United States Environmental Protection Agency | Office of Solid Waste and Emergency Response | Publication 9200.2-16FS February 1993

EPA

Quality Assurance for Superfund Environmental Data Collection Activities

Office of Emergency and Remedial Response
5203G

Quick Reference Fact Sheet

Many Superfund decisions (both Fund-financed and enforcement) require the collection and evaluation of site-specific environmental data. Major activities associated with acquiring these data include planning, sample collection and analysis, and data quality assessment. EPA policy requires the development and implementation of quality assurance (QA) programs to ensure that these activities generate data of known quality. The overall goal of a QA program is to measure and minimize systematic sources of error and to monitor conditions of sampling, storage and transport.

The Office of Emergency and Remedial Response (OERR) developed this fact sheet to promote a common understanding of Superfund QA requirements for site-specific environmental data collection activities. The fact sheet focuses on the preparation and implementation of sampling and analysis plans (SAPs). Requirements for planning and design, sampling, analysis, quality control (QC), and data assessment are discussed. The process described is consistent with the integrated site assessment and accelerated response objectives of the Superfund Accelerated Cleanup Model (SACM). Conforming to these requirements will help ensure that site managers generate data of known quality.

INTRODUCTION

This fact sheet provides Superfund program participants with an overview of Superfund QA requirements for data collection activities. The information is pertinent to all Superfund site managers, including remedial project managers (RPMs), site assessment managers (SAMs), and on-scene coordinators (OSCs). The information also applies to Agency contractors, states, and potentially responsible parties (PRPs) and their contractors.

The fact sheet addresses three primary areas: (1) the mandatory QA requirements specified in Agency policy documents; (2) QA management for Superfund; and (3) the process for developing SAPs for Superfund activities. The relationship between these primary areas is depicted in Exhibit 1. References are identified after each primary section to provide additional information on discussion topics. These reference materials contain guidance on the appropriate quality control (QC) considerations site managers should include as part of the QA program.

AGENCY QA POLICY

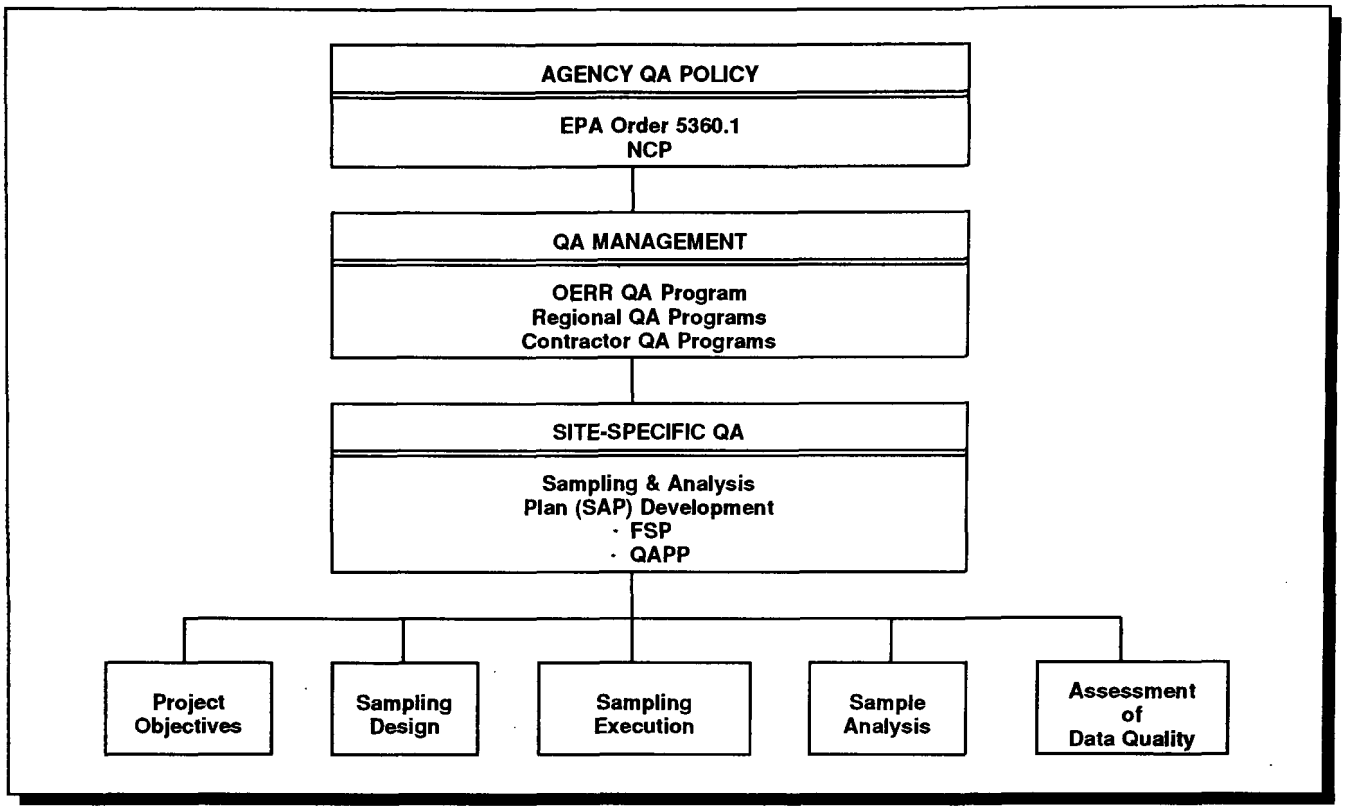
EPA Order 5360.1 establishes mandatory QA requirements for Agency environmental data collection activities. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) mandates specific Superfund QA requirements.

EPA Order 5360.1 and the NCP collectively define Superfund QA policy for environmental data collection. Both documents emphasize two requirements. The first is that Superfund environmental data must be of known quality. The quality of data is known when all components associated with its derivation are thoroughly documented and the documentation has been reviewed by a qualified reviewer. Second, QA plans are required to attain the first objective. These may be based on generic or site-specific procedures depending on project requirements. This section summarizes the QA requirements contained in each document.

EPA Order 5360.1, entitled, Policy and Program Requirements to Implement the Mandatory Quality Assurance Program, describes two major EPA requirements related to environmental data collection activities. The first is participation by all EPA organizations in a central QA program. The goal of the QA program is to ensure the generation of data of known quality. Basic Agency QA implementation requirements are summarized in Exhibit 2. The second major requirement is the development of QA project plans for all environmental data collection activities. These plans specify data quality goals acceptable to data users, and they assign responsibility for achieving these goals.

The NCP establishes the specific requirements used in the Superfund program to comply with EPA's overall QA policy. The NCP requires site managers to develop SAPs for the following Superfund hazardous substance response activities:

EXHIBIT 1 - SUPERFUND QA OVERVIEW



- Remedial site inspections
- Removal site evaluations
- Remedial investigation/feasibility studies

These plans document the process for obtaining data of sufficient quality and quantity to satisfy data users' needs. The NCP further states that the SAP shall include a field sampling plan (FSP) and a QA project plan (QAPP). The FSP defines the number of samples, sample type (matrix), sampling location, and required analyses. The QAPP describes the policy, organization, functional activities, and data quality objectives (DQOs) that site managers need to establish and document prior to performing any site-specific work. The SAP is a single document with two separable components - the FSP and QAPP - allowing for separate submissions consistent with Regional guidance.

REFERENCE BOX 1

Environmental Protection Agency (EPA). 1984. EPA Order 5360.1 - Policy and Program Requirements to Implement the Mandatory Quality Assurance Program. Office of Research and Development.

Environmental Protection Agency (EPA). 1988. National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 40 CFR 300.

QA MANAGEMENT FOR SUPERFUND ACTIVITIES

OERR, Regional Offices, and contractors participate in Superfund QA management activities.

To conform to the requirements specified in Order 5360.1 and the NCP, Superfund follows a well-defined management structure operated by the Office of Solid Waste and Emergency Response (OSWER). Within OSWER, OERR establishes and oversees QA procedures, performed in support of Superfund data collection activities. Regions perform most data collection activities and implement the associated QA program. Regions achieve QA goals by using qualified personnel and well-defined procedures (including the development of DQOs) and performing or requiring the performance of precise data collection and accurate interpretation of data results.

OERR Quality Assurance Program

The OERR QA program applies to all Superfund site-specific data collection activities. This program has been developed to establish national consistency in the implementation of the Superfund QA program. Agency and Superfund policy is set forth in the OERR Quality Management Plan to provide site managers with information on program requirements for generating data of known quality.

EXHIBIT 2 - EPA ORDER 5360.1 BASIC QA REQUIREMENTS

- Preparation and annual update of a Quality Management Plan
- Development of QA project plans for all major contracts involving environmental measurements
- Implementation of QA procedures for all contracts involving environmental data collection activities as specified in applicable Agency regulations, subcontracts, and subagreements
- Conduct audits on a scheduled basis
- Development and adoption of technical guidelines for assessing data quality
- Establishment of achievable data quality limits for methods cited in regulations
- Implementation of a corrective action program
- Provisions for appropriate training as required for all levels of QA management

Regional Quality Assurance Programs

Regional Administrators are responsible for implementing EPA Order 5360.1 and for tailoring the OERR QA program to Region-specific operations. Regional Quality Management Plans contain Region-specific policies, procedures, and organizational structures necessary for generating data of known quality.

Contractor Quality Assurance Programs

Each Superfund contractor performing data collection activities must also establish a QA program to generate data of known quality and to meet other Agency policies. Specific requirements for contractor QA programs are defined in the OERR and Regional Quality Management Plans.

The contractor QA program must be documented through a Quality Management Plan that describes the corporate QA policies and general requirements for all environmental data collection activities. In addition, the contractor must develop project-specific QA plans and SAPs that are presented for review and approval as delineated in each Region's Quality Management Plan.

Superfund Quality Assurance Program Assessment

EPA Headquarters and the Regions continually monitor the effectiveness of the Superfund QA program through the use of management and technical systems reviews. EPA Regional and Headquarters staff review the performance of each contractor to ensure conformance to technical and contractual requirements. The frequency of these reviews will be determined by contract requirements or as specified in the Region's Quality Management Plan.

Exhibit 3 presents a brief description of the systems reviews. These reviews assist OERR and Regional QA staff in assessing the implementation and adequacy of Superfund QA at the program and project management levels. Project reviews, a type of management systems review, evaluate the integral components associated with data collection activities. The results of these reviews assist site managers and other data users to verify the quality of sampling and analytical operations.

EXHIBIT 3 - SYSTEMS REVIEWS

Management Systems Reviews assess the effectiveness of the implementation of the approved QA program. These reviews consider linkages across organizational lines and can be used to discern areas requiring improved guidance.

Technical Systems Reviews assess project QC activities and environmental data collection systems. Areas typically examined during this review include: sampling/measurement systems; equipment/facility maintenance records; and control charts.

Audits of Data Quality address whether or not sufficient information exists for data sets to support data quality assessment. This type of audit may also be used to determine if the organization collecting or using the data performed a data quality assessment.

Performance Evaluation Reviews evaluate the laboratory and/or field analytical personnel's performance and the instrumentation or analytical systems used.

Superfund Evidentiary Concerns

The National Enforcement Investigations Center (NEIC) is responsible for providing a range of technical, investigative, and litigation expertise for the Agency's enforcement cases. NEIC is granted statutory authority under CERCLA for inspecting, record-keeping, and compiling confidential information. Applicable NEIC evidentiary requirements for site-specific field activities must be included in the project SAP.

NEIC has prepared guidance pertaining to evidentiary requirements for Superfund in the NEIC Policies and Procedures Manual. Examples of evidentiary requirements include:

- Sample identification
- Chain-of-custody procedures
- Sample receiving procedures
- Sample tracking procedures
- Document control procedures
- Standard operating procedures

Additional information on evidentiary policies for the Contract Laboratory Program (CLP) can be found in Exhibit F of the current CLP Statements of Work. Exhibit F describes the chain-of-custody, document control, and related standard operating procedures for the CLP. Individual laboratories are expected to incorporate Agency evidentiary requirements in their own standing procedures.

REFERENCE BOX 2

Environmental Protection Agency (EPA). 1985. Interim Policy and Guidance for Management Systems Audits of National Program Offices. Quality Assurance Management Staff (QAMS).

Environmental Protection Agency (EPA). 1987. Guidelines and Specifications for Preparing Quality Assurance Program Plans (QAPPs) and Quality Assurance Annual Report and Workplans (QAARWs) for EPA National Program Offices and the Office of Research and Development (ORD). Quality Assurance Management Staff. EPAQA/G-2.

Environmental Protection Agency (EPA). 1992. Quality Assurance Management Plan for the Office of Emergency and Remedial Response.

Environmental Protection Agency (EPA). 1980 Guidelines and Specifications for Preparing Quality Assurance Program Plans, QAMS-004/80. QAMS is currently developing an update to this guidance entitled, Guidance for Preparing, Reviewing, and Implementing Quality Assurance Management Plans, EPAQA/G-2.

SAMPLING AND ANALYSIS PLAN DEVELOPMENT

Sampling and analysis plans are site-specific documents that contain sampling objectives, strategies, and the appropriate QA procedures necessary to meet project objectives. SAPs should incorporate or build upon generic plans and standard operating procedures, when available. Major activities associated with the development of the plans are presented in Exhibit 4.

The effective and efficient development and implementation of SAPs is essential to obtaining data of sufficient quantity and quality to support program decisions. As defined in the NCP, SAPs consist of two integral components, the FSP and the QAPP. Exhibit 5 presents the minimum requirements for each component. When preparing SAPs, care should be taken to streamline the process and avoid duplication between the two components. Also SAPs should incorporate or reference generic plans and Regional standard operating procedures, as appropriate.

The SAP should describe each project objective in detail. Usually this is done by describing the specific decisions to be made with the data and involving the decision maker from the beginning. The plan should describe how each data value will be used to make a decision. It should include a description of the monitoring network, the location of each place samples will be collected, the sampling frequency, the types of analyses for each sample, the target precision at the concentration of interest and the rationale for the design. All factors that will influence the eventual decision should, to the extent practical, be evaluated and specified at the beginning of the process. The plan should balance the need for an appropriate level of QA (commensurate with project needs) with timeliness and cost considerations. Finally, the plan should include the organization's functional activities and the names of all key people. The remaining sections of this document discuss the SAP development process, from definition of the project objectives to generation and evaluation of the environmental data.

Project Objectives

Project and data quality objectives must be developed to assist in assuring the generation of useable data.

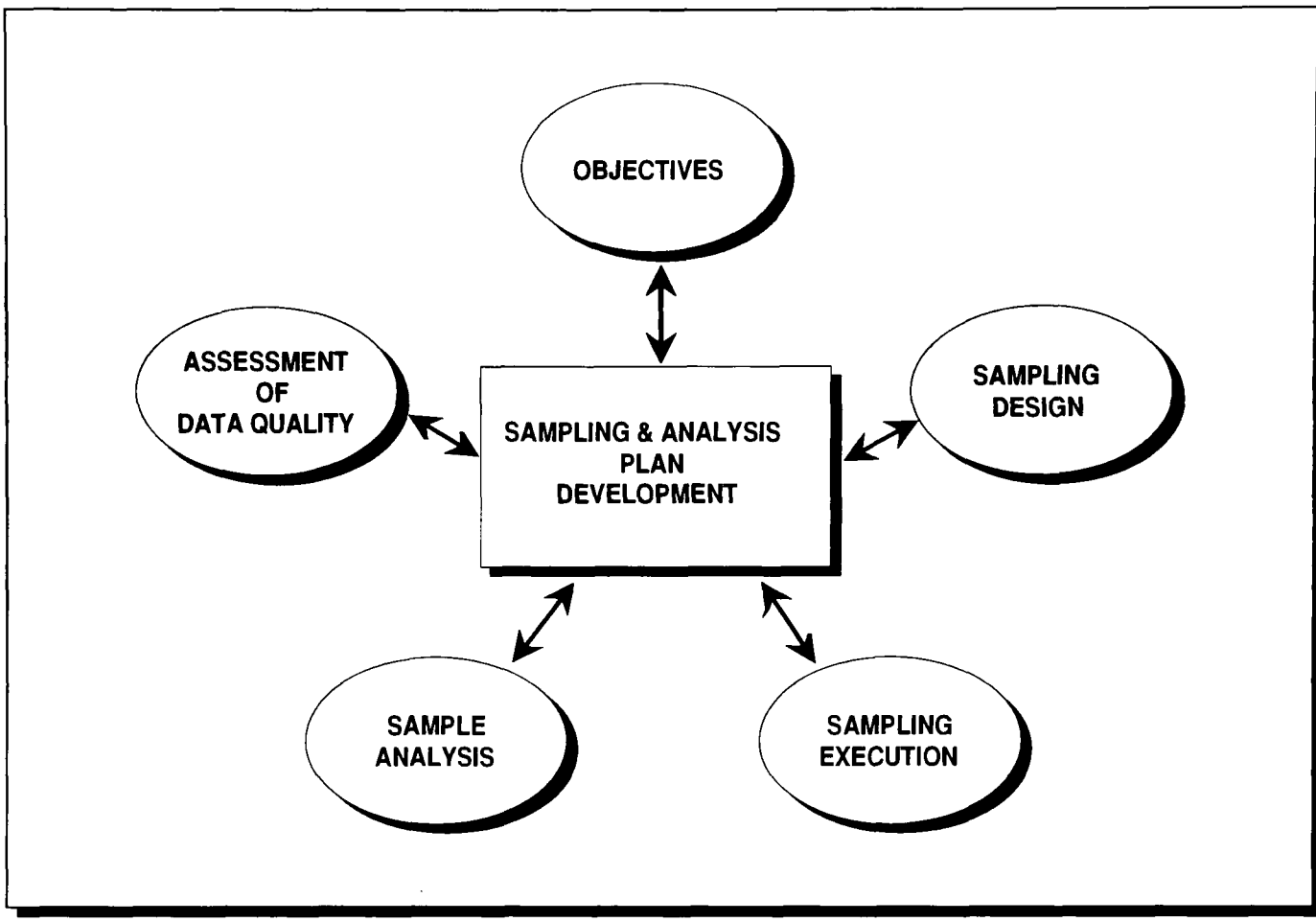
The first stage in developing the SAP is to determine overall project objectives and DQOs. Project objectives define the type and extent of investigations required at a given site. DQOs specify the level of uncertainty that site managers are willing to accept in results or decisions derived from environmental data. Site managers should develop project objectives and DQOs in accordance with data useability requirements for project activities. For example, the technical requirements for scoring a site using the Hazard Ranking System (HRS) may be less stringent than those required for a risk assessment.

Because DQOs are developed before the data are collected, this process can improve the efficiency of data gathering by defining the number and type of samples and level of QA. Since these factors are determined based on project need, DQOs assist in streamlining the process and ensuring cost effectiveness.

Exhibit 6 illustrates the DQO process as it is defined in Guidance for Data Useability in Site Assessment. Additional references on the DQO process can be found in Reference Box 3.

Once these objectives have been defined, the site manager must identify the procedures required to achieve these objectives and the acceptable degree of uncertainty. Chemists, geologists, biologists, ecologists, risk assessors, computer modelers, statisticians, QA staff, and Regional Counsel should be invited to participate in this process, as appropriate.

EXHIBIT 4 - SAMPLING AND ANALYSIS PLAN DEVELOPMENT



Sampling Design

> *Effective sampling designs are dependent upon project and data quality objectives. It is important to avoid collecting more samples than required to support project decisions.*

During sampling design, site managers develop project objectives into specific operational parameters. The design identifies the number, type, and location of samples. Effective sampling designs result in the generation of data that meet the project objectives and DQOs. The sampling design should also generate data that are representative of the conditions at the site within resource limitations.

Examples of the types of site-specific factors that should be considered when designing a sampling plan include: site accessibility, climate, potential hazards, media of concern, and site heterogeneity. Information that can be used to support the design often includes site maps, geological information, disposal records, and historical data. Standard Operating Procedures (SOPs) for the most common sampling techniques and field procedures should be used consistent with Regional guidance.

Sampling designs may be statistical, judgmental, or a combination of both. Statistical sampling designs entail selecting sampling locations using a probability based scheme. Judgmental sampling designs focus the sampling location specifically in the area of concern. HRS scoring is an example of when high bias is acceptable, therefore, the use of non-statistical or judgmental sampling is appropriate. To determine which design is appropriate, practical trade-offs between response time, analytical costs, number of samples, sampling costs, and level of uncertainty should be weighed by the site manager. A combination of statistical and judgmental sampling can often be used to maximize available resources, but a statistician should be consulted.

Because site conditions may change, sampling designs should be flexible enough to allow for modifications during sampling execution. However, deviations from the original design should be approved in advance by the site manager.

Field analyses can also be an important component of the overall sampling design. These analyses can be used to provide threshold indications of contamination and may be helpful in revising and refining the sampling strategy. Analytical field methods also can be useful in directing sampling into areas of greatest contamination or "hot spots."

EXHIBIT 5 - SAMPLING AND ANALYSIS PLAN COMPONENTS

Field Sampling Plan: Specifies field activities necessary to obtain environmental data and contains the following elements:

- Site background
- Sampling objectives and rationale
- Sampling matrix/location/frequency
- Sample identification/documentation
- Sampling equipment/procedures/decontamination/ disposal
- Sample handling/packaging/analysis

Quality Assurance Project Plan: Describes the policy, organization, and DQOs for decision-making purposes. Key elements include:

- Project description
- Project organization/responsibilities
- QA objectives for measurement
- Sampling procedures and QC
- Sample custody
- Calibration procedures
- Analytical procedures with detection limits/quantitation limits
- Data reduction/validation and reporting
- Internal quality control
- Performance and systems reviews
- Preventive maintenance
- Data assessment procedures
- Corrective actions
- QA reports

Finally, field analytical methods should be used to accelerate the site assessment process and reduce costs when their use is consistent with site conditions (e.g. contaminants, media) and the DQO's established for the site.

Sampling Execution

Representative samples are collected through the use of well-defined sampling practices.

Sampling execution involves the collection and documentation of samples identified by site managers during the sampling design phase. The goal of sampling execution is to collect samples representative of site conditions to fulfill project requirements and DQOs.

In order to collect representative samples, the number, location, sampling methods, equipment, and containers must be appropriate for the sample matrix and the contaminants of concern. Collection procedures should not alter the matrix sampled. In addition, samples should be preserved in a manner that minimizes potential chemical and biological degradation.

Site managers are responsible for identifying background and QC samples during the sampling design stage. Background samples are collected in conjunction with environmental samples and are evaluated to establish baseline values for the contaminants of concern. These samples are collected at or near the hazardous waste site in areas not influenced by site contamination. Background samples should be collected at approximately the same time and under the same conditions as the test samples, and they should be collected for each matrix.

EXHIBIT 6 - THE DQO PROCESS

STEPS IN THE DQO PROCESS

State Problem - Describe the problem, possible resolutions, and data collection constraints.

Identify Problem - State the question that will be answered using environmental data.

Identify Input Affecting Decision - List the variables to be measured and other information needed to make the decision. List procedures for assessing the precision and accuracy of the data at the concentration of interest.

Specify Domain Of Decision - Specify the locations of concern within the site and describe the different pathways.

Develop Logic Statement - Develop a quantitative statement defining how the data will be summarized and used to answer each question.

Establish Constraints On Uncertainty - Define the procedures for determining total uncertainty in the data, and develop data acceptance criteria.

Optimize Design For Obtaining Data - Develop a practical design for the study that is expected to produce the necessary data.

QC samples assist in assessing the data quality. Field QC samples are collected on-site in conjunction with environmental samples and are used to gather information on the precision and bias of the sampling process. Types of field QC samples include double-blind samples (e.g., field evaluation samples, field matrix spikes, and field duplicates), single-blind samples (e.g., trip blanks, rinsate blanks), and non-blind samples (e.g., laboratory control samples as used in the CLP).

The precise composition and frequency of QC samples is dependent on the objectives for the sampling event and existing Regional guidelines. All field QC samples should be stored, transported, and analyzed using the same procedures used for site samples.

Site managers should assess sampling execution by evaluating the data from field QC samples and observing field activities. Field duplicate sample results can provide useful QC information. However, this field assessment will not provide

real time data on the precision of the sampling event since it is assessed during the data review.

On-site observations of field activities are conducted to verify that the SAP is being followed. The SAP should specify areas where flexibility in procedures and/or criteria may be acceptable and should specify procedures for documenting these changes. Field documentation is critical to a successful QA program. The field log book should be legally defensible and all entries should be complete and accurate enough to permit reconstruction of field activities.

Sample Analysis

> *Contract Laboratory Program (CLP) or non-CLP analytical services may be procured in support of Superfund activities. Laboratories which can demonstrate a successful history of independent audits should be selected for use.*

Project DQOs and analytical factors dictate the selection of analytical methods. The analytical method and associated QC should provide data of known quality for the contaminants of concern. Data users should consider the following factors when selecting analytical methods:

- Quantitation limit
- Detectable constituents
- Qualitative confidence
- Method precision and bias
- Turnaround time
- Analytical cost

Once the site manager has evaluated these factors, analytical services may be procured through either CLP or non-CLP services. The site manager or other data user is responsible for planning, monitoring, and assessing the quality of data regardless of the analytical service procured.

The CLP is a national program of commercial laboratories under contract to EPA that provides routine or specialized analytical services. Routine analytical services (RAS) use a limited number of standardized methods and are designed to generate consistent results. Specialized analytical services (SAS) provide non-standardized analyses or faster turnaround time and require the data user to specify the necessary analytical methods and QC requirements. The CLP adheres to specific data acceptance criteria that result in data of known and documented quality. However, it cannot be assumed that CLP data achieve the DQO requirements established for the project. Data quality assessment is still required.

Analytical services procured outside of the CLP are characterized as non-CLP. These can be provided by laboratories that participate in the CLP, use CLP methods, generate CLP-type data packages, or by laboratories that have never participated in a national analytical program. It is recommended that non-CLP laboratories be audited to assure the validity and defensibility of any data generated.

Non-CLP data are generated by laboratories whose proficiency in the methods of interest may or may not be known. It is the responsibility of the data generator and user to select the method and data acceptance criteria that will verify method and laboratory performance.

Two categories of non-CLP services are available: fixed laboratory and field analyses. Fixed laboratory analyses are performed by commercial laboratories selected by the data user. Field analyses are commonly performed in mobile laboratories or with fieldable or portable analytical instruments.

In addition to quick turnaround and lower cost, field analyses can: (1) focus sampling efforts; (2) provide qualitative information; (3) provide quantitative results when supplemented by confirmatory samples sent to a fixed laboratory; and (4) potentially satisfy project needs.

Analytical QC is comprised of a planned system of routine activities for obtaining prescribed standards of performance. QC frequency, type, and acceptance criteria should correlate with the study objectives. The type, frequency, sequence, and control criteria for analytical QC samples are predetermined for CLP RAS. Site managers specify the control criteria for both CLP SAS and non-CLP analyses.

Assessment of Data Quality

> *Site managers and other data users assess data quality to determine if the data are consistent with project objectives and are appropriate for supporting a specific decision.*

Steps in assessing data quality may include data review, uncertainty determination, and data useability assessment. Benefits data users can obtain from proper assessment of data quality include: (1) establishment of data useability; (2) determination of sufficient data quantity; and (3) improvement of future data collection efforts by identifying major sources of error in the data.

Data Review/Validation: The first step in assessing data quality is data review, also known as data validation. Data review/validation is the technical examination of environmental data and the associated QC data to determine the limitations of the data. During this process, the reviewer applies analytical criteria to determine if analyses were performed under controlled conditions and whether or not the data should be qualified. Because data review/validation criteria are based on the methods used to generate the data, the results of a data review/validation are frequently independent of the intended use of the data. The data review/validation process establishes the quality of the data. Data review must be consistent with the project DQOs and QAPP.

CLP data review is performed by technical personnel who have been trained by Regional staff or follow Agency guidance. The data package is reviewed using EPA's functional guidelines for evaluating organic and inorganic laboratory data (see Reference Box 3) and Regional SOPs that comprise standardized procedures and criteria based on the associated analytical methods. Non-CLP data are reviewed based on available information including the sample matrix and analytical method used and in accordance with the procedures and criteria specified in the DQOs. Data validation procedures must avoid conflict of interest problems.

Determination of Total Uncertainty: Each step of the data acquisition process has an inherent uncertainty associated with it. The uncertainty acceptance level depends on the purpose for which the data are being collected. Total error is comprised of two types of error: sampling variability and measurement error. Sampling variability is the variation between true sample values and is a function of the spatial variation in the pollutant concentrations. Measurement error represents the difference between the true sample value and the reported value. Examples of these types of errors are provided in Exhibit 7.

Factors that can influence sampling and measurement errors include:

- Instrument capabilities
- Variability (media, spatial, temporal, operational)
- Incorrect sample collection coordinates
- Improper decontamination procedures
- Improper sample preservation
- Inadequate storage procedures
- Inappropriate sample preparation analysis
- Exceeded holding times

EXHIBIT 7 - TOTAL ERROR COMPONENTS

Sampling variability is a function of the spatial variation in pollutant concentrations. For example, landfills may have "hot spots" with non-representative concentrations.

Measurement error, which has components from both sampling and analysis, is estimated using the results of QC samples. For example, sample results may be biased low due to the holding time being exceeded.

Site managers and other data users should establish procedures for estimating total uncertainty and data acceptance criteria during the DQO development stage. EPA currently is developing procedures for determining total error for soil analyses. The Environmental Monitoring Systems Laboratory in Las Vegas (EMSL/LV) has developed a guidance, A Rationale for the Assessment of Errors in the Sampling of Soils, to serve this purpose.

Data Useability Assessment: After the data have been reviewed and the total uncertainty estimated, the data must be examined in the context of the DQOs to determine whether they are valid for their intended use.

Site managers or other data users assess data useability by evaluating the sampling and analytical performance against the quality indicators specified in the DQOs. Quality indicators consist of quantitative statistics and qualitative descriptors and are used to interpret the degree of acceptability of data to the user. The data quality indicators are:

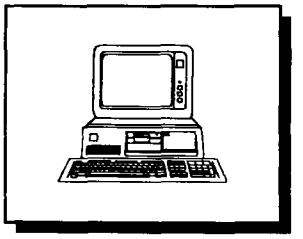
- Bias/Accuracy
- Precision
- Comparability
- Completeness
- Representativeness

Site managers may be required to implement corrective action in the event the system fails to achieve the established performance criteria.

EPA has established a Data Useability Workgroup to develop national guidance for minimum data quality requirements to increase the useability of environmental data in support of Superfund. Within this workgroup, the risk assessment subgroup has developed minimum requirements for risk assessments (see Guidance for Data Useability in Risk Assessment: Final). The site assessment subgroup has developed similar guidance for site assessments.

Automated Computer Systems

Automated computer systems are useful tools in supporting data collection activities.



Several automated computer systems are being developed that can assist site managers in performing various aspects of data collection, including developing SAPs, developing and evaluating sampling strategies, and performing automated data review. This section describes some of the systems that are in the prototype stage of development. Because these systems have not been finalized, their current useability cannot be guaranteed. Exhibit 8 provides EPA contacts for further information on each of these systems.

Sampling and Analysis Plan Development: The Quality Assurance Sampling Plan for Emergency Response (QASPER) was created to automate the development of a site-specific SAP for the Removal program. The system is implemented using WordPerfect software. QASPER includes step-by-step procedures for developing a SAP, from development of DQOs

through data validation. The system significantly expedites the SAP development process.

Development and Evaluation of Sampling Strategies: Several automated systems have been produced to develop and evaluate sampling strategies. Each automated system has specific data requirements and is based on specific site assumptions.

The DQO Expert System was developed by the Quality Assurance Management Staff (QAMS). It is a training system that assists in planning environmental investigations based on the DQO process. The four systems that follow were developed by EMSL/LV. The Environmental Sampling Expert System (ESES) assists in planning sample collection. It includes models that address statistical design, QC, sampling procedures, sample handling, budget, and documentation. The current system addresses metal contaminants in a soil matrix. Expanded application of this system is under development. The Geostatistical Environmental Assessment Software (GEO-EAS) is a collection of software tools for two-dimensional geostatistical analysis of spatially distributed data points. Programs include file management, contour mapping, variogram analysis, and kriging. SCOUT Multivariate Statistical Analysis Package is a collection of statistical programs that accept GEO-EAS files for multivariate analysis. The Assessment of Errors in Sampling of Soils (ASSESS) system estimates measurement error variance components. It presents scatter plots of QC data and error plots to assist in determining the appropriate number of QC samples required.

Automated Data Review: Automated data evaluation systems have been developed to reduce the resources and the amount of time required to review data. The Computer-Aided Data Review and Evaluation (CADRE) system developed by EMSL/LV is an automated evaluation system that assists in the review of CLP organic RAS data. CADRE evaluates data quality according to the QC criteria defined in the EPA's functional guidelines for evaluating inorganic and organic data. The system is being modified to accept manual entry of other data sets and to accept user-defined criteria to meet specific information needs.

The Electronic Data Transfer and Validation System (eDATA) developed by the Removal program assists in rapid evaluation of data in emergency responses. This system may be applicable for both CLP and non-CLP data. The system combines DQOs, pre-established site specifications, QC criteria, and sample collection data with laboratory results to determine useability. This software consists of three separate and distinct modules that reflect the needs of the site manager, the laboratory, and the data validator. In using eDATA, the site manager specifies the DQOs associated with any given batch of samples, the choice of the pre-established QA/QC criteria, and the limits for volatile, semivolatile, PCB and pesticide, and metal constituents. The site manager can also create sets of user-defined criteria to meet project-specific needs.

EXHIBIT 8 - COMPUTER SYSTEM CONTACTS

ASSESS: Jeff Van Ee, Exposure Assessment Division, USEPA EMSL/LV, (702) 798-2367.

CADRE: John Nocerino, Quality Assurance Division, USEPA EMSL/LV, (702) 798-2110.

DQO Expert System: John Warren, USEPA Quality Assurance Management Staff, (202) 260-9464.

eDATA: William Coakley, USEPA Environmental Response Team, (908) 906-6921.

ESES: Jeff Van Ee, Exposure Assessment Division, USEPA EMSL/LV, (702) 798-2367.

GEO-EAS: Evan Englund, Exposure Assessment Division, USEPA EMSL/LV, (702) 798-2248.

QASPER: William Coakley, USEPA Environmental Response Team, (908) 906-6921.

SCOUT: Jeff Van Ee, Exposure Assessment Division, USEPA EMSL/LV, (702) 798-2367.

REFERENCE BOX 3

American Public Health Association. 1985. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, 16th Edition, 1985.

Environmental Protection Agency (EPA). 1986. Test Methods for Evaluating Solid Waste (SW-846): Physical/Chemical Methods. Third Edition. Office of Solid Waste.

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GLOSSARY

Assessment - the evaluation process used to measure the performance or effectiveness of a system and its elements. Assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection or surveillance.

Audit - a planned and documented investigative evaluation of an item or process to determine the adequacy and effectiveness as well as compliance with established procedures, instructions, drawings, QAPPs, and/or other applicable documents.

Data Quality Objectives (DQOs) - a statement of the precise data, the manner in which such data may be combined, and the acceptable uncertainty in those data in order to resolve an environmental problem or condition. This may also include the criteria or specifications needed to design a study that resolves the question or decision addressed by the DQO process.

Data Quality Objectives Process - a Total Quality Management (TQM) tool developed by the U.S. Environmental Protection Agency to facilitate the planning of environmental data collection activities. The DQO process asks planners to focus their planning efforts by specifying the use of the data (the decision), the decision criteria, and their tolerance to accept an incorrect decision based on the data. The products of the DQO process are the DQOs.

Data Useability - the process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Detectable Constituent - a target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Management Systems Review (MSR) - the qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained.

Performance Evaluation (PE) - a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Quality - the sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs and expectations of the user.

Quality Assurance (QA) - an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Project Plan (QAPP) - a formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality Control (QC) - the overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer.

Quality Management Plan (QMP) - a formal document that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all activities conducted.

Quantitation Limit - the maximum or minimum level or quantity of a target variable that can be quantified with the certainty required by the data user.

Sampling and Analysis Plan (SAP) - a formal document that provides a process for obtaining data of sufficient quality and quantity to satisfy data needs. A sampling and analysis plan consists of two parts:

(a) The field sampling plan, which describes the number, type, and location of samples and the types of analyses; and

(b) The quality assurance project plan, which describes policy, organization, and functional activities and the data quality objectives and measures necessary to achieve adequate data for use in planning and documenting the response action.

Technical Review - a documented critical review of work that has been performed within the state of the art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work, but are collectively equivalent in technical expertise to those who performed the original work. The review is an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements are satisfied.

Technical Systems Audit (TSA) - a thorough, systematic, on-site, qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system.

Validation - an activity that demonstrates or confirms that a process, item, data set, or service satisfies the requirements defined by the user.