TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

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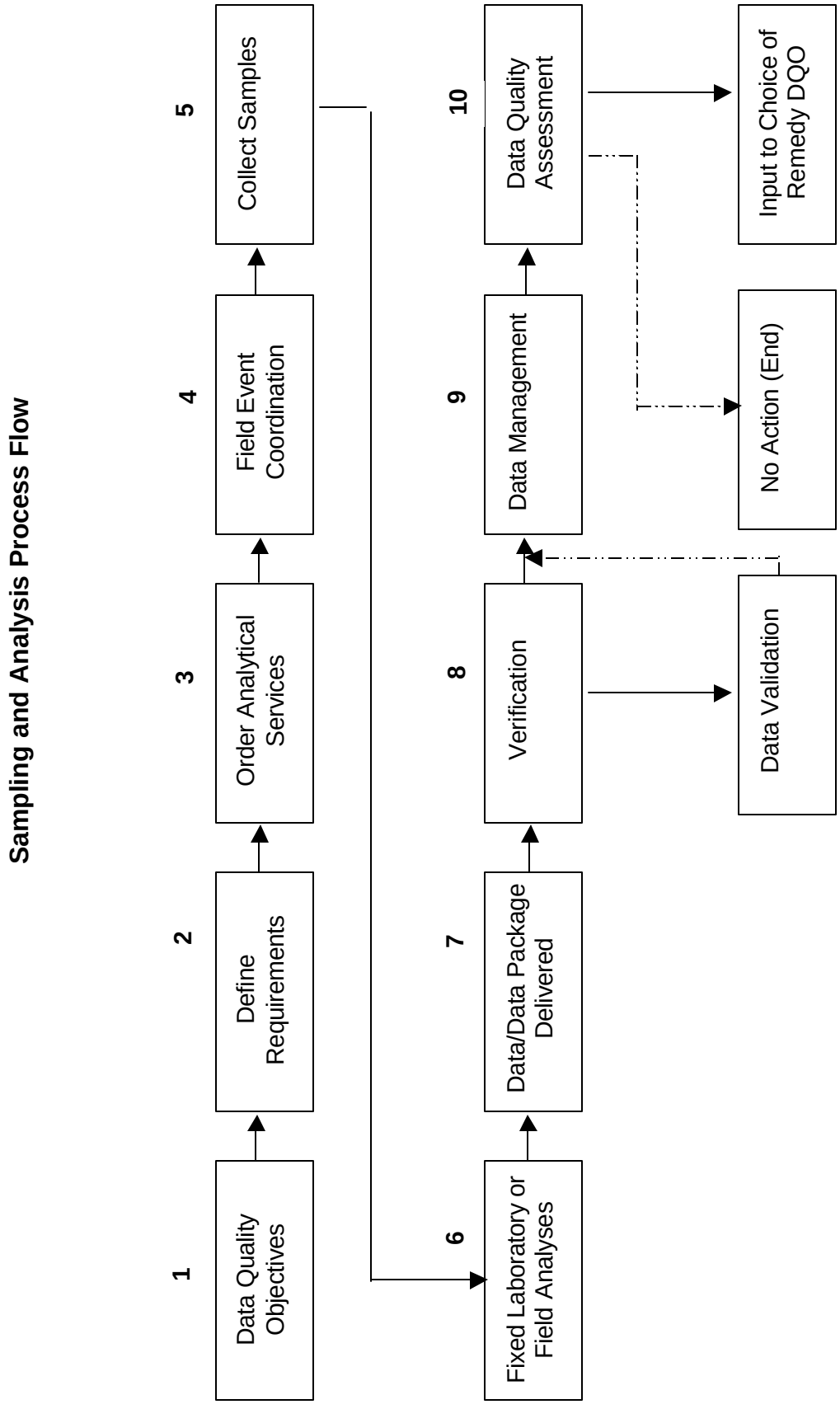
1.0 SAMPLING AND ANALYSIS PROCESS

It is important for all involved parties to be knowledgeable of the sampling and analysis process. A process flow chart has been developed to facilitate an understanding of the work flow process (see Figure 1-1). This volume of HASQARD (Volume 2) pertains to steps 4 and 5 of the work flow process. Volume 4 of HASQARD pertains to steps 6 and 7 of the process.

Each company and organization involved with sampling and analysis likely will have a more detailed work flow process described for each step. The project-specific DQOs also will impact the work flow process. Appendix A includes a brief description of the controlling documents, responsible organization(s), and desired inputs/outputs of the work flow process.

Figure 1-1. Sampling and Analysis Process Flow.



2.0 DATA QUALITY OBJECTIVES

The DQO process is a validated planning tool that is used to support programs in the accomplishment of the Hanford Site clean up mission. Properly applied, DQOs can save significant time and money by clearly defining programmatic objectives and decisions up front, getting stakeholder consensus, and optimizing data collection.

The DQO process is a logical method that clarifies the problems or questions that a program must solve. It further defines the information needed to answer questions and objectives including an assessment of risk or uncertainty. The DQO process may be applied to either programmatic or technical issues.

The DQO process is based on the principles of Total Quality Management, systems engineering, decision analysis, statistical experimental design, laboratory management and operations, and operations research.

The DQOs are developed by the stakeholders with technical support. The DQO process can be facilitated by a DQO specialist. RL has specialists available to programs for assistance in developing DQOs. The process fosters strong interface communication between the representative groups to achieve clear and commonly acceptable objectives required for the resolution of a question. The party ultimately responsible for the use and implementation of data quality objectives is the program. The seven steps in the DQO process are defined in Figure 2-1. Further discussion on DQOs can be found in Volume 1, Appendix B of this document and in EPA QA/G-4, *Guidance for the Data Quality Objectives Process* (EPA 1994).

Figure 2-1. The Seven Steps of the DQO Process*.

STEP 1: State the Problem - Concisely describe the problem to be studied. Review prior studies and existing information to gain sufficient understanding to define the problem.

STEP 2: Identify the Decision - Identify what questions the study will attempt to resolve, and what actions may result.

STEP 3: Identify the Inputs to the Decision - Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.

STEP 4: Define the Study Boundaries - Specify the time periods and spatial area to which decisions will apply. Determine when and where data should be collected.

STEP 5: Develop a Decision Rule - Define the statistical parameter of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions.

STEP 6: Specify Tolerable Limits on Decision Errors - Define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision.

STEP 7: Optimize the Design - Evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all the DQOs.

*As defined in the EPA QA/G-4, *Guidance for the Data Quality Objectives Process*, September 1994, page 3.

3.0 SAMPLING SYSTEMS

Line management shall develop, establish, and update requirements for sampling organizations and personnel qualifications, personnel training, site guidelines, sampling methods, procedures, corrective actions, document control, and field assessments. Documented procedures shall be in place. Program/Project management identifies specifications and ensures they are satisfied. If project management determines that existing sampling procedures are sufficient to meet or exceed project needs, new documents need not be developed. For most projects, existing sampling procedures will meet project requirements.

3.1 FACILITY MANAGEMENT

The following conditions shall be considered:

Site facilities are secure. The buildings, field laboratories, and controlled sampling points (e.g., monitoring wells) have access limited to authorized personnel.

Adequate storage areas for reagents, solvents, standards, and reference materials to prevent cross contamination or degradation.

Instrumentation, equipment, and utilities are maintained to perform the required/contracted sampling operation. Safety equipment will be available and readily accessible. Sampling equipment shall be kept secured when not in use.

Surface disturbances such as pits, holes, excavations, and trenches will be clearly marked or barricaded. Addition of new surface features such as well heads, pumps, piping, and electrical traces also will be clearly marked.

Sampling designs shall minimize interactions between high and low concentration areas, as well as minimize common utilization of equipment, instrumentation, and facilities. A formal, active contamination control that minimizes the potential spread of contamination between sample processing and sample storage areas will meet the fundamental elements of an active as low as reasonably achievable (ALARA) program. Specially controlled facilities or areas shall be established, as specified in the *Hanford Site Radiological Control Manual* (HSRCM), for the

receipt of highly contaminated materials and storage of samples (see EPA's SW-846 Chapter 9, Sampling Plan for more information).

C Line management is responsible for ensuring that waste disposition and worker health and safety are adequately addressed.

Design and implementation of sampling programs shall address situations or conditions necessary for the controlled use, storage, and disposition of sample material rejects (e.g., soil discards, purged waters), equipment decontamination residues, and/or remnants of samples. These programs also ensure that all activities that may impact environmental data are documented and recorded in a field logbook (see WAC 173-303-210 and 380 for more information).

3.2 SAMPLING METHODS

Documentation of sampling procedures is critical to the technical defensibility and the legal defensibility/admissibility of the resulting data. Whenever possible, industry-recognized sampling methods from agency published source documents, such as DOE, EPA, and American Society for Testing Materials (ASTM), shall be employed. Sample collection and processing procedures may also use methods published by the U.S. Geological Survey, U.S. Department of Agriculture, and professional groups such as the American Water Works Association. Current DOE, EPA, and ASTM sampling methods are detailed in the following sources:

DOE Methods for Evaluating Environmental and Waste Management Samples, DOE/EM-0089T, October 1992.

DOE EML Procedures Manual, 27th Edition, Volchok 1992.

DOE Environmental Survey Manual, Appendix E, Field Sampling Protocols and Guidance, Office of Environmental Audit, 1987.

EPA, *Representative Sampling Guidance*, Vol. 1, Soil, 1991.

EPA, *Soil Sampling Quality Assurance User's Guide*, 1989.

EPA, *Sampling of Water and Wastewater*, Shelley 1977.

EPA, *Practical Guide for Groundwater Sampling*, 1985.

EPA, *Compendium of Superfund Field Operations Methods*, 1987.

ASTM, *Sampling Surface Soils for Radionuclides*, ASTM C-998-83, 1983.

ASTM, *Standard Practices for Sampling Water*, Method D 3370-76, 1977.

WAC-173-303-110(2), *Dangerous Waste Regulation*.

Methods employed that are not found in the above references shall be thoroughly reviewed and approved by the cognizant project management prior to implementation. Complete and well documented method references shall be available for all methods. If specific method references do not exist, appropriate documents, such as suppliers manuals, equipment manufacturer instructions, and instrumentation specifications are recommended for use. Such documents shall include adequate descriptions and criteria to ensure the required quality of work performed.

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4.0 SAMPLING OPERATIONS

Project management, in conjunction with personnel knowledgeable in the relevant sampling criteria, shall develop, establish, and update requirements for management of documentation, sample collection, waste disposition, chain-of-custody, subsampling, holding times, sample containers, and preventative maintenance. If project management determines that existing sampling procedures are sufficient to meet or exceed project needs, new documents need not be developed.

4.1 SITE/FIELD DOCUMENTATION

Site and field logbooks and data forms are means for providing a daily handwritten record of all field activities at an investigation site and are generally considered the primary record for sampling activities. The project specific quality assurance plan determines the type and extent of documentation (site and field logbook, data forms, and/or others as specified) needed at a site.

All logbooks shall be permanently bound, and field logbooks shall be waterproof. Logbooks shall be ruled with sequentially numbered pages. All logbook entries will be made in indelible ink. Corrections are made by marking the erroneous data through with a single line, entering the correct data, and initialing and dating the changes. Correction fluid and erasers are not to be used. Pages will not be removed from logbooks for any reason. Space left on pages should be lined through and initialed and dated. This indicates the completion of the entry and prevents nonrelated information from being added. Blank pages shall be marked "page intentionally left blank" or shall be lined through, initialed, and dated. Only authorized persons may make entries in logbooks.

Automated data entry systems for field data collection are frequently used. Computer notebooks and data loggers reduce repetitive data entry and transcription errors. Guidance is available in the EPA report *Good Automated Laboratory Practice* (1990).

4.1.1 Site Logbook

A site logbook is the master reference document for activities performed at a site. In small investigations, the field logbook may also serve as the site logbook. Entries shall be made and initialed on a real-time basis, with summaries completed at the close of each work day. The site logbook must be identified with a unique project name and number on the front or inside cover,

if appropriate. Start and completion dates shall be indicated by documentation within the logbook.

The following items shall be recorded in the site logbook:

The day, date, time arrived onsite, weather conditions; names, titles, organizations of personnel present onsite; and individuals responsible for field logbooks shall be listed with their assigned logbook number

The name, title, organization represented, and the purpose of the visit

Forms, including computer data files or logbooks that register the details of tasks performed on site (e.g., well installation logs)

All site activities, including field tests. The site logbook summarizes daily activities and shall therefore not be as detailed as field logbooks

Chain-of-custody details, and all activities and variances relating to chain-of-custody

Equipment decontaminated, number of decontaminations, and the decontamination procedures followed when different from the QAPjP or procedures. The site log references the field logbook where specific information is documented

Any equipment failures or breakdowns, with a brief description of repairs or replacements made, and indications of the impact of the equipment failure

Any deviations from the QAPjP or procedures, including the reasons for the change, the detail of the change, and a discussion of the possible impacts of the change

A record of telephone calls relating to field activities. If a separate phone log is maintained, the site log shall reference the page containing the specific details.

The field manager, supervisor, or cognizant scientist/engineer shall review entries and document the review with signature and date.

4.1.2 Field Logbook

In addition to the information contained in the site logbook, field logbooks contain area- or task-specific information. As stated in 4.1.1, in the case of small scale investigations, the field notebook may also serve as the site logbook. The field logbook cover shall indicate the particular tasks or areas within the site (or the specific individuals) to which the logbook is assigned. The field logbook may be identified as a quality record and if so, shall be maintained as such.

Information to be recorded in the logbook (or Data Forms 4.1.3), as appropriate, include the following:

The day and date, time the task started, weather conditions, and the names, titles, and organizations of personnel performing the task.

The name, title, organization, and purpose of the visit to the task area.

Site activities in specific detail (e.g., maps and drawings) or the forms used to record such information (e.g., soil boring log or well completion log). It is good practice for the site engineer or geologist to duplicate the most important information in the field logbook and on data forms.

Details of any field tests that were conducted. Reference any forms that were used, other data records, and the procedures followed in conducting the test. Results of any field activity shall be annotated in the field logbook.

Details of any field calibrations and surveys that were conducted. Reference any forms that were used, other data records, and the procedures followed in conducting the calibrations and surveys. Results of any field calibrations and surveys shall be annotated in the logbook.

Details of any samples collected and indicate the preparation, if any, of splits, duplicates, matrix spikes, or blanks. Reference the procedure(s) followed in sample collection or preparation. List location of sample collected, sample type, all label or tag numbers, sample identification, sample containers and volume, preservation method, packaging, chain-of-custody form number, and the analytical request form number pertinent to each sample or sample set. Note the time and the name of the individual to whom custody of samples was transferred.

The time, equipment type, and serial or identification number, and the procedure followed for decontaminations and equipment maintenance carried out. Reference the page number(s) of any logbook (if any) where detailed information is recorded; detailed information shall otherwise appear in the field logbook.

Any equipment failures or breakdowns that occurred, with a brief description of repairs or replacements.

The sampler or task leader shall review and sign the field logbook as described in 4.1.1.

4.1.3 Data Forms

It is often convenient to document field information on pre-printed data forms. A copy of any data form to be used with a detailed key/legend describing the content of each space or block on the form shall be included in the QAPjP and/or the procedure. As with logbooks, data forms shall be completed with indelible ink and may be considered a quality record; if so, they shall be maintained and stored as such.

4.2 MANAGEMENT OF SAMPLES

Samples may be collected from known or suspected hazardous sites that may contain hazardous organic, inorganic, and/or radiochemical materials. Sampling organizations must be aware of potential hazards associated with the collection, handling, and disposition of these samples. The sampling team shall be provided with historical and background information on the potentially contaminated site to give them guidance on health and safety precautions that should be initiated. It is the responsibility of the sampling organization to take necessary measures to ensure the health and safety of its employees, to follow as low as reasonably achievable (ALARA) principles and to meet regulatory requirements.

During the pre-job planning phase the field organization shall be cognizant of any special requirements that come into effect when working with listed waste, environmental media that contains listed waste, and hazardous debris containing a listed waste. Communication with the laboratory pertaining to these issues shall occur prior to sample collection and delivery.

4.2.1 Sample Identification

Project-specific QA plans or procedures shall describe methods to ensure that samples are identified and controlled in a consistent manner. The identification system shall ensure traceability of samples from time and place of collection through shipment to authorized persons or organizations and/or disposition. The identification of QC samples shall be contained within project documentation to allow the relationship of QC data to specific samples to be traceable. Samples have their own unique identification numbers. The sample identification number is a critical link in the traceability of analytical data to the project. This number shall be recorded in the appropriate field and project documentation (i.e., chain-of-custody and/or field data sheets) with information describing the sample. Each sample is identified by affixing a standardized label or tag on the container. This label or tag shall contain the sample identification number, date and time of collection, media, preservative used, analysis required, and the collector's initials or signature.

Sample identification records shall contain the following information:

Unique sampling number
Date and time collected
Analysis required
Name of collector
Source of sample (including name, location, etc.)
Field data (pH, dissolved oxygen, radiation readings)
Serial numbers and transportation cases.

Additional information pertinent to analysis or safety (i.e., preservative used) may be marked on the sample container.

4.2.2 Sample Preservation

Chemical analyses of samples generally shall be conducted as soon as possible after collection. Because samples are normally transported from the field to an analytical laboratory, some preservation is necessary to maintain the integrity of the samples. Samples shall be preserved in a manner consistent with regulatory requirements and with the established procedure. Any use of chemical preservatives shall be indicated on the sample label.

Sample preservatives should be added to the sample container prior to sample collection or immediately upon sample collection whenever possible. In some instances, samples may be preserved by the laboratory upon receipt. Case-by-case preservation decisions shall be made

based on laboratory requirements, matrix concerns, DQOs, and state or Federal regulations. DOT regulations apply to pre-preserved containers, preservatives transported to the field, and preserved samples. Sample preservation and extension of holding times may be negotiated with the regulators to support cost-effective collection of data with known and controlled sources of variability. This analyte- and sample-specific approach is consistent with EPA processes of DQOs and Data Quality Assessment.

Methods of preservation are relatively limited and generally are intended to: (1) retard biological action, (2) retard hydrolysis and radiolysis of chemical compounds and complexes, (3) reduce volatility of constituents, and (4) reduce absorption and adsorption effects. Preservation methods generally are limited to pH control, chemical addition, refrigeration, and freezing. No single standard method of preservation and storage can be recommended for samples. Generally, the analytical method procedure will specify the acceptable preservation technique. In addition, work authorizing documents, SAPs, letters of instruction, etc, shall specify acceptable preservation techniques.

The method of preservation shall be recorded in the field documentation with the pertinent information required by the procedure. Preservatives shall be tracked by lot number, date of receipt, and date opened.

4.2.3 Sample Storage

Site storage can be minimized by coordinating a sample shipment schedule with the laboratory. Storage areas shall be dedicated to samples only and controlled to prevent damage or loss, and to maintain sample container and identification integrity. Measures shall be taken to avoid sample contamination during storage. Measures also shall be taken to contain and avoid material spills during storage.

When storage is necessary, the samples shall be stored in predetermined physical and environmental conditions commensurate with the intended analysis and regulatory requirements specific for the analyte and matrix. Daily verification and documentation of storage temperature shall be maintained in accordance with project DQOs. Storage blanks shall be used as appropriate.

4.2.4 Sample Handling and Transfer

The number of persons involved in collecting and handling samples shall be kept at a minimum. One member of the sampling team shall be identified as the field custodian. It also is acceptable that the person who collects the sample remains the custodian until delivery at the laboratory; in these cases, no field custodian is identified. Samples shall be turned over to the field custodian by team members who collected the samples. The field custodian documents each transaction and the sample remains in the custodian's possession until shipped/delivered to the laboratory.

Procedures shall establish methods to control samples during handling and transfer to preclude loss of identity, damage, deterioration, and loss of sample. Chain-of-custody documentation accompanying samples will be maintained at all times.

Custody seals shall be placed on the containers to prevent opening without breaking the seal. The sample identification number shall be marked on the sample container and the chain-of-custody form. Samples shall be packaged and shipped in accordance with the applicable state and Federal regulations.

The field custodian is responsible for properly packaging and dispatching samples to the appropriate laboratory or facility. This responsibility includes completing, dating, and signing the appropriate portion of the chain-of-custody record, sample transfer, and shipping forms (as applicable). Verification of sample identification and integrity shall be performed prior to acceptance of the sample from another staff member or organization for field analysis, introduction into storage, or delivery to the designated laboratory. When transferring the samples, the person who accepts the samples shall legibly print and sign their name and record the date and time of the transfer on the chain-of-custody record. If the transfer of custody is between companies, the company affiliation along with the signatures must be noted.

Precautions shall be taken not to contaminate samples or field personnel. The outside of the container shall be wiped clean of any visible dirt, grime, or liquid after the sample has been placed in the container. When working in a radiologically controlled area the container shall be surveyed according to site-specific procedures. The container shall be placed in a plastic bag to ensure that the outside of the container does not become contaminated.

The field custodian shall seal the cap of the individual sample container so that any tampering is easy to detect. Custody seals shall be used to verify that sample integrity has been maintained during transport. Custody tape shall be selected that is not removable from the shipping container without breaking the seal. Samples shall be shipped in insulated containers with either synthetic ice or ice packed in plastic bags when samples require cooling to 4∀2EC.

The sample container(s) shall be placed in a transportation case. Pertinent field records, analysis request forms, and chain-of-custody record may be included in the transportation case or accompany the samples. A copy of each form shall be retained by the originating office. The transportation case shall be secured, labeled, and marked in accordance with appropriate DOT regulations.

4.2.5 Sample Screening, Packaging and Shipping

Instructions for screening, packaging, and shipping of samples shall be established in the procedure. These instructions will ensure compliance with OSHA and state regulations regarding the protection of personnel and the environment. The transportation of samples shall be accomplished not only in a manner designed to protect the integrity of the sample, but also to prevent any detrimental effects from potentially hazardous samples.

Regulations for packaging, marking, labeling, and shipping hazardous materials, hazardous substances, and hazardous wastes are enforced by the DOT and described in 49 CFR 171-177. Packaging and transportation of Hanford Site materials along roads accessible to the public or in the public domain shall be in compliance with DOT regulations and DOE requirements. Other packaging and transportation of Hanford Site materials should be in compliance with DOE requirements. Packaging and transportation of Hanford Site materials shall adequately protect personnel, the public, and the environment.

All sample containers and shipping containers obtained from radioactive areas shall undergo field radiological screening to determine proper shipping and handling requirements. The field sampling organization's procedures shall specify protocols for actual radioactivity screening, action levels, and shipping procedures. (See the HSRCM for further detail related to radiological control requirements.)

The procedures shall address sample collection, preparation (if required), counting protocols, and QC considerations. The procedures also shall define action levels that will determine what samples are considered nonradioactive, what samples will require further screening, and what samples shall be submitted to a licensed laboratory. The action levels shall meet or exceed current Federal, state, and local regulations.

Radiological survey instruments shall be calibrated and maintained as specified in the HSRCM.

4.2.5.1 Hazardous Samples. Samples containing hazardous constituents shall be considered hazardous materials in transportation and transported according to DOT requirement

49 CFR 172.101. If the material in the sample is known or can be identified, then it shall be packaged, marked, labeled, and shipped according to the specific instructions for that material. For potentially hazardous samples with unknown contents, the selection of the appropriate transportation category is based on the DOT Hazardous Material Classification (49 CFR 172), a prioritized system of transportation categories.

4.2.5.2 Radioactive Samples. Materials are classified by the DOT as radioactive material if the specific activity is greater than 2 nCi/gm. Samples shall be screened to determine if they have a specific activity greater than 2 nCi/gm. When screening indicates the samples are radioactive, they are to be transported according to DOT requirement 49 CFR 172.310 for marking, 49 CFR 172.436, 438, and 440 for labelling, and 49 CFR 172.556 for placarding and shipping.

Limited quantities of radioactive materials (whose activity per package does not exceed the limit specified in 49 CFR 173.423) are excepted from the specification packaging, shipping paper and certification, marking, and labeling requirements if they meet the requirements detailed in the CFR.

Prior to shipping radioactive samples to the laboratory, the organization responsible for shipping shall notify the laboratory of the approximate number and radiological level of the samples. This notification is conducted through a laboratory coordination office. However, the laboratory is responsible for ensuring that applicable license limits are not exceeded.

4.3 WASTE DISPOSITION

Waste materials are generated during sample collection, processing, and subsampling activities. The method of identification, storage, and disposition of these waste materials and unused samples shall be specified when hazardous, radioactive, or mixed waste is generated. These polices and guidelines apply to personnel who generate, handle, manage, and/or disposition waste in the field activities.

Program and project managers shall ensure their waste management plan for the sampling and field analysis event has addressed the return of unused sample material and/or the wastes generated from analysis inside the laboratory upon completion of the work. Information provided to the laboratory pertaining to listed waste, in accordance with Section 4.2 of this Volume, may impact the management of the waste being returned to the program or project manager.

Consultation with a health physicist or waste management specialist shall be considered when polices and guidelines for waste management are being developed. The waste management plan shall detail the responsibilities for waste management and handling, along with the approved disposition methods for derived wastes.

4.4 CHAIN-OF-CUSTODY

A major consideration for the legal credibility of analytical data generated from a field sampling activity and subsequent sample analysis is the ability to demonstrate that samples have been obtained by the sampling group and have reached the laboratory without alteration. Evidence of collection, temporary storage, and shipment to the laboratory shall be documented. Documentation is accomplished through chain-of-custody procedures and records that describe and document how physical custody is maintained, how custody is transferred, who are the individuals responsible for sample collection, and what is the process for processing, shipment, storage, and disposition. A sample is considered in custody if it is in the person's actual possession, is in view after being in physical possession, is locked so that no one can tamper with it after having been in physical custody, or is in a secured area restricted to authorized personnel.

The field sampling organization will establish procedures that describe the interface and custody responsibilities for sample collection, temporary storage, custody transfer, shipping of the samples to the final destination, and disposition.

The following information is required on the completed chain-of-custody form at a minimum:

Project name
Signature of sampler
Unique sample number
Date and time of collection
Matrix
Preservatives
Signatures of individual involved in sample transfer
Requested analyses or reference thereto

Chain-of-custody forms initiated in the field shall be protected from tampering or other damage. This may be accomplished by placing the chain-of-custody form in a plastic cover and taping it to the inside of the shipping container used for sample transport from the field to the laboratory.

Often chain-of-custody forms are altered to meet the needs of specific organizations. The chain-of-custody form is a document that provides consistent information to user parties. Due to the large variety of sampling organizations and the relatively few numbers of laboratories, only company-approved chain-of-custody forms shall be used by the field organizations. Chain-of-custody forms shall accompany samples delivered to the laboratory facility(ies) that are performing the analyses. These forms shall be signed and dated upon receipt in the facility.

When samples are relinquished to a shipping company for transport in a custody-sealed shipping container, the shipping company shall provide a shipping bill/receipt. Employees of the shipping firm do not sign the chain-of-custody. The tracking number from the shipping bill/receipt is to be recorded on the chain-of-custody form or in the project documentation. See Section 4.2.4, "Sample Handling and Transfer," for further information related to the transfer of samples.

Agreement shall be reached between the laboratory and customer regarding disposition of the original custody form (i.e., retained by the laboratory, returned immediately to the customer, delivered to the customer as part of the final data deliverable). If copies of the chain-of-custody forms associated with the samples are not maintained as part of the formal analytical data package, the reason for this shall be documented by the project manager. Chain-of-custody forms are to be reviewed for accuracy by the cognizant lead person.

4.5 SUBSAMPLING AND COMPOSITING

Processing, compositing, and subsampling of bulk materials collected in the field are key links in the sampling and analytical chain, and can have a substantial impact on the usability of resulting analytical data. When the entire content of a sample container is subjected to analysis by a single method, processing and subsampling in the laboratory are not required. When more than the analytical sample size is collected, processing and subsampling in the laboratory is required.

It is important that participants in a sampling effort are aware of proposed and implemented field compositing and subsampling methods, including their impact on data usability and the achievement of DQOs. The collection of samples from a population for the purpose of compositing generally is used as a cost saving method. Proper attention to population variability, sample collection techniques, compositing, and subsampling for submission to the analytical laboratory enhances the representativeness of the data.

During the pre-planning stages, the sampling organization shall be cognizant of the laboratory analysis volume requirements. This information is very useful for ensuring that sufficient material for analysis, and its associated QC, is submitted to the laboratory, as well as for

minimizing the submission of excess sample to aid in the reduction of waste generation. This information aids in determining the proper choice of compositing and subsampling methods.

The field sampling organization shall establish procedures to attain the following:

Minimize the possibility of subsampling bias and non-representative subsampling

Recognize benefits that can be realized using compositing to enhance representativeness and drive costs down

Ensure that processing, compositing, and subsampling are completed correctly

Ensure that the samples shipped to the laboratory are representative of the material of interest.

4.6 HOLDING TIMES

Holding times identified in each project plan or scope of work for each parameter or group of parameters to be analyzed shall be met when implementing work for projects, including the following:

Sample shipment and delivery shall be coordinated between the field supervisor/site manager and the laboratory to meet sample holding times, where applicable.

Sample holding time begins at the time and date the bulk sample is collected in the field.

The use of preservatives may extend the acceptable holding times. This approach can be negotiated with the regulators to support the collection of cost-effective data of known and controlled variability.

4.7 SAMPLE CONTAINERS

The project plan and laboratory guidance shall specify those types of containers and the level of cleanliness required. When bottles or containers are provided by the laboratory, the field sample collection record shall indicate the laboratory lot number of the bottle. When commercially precleaned containers are used in the field, the name of the manufacturer, the lot identification, and certification shall be retained for documentation.

Containers shall be capped and stored in a contaminant-free area. Samples should be collected, where and when appropriate, in break-resistant containers. Samples in glass containers shall be transported using secondary containment (e.g., coolers, sealed cans) as specified in the procedure and in accordance with DOT requirements.

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5.0 QUALITY CONTROL FOR THE SAMPLING PROCESS

Several control samples are introduced into the collection system to monitor the adequacy of the sampling system and the integrity of samples during their journey from the field collection point through laboratory analysis. Program/project QC requirements shall be established prior to sample collection. These samples are defined below with their mode of collection and purpose.

5.1 TRIP BLANKS

Trip blanks are used to detect contamination during sample shipping and handling. A trip blank consists of an analyte sample container filled with ASTM Type II water or silica sand, which is transported to the sampling site and returned to the laboratory with the samples. Trip blanks are filled in the laboratory and are not to be opened in the field. Trip blanks can either be Volatile Organic Analysis (VOA) only or a complete set of sample containers. Project-specific QA documents shall define the type and frequency of trip blank use.

Trip blanks are primarily used for volatile organic compounds (VOC). Trip blanks, however, may be used whenever there is concern that concentration of the parameter may be biased by contamination. A trip blank not only will detect contamination during the shipping and handling of the containers, but also will serve to detect contamination from containers (i.e., function as a bottle blank), which is important if non-certified sample containers are being used.

One VOA trip blank shall accompany each cooler that contains site samples or as specified in the site-specific controlling documents. Each trip blank shall be stored at the laboratory with associated samples and analyzed with those samples. Trip blanks are sent whether soil or water samples are to be collected. Analyte-free solid matrices should be employed when collecting soil samples. If a solid matrix is not available for a trip blank, ASTM Type II water may be used.

These samples are to be reviewed at the completion of the analysis to determine if any cross-contamination occurred that could affect sample results. Sample results shall be evaluated to determine the possible effects of any contamination detected in the trip blank.

5.2 EQUIPMENT RINSATES (BLANKS)

Equipment blanks are samples of ASTM Type II water passed through decontaminated sampling equipment prior to use of the equipment in the same environment. They are used as a measure of decontamination process effectiveness. Equipment blanks shall be collected in the field and at the rate specified in the QAPjP. An equipment blank shall be collected from each type of sampling equipment used to ensure that the decontamination procedures are applicable to the specific equipment types.

Equipment blanks are analyzed for the same analytes as samples collected using that equipment. Sample results shall be evaluated to determine the possible effects of any contamination detected in the equipment blank.

Equipment blanks shall be employed throughout the course of the project to monitor the efficiency of the decontamination procedures. If contamination is detected and the field source water blank is free of the analytes of interest, it may be necessary to monitor the field crew to ensure adherence to the procedures. If it is determined that the crews are properly following the decontamination procedure, and no laboratory contamination source is determined through the result of analysis, it may be necessary to change the field procedure.

5.3 FIELD SOURCE WATER BLANKS

Field source water blanks are samples of source water used for decontamination and steam cleaning. At a minimum, one sample for each source of water for a given event shall be collected for analysis. Normally, there will be two field source water blanks per event: (1) a sample of the potable water used for steam cleaning, and (2) a sample of the ASTM Type II water used for decontamination. If more than one batch or lot number of ASTM Type II water is used or if potable water is taken from more than one location, then additional field source water blanks shall be taken since these are different sources.

The field source water blanks shall be monitored throughout the project to detect any possible contamination present in the decontamination water. The field source water blanks shall be monitored for the same analytes as the samples being analyzed.

This may prevent the introduction of contaminants to the site samples. If contamination is detected, a different source of water should be used. Sample results shall be evaluated to determine the possible effects of any contamination detected in the field source water blank.

5.4 FIELD DUPLICATES (REPLICATES)

Field duplicates are two samples produced from material collected in the same location. Each will be numbered uniquely. Field duplicates provide information regarding the homogeneity of the matrix. A matrix includes soil, sediment, water, biota, or waste from a given site. Field duplicates may also provide an evaluation of the precision of the analysis process. Field duplicates for soil are collected and homogenized before being divided into two samples in the field. Field duplicates normally will be collected at a frequency of 5 to 10% of the samples collected per matrix. Soil samples submitted for VOC analyses are not to be homogenized or split; instead, it is necessary to collect collocated samples as defined in Section 5.5.

Field duplicates shall be sent to the laboratory in the same manner as the routine site samples. They may or may not be identified to the laboratory as field duplicates. It may maximize the utility of information to submit extra samples from the field duplicates for the laboratory to use as duplicates. This will help distinguish between variability resulting from sample heterogeneity and laboratory manipulation.

Field duplicate data shall be reviewed for agreement. Data shall meet the precision criteria established in the QAPjP. If the duplicate data do not meet the established criteria, they shall be examined to ascertain the source of disagreement. The laboratory QC data shall be reviewed to determine if the laboratory was operating in control. If the laboratory was in control, the sampling data shall be reviewed to determine if there were any matrix anomalies that could contribute to differences in the concentrations. Additionally, the process used to collect and duplicate the samples shall be reviewed to determine if it is the source of imprecision.

5.5 FIELD SPLIT SAMPLES

Split samples are a variation of field duplicate samples. The frequency and method for collection of field split samples is directed by the project plan or implementing procedure. Split samples are collected for the purpose of comparing data from different laboratories. Usually, the volume needed is homogenized and subsequently placed in separate, identically prepared containers, numbered uniquely, and forwarded to separate laboratories for analysis using the same method/protocol. The data generated by field split samples is used during the data assessment process to evaluate the data from the analyses performed by the primary laboratory on samples from the same source.

5.6 COLLOCATED SAMPLES

Collocated samples are independent samples collected as close as possible to the same point in space and time and are intended to be identical. Because of the possible loss of volatile analytes when generating field duplicates, it is necessary to collect soil samples for VOA analysis as collocated samples. Collocated soil cores collected for VOA analyses shall be sealed immediately and shipped to the laboratory.

Collocated sample data are to be reviewed in the same manner as duplicate sample data as discussed in Section 5.4.

5.7 FIELD BLANKS

Field blanks are samples of analyte-free media similar to the sample matrix that is transferred from one vessel to another or exposed to the sampling equipment at the sampling site. This blank is preserved and processed in the same manner as the associated samples and is used to document contamination in the sampling and analysis process.

6.0 SAMPLING DATA

Project management, in conjunction with personnel knowledgeable in the relevant analytical criteria, shall develop, establish, and update data deliverable requirements based on project DQOs. Each project or program shall identify and clearly define specific data deliverables expected from the sampling organization supporting its work. These deliverables shall be designed to ensure project information contains the appropriate QC and documentation.

Documented procedures shall be in place that address data deliverable requirements to meet project requirements. Sampling organizations providing projects with samples and data shall be aware of deliverable requirements and be able to provide the stated deliverables in a consistent and timely manner. If project management determines that existing SOPs are sufficient to meet or exceed project needs, new documents need not be developed.

If sampling deliverables include electronic files, reporting formats shall be compatible with the project's system. Standard formats for transmission and database structure requirements shall include consistency with Hanford Site standards (e.g., Hanford Environmental Information System [HEIS], Format for Electronic Analytical Data [FEAD]) for collecting, storing, transmitting, and evaluating environmental data.

Quality assurance in the sampling process is normally provided by frequent (daily) review of the site and field logs, and comparison with the data quality requirements of the project plan. Frequently, the selection of sampling points and/or samples for more detailed examination is based on field analytical data (qualitative and/or semi-quantitative) so it is necessary to review the field analytical results as well. Field documentation shall be reviewed to ensure that the proper number of field QC samples were submitted to the laboratories.

The principal acceptance criteria for this QA review of sampling activities are the following:

Correct number and locations of the sampling points were documented

Selected sampling points indicate the presence/absence of the target analytes

Samples were collected and shipped properly

Field records and documents are complete

Data reporting requirements for the day's activity were met.

The data in the field logbook shall be reviewed and signed by the person generating the data. Subsequent reviews shall be done by the field manager, supervisor, or cognizant scientist/engineer and document the review with signature and date.

7.0 CLARIFICATIONS AND INTERPRETATIONS

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APPENDIX A

DESCRIPTION OF THE SAMPLING AND ANALYSIS PROCESS FLOW CHART

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APPENDIX A

DESCRIPTION OF THE SAMPLING AND ANALYSIS FLOW CHART

Information pertaining to the (a) identification of controlling documents, (b) responsible organization(s), and (c) the essential inputs/outputs of each step are conveyed. It is important to note that each company and division will likely have specific groups responsible for these basic tasks. The intent is to provide the overall understanding of how each step is related to the overall accomplishment of the sampling and analysis task.

1. DATA QUALITY OBJECTIVES

a. Controlling Documents

DOE-HQ directive set forth in a September 7, 1994 letter from Assistant Secretary Thomas Grumbly requiring the use of the Guidance for the Data Quality Objectives Process, September 1994, EPA QA/G-4.

DOE-RL direction to Hanford contractors to use the DQO process set forth in a January 19, 1995, letter from John Wagoner, Manager, to Pacific Northwest National Laboratory and WHC, and in a December 12, 1994, letter from Roger Freeberg, Director, Environmental Operations Division to Bechtel Hanford, Inc.

Contractor-specific management control and implementing procedures such as BHI-EE-01, Volume 1, Environmental Investigations Procedures, Data Quality Objectives.

b. Responsible Organization(s)

The program charged with the responsibility of making decisions based on the recommendation of the planning team to "own" the DQO process.

The essential component contributing to the success of the DQO process is the selection of the planning team. This team is the group that will develop DQOs for the study. Organizations that base their work process on the agreed on DQO are to be considered as participants in the DQO process. This includes project managers, laboratories, sampling organizations, data management groups, etc.

c. Essential Inputs and Outputs

The inputs to the DQO process are defined as information that add to the generation of a decision rule. Each application of the DQO process will require different types of information. Generally inputs include historical data, process information, technical knowledge of current situation, regulatory or contractual driver, and sampling and analysis data.

The output of the DQO process is the development of a quantitative and qualitative framework for a study. Much of the information that is developed in the DQO process can be used directly and indirectly as inputs for the QAPjPs. A report is issued (approximately 5 to 50 pages depending on the complexity of the study) to the project management office by the planning team. More detail on this step in the process is provided in Appendix B of this document and in EPA-QA/G-4, Guidance for the Data Quality Objectives Process, September 1994.

2. DEFINE REQUIREMENTS

a. Controlling Documents

QAPjPs and Characterization Plans (i.e., Work Plans [WP], Sampling and Analysis Plans [SAP], Waste Analysis Plans [WAP], Statements of Work [SOW], and Contractor Work Plans [CWP]) are the formal documentation and communication of the DQO requirements.

b. Responsible Organization(s)

The program needing information to assist decision-makers or responsible for authorship of the requirement documentation.

c. Essential Inputs and Outputs

Inputs to the definition of the requirements is based on the DQO process.

The output of this stage is controlled formal documents that define the QA parameters to enable the DQOs to be met.

3. ANALYTICAL SERVICES REQUISITION

a. Controlling Documents

Analytical services are arranged through well defined programmatic procedures. Each contractor is likely to have specific methods of requiring analytical services. In some cases, divisions and/or organizations may have specific agreements or contracts directing the method to be used to request analytical services.

b. Responsible Organization(s)

Analytical services are arranged to meet the programmatic needs through agreements reached with contracting officials and technical representatives.

c. Essential Inputs and Outputs

The input for this step in the process is the direct communication from the program coordinators to the laboratory coordinators in the organizations listed above.

The output for this step is typically a Sample Authorization Form/Field Sampling Requirements communication to the laboratories, the sampling organizations, and the program requesting the work.

4. PREPARE FOR SAMPLING OR FIELD ANALYSIS

a. Controlling Documents

The preparation for the sampling event is controlled by internal procedures specifying how support functions for the event are coordinated within that company. When support is needed across company lines contracts, memorandums of understanding, letters of instruction, or basic ordering agreements are established. The usage of these documents are controlled in company-specific procedures.

b. Responsible Organization(s)

The preparation for a sampling event requires parallel preparation efforts from the involved parties. Sampling organizations prepare paperwork, test and verify equipment and personnel availability; the support organizations (i.e., Health Physics, craft support, heavy equipment operators, facility operations, transportation) arrange for coverage; and the laboratories ensure equipment, personnel, and standards are available to conduct the requested analyses to generate the data within the specified time frame. Any additional documentation (National Environmental Policy Act [NEPA], cultural resource review, excavation permits, etc.) also should be prepared during this time. If required by permits or other regulatory agreements, notification of intent to sample may also be necessary.

c. Essential Inputs and Outputs

The primary input to this step is the work plan, SAP, or WAP.

The availability of this document is essential to the efficient preparation for a sampling event. New and unique sampling events may result in the input of safety concerns. Often a walk-through of the intended activities prior to the actual event clarifies the interactions that will be necessary to ensure a safe and successful sampling event.

The output of this step is a team fully prepared for the sampling event. Support functions and sampling team members are aware of their responsibilities and functions. In some organizations, a review of the preparation is conducted to ensure the pre-job planning is complete prior to the scheduled sampling event. Questions or concerns related to the safety of the planned sampling event are to be mitigated prior to the sampling event.

5. COLLECT SAMPLES

a. Controlling Documents

Sample collection is controlled by company and program specific procedures.

b. Responsible Organization(s)

Organizations that are responsible for the collection should be responsible for generating their own program specific procedures when existing site procedures do not adequately address the sampling event.

c. Essential Inputs and Outputs

Input to sampling procedures is derived from the QAPjP, SAP, WAP, and facility-specific process configurations. The output is the generation of samples that are collected such that they meet the specified DQOs and provide the means for the generation of analytical data of sufficient quality.

Sample tracking is an essential component of the Sampling and Analysis process and is initiated during this step. Chain-of-custody is the documentation that travels with the sample to facilitate input to tracking systems.

6. FIELD OR FIXED LABORATORY ANALYSIS

a. Controlling Documents

Analytical specifications are defined in contracts or statements of work.

Field analytical requirements are specified in statements of work or letters of instruction.

b. Responsible Organization(s)

Laboratories or field analysis organizations that have been reviewed as meeting the specifications necessary to ensure the readiness of their operation to meet the QA specifications, should perform requested analyses.

c. Essential Inputs and Outputs

The input to this process is the mutual agreement to the conditions of the contract, statement of work, or letter of instruction.

The DQO process and subsequent documentation should be forwarded to the analytical organization for review and approval as appropriate. The output of this step is data of sufficient quality.

7. DATA/DATA PACKAGE DELIVERED

a. Controlling Documents

The contract, statement of work, or letter of instruction should specify the data deliverables for each analytical organization. The type of deliverable may vary based on the outcomes of the DQO process.

b. Responsible Organization(s)

The analytical organization is responsible for providing the customer with the specified data deliverable.

c. Essential Inputs and Outputs

Inputs to this step are the DQOs as specified through the DQO process and subsequent QA documentation. The laboratory must verify that the project requirements and QC criteria have been met.

The output of this step is the report in specified format of the analytical results obtained from the submitted samples. Data deliverables may range from quantitative results to fully documented results and raw data. Usually the laboratory should be required to discuss any difficulties or anomalies encountered during the course of analysis.

8. VALIDATION/DATA USEABILITY ASSESSMENT (V/DUA)

a. Controlling Documents

The DQO document or similar project document should describe the key elements to be used to accept or reject field and laboratory data for the particular application or data use.

b. Responsible Organization(s)

Each company has specific organizations are that responsible for the V/DUA of data. Project managers may also designate specific V/DUA procedures to be followed.

c. Essential Inputs and Outputs

The inputs to the V/DUA step are the laboratory and field deliverables and the agreement to which the analytical work was conducted (contracts, QAPP, QAPjP, descriptions of work, letters of instruction, etc.) The output of this step is a data package/report that has been V/DUA relative to the specifications.

9. DATA MANAGEMENT

All records generated in steps 1-8 shall be maintained in accordance with approved Records Inventory and Disposal Schedule. All environmental analytical data shall be submitted to the Hanford Environmental Information System (HEIS)

10. DATA QUALITY ASSESSMENT

Data Quality Assessment (DQA) Process is the scientific and statistical evaluation of data to determine whether the data are of the right type, quality, and quantity to support their intended use. The DQA Process completes the Data Life Cycle (planning, implementation, and assessment) that was begun by the Data Quality Objectives Process (step 1).

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