
Semi-volatile organics	8270D	
Pesticides PCBs	8081B, 8082A	D5175-91, D6160-98
Aldehydes/Ketones	8315A	
Polychlorinated Dibenzo-p-dioxins/ Polychlorinated Dibenzofurans	8290A	
Polycyclic aromatic hydrocarbons (PAHs)	8310	D7363-13a
Inorganics		
Alkalinity		D4972-13, D1293-12
Ammonia nitrogen		D1426-15
Chlorides	9057	D512-12
Conductivity	2510	D4511-11, D7664-10
Cyanides	9010C	D2036-09
Nitrate nitrogen	6500, 9056A	
Sulfates and Fluorides	6500, 9056A	D516-11
Sulfides	9030B, 9031, 9215	D4658-09
Total Dissolved Solids		D5907-13

Parameters	SW-846 method	ASTM method
Metals		
Antimony	7062, 6010D, 6020B	D3697-12
Arsenic	7061A, 7062, 6010D, 6020B	D2972-15
Barium	6010D, 6020B	D4382-12
Beryllium	6010D, 6020B	D3645-08
Cadmium	6010D, 6020B	D3557-12
Chromium	6010D, 6020B	D1687-12
Chromium (hexavalent)	7195, 7196A, 7197, 7198, 7199	D5257-11
Cobalt	6010D, 6020B	D3558-08
Copper	6010D, 6020B	D1688-12
Iron	6010D, 6020B	D1068-10
Lead	6010D, 6020B	D3559-08
Magnesium	6010D, 6020B	D511-14
Manganese	6010D, 6020B	D858-12
Mercury	7470A, 7471B, 7472, 7473, 6010D, 6020B	D3223-12
Nickel	6010D, 6020B	D1886-14
Potassium	6010D, 6020B	D4192-15
Selenium	7741A, 7742	D3859-08
Silver	6010D, 6020B	D3866-12
Sodium	6010D, 6020B	D4191-15
Uranium		D3972-09
Vanadium	6010D, 6020B	D3373-12
Zinc	6010D, 6020B	D1691-12
Hazardous Waste Characterization		
Ignitability	1010A, 1020B	
Corrosivity	9040C, 1110A	
Toxicity	1311 followed by appropriate procedure	

B5. Quality Control

In order to ensure the quality and defensibility of the analytical data on which HW program decisions are based, all laboratories providing analytical data to the program must have a quality control program described in a QA Manual that includes the "Essential Quality Control Requirements" for chemical testing published by TNI in the "2009 NELAC Standard" or the "2016 NELAC Standard" and the QC analyses discussed below. Laboratory QA Manuals, including detailed QC information, will be reviewed and approved by the SHWB QAO prior to the acceptance of analytical reports (see section A4.2 and A9). The QC guidelines discussed below are based upon the NELAC Standard and also take into account HW program DQOs (see section A7).

QC sample analysis

The laboratory QA manager is responsible for ensuring that all laboratory internal QC checks are conducted according to the laboratory's QA Manual, the requirements of this QAPP, and, if applicable, the requirements of a project-specific SAP, WAP, closure plan, or post-closure plan. Many of the laboratory QC procedures and requirements for specific analytes are described in SW-846 and ASTM analytical methods, laboratory method SOPs, and method guidance documents. If laboratory QC requirements are not specified in an analytical method or if additional requirements beyond those included in an analytical method and this QAPP are necessary to ensure that DQOs are met, the project-specific plan should identify the additional laboratory QC checks to be performed. The following types of information should be included:

- Laboratory analytical method(s) to which the internal QC check applies
- Complete procedures for conducting the internal QC check
- QC samples and QC measurements involved in the internal QC check
- Complete collection and preparation procedures for the QC samples
- Spiking analytes and concentrations
- Control limits for the internal QC check
- Corrective action procedures to be followed if the internal QC check is not done properly or results are outside control limits

The recommended minimum QC sample analyses required to meet HW program DQOs for most sampling events are listed in Table 9. WAPs, SAPs, closure plans, and post-closure plans may propose alternative frequencies for QC sample analyses. If proposing different QC sampling frequencies, the proposed QC sampling program and the rationale should be presented in detail in the project-specific plan, which must be approved by the QAO (for SAPs) or the QAO and Permitting & Corrective Action staff (for WAPs, closure plans, post-closure plans) prior to sampling.

Table 9. Recommended QC Sample Frequency

QC Type	QC Sample	Recommended Frequency
Field QC	Field duplicate	1 per sampling site per day
	Equipment rinsate blank	1 per day per type of non-disposable sampling equipment
	Field blank	1 per sampling site per day
	Trip blank	1 per shipping container containing volatile samples
Laboratory QC	Method blank	1 per preparation batch of up to 20 samples
	Laboratory duplicate	1 per batch up to 20 samples
	Matrix spike	1 per matrix batch up to 20 samples
	Matrix spike duplicate	1 per matrix batch up to 20 samples
	Laboratory control sample	1 per preparation batch of up to 20 samples
	Laboratory control sample duplicate	1 per preparation batch of up to 20 samples
	Surrogate spike	Every sample for organic analysis by gas chromatography
	Additional method-suggested QC parameters	As specified in the EPA or ASTM method used

Data Quality Indicators

The results of QC analyses provided by the laboratory, in conjunction with sample results, field documentation, and COC information, allow for evaluation of the following data quality indicators (DQIs):

- Precision
- Accuracy
- Representativeness
- Comparability
- Completeness
- Bias

- Reproducibility
- Repeatability
- Sensitivity

Precision measures the agreement among a set of replicate measurements. A combination of field and analytical precision is assessed by collecting and analyzing field duplicates. Analytical precision can also be estimated by analyzing duplicate laboratory control samples, spiked samples, or field samples. The most commonly used estimates of precision are the relative standard deviation (RSD) and, when only two samples are available, the relative percent difference (RPD). RSD is the standard deviation of the set of measurements divided by the average value and multiplied by 100 to yield a percentage. The RPD between two results can be calculated using the following formula, where A and B are results from the duplicate analyses:

$$RPD = \frac{A - B}{(A + B) / 2} \times 100$$

Accuracy is the closeness of a measured result to an accepted reference value. Laboratory accuracy is usually measured as a percent recovery. QC analyses used to measure accuracy include recoveries from surrogate spikes, laboratory control samples (LCS) and LCS duplicates, matrix spikes (MS) and MS duplicates, and method blanks. Percent recovery can be calculated using the following formula, where S_m is the measured concentration of the spiked sample, U is the measured concentration of the unspiked sample, and S_k is the known concentration of the spike:

$$\% \text{ Recovery} = \frac{S_m - U}{S_k} \times 100$$

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. As discussed in sections A7 and B2, a method for collecting a waste sample that is defined as representative by the regulations is provided in some cases. For complex wastes and environmental monitoring for closure and post-closure, representativeness is dependent on proper sampling design (see section B1) and will be satisfied by ensuring the approved plans were followed during sampling and analysis. The degree to which the sampling strategy has achieved representativeness can be measured as a qualitative parameter based on the proper implementation of the sampling design and laboratory analytical program. Analysis of equipment blanks, field blanks, trip blanks, sample temperature on arrival at the laboratory, and sampling holding time as recorded on the COC record can indicate procedural deviations or possible contamination that may decrease the representativeness of the samples.

Comparability is a qualitative parameter that expresses the degree of confidence with which one data set can be compared to another. Comparability of data can be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. The factors affecting comparability include sample collection and

handling techniques, matrix type, and analytical method. If these aspects of sampling and analysis are carried out according to standard analytical procedures and the procedures are implemented properly, the data may be considered comparable. Comparability is also dependent upon other quality criteria, because data sets can only be compared with confidence when precision, accuracy, and representativeness are known.

Completeness is a measure of the amount of valid data collected compared to the amount planned. Field completeness is a measure of the number of samples collected versus the number of samples planned. Laboratory completeness is a measure of the number of valid measurements compared to the total number of measurements planned. Analytical data are considered valid if field data sheet and COC information show that field QC procedures were properly followed, no significant level of analytes are detected in QC blank analyses, and none of the QC objectives that affect data usability are exceeded (see sections D1 and D2). Completeness is calculated to determine if an acceptable amount of valid data was obtained so that legitimate conclusions may be drawn (incomplete data may not be sufficiently representative). Percent completeness can be calculated using the following formula, where SV is the number of valid sample measurements and ST is the total number of samples planned:

$$\% \text{ Completeness} = \frac{SV}{ST} \times 100$$

Bias is the systematic or persistent distortion of a measurement process that causes error in one direction (e.g., the sample measurement is consistently lower than the sample's true value). Sampling bias is best addressed through the proper selection and use of sampling tools, uses of correct sampling and subsampling procedures to limit preferential selection or loss of sample media, use of random sampling designs, and use of sample handling procedures that limit the loss or gain of constituents to the sample media. Analytical bias can be assessed by comparing a measured value in a sample of known concentration to an accepted reference value or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike).

Reproducibility refers to the uncertainty associated with the use of multiple laboratories for a specific study. The ability of multiple laboratories to generate the same result for splits of the same sample can be expressed as a measure of interlaboratory precision and bias. Specific indicators of precision and bias (such as range or variance) are generated using data from replicate samples sent to multiple laboratories.

Repeatability is a quantitative indicator used within a single laboratory (i.e., intra-laboratory precision). It is determined by keeping the laboratory, analyst, test method, and equipment constant and analyzing random aliquots of the same sample within a short time period.

Sensitivity of instruments and analytical methods is another important QA concern relating to laboratory analysis. Sensitivity is not a description of the data, but a description of the process that generates it against which the data should be compared and contextualized. Sensitivity is usually expressed in terms of a method detection limit (MDL) and/or a lower limit of

quantitation (LLOQ). The HW program is following EPA guidance associated with SW-846 Update V (see 80 FR 48522), which recommends using LLOQ rather than MDL whenever possible. The LLOQ, in most cases, is the lowest concentration in the calibration curve and represents the minimum concentration that can be reliably measured by an instrument and method. The MDL is typically lower and may establish an unrealistic lower limit for analysis of complex matrices such as soils and sludges. The LLOQ considers matrix effects by taking the LLOQ sample through the entire sample preparation and analytical process. SW-846 method 6020B section 9.8 for inorganic analytes and method 8000D section 9.7 for organic analytes include more information on verifying the LLOQ.

The first five DQIs listed (precision, accuracy, representativeness, comparability, and completeness) are sometimes referred to by their initials as "PARCC" and are considered the key quality indicators to consider in evaluating sample data. If data are precise, accurate, and complete they should theoretically also be reproducible, repeatable, and unbiased. The DQIs are evaluated by using analytical data from the QC samples listed in Table 9. In order to allow for this evaluation of data quality, all laboratory reporting packages submitted to the HW Section must include data for the minimum QC samples listed in the table or approved alternative QC samples.

QC performance criteria

This section discusses measurement quality objectives (MQOs), which are data quality objectives as they apply to the DQIs described above. All analytical data must be evaluated for compliance with MQOs. Data is accepted as valid and usable when these MQOs, also known as quality control performance criteria, acceptance criteria, or QC limits, are met. When these criteria are not met, corrective action should be taken. If corrective action is not possible in the laboratory (for example, additional samples are required because samples are contaminated or holding times have been exceeded) or does not remedy the problem, data must be either rejected or flagged with an explanation and evaluated carefully for usability (see Part D). All corrective action attempts must be documented.

The parameters of precision, accuracy, completeness, bias, reproducibility, repeatability, and sensitivity are quantitative measures, while representativeness and comparability are largely qualitative. Representativeness and comparability are evaluated qualitatively as described above. The HW program MQO for completeness is 90% for field and laboratory combined. In other words, 90% of the planned samples must produce valid data, as determined by meeting the MQOs for all other data quality indicators.

The necessary sensitivity (LLOQ) of analytical procedures to produce valid data varies significantly since it is matrix and analyte dependent. The HW program requires the use of analytical methods with sensitivities appropriate to the intended data use. Therefore, when analytical method is not mandated, a method should be specified such that the matrix-specific LLOQ is lower than the action level for any contaminant of concern (see section A7 for a discussion of action levels). In the case of method-defined parameters, such as TCLP regulatory levels, there are instances when the LLOQ for a contaminant may be higher than the calculated

maximum concentration that would otherwise define toxicity; the regulations specify that the LLOQ becomes the action level in this situation (see the notes to Table 1 in 40 CFR §261.24, as incorporated and amended in chapter 11-261.1, HAR). Laboratory reports should include information on LLOQ (or, if necessary, MDL) for each analyte/matrix/analysis.

The HW program requires analysis of one QC laboratory duplicate per batch of up to 20 samples to test repeatability. An RPD less than or equal to 20% is acceptable. The HW program does not require split samples to be analyzed by multiple labs to determine reproducibility of data.

Sampling bias is evaluated by ensuring that the samples are collected according to the sampling plan (e.g., proper location and sampling method) and that field measurements are implemented as specified (e.g., instruments are properly calibrated and maintained, proper conversion units are applied, etc.). Laboratory bias is assessed by ensuring that equipment rinsate, field, trip, and method blanks are not contaminated (concentration of contaminants is below the LLOQ, no contamination is measurable) and by percent recovery from a matrix spike.

Precision (expressed as RPD) and accuracy (expressed as percent recovery) are evaluated using matrix spikes and matrix spike duplicates. Appropriate performance criteria for these DQI can vary depending upon the sample matrix and analyte of interest. MQOs for percent recovery and RPD for common analyte types are listed in Table 10. Table 11 lists performance criteria for surrogate spike percent recovery for organic analyses by gas chromatography. In the absence of established guidelines for a particular type of analyte, an RPD of 20% or less and percent recovery in the range of 70 to 130% can be considered default QC limits for MS/MSDs. Precision and accuracy should also be assessed with laboratory control samples and LCSDs, for which HW program QC limits are an RPD of 20% or less and percent recovery in the range of 80 to 120%.

Table 10. Matrix Spike/Matrix Spike Duplicate Acceptance Limits For Organic Gas Chromatography & Gas Chromatography Mass Spectrometry and Inorganic Analyses

Matrix Spike compound	Water		Soil/Sediment	
	% Recovery	RPD	% Recovery	RPD
Volatile organics	75-125	20	75-125	20
Semi-volatile organics	70-130	25	70-130	25
Herbicides	70-130	25	70-130	25
Pesticides	70-130	25	75-125	25
Metals	80-120	20	80-120	20

Table 11. Surrogate Spike Acceptance Limits for Gas Chromatography & Gas Chromatography Mass Spectrometry Organic Analyses

Surrogate Compounds	% Recovery (water and soil/sediment)
Volatile organics	75-125
Semi-volatile organics	70-130
Herbicides	70-130
Pesticides	70-130

Corrective action

When any QC parameters are outside of the QC limits specified in the previous section (or in the project-specific SAP, WAP, closure plan, or post-closure plan approved by the HW program), the laboratory must identify the potential origin(s) of the problem(s), and initiate any appropriate corrective action. Any investigation should include a checklist of MQOs or questions related to data quality issues potentially needing corrective action. Such questions should include (but are not limited to) the following:

- Were any analytes detected in laboratory blanks that could be attributed to laboratory contamination rather than field contamination? (e.g., solvents commonly used in analytical laboratories such as methylene chloride and acetone that were not expected to be present in the field sample)
- Were any analytes of concern detected in the method blank that could indicate laboratory contamination?
- Did the RPD and percent recoveries for any of the QC analyses exceed the QC limits specified in this QAPP or the project-specific planning document?
- Was there any matrix interference suspected or determined? This may result in a degree of uncertainly for contaminants that may potentially mask each other on a chromatogram, such as pesticides and polychlorinated biphenyls (PCBs), or it may cause the LLOQ to exceed the action level.
- Were all calibration verification sample results within control limits?

Possible corrective actions include stopping the analysis, examining instrument performance, sample preparation, and analysis information, recalibrating instruments, and re-preparing and reanalyzing samples. Specific corrective actions responding to different data problems should be discussed in each laboratory's QA Manual and SOPs.

All corrective actions performed in the laboratory as a result of data not meeting the MQOs shall be documented and all records shall be maintained by the laboratory for a minimum of three years. If corrective action does not result in samples being analyzed under in-control conditions, then all affected data must be flagged by the laboratory (see section D1). For example, if a matrix spike recovery is not within acceptable criteria, then data for all samples associated with the same matrix type in the batch must be flagged. The description of the problem must be included in the data validation narrative on the final analytical report (see section D2).

B6. Field Instrument/Equipment Testing, Inspection, and Maintenance

All sample collection equipment and instruments used to take field measurements must be properly maintained and periodically tested or inspected to verify that they are in proper working condition. The HW Section does not possess any field testing or sampling equipment at this time. In the rare case that samples are taken by CM&E staff, they are likely to be taken with simple tools such as a plastic or metal spoon or the sampling jar itself. Any new equipment or instruments secured for the purpose of sampling by HW program staff will be inspected to determine acceptability and calibrated or standardized to applicable specifications and tested prior to each use.

Regulated facilities and their contractors may use field equipment such as pH meters and dissolved oxygen meters to take environmental measurements. Any such equipment must be properly maintained, calibrated, and tested prior to use according to established, written SOPs and following the equipment manufacturer's recommendations. A testing, inspection, and maintenance schedule should be included in the SAP, WAP, closure plan, or post-closure plan if applicable. Records of equipment maintenance, calibration, and testing should be maintained by the regulated facility. These records are part of the QA/QC information for any data generated from the samples taken by the equipment and must be maintained for three years.

B7. Laboratory Instrument/Equipment Calibration and Frequency

General standards for laboratory instrument maintenance and calibration are included in laboratory accreditation processes. Detailed information about the particular instruments used, calibration methods and frequency, and record-keeping should be included in the laboratory's QA Manual and SOPs for each method. A three-point calibration is typically completed for each analytical method. Records of equipment maintenance, calibration, and testing must be maintained by the laboratory for each specific instrument and are part of the QA/QC record for any data generated from analyses performed using the instrument. These records should be retained for three years.

B8. Inspection/Acceptance of Supplies and Consumables

HW program inspection and acceptance of supplies and consumables used to generate environmental data follows State procurement rules (Chapter 103D, Hawaii Revised Statutes and Hawaii Administrative Rules adopted pursuant to chapter 103D), State procurement office policies, and applicable contract specifications. CM&E staff visually inspect single use sampling equipment and containers to ensure that they are clean and intact, and containers are checked by appearance and shipping description to ensure that they are of the proper volume and material for the samples to be collected (the container material must be compatible with the waste to be sampled). CM&E staff conduct a very limited number of sampling events and use only single-use field equipment. If supplies received are not clean, intact, and correct upon inspection, the

shipment is returned and re-ordered in compliance with procurement policy and, if applicable, the existing contract.

Regulated facilities, their contractors, and laboratories providing analytical services to these entities or directly to the HW Section should have written QA policies for the acceptance of consumables such as standard solutions, deionized water, sampling equipment and containers, calibration gasses, and reagents. The inspection/acceptance of supplies and consumables by laboratories must be described in each laboratory's QA Manual.

B9. Non-direct Measurements

The majority of the data that HW staff use to make regulatory decisions can be considered secondary data because they consist of laboratory reports provided by regulated facilities upon request by CM&E staff, when applying for a permit, or when specified by an existing permit. All data generated by facility and contractor sampling, including site assessment, remediation, and closure data, are subject to the QA/QC specifications of this QAPP. All QA/QC protocol for this data must be documented and documentation provided to and/or approved by HW staff as specified in relevant sections of this QAPP.

Occasionally, when determining whether a multi-pathway risk assessment is necessary for a closure or post-closure permit, Permitting & Corrective Action staff work with toxicologists from the HEER Office and use data from other sources. Existing data and model assumptions used in such assessments must be taken from a nationally recognized source with an existing QA protocol, including peer review. For example, toxicological data and risk levels for direct and indirect exposure may be taken from EPA's Integrated Risk Information System (IRIS).

HW staff may also use published information, such as EPA risk analyses and summaries of such analyses in Federal Register preambles, in making program decisions such as whether or not to adopt an optional federal rule into state regulations. Existing mechanisms, from the original QA/QC procedures of the investigators and peer review to public comment periods and study revisions in response to comments, typically ensure appropriate data quality in these documents. HW program decisions should always be based on sound data, so staff using secondary data from any source will check to ensure that such mechanisms are in place and offer reasonable assurance of data quality.

B10. Data Management

The HW program generates data in the form of field data sheets and COC records and receives laboratory reports via postal mail and electronic mail (usually as PDF attachments). CM&E and Permitting & Corrective Action staff receiving data electronically may store these files on individual SHWB computer hard drives and on an Environmental Management Division local area network (LAN) drive, which is maintained as specified in section 13 of the EMD QMP. All data documents received electronically must be stored within the electronic facility file on SharePoint cloud storage and/or printed and the paper copy included in the centrally filed paper

copy of the facility file. Field data sheets, COC records, and laboratory reports are filed in the facility file as part of the inspection report in the facility file (see section A9). Paper hazardous waste facility files are stored in a central filing location in the SHWB office as permanent records. The HW program is also in the process of converting all file to electronic copies on SharePoint cloud storage. An Access database on the LAN drive is used to catalog and search for both paper and electronic facility files.

Regulated facilities, contractors taking samples for regulated facilities, and laboratories are required to retain data and QA/QC documentation as discussed in this QAPP, generally for a period of three years (see especially section A9).

C. Assessment and Oversight

C1. Assessment and Response Actions

Periodic assessments of the HW program QA system ensure that the system is implemented as described in this QAPP and that the QAPP is effective in guiding production of data of appropriate quality for program decision-making. When deviations from the QAPP exist, assessments help to identify where additional resources may be needed, what remedial actions can be taken, and whether data quality has been critically compromised. The assessment process includes follow-up to ensure that any problems identified have been adequately corrected. Revisions of this QAPP may also be based on information gathered during assessments. (Assessment of data quality is discussed in Part D.)

All laboratories providing data to the HW program must be accredited, as described in section A4.2. Since these nationally recognized accreditation processes include periodic QA assessments of various types, the performance of laboratory QA systems is not assessed directly by the HW program. Laboratory QA Manuals, which are reviewed and approved by the QAO prior to HW Section acceptance of laboratory data, are also expected to include provisions for internal QA assessments carried out in response to certain triggers, such as severely out of control QC results.

Assessment types

A *Technical System Audit* (TSA), which is an objective, qualitative evaluation of how well current HW program practices conform to this QAPP, is conducted at least annually by the QAO. The scope of this assessment includes all QA/QC activities carried out by CM&E and Permitting & Corrective Action staff. Therefore, the most frequent and critical QA/QC activity of staff, review and interpretation of laboratory data packages and other QA information submitted by regulated facilities (sample analysis plans, waste analysis plans, etc.) is the main focus of the evaluation. Sample collection and maintenance of QA documentation are secondary foci.

TSAs are authorized and initiated by the SHWB Chief. Sample collection, laboratory package and QA plan review, and documentation tasks for which CM&E and Permitting & Corrective Action staff are primarily responsible are assessed by the QAO or an audit team led by the QAO.

This qualitative assessment relies primarily on interviews and record review and is further described below.

A *Quality System Audit* (QSA) is authorized by the EMD Chief and scheduled and carried out by the EMD QAM at least once during the period in which this QAPP is valid, as described in the EMD QMP. QSAs include an examination of the development and documentation of QA procedures (QA planning) as well as how procedures are implemented.

A *Management Systems Review* (MSR), an overall review of the effectiveness of the HW program's QA system similar to a QSA, may be scheduled by EPA Region 9 QA staff at their discretion, as discussed in the EMD QMP.

Technical System Audit specifications

The goals of the annual TSA are to:

- Determine whether environmental data collection and use by the HW program comply with this QAPP
- Determine whether the procedures defined by the QAPP are implemented effectively
- Determine whether the procedures defined by the QAPP are adequate to achieve the program's data quality goals
- Determine the suitability and effectiveness of QA practices actually being implemented, if deviations from the QAPP exist
- Provide HW program staff with an opportunity to improve the quality system
- Provide increased confidence that environmental data collected and used by the HW program are defensible and properly documented

The QAO will observe sample collection events by CM&E staff whenever possible, since they may take place only once or twice during the year, and take notes for use during QA assessment. Laboratory package and QA plan review and QA documentation tasks will be assessed by record review and interviews with staff. In planning for the annual TSA, the QAO or audit team will develop an interview questionnaire and document review checklist based upon the DQOs discussed in this QAPP and the standard QA assessment questions listed in Appendix E.

If necessary, the QAO will recruit an assessment team qualified to perform their duties by virtue of education, training, and/or experience. Everyone on the assessment team should be familiar with basic quality system concepts and principles and the team as a whole should possess the needed subject matter knowledge to cover the scope of the assessment. For example, assessment of Permitting & Corrective Action staff's review of large data sets from environmental monitoring may require the QAO to recruit staff with more statistical expertise, such as a toxicologist from the HEER Office, to serve on the assessment team.

Upon completion of a TSA, the QAO will prepare a report of preliminary findings for circulation to all HW Section staff. Staff will have an opportunity to give feedback, which will be addressed in the final annual QA assessment report to the SHWB Chief, which is discussed in section C2.

Response actions

Rapid and thorough correction of QA problems minimizes the possibility of questionable data or documentation, thus minimizing decision errors by the HW Section. Corrective response actions can be either immediate or long-term. Examples of immediate response actions include taking another sample and correcting errors or deficiencies in documentation. Examples of long-term response actions are providing staff with refresher training or additional training in specific subject areas such as sample collection techniques or the interpretation of QC data in laboratory data packages.

The QAO does not have the authority to halt data acquisition or review processes or demand that HW Section staff take specific actions or make specific changes to processes. However, the QAO has direct access to the SHWB Chief and may provide recommendations to the Section Supervisor and SHWB Chief, who are authorized to implement changes. The annual QA system review is intended to keep the Section Supervisor and SHWB Chief informed about the HW Section's functioning and identify opportunities for preventative measures, corrective actions, and continuous improvements of the HW program.

The SHWB Chief and Section Supervisor are responsible for implementing corrective response actions. The QAO will document all QA response actions applied in order to provide a complete record of QA activities. These records assist the management team in identifying long-term QA problems and enable the application of long-term response actions such as personnel training and improvement of sampling procedures.

Response actions should address the following:

- Measures to correct each nonconformance
- Identification of all root causes for significant deficiencies
- Determination of the existence of similar deficiencies
- Corrective actions to preclude recurrence of similar deficiencies
- Assignment of action responsibility
- Completion dates for each response action
- Measures to evaluate success of the response action

The QAO will monitor the completion and effectiveness of response actions. Verification of the effectiveness of response actions is important because often a solution may sound good or "look good on paper" but not be easily or effectively implemented. Failure to adequately identify and correct all root causes will most likely result in a recurrence of the problem. The QAO will monitor implementation of response actions using methods appropriate to the situation, such as:

- Reassessing the deficient areas
- Reviewing new or revised QA documents such as manuals, procedures, and training records
- Observing the work of other staff members conducting sampling or data review
- Confirming the successful completion of response actions during the next scheduled TSA

A record of all response actions implemented and evaluated during the annual reporting period is included in the QA final report to management discussed in section C2. Informal reports on the

evaluation of ongoing response actions may be appropriate in some circumstances. The SHWB Chief and Section Supervisor will define the necessity for follow-up to assess the effectiveness of particular response actions at the time of their implementation.

C2.Reports to Management

The QAO shall submit a comprehensive report on HW program QA/QC activities to the Section Supervisor and SHWB Chief on an annual basis. This report will include the following information for the reporting period:

- Dates of reporting period
- Summary of QA/QC program, including trainings and accomplishments
- Changes in QAPP
- Summary of all internal QA system assessments performed
    - Date and type of assessment
    - Names of assessors
    - Description of assessment, including list of personnel interviewed
    - Assessment questionnaire and/or checklist used
    - Feedback on draft assessment report provided by Section staff
    - Final assessment report findings
- List of significant deviations from the QAPP and any other identified QA program deficiencies
    - Description of problem
    - Date of problem report and name of reporter
    - Source of problem
- Discussion of the impact of these deviations on data quality and potential uncertainties in program decisions based on the data
- Discussion of response actions recommended/implemented
- Evaluation of efficacy of response actions implemented
    - Including evaluation of response actions initiated in previous reporting period

If the quality of data on which critical program decisions are based may be compromised, any HW staff member who becomes aware of the situation should make an informal, verbal report to the Section Supervisor as soon as possible. This protects the integrity of HW Section data by allowing a response action to be initiated and evaluated in a timely manner. Corrective actions and follow-up recommended by the QAO or specified by the Section Supervisor should begin as soon as practicable and the QAO should complete a report as soon as possible, identifying the problem and documenting the details of the response actions taken. The following situations may call for immediate correction and reporting:

- Preservation and holding time requirements for any sample were not met
- Unacceptable QC data is received in a laboratory data package
- Sample collection protocols or analytical methods specified in the regulations, QAPP, or other relevant planning documents were not used

- An activity was noted that affected the quality of the program's data
- Corrective action was initiated

The QA system shall be open to continual improvement. The SHWB Chief and HW Section Supervisor are responsible for deciding how to implement changes or response actions recommended in the QA annual report and informal reports from staff pertaining to QA/QC issues. The QAO shall document all changes made throughout the year and ensure that the QAPP is updated to reflect the current QA program at least once a year. As noted in section A9, major changes to the program require the QAPP to be resubmitted to EPA Region 9 Quality Assurance for review and approval.

D. Data Review

D1. Data Verification, Validation, and Assessment

This section describes the review process all data submitted to the HW program must undergo to determine whether or not the data conform to appropriate QA/QC criteria (the criteria explained in this QAPP and/or project-specific criteria outlined in an approved SAP, WAP, or closure or post-closure plan) and to assess the usability of the data in making program decisions. This data review process is broken down into three stages: verification, validation, and assessment.

Verification

CM&E staff, or sample collectors from regulated facilities or their contractors, are responsible for in-field data verification at the time of sample collection. This is simply a process of double-checking to make sure that all QA field procedures outlined in the QAPP and any relevant SAP, WAP, or closure or post-closure plan have been followed, a sufficient volume of sample and the appropriate blank samples have been collected, and identifying information has been correctly recorded on sample labels, the field data sheet, and the COC form. The completion of these verification checks should be documented on the field data sheet and signed and dated by the verifier. Any deviations from QA procedures or corrective actions taken must be noted on the field data sheet.

Most data verification is completed by the analytical laboratory prior to submitting a data package to a regulated facility or the HW Section. At this stage, it is not the quality of the data that is being evaluated, but the conformance of the data generation process to QA guidelines. During the data verification process, which should be outlined in the laboratory's QA Manual and is usually completed by the laboratory staff responsible for the data generation, data are evaluated for completeness, correctness, consistency, and compliance with sample handling and analytical procedures of this QAPP, any relevant SAP, WAP, or closure or post-closure plan, the laboratory QA Manual and sample preparation SOPs, and the published analytical method used. The verification step includes checking for data entry, transcription, calculation, reduction, and transformation errors, and ensuring that complete sample information is available (sample matrix, blanks, duplicates, shipping dates, preservatives, holding times, etc.). Any deviations

from QA procedures or missing data must be noted on the data validation report (see section D2).

Validation

Validation processes analyze the quality of the available data themselves and must therefore be analyte- and sample-specific. Data validation involves checking to see how well QC data align with HW program MQOs (see section B5) and quality considerations specific to analytical method, such as instrument calibration standards for the particular equipment used. When an approved project-specific SAP, WAP, closure plan, or post-closure plan specifies different data acceptance criteria, data validation will also consider these project-specific MQOs. Validation is completed by the laboratory prior to submitting a laboratory report to a regulated facility or to the HW Section. Validation processes should be outlined in the laboratory's QA Manual and completed by staff who were not involved in generating the data being validated.

Validators evaluate the degree to which data may be biased or unreliable due to failure to meet any MQOs and label or "flag" any data whose validity may be in question. For example, a high concentration of contaminant in a field blank may indicate that samples were contaminated during collection and concentration measurements for the samples do not accurately represent contaminant levels found at the sampling site. By flagging associated data on its report, the laboratory alerts the data user (the regulated facility and/or HW program staff) that there may be quality problems and data should be evaluated closely for usability. Laboratories typically perform data validation as an in-process step to allow for corrective action if necessary, but data validation must also be performed by the laboratory after all analyses are complete and any errors or failures to meet relevant MQOs and corrective actions taken must be noted in the data validation records.

All laboratory reports submitted to the HW program must bear a certification statement signed by the laboratory manager stating that the data have been validated and that any departures from MQOs have been flagged (see section A9). The data qualifier flags used by the HW program are defined in Table 12. If a lab uses a different set of data qualifiers, a key must be included with all results reported to the HW Section. Data validation records included in the data package should also include a narrative that identifies any corrective actions taken in response to QC issues, and describes, where possible, the reasons for any failure to meet method, procedural, or QC requirements, and evaluates the impact of such failure on the overall data set.

Table 12. Data Qualifiers and Definitions

Data qualifier	Definition
U	The analyte was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. The associated numerical value is an estimated quantity and may be inaccurate or imprecise.
J	The analyte was positively identified. The associated numerical value is an estimated quantity and may be inaccurate or imprecise.
J+	The analyte was positively identified. The associated numerical value is an estimated quantity and may be biased high.
J-	The analyte was positively identified. The associated numerical value is an estimated quantity and may be biased low.
R	The sample results are rejected as unusable due to serious deficiencies in meeting quality control criteria. The presence or absence of the analyte cannot be confirmed.
B	The analyte was identified in a field blank or equipment blank that was used to assess field contamination associated with sampling.

Assessment

Data assessment uses the results of the data verification and validation steps and all other available information about the data collection event and analytical procedures to determine overall usability of the data. The question at this stage, essentially, is whether the data are of appropriate quality that they can be used for their intended purpose, to make a particular regulatory decision. CM&E staff and Permitting & Corrective Action staff receiving analytical reports from laboratories or, more often, from regulated facilities are responsible for performing data assessment prior to making any decisions based upon the data. When the laboratory has flagged any data in its data validation reporting, the QAO should be consulted to assist with data assessment.

Regulated facilities should also perform data assessment when receiving laboratory data before using that data to make decisions about how to manage wastes, since those decisions are subject to regulatory review by the HW program. For example, if the data a regulated facility uses to make a hazardous waste determination are not valid (according to CM&E staff's later assessment), and the facility handles the waste as non-hazardous, CM&E staff may cite and fine the facility for improper storage, treatment, or disposal of hazardous waste.

D2. Approaches to Verification, Validation, and Assessment

Verification

Verification involves checking the records of sample collection, handling, and analysis against the method and procedural requirements for the following and noting any deviations that occurred from specifications in the appropriate planning document:

- Sample collection
- Sample receipt
- Sample preparation
- Sample analysis
- Records associated with samples

CM&E staff do a verification check after collecting samples to ensure that sample collection occurred as planned, using the checklist in Table 13 (this table is also contained in the field data sheet in Appendix C). Field staff for regulated facilities and their contractors should also complete this verification immediately after sampling. This check should be recorded in the field data sheet and any deviations from the QAPP or other relevant planning document must be noted.

The remaining verification procedures are completed at the analytical laboratory (see section D1). The data verification process should follow procedures outlined in the laboratory's QA Manual and is usually completed by the laboratory staff responsible for the data generation. A good general description of this process is given in chapter five of "EPA Guidance on Environmental Data Verification and Data Validation" (EPA QA/G-8, November 2002) and will not be repeated here. Any deviations from QA procedures or missing data must be noted in the laboratory's data validation report. Laboratories may perform data verification as an in-process step to allow for corrective action if possible, but data verification must also be performed after all analyses are complete and any deviations and corrective actions taken must be noted.

Table 13. Field data verification checklist

	verified	verified w/ corrections	not verified	not applicable	Comments
appropriate number and volume of samples collected					
location of sampling follows applicable plan					
appropriate type, number, and volume of blanks collected					
identifying information correctly recorded on sample labels, field data sheet, and COC form					
date and time of sampling recorded on field data sheet and COC form					
preservatives, if any, are added to samples and recorded on COC form					
if field readings were taken, records of field instrument calibration are present					

Validation

Laboratories validate sample data by checking to see that instruments were properly calibrated, all appropriate QC samples have been collected and analyzed (see Table 9, section B5), and the results fall within the MQOs (see "QC performance criteria" in section B5). Any QC sample results outside these data acceptance criteria must be flagged along with all associated samples (for example, a batch of 20 samples for which the associated QC matrix spike/matrix spike duplicate show an unacceptable RPD). The laboratory flags data as explained in section D1 so that regulated facilities and HW staff are aware of potential limitations on how the data may be used to make decisions. Whenever possible, a determination should be made by the laboratory as to the cause of the data's non-conformance to MQOs and an explanation provided in the data validation report.

Any discrepancies noted by the laboratory during data verification and validation that are not sufficiently explained should trigger a more extensive "focused validation" by the laboratory's QAO or other laboratory staff not involved in data generation. This process involves detailed examination of records (bench notes, calibration curves, reagent prep logs, etc.) and discussions with the analyst(s) involved in generating the data. The intent of a focused validation is to properly qualify data—in this case to assist HW Section staff in understanding whether or not the

data has some limited use for regulatory decision-making and what its possible uses and limitations are. The validator will determine whether data quality of a sample batch is adversely affected, non-compliance with acceptance criteria indicates a widespread bias affecting data quality for all samples, or there is no significant impact on data quality. This information is important in assessing the potential impact of this failure to meet MQOs on the data's usability.

The data validation report should outline the data that were reported, a summary of the quality of the data, any deficiencies in the sample data or QC data, the data qualifiers assigned, and any additional information gathered in focused validation efforts. This report is part of the data package submitted by the laboratory to the data user and may take the form of a case narrative or cover letter in addition to data qualifiers or "flags" displayed with analytical results.

Assessment

Data assessment evaluates the data quality—specifically whether the data meets the data quality objectives of this QAPP or, when applicable, an approved project-specific SAP, WAP, closure plan, or post-closure plan—and the usability of a data set for its intended purpose in environmental decision-making. To evaluate data quality, the HW staff complete a desk-top review as described in EPA Region 9's data review manual (United States Environmental Protection Agency Region 9 Quality Assurance Office, 2014b). HW Staff use the guidance in sections 3 and 7 of the manual to complete the desk-top review checklist (US EPA Region 9 Quality Assurance Office, 2014b, p. 8). The manual guides a review of information available from the laboratory data package and other sources to answer the following questions:

1. Were problems noted in the laboratory's data validation report (may be contained in case narrative or cover letter)?
2. Was laboratory accreditation/certification information provided? (lab must be NELAP or A2LA accredited, see section A4.2)
3. Was laboratory contact information provided?
4. Were the date(s) that samples were collected, received, prepared, and analyzed by the laboratory provided?
5. Was the correct analytical method used? (see section B4)
6. Were all requested analytes reported?
7. Were holding times met? (see Tables 5 and 6)
8. Were units of measurement reported? (dry/wet weight if applicable)
9. Were detection/reporting limits sufficiently low to meet project objectives? (see "QC performance criteria" in section B5)
10. Were data qualifiers reported and explained? (see "Validation" in section D1)
11. Were all surrogate recoveries (organic samples) within allowable limits? (see Table 11)
12. Was there any contamination in blank samples? (relevant blank samples should be included in the laboratory analytical report as listed in Table 9)
13. Were Laboratory Control Sample (LCS) recoveries within allowable limits? (80-120%)
14. Were Matrix Spike / Matrix Spike Duplicate or Laboratory Duplicate recoveries within allowable limits? (see Table 10)
15. Were any interferences noted in the case narrative that could affect the results?

16. Were any problems noted on the chain-of-custody form?
17. Were any problems noted on sample receipt checklist (if provided)?

Once HW staff determine whether the data meets applicable MQOs, the second part of assessment is to determine how any missing, questionable, or rejected data affect the data set's usability. This is especially important when there are multiple QC measures outside the MQOs. When CM&E or Permitting & Corrective Action staff are considering using flagged or rejected data to support a regulatory decision, the QAO should be consulted to assist in assessment. It is impossible to make a general rule for these circumstances because the ultimate usability of data depends on the specifics of the analyte, matrix, analytical method, QC failure, and decision to be made based on the data. Usability of data must be assessed on a case-by-case basis.

In some cases, flagged or rejected data may still be usable for making a program decision, but the data must be carefully assessed before such a determination can be made. To illustrate this point, two examples follow:

1. A data package is submitted to the HW Section. The data are intended to be used to demonstrate compliance with the HEER Office Tier 1 EAL of 0.3 mg/kg for benzene concentration in soil at a post-closure site. The concentration of benzene in the sample is reported as 0.2 mg/kg, but the recoveries in the MS, MSD, and LCS are 25%, 45%, and 50% respectively. Because of these low recoveries, the laboratory has flagged the 0.2 mg/kg result for benzene to advise data users that the result should be considered an estimated concentration and may be biased low (J-). If the data are significantly biased low, actual concentrations of benzene in the sample could easily exceed 0.3 mg/kg. Therefore, the data cannot be used to demonstrate compliance with this EAL; the data are not of appropriate quality for this intended use. Possible corrective actions the laboratory could take include reanalysis of the matrix, analyzing a larger sample volume, or collection of additional samples. Alternatively, Permitting & Corrective Action staff may conclude that the probability that the actual concentration of benzene in the soil exceeds the cleanup criteria warrants additional cleanup of the site, followed by additional sampling.
2. A data package is submitted to the HW Section. A sample has been tested for mercury to determine if a waste is characteristically hazardous for toxicity. The concentration of mercury in the TCLP leachate is reported as 20 mg/L, 100 times the regulatory level of 0.2 mg/L for mercury listed in 40 CFR §261.24, as incorporated and amended in chapter 11-261.1, HAR. A review of the data package reveals the recoveries of mercury in the MS and MSD samples are 25% and 30%, respectively, and recovery of the LCS is 85%. The percent recoveries for the MS and the MSD are outside the MQOs and indicate the mercury result is biased. This could lead to a rejection of the data. However, CM&E staff may conclude that the mercury data are still usable for classifying the waste as hazardous because the reported results for mercury exceed the action level by a factor of 100, the LCS recovery was acceptable, and the direction of bias is "low" as indicated by the MS/MSD results. The low recoveries in the MS and MSD were likely due to matrix interference. Correcting for this interference would likely result in a higher sample value

for mercury, which would not change the waste characterization. No corrective action is needed, because even if the reported results were biased low, the concentration of mercury in the waste significantly exceeds the regulatory level; the data are sufficient for their intended use of making a hazardous waste determination.

D3. Reconciliation with Data Quality Objectives

The reconciliation of data with DQOs is similar to the assessment phase of data review, but at this stage the evaluator takes a step back to look at the bigger picture. In the assessment phase the focus remains on MQOs and the integrity and quality of the data set itself. The reconciliation step is part of the assessment phase but is focused on the project at hand (as opposed to the programmatic assessments discussed in Part C). The questions here is: Can overall program objectives be met with the existing data? If data are involved in an enforcement action, this is the stage at which CM&E staff, the Section Supervisor, the QAO, and the Deputy Attorney General (AG) would together evaluate whether the data are legally defensible. The outcomes of the data review processes discussed in sections D1 and D2 are important inputs for this process.

Although the focus is still on the particulars of the case, reconciliation with DQOs is not only a question of whether the decision to be made in the current case is fully supported by validated data, but also includes a broader assessment of the planning process and how it was implemented. Did the quality assurance planning process result in the production of environmental data of appropriate quality for program decision-making? Were the assumptions the project was based on correct? Were the DQOs realistic? What improvements in planning, data collection, analysis, or data review can be applied to future projects based on what was learned from this case? If the data are not appropriate, sufficient, and usable for their intended purpose, this evaluation may determine that some or all aspects of the project must be repeated, either as originally planned or with changes.

CM&E staff, Permitting & Corrective Action staff, the QAO, the HW Section Supervisor, the EMD QAM, and any other staff involved in a particular case (the Deputy AG, EPA Region 9 partners, etc.) may contribute to this stage of data review, which is qualitative in nature. The Section Supervisor and QAO are responsible for collecting information from this stage and feeding it back into the QA planning process and implementation of other program QA activities.

REFERENCES

American Society for Testing and Materials. *Annual Book of ASTM Standards.*

National Environmental Laboratory Accreditation Conference. 2003. "2003 NELAC Standard." (EPA/600/R-04/003, June 5, 2003).

State of Hawaii Department of Health Environmental Management Division. 2013. "Quality Management Plan, Revision 0." (October 31, 2013).

State of Hawaii Department of Health Hazard Evaluation and Emergency Response Office. 2021. "Technical Guidance Manual for the Implementation of the Hawai'i State Contingency Plan, Interim Final – November 12, 2008." https://health.hawaii.gov/heer/tgm/. Accessed November 30, 2021.

-----. 2015. "Environmental Hazard Evaluation and Environmental Action Levels." https://health.hawaii.gov/heer/guidance/ehe-and-eals/. Accessed March 15, 2021.

United States Environmental Protection Agency Emergency Response Team. "ERT Standard Operating Procedures." http://www.epaosc.org/site/site_profile.aspx?site_id=2107. Accessed March 15, 2021.

United States Environmental Protection Agency Office of Environmental Information. 2000. "Guidance on Technical Audits and Related Assessments for Environmental Data Operations." (EPA QA/G-7 Final, January 2000).

-----. 2001. "EPA Requirements for Quality Assurance Project Plans." (EAP QA/R-5, March 2001).

-----. 2002a. "Guidance on Environmental Data Verification and Data Validation." (EPA QA/G-8, November 2002).

-----. 2002b. "Guidance for Quality Assurance Project Plans." (EPA QA/G-5, December 2002).

-----. 2003. "Guidance on Assessing Quality Systems." (EPA QA/G-3, March 2003).

United States Office of the Federal Register, National Archives and Records Administration. *Code of Federal Regulations*. Title 29, Part 1910.

-----. *Code of Federal Regulations*. Title 40, Parts 260 to 279.

United States Environmental Protection Agency Office of Resource Conservation and Recovery. 2015a. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, Final Update V.* (EPA Publication SW-846, August 13, 2015).

------. 2015b. "Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Waste – Final." (EPA 530-R-12-001, April 2015).

------. 2015c. "Waste Management System; Testing and Monitoring Activities; Notice of Availability of Final Update V of SW-846." *Federal Register, Volume 80*(156), August 15, 2015. United States Office of the Federal Register, National Archives and Records Administration.

United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation. 2014a. "National Functional Guidelines for Inorganic Superfund Data Review." (EPA-540-R-013-001, August 2014).

-----. 2014b. "National Functional Guidelines for Superfund Organic Methods Data Review." (EPA-540-R-014-002, August 2014).

United States Environmental Protection Agency Region 9 Quality Assurance Office. 2012. "EPA Region 9 Guidance for Quality Assurance Program Plans." (R9QA/03.2, March 2012).

-----. 2014a. “Sampling and Analysis Plan Guidance and Template, Version 4, General Projects.” (R9QA/009.1, May 2014).
-----. 2014b. “Laboratory Data Review for the Non-Chemist.” (October 2014).

APPENDIX A. Acronyms

A2LA	American Association for Laboratory Accreditation
AG	Attorney General
ASTM	American Society for Testing and Materials
CEI	Compliance Evaluation Inspection
CFR	Code of Federal Regulations
CM&E	Compliance Monitoring and Enforcement
COC	Chain of Custody
COLIWASA	Composite Liquid Waste Sampler
DQI	Data Quality Indicator
DQO	Data Quality Objective
EAL	Environmental Action Level
EHE	Environmental Hazard Evaluation
EMD	Environmental Management Division
EPA	Environmental Protection Agency
ERT	Emergency Response Team
FP	Flashpoint
FR	Federal Register
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDOH	State of Hawaii Department of Health
HEER	Hazard Evaluation and Emergency Response
HW	Hazardous Waste
IRIS	Integrated Risk Information System
LAN	Local Area Network
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LLOQ	Lower Limit of Quantitation
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSR	Management Systems Review
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, Completeness
PCB	Polychlorinated biphenyl
PDF	Portable Document Format
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer

QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QMP	Quality Management Plan
QSA	Quality System Audit
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SHWB	Solid and Hazardous Waste Branch
SOP	Standard Operating Procedure
SW-846	EPA Publication SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"
TCLP	Toxicity Characteristic Leaching Procedure
TGM	Technical Guidance Manual
TNI	The NELAC Institute
TSA	Technical Systems Audit
TSD	Treatment, Storage, and Disposal
US	United States
USDA	United States Department of Agriculture
VOA	Volatile Organic Analysis
WAP	Waste Analysis Plan

APPENDIX B. Glossary of Key Quality Assurance Terms

Acceptance criteria: Quantitative criteria for quality control measurements, such as relative percent difference and percent recovery for matrix spikes and duplicates and laboratory control samples and duplicates, which indicate acceptability of related data for their intended use. Also known as measurement quality objectives (MQOs), performance criteria, or quality control (QC) limits.

Accreditation: The process by which an independent organization (such as NELAC or A2LA) evaluates and recognizes an analytical laboratory as meeting predetermined qualifications or standards.

Accuracy: The closeness of a measured result to an accepted reference value. Laboratory accuracy is usually measured as a percent recovery. See data quality indicators.

Action level: The concentration of an analyte of interest which, if exceeded, triggers a specific program decision or other action. Regulatory levels, such as maximum concentrations for the toxicity characteristic, are a type of action level.

Bias: The systematic distortion of a measurement process that causes error in one direction (e.g., the sample measurement is consistently lower than the sample's true value). See data quality indicators.

Blank: A sample that has not been exposed to the analyzed sample stream and that should not contain the analyte of interest. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is used to monitor contamination during sampling, transport, storage or analysis. Blanks include equipment rinsate blanks, field blanks, method blanks, and trip blanks.

Chain of custody (COC): An unbroken trail of accountability that ensures the physical security of samples and prevents contamination or tampering. Documenting sample chain of custody from collection through analysis is essential to collecting valid laboratory data which may be used in legal proceedings.

Comparability: A qualitative parameter that expresses the degree of confidence with which one data set can be compared to another. See data quality indicators.

Completeness: A measure of the amount of valid data collected compared to the amount planned (usually a percentage). See data quality indicators.

Corrective action: An action taken to eliminate the causes of an existing nonconformance, deficiency, or other undesirable situation in order to prevent recurrence. In the context of quality control, corrective actions are taken to ensure high quality data when acceptance criteria are not

met and may include taking new samples, re-preparing and/or reanalyzing samples, recalibrating instruments, etc. See also response action.

Data Quality Indicators (DQIs): A set of qualitative and quantitative descriptors of a data set that together indicate the acceptability or usefulness of the data for its intended purpose. The most commonly used DQIs are precision, accuracy, representativeness, completeness, and comparability (PARCC). Additional DQIs discussed in this QAPP are bias, reproducibility, repeatability, and sensitivity (see section B5 for more detail).

Data Quality Objectives (DQOs): Qualitative and quantitative statements used in quality assurance planning to define the appropriate type of data needed to support decision-making. DQOs are the broadest description of the data quality required by a program and include both the action levels used to make decisions and acceptance criteria for DQI measures such as percent recovery and relative percent difference (RPD).

Field duplicates: Two samples taken from the same sampling location and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess error associated with sample heterogeneity, sample methodology, and analytical procedure.

Equipment rinsate blank: A sample of rinsate which has been used to rinse clean sampling equipment; used to check the effectiveness of decontamination procedures.

Field blank: A sample prepared in the field by filling a clean container with pure deionized or distilled water and appropriate preservative, if any, for the sampling being undertaken. For soil samples, field blanks can be prepared with certified clean sand or soil rather than clean water. Field blanks are used to assess contamination during the sampling process.

Laboratory Control Sample (LCS): An uncontaminated sample matrix, free from the analyte of interest, spiked with a known amounts of analytes usually from the same source as the calibration standards. It is generally used to establish the stability of the analytical system but may also be used to assess the performance of the measurement system (precision, accuracy, bias).

Laboratory Control Sample Duplicate (LCSD): A second laboratory control sample prepared in the laboratory. Laboratory control sample and laboratory control sample duplicate recovery can be compared to obtain a measure of precision (relative percent difference).

Laboratory split: An equal division of a sample taken from the sample container under laboratory conditions and processed and analyzed independently to assess repeatability.

Lower Limit of Quantitation (LLOQ): The minimum concentration of an analyte that can be reliably quantified by an instrument and method; also usually the lowest concentration in the calibration curve. The LLOQ is usually higher than the method detection limit.

Management Systems Review (MSR): An assessment of a developing quality system conducted by an external reviewer, including technical assistance in developing the quality system.

Matrix Spike (MS): A sample prepared by adding a known mass of target analyte (spike) to a specified amount of matrix sample. Matrix spikes are used to determine the effect of the matrix on a method's recover efficiency.

Matrix Spike Duplicate (MSD): A second matrix spike prepared in the laboratory. Matrix spike and matrix spike duplicate recovery are compared to obtain a measure of precision (relative percent difference).

Measurement Quality Objectives (MQOs): See acceptance criteria.

Method blank: A blank sample of a matrix similar to the batch of associated samples that is processed under the same conditions as samples through all steps of the analytical procedures in order to assess laboratory contamination.

Method Detection Limit (MDL): The minimum concentration of an analyte that can be measured and reported with confidence that the analyte concentration is greater than zero. See also lower limit of quantitation (LLOQ).

Percent recovery: A measure of accuracy calculated using the following formula, where S_m is the measured concentration of the spiked sample, U is the measured concentration of the unspiked sample, and S_k is the known concentration of the spike:

$$\% \text{ Recovery} = \frac{S_m - U}{S_k} \times 100$$

Performance criteria: See acceptance criteria.

Precision: The degree of agreement among duplicate measurements or a set of replicate measurements. The most commonly used measure of precision for duplicate measurements is relative percent difference (RPD). See data quality indicators.

Quality assurance (QA): An integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service (in this case, environmental data) is of the type and quality needed and expected by the user.

Quality control (QC): The overall system of technical activities that measures the attributes and performance of a process, item, or service (in this case, environmental data) against defined

standards to verify that they meet the stated requirements established by the user; operational techniques and activities that are used to fulfill requirements for quality.

Quality Control (QC) limits: See acceptance criteria.

Quality Control (QC) sample: A sample used to assess the performance of all or a portion of the measurement system. QC samples include various types of blank, duplicate, and spiked samples.

Quality System Audit (QSA): A documented assessment of a quality system performed to verify, by examination and evaluation of objective evidence, that applicable elements of the system are suitable and have been developed, documented, and effectively implemented in accordance with specified requirements.

Relative Percent Difference (RPD): A measure of precision calculated using the following formula, where A and B are results from the duplicate analyses:

$$RPD = \frac{A - B}{(A + B) / 2} \times 100$$

Repeatability: The degree to which a laboratory is able to generate consistent results for equal divisions of the same sample. It is determined by keeping the analyst, test method, and equipment constant and analyzing multiple subsamples within a short time period. See data quality indicators.

Representativeness: The degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. See data quality indicators.

Reproducibility: The degree to which multiple laboratories are able to generate the same result for equal divisions of the same sample, expressed as measures of interlaboratory precision and bias. See data quality indicators.

Response action: Also known as corrective actions, response actions are actions taken to correct problems with a Quality Assurance system, usually in response to an assessment such as a technical system audit, a quality system audit, or a management systems review. Examples of response actions are changes to standard operating procedures and additional training requirements for staff.

Sensitivity: The capability of a specific method and/or instrument to discriminate between measurement responses representing different levels of a variable of interest. The key measures of sensitivity for quality control pertain to the minimum amount of an analyte than can be detected or quantified (method detection limit and lower limit of quantitation). See data quality indicators.

Spike: A known mass of target analyte or surrogate added to a sample to determine recovery efficiency or for other quality control purposes.

Surrogate: A substance with properties that mimic that analyte of interest. It is unlikely to be found in an environmental sample and is added to them as a spike for quality control purposes.

Technical System Audit (TSA): A systematic, on-site, qualitative audit of a quality assurance (QA) system's technical aspects, which may include facilities, equipment, personnel, training, procedures, recordkeeping, data validation, data management, and reporting. TSAs evaluate QA and quality control activities of a project to ensure that QA planning documents are being properly implemented, but do not evaluate the QA planning process and planning documents themselves.

Trip blank: Blanks prepared prior to going into the field by filling volatile organic analysis (VOA) vials with organic-free water or sand. The sample containers are kept closed, handled, transported in the field, and then returned to the laboratory in the same manner as all other samples. Trip blanks are used when samples are collected for VOA in order to evaluate error associated with shipping and handling (i.e., diffusion of volatile organics through the vial septum with shipping and storage) and analytical procedures.

APPENDIX C. Field Data Sheet

See following pages.

APPENDIX D. Chain of Custody Form

See following page.

APPENDIX E. General QA Program Assessment Questions

ASSESSMENT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
General				
Has the approved QA Project Plan been reviewed by all appropriate personnel?				
Is implementation of the program in accordance with the QA Project Plan?				
Are there deviations from the QA Project Plan? Explain.				
Do any deviations from the QA Project Plan affect data quality?				
Data review				
Has the QC performance of each of the critical measurements been assessed and documented during the year?				
Have any data quality corrective actions been taken during the year?				
Were corrective action procedures taken consistent with the QA Project Plan?				
Sampling				
Were standard field data sheets and COC forms used to record sampling information?				
Are the standard forms dated?				
Is the person who recorded the data identified on the form?				
Are paper records written in indelible ink?				
Training				
Do personnel have appropriate technical and QA training to carry out data collection and review tasks assigned to them in the QAPP?				
Do the personnel files contain current summaries of the training and qualifications of program personnel?				