



3.6 SAMPLING AND ANALYSIS PLANS

The Sampling and Analysis Plan (SAP), developed during Step 6 of systematic planning, specifies the final design and configuration of the environmental measurement effort required to resolve issues and questions stated in the systematic planning steps (Steps 1- 5). The SAP is a comprehensive document that would enable an experienced field sampling team unfamiliar with the site to come in and examine the site and collect the required samples and field information. The SAP designates the types and quantities of samples or monitoring information to be collected; where, when and under what conditions they should be collected; the variables to be measured; and the Quality Assurance/Quality Control (QA/QC) procedures to ensure that sampling design and measurement errors meet the tolerable decision error specified.

The QA/QC procedures are described within the Quality Assurance Project Plan (QAPP), which is included within the SAP. The site-specific Health and Safety Plan is also included as part of the overall SAP (alternately, the Health and Safety Plan can be presented with the SAP in a site Work Plan). The SAP must be flexible and dynamic to deal with unexpected discoveries or circumstances that may be encountered during the site investigation. To ensure appropriate characterization of the site and to minimize the need to perform additional sampling, it is recommended that SAPs be reviewed and approved by the HEER Office. In addition, it is important to consult with the laboratory while developing the SAP to ensure objectives are in alignment with chosen laboratory practices, and to provide contingencies for matrix problems that may occur.

The suggested outline for the SAP is as follows:

I. Introduction	VI. Description of Sampling Activities
II. Site Background	VII. Analytical Methods
a. Site description	VIII. Quality Assurance Project Plan
b. Site characteristics	IX. Documentation and Reporting
III. Investigation History	X. Schedule
IV. Site Investigation Objectives	XI. Health and Safety Plan
V. Scope of Work	XII. References

More detailed information regarding the outline, format, and required content of the SAP is presented in Section 18.



3.6.1 Sample Collection Strategy

A sampling strategy should reflect the approach that will best meet investigation objectives within acceptable uncertainty limits, with consideration taken for efficient use of time, money, and human resources.

Sample collection for soils generally falls under two main categories: *Multi-increment* samples and discrete samples (see Section 4):

- The HEER Office strongly encourages the use of *Multi-increment/decision unit* strategies to investigate contaminated soil. *Multi-increment* samples are collected using a probabilistic sampling theory and involve the collection of a large number of increments (30-100) from within the subject DU. Each increment is made up of approximately 5 to 50 grams of soil. The increments are combined to form a single, *Multi-increment* sample for the DU. A detailed discussion of *Multi-increment* sampling approaches is provided in Section 4.
- Discrete samples (i.e., samples typically consisting of only one increment) are collected using either random or biased sample point locations based on professional judgment. In some cases, groups of discrete samples are combined for analyses. A small number of discrete samples are less representative of average contaminant levels in a specific DU than *Multi-increment* samples, and therefore not recommended in most cases. However, in limited circumstances, discrete samples may provide useful site investigation data. This includes screening sites for the presence of large spill areas not obvious in the field, and providing data to help select decision unit boundaries for collection of *Multi-increment* samples (see Section 4.3). Multiple discrete samples (combined and analyzed together, or analyzed separately), may also be the best compromise situation for collecting some subsurface samples, particularly where access to collect a minimum of 30 increments for *Multi-increment* samples is very difficult, and the results from sampling in this manner is compatible with the DQO established for the project.

The sample collection strategy for a given site may include more than one approach. For example, *Multi-increment* sampling may be selected as the most appropriate sampling approach for the surface soils of an identified spill area, while collecting a number of discrete



soil samples (combined) is specified to characterize contamination at depth in a hard to access decision unit. In both these examples, replicates in at least one or more DU would be collected to assess the precision of the data collected.

See Section 6 for sample collection strategies for groundwater, and Section 13 for information and references regarding ecological risk evaluations.

Information regarding sampling design is also available in USEPA's *Guidance on Choosing a Sampling Design for Environmental Data Collection* (USEPA, 2002f), although the guidance focuses on the collection of discrete samples. Software is available to assist in designing a sampling strategy, although again, they are primarily applicable to discrete sampling approaches. One example is Visual Sample Plan [VSP] software available from Pacific Northwest National Laboratory (PNNL, 2005).

3.6.2 Sampling Collection Methods

After the sampling design is determined, sampling methods are selected to facilitate the sampling design. Sampling methods are specific to the sampling design and the needs of the site and are selected to meet requirements of the site investigation objectives and associated DQO. Sampling DUs at depth typically involves additional time and resources compared to DUs for surface soil. Several sampling methods may be applicable for a given site. Sampling design approaches are discussed in Section 4. Sampling method procedural guidance for soil and sediment, groundwater and surface water, and soil vapor and indoor air is presented in Sections 5, 6, and 7, respectively.

3.6.3 Health and Safety Plans

Hawai'i SCP hazardous substance release sites fall under the definition of "uncontrolled hazardous waste sites" pursuant to Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) Title 29 Code of Federal Regulations (CFR) Section 1910.120(a)(1). A health and safety plan (HASP) is required under Title 29 of the Code of Federal Regulations, Section 1910.120 (Hazardous Waste Operations and Emergency Response), which includes a requirement for a hazard communication program meeting the requirements of 29 CFR 1910.1200. Like rules were adopted under Hawai'i Administrative Rules (HAR) Title 12, Chapters 60 and



203.1, Division of Occupational Safety and Health Standards. The Health and Safety plan is typically a part of the SAP (or alternately, part of the site Work Plan). The HEER Office recommends that an employer develop a written HASP, which includes the following elements:

- An organizational structure
- A comprehensive work plan
- A site-specific health and safety plan
- A health and safety training program
- A medical surveillance program
- Standard operating procedures for health and safety
- Any necessary interface between general program and site-specific activities

The OSHA HAZWOPER Standard, Title 29 CFR 1910.120, requires that personnel working in and around hazardous waste have a site-specific HASP and competent safety officers to enforce health and safety rules. OSHA has determined that employees must be trained if they work in proximity to hazardous chemicals with a potential for release, or substantial threats of release, of hazardous substances, without regard to the location of the hazard.

An OSHA-certified 40-hour class focusing on HAZWOPER training is required for those who are performing regular work on hazardous waste sites; an annual 8-hour refresher course is required to maintain the certification achieved through this training. An OSHA-certified 24-hour course is required for those who have occasional exposure to hazardous waste. In addition, an 8-hour course is required for supervisors and management personnel who oversee hazardous waste projects. The amount of training required is contingent upon an employee's responsibilities regarding involvement with hazardous materials; these must be clearly established by the employer and communicated to the employee(s). The HEER Office does not approve HASPs, but does require that one be in place for all field activities that meet the requirements of 29 CFR 1910.120 or HAR 12-60. Contact the Hawai'i Division of Occupational Safety and Health (HIOSH) for detailed information on HASPs and on organizations offering HAZWOPER training.