

**FINAL**

# **ENVIRONMENTAL INFORMATION MANAGEMENT PLAN**

**FOR THE**

## **RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO**

*Prepared for*



**US Army Corps  
of Engineers®**

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FOR THE  
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RAVENNA, OHIO**

**Prepared for**

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## **ABBREVIATIONS AND ACRONYMS**

AOC	Area of Concern
ARNG	Army National Guard
CAD	computer-aided design
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COTS	commercial off-the-shelf
DENIX	Defense Environmental Network and Information Exchange
DoD	U.S. Department of Defense

DSM	Decision Support Module
EDD	electronic data deliverable
EIMP	Environmental Information Management Plan
EIMS	Environmental Information Management System
GIS	Geographic Information System
GQT	geospatial query tool
IMP	Information Management Plan
IOC	Industrial Operation Command
IRP	Installation Restoration Program
LAN	local area network
LCTA	Land Condition-Trend Analysis
NAD	North American Datum
NGB	National Guard Bureau
Ohio EPA	Ohio Environmental Protection Agency
ODBC	Open Database Connectivity
OSC	Operations Support Command
PC	personal computer
PDF	Portable Document Format
RAB	Restoration Advisory Board
RI	Remedial Investigation
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SEIMS	SAIC's Environmental Information Management System
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
UTM	Universal Transverse Mercator

## 1.0 INTRODUCTION

The Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, was constructed in the early 1940s to produce munitions for World War II. Although munitions are no longer produced there, RVAAP has continued to operate into the 21st century with changes in the intensity and scope of the operations it performs. Operations over the last 50 years have included the production, testing, storage, and destruction of munitions; storage of strategic materials; and training of Army National Guard (ARNG) personnel. Environmental regulations enacted in the early 1970s required the identification, tracking, and safe disposal of all materials that could potentially pose a risk to human health or the environment. Beginning in the 1970s, RVAAP began to conduct studies and produce reports to document its compliance with these laws. An Installation Restoration Program (IRP) was established to evaluate and remediate (clean up) any contaminated areas. Since the early 1990s, significantly increased environmental efforts have occurred, including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Phase I and II Remedial Investigations (RIs), Resource Conservation and Recovery Act (RCRA) closures, demolition/salvage, etc. Currently, environmental studies and remedial actions are set to dramatically accelerate at RVAAP under the responsibility of the Operations Support Command (OSC) with support from the U. S. Army Corps of Engineers (USACE).

In May 1999, The National Guard Bureau (NGB) assumed accountability for 6,541 hectares (16,164 acres) of what had formerly been RVAAP property. NGB then delegated daily management of the property to the Ohio ARNG. This 6,541-hectare parcel is considered the Ravenna Training and Logistics Site (RTLS) and almost totally encircles the remaining 2,127 hectares (5,255 acres) of RVAAP. As IRP and other environmental work progresses at RVAAP, the Ohio ARNG will need to be kept aware of the changes in conditions that affect the safety of personnel and the potential uses of the land. As eventual custodian of the property, the Ohio ARNG has a stake in the decisions concerning remedies for contaminated areas. Information collected by the Ohio ARNG to characterize the site may be useful for environmental evaluations that will need to be conducted.

As environmental protection activities at RVAAP move into the actual remediation of contaminated areas, the access to preexisting information about the site is essential for safe, efficient, and effective remediation. Information produced during the early construction and production years at RVAAP, such as as-built plans, construction specifications, operational standard operating procedures, and operational records, can provide many benefits to the environmental program if it is readily available. Access to historical information allows workers to

- efficiently identify the areas of potential contamination and the types of contamination that might be encountered,
- identify potential hazards and obstacles to the remediation process, and
- estimate the types and amounts of materials that must be remediated to aid in planning the allocation of remediation resources.

Information generated since the 1970s includes National Pollutant Discharge Elimination System (NPDES) permits, installation environmental assessments, facility groundwater studies, RCRA permit applications, solid waste permits, underground storage tank (UST) removals, polychlorinated biphenyl (PCB) cleanup, compliance monitoring, hazardous waste manifests, and other CERCLA and RCRA documents. Access to these documents



- helps to avoid the costly reevaluation of areas that have already been investigated;
- fulfills legal requirements for documenting compliance with regulations;
- provides information that may be used to evaluate the effectiveness of remediation;
- allows decisions to be made quickly, without collection of additional field data; and
- allows the integration of information from multiple areas to assess larger-scale or facility-wide questions.

The IRP has identified more than 50 Areas of Concern (AOCs) at RVAAP. Over the next 20 years, various government entities and contractors will write reports detailing the condition, need for remediation, and status of each of these AOCs. There is, thus, a large amount of environmental information that has already been developed and a virtual explosion of new environmental information that will occur within the next few years.

There are multiple stakeholders at RVAAP who need access to information and who produce information that is relevant to the environmental program at RVAAP. These stakeholders include:

- RVAAP site managers;
- the Operations Support Command (OSC), formerly Industrial Operations Command (IOC);
- the Ohio ARNG;
- the U.S. Army Corps of Engineers (USACE);
- the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM);
- the Ohio Environmental Protection Agency (Ohio EPA);
- the U.S. Environmental Protection Agency (U.S. EPA);
- the Restoration Advisory Board (RAB);
- the general public; and
- contractors/subcontractors.

The large amount of available information, the large volumes of information that will be produced as work at RVAAP continues, and the number of stakeholders who need ready access to the information point to the immediate need for an integrated Environmental Information Management System (EIMS) at RVAAP.

An integrated EIMS is a system of computer hardware, software, procedures, and people that facilitates the rapid, secure, and reliable flow of information between users. An integrated EIMS provides a variety of users access to information of different types (such as maps, documents, and environmental characterization and monitoring data) from different sources (such as the OSC, Ohio ARNG, USACE, and contractors). The purpose of an integrated EIMS is to save time and money for the IRP and other regulatory compliance and facility management operations at RVAAP by

- providing a systematic means of accessing existing information,
- reducing the time needed to find information,
- efficiently adding new information,

- preventing loss of information,
- providing varying levels of access to this information to different data users, and
- presenting information in ways (such as maps and tables) that make data analysis and decision making more efficient.

This report summarizes the information management needs of each stakeholder group listed above; provides an overview of an EIMS that can fill these needs; lists the hardware, software, and personnel requirements of each component of the system; and proposes a schedule for implementation of the system.

## 2.0 NEEDS ASSESSMENT SUMMARY

To begin the process of developing an EIMS, the *Environmental Information Management Needs Assessment for the RVAAP* was prepared (USACE 1999). The needs assessment report presented the results of a survey of stakeholders that identified the information flow to and from the stakeholders as well as the current infrastructure and procedures for managing this information. The needs of each stakeholder are summarized below, followed by an overview of EIMS requirements.

### 2.1 RAVENNA ARMY AMMUNITION PLANT

The U.S. Army OSC representatives at RVAAP are responsible for managing the IRP and other regulatory compliance activities at RVAAP. They must coordinate and facilitate all RVAAP site activities. They are responsible for maintaining the information that supports the remedial decisions made for RVAAP.

The RVAAP on-site managers have the primary responsibility for the activities conducted at RVAAP; therefore, the information needs of the RVAAP staff must have the highest priority in the design of the EIMS. The EIMS must support RVAAP with information that allows them to make decisions rapidly.

RVAAP has a large collection of IRP-related documents as well as photos, maps, and drawings of the facilities over the years and standard operating procedures for processes performed at the site. RVAAP must keep some of these documents on file to fulfill environmental regulations. Others may be useful in planning IRP activities. Documentation such as hazardous waste manifests and disposal certificates required to fulfill state and RCRA requirements concerning the disposition of hazardous materials must be maintained. RVAAP needs a system for identifying documents related to a particular subject, locating documents that are needed, preserving and storing documents over time, and providing documents to those who need them.

Site characterization data are the basis for the remediation decisions that are made at the site. These data must, therefore, be securely stored and available for use in the management decision process. Currently, contractors who collect the data are responsible for the data that they collect. RVAAP needs a system that will keep data secure and available throughout the IRP process. The system should also allow data to be easily combined across sites and rapidly accessed by contractors, regulators, and technical advisors.

RVAAP extends over 8,668 hectares (21,419 acres). Site managers need a Geographic Information System (GIS) that allows them to visualize the spatial relationships among various features at the site. These features include such things as topography, streams and ponds, roads, buildings, AOCs, areas of previous and present activities, etc. Managers also need to be able to superimpose the site characterization data on the spatial features to help understand how contamination is related to these features.

The RVAAP site managers must also respond to public inquiries concerning activities at the site and manage public input to the CERCLA process as required by law. RVAAP needs a system for providing schedules of site activities and summaries of those activities to the public. In some cases large documents must be available for public review.

The information produced at RVAAP is primarily in the form of reports required by environmental regulations. RVAAP staff also generate review comments on the work of others and compile schedules of on-site activities.

## **2.2 U.S. ARMY OPERATIONS SUPPORT COMMAND**

The U.S. Army OSC is responsible for oversight of RVAAP activities and must prioritize the environmental management activities at RVAAP and other sites. This oversight includes reviewing and commenting on all RVAAP IRP documents. The OSC would benefit from a system that provides indexed and cross-referenced access to documents and allows easy access to maps and summary tables. Access to raw data, such as concentrations of a specific analyte, is also desirable if the interface is simple to use.

Information produced by the OSC would mainly take the form of review comments on documents produced by others.

## **2.3 OHIO ARMY NATIONAL GUARD**

In May 1999, the NGB assumed accountability for 6,541 hectares (16,164 acres) of what had formerly been RVAAP property. NGB then delegated daily management of the property to the Ohio ARNG. This 6,541-hectare parcel is considered the RTLS, and almost totally encircles remaining 2,127 hectares (5,255 acres) of RVAAP.

The Ohio ARNG uses RTLS as a training facility. It is also the land and natural resources manager of RVAAP. It manages all environmental aspects of Ohio ARNG activities. The Ohio ARNG also serves in an advisory and cooperative capacity with the OSC in the management of the IRP and other environmental regulatory compliance activities.

The Ohio ARNG generates spatial information as map coverages as part of the U.S. Army's Integrated Training Area Management system. These coverages include a wide range of information related to land management such as topography, aerial photos, buildings and roads, creeks and rivers, wetlands, AOCs, training management areas, agricultural leases, threatened and endangered species, groundwater resources, watersheds, hunting cells, aviation patterns, bridges and culverts, forestry, and Land Condition-Trend Analysis (LCTA) plots.

The Ohio ARNG uses data produced by the RVAAP IRP to assess the suitability of land for Ohio ARNG uses and to track the status of AOCs. Currently, this information is obtained from hard-copy reports. The

Ohio ARNG also reviews IRP documents. The Ohio ARNG would use contamination data or mappings of contamination data from the IRP, if available electronically, to help assess and prevent exposure of personnel to potentially harmful chemicals.

The Ohio ARNG requires rapid access to map data for use in planning and assessing site activities. An interface is needed that allows map coverages to be displayed and overlaid. The interface system needs to be simple enough for soldiers to operate with minimal training. It needs to be rapid enough to deliver results in a matter of minutes.

## **2.4 U.S. ARMY CORPS OF ENGINEERS**

USACE coordinates Corps Defense Environmental Restoration Program work at RVAAP. USACE also provides technical and contract support for environmental services at RVAAP. In this role USACE needs access to IRP documents produced at the site, as well as maps, graphs, and figures.

Information is currently used as hard-copy reports. USACE needs an EIMS that can identify relevant documents and provide access to them. In its technical support role, USACE needs access to site characterization data and to maps that show how contamination and map features are related.

USACE produces information in the form of documents such as white papers on technical subjects, comments on reports, and statements of work for architectural, engineering, and construction contractors. USACE may also produce data such as results from split environmental samples.

## **2.5 U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE**

USACHPPM provides technical risk assessment support to the IRP at RVAAP. Information generated by USACHPPM includes document comments, memoranda, letters, and position papers. This information is generated in hard-copy or e-mail format. Currently, USACHPPM obtains RVAAP information through hard-copy reports. If the data were available electronically, USACHPPM would like the capability to access raw characterization data through a map interface and/or a query tool.

## **2.6 OHIO ENVIRONMENTAL PROTECTION AGENCY**

Ohio EPA provides the primary regulatory oversight for the RVAAP environmental remediation projects. Information generated by Ohio EPA concerning RVAAP includes Cooperative Agreements, Installation Action Plans and Obligation Plans, and comments on documents submitted by RVAAP to fulfill environmental regulations. Ohio EPA also collects characterization data from split samples and groundwater from residential wells.

To fulfill its regulatory oversight role, Ohio EPA needs access to the environmental characterization data generated by RVAAP and its contractors. These data are available in hard-copy reports, but the most efficient access would be one that allowed the data to be interactively queried into an electronic database or spreadsheet. The data interface should be quick and simple enough that it could be readily used by regulators without detailed knowledge of the database. The data query interface needs to be intuitive.

Ohio EPA would like an integrated EIMS with GIS capabilities for selecting and displaying many layers. The system should be able to zoom in on AOCs by name and be able to plot distributions of a specified analyte for a specified medium.

Ohio EPA would like the ability to download documents and parts of documents in Portable Document Format (PDF), MS Word, or Corel WordPerfect from an integrated EIMS. They would like access to all current RI documents, as well as selected historical documents. USACE guidance documents should also be available either directly or via a link to a web site. A RVAAP web site should link to USACE, U.S. EPA, Ohio EPA, Ohio Department of Health, Defense Environmental Network and Information Exchange (DENIX), OSC, Army Environmental Center, Army Material Command, RVAAP Installation Action Plan, and Risk Advisory Board web sites.

## **2.7 U.S. ENVIRONMENTAL PROTECTION AGENCY**

U.S. EPA provides regulatory oversight for the RVAAP environmental remediation projects. Information generated by U.S. EPA concerning the RVAAP IRP includes comments on documents submitted by RVAAP to fulfill environmental regulations.

## **2.8 RESTORATION ADVISORY BOARD**

RAB provides public input to the IRP process at RVAAP. RAB needs to be kept informed of the process and schedule of IRP activities at RVAAP. Documents and data need to be available for review. To be most widely available to the public, information should be accessible using only web-browser software. The system should allow for electronic comment submission and provide for acknowledgment and response. Generally, the IRP documents include all data in raw and summary format after validation. Providing data through electronic distribution of the documents will fill RAB's needs.

## **2.9 GENERAL PUBLIC**

The general public needs to be kept informed of site activities and opportunities to comment on IRP documents. The public is currently kept informed through newsletter distribution and public meetings. Posting the schedule and newsletter information on a web site is currently planned as an additional way to make information available to the public. The web site should also have a facility to allow for the submission of comments and questions.

## **2.10 CONTRACTORS/SUBCONTRACTORS**

Various contractors and subcontractors will be conducting characterization, remediation, and monitoring to support the IRP at RVAAP over at least the next 20 years. To provide efficient service to RVAAP, these organizations will need rapid access to historical documents and data. These organizations will also generate data that must be maintained and archived by RVAAP so that it is available to the regulators and the public to support the decisions of the IRP and for subsequent characterization, assessment, and planning purposes.

During the data collection process, the contractor requires an integrated EIMS that allows the status of data to be tracked from planning through validation. The system should allow interactive queries about

specific analytes, batches, or samples as well as canned reports that show the percentage of analyses completed. The database needs to be updated at least daily for these reports to be useful. The database must have status flags to indicate whether data have been reviewed and approved for use. The database system must be capable of exporting data to other applications such as GIS, computer-aided design (CAD) programs, modeling programs, statistical programs, spreadsheets, or word processing programs to facilitate data analysis and the production of reports.

Contractors also need access to scheduling information for the site. The schedule of environmental compliance activities is needed to know when reports are due. Contractors also need to know the schedule of activities, such as hunting or Ohio ARNG training activities, that might affect their ability to operate at the site. Contractors also need access to the latest map coverages to aid in the display and interpretation of data.

## **2.11 NEEDS OVERVIEW**

There are four general areas of information management needs that were expressed by the stakeholders. These areas are the following:

- environmental analytical and field data management,
- spatial information management,
- document management, and
- decision support.

The information required may concern environmental compliance activities as well as unexploded ordnance removal, site monitoring, and public relations. Environmental analytical and field data form the basis of nearly all decisions concerning the need to remediate and the effectiveness of remediation efforts. Highest priority should, therefore, be placed on obtaining, preserving, and maintaining the data collected during field investigations. Placing data in an electronic database provides preservation through electronic backup, maintenance through hardware and software updates, and accessibility through consolidation and Internet access.

Nearly all information used at RVAAP has a spatial component. The information may be related to a specific point or area on a map. There is a definite need to be able to spatially overlay different attributes. It is especially important to be able to see contamination levels relative to the map attributes. A system that allows a user with little training to view data spatially would provide a powerful and much-needed analysis tool.

The majority of the environmental information used at RVAAP is generally in hard-copy format. RVAAP needs a system that makes documents readily available to the RVAAP manager and makes information easy to find through indexing and cross-referencing within and between documents. The EIMS should identify the physical location of those documents that are not available electronically. In addition to having an indexing system, the EIMS should store the documents in electronic format. Storing documents electronically would make them easier to access, preserve them from physical degradation, and make them easier to distribute to reviewers, regulators, contractors, and the public. The CERCLA process also requires that certain documents be available for public review and comment. The EIMS should, therefore, also make documents available to the public and provide a mechanism for public comment.

Decision support involves putting information management tools together so that questions may be easily answered. For example, when a question arises, the document management system can identify reports that have been conducted on the subject. The reports identify the data that were collected. The data query component extracts the data and runs summary statistics. The spatial component maps the results so that the user may determine whether a problem exists. Decision support also includes making schedules and organizational charts available so that stakeholders know what IRP activities are occurring at the site and who is responsible.

The needs assessment listed some additional considerations for the development of an EIMS, as outlined below.

- Implementation of the EIMS should result in an overall time savings for the activities conducted at RVAAP.
- The EIMS must be cost effective. It should result in an overall cost savings to RVAAP operations.
- The general public should not have access to unvalidated data or unreviewed documents.
- Any interactive user interface should be simple and quick, requiring only one or two mouse clicks as much as possible.
- A system should provide information quickly.
- Because data collection is sampling-event driven, updates to the characterization database could be made at fairly long intervals, such as weekly or even quarterly for most users. (However, the contractor collecting the data would need at least daily updates to track sampling status.)
- Most users have Pentium-based personal computers (PCs) on a local area network (LAN) with Internet access. Microsoft Office '97 and ArcView software are common.
- Most users have experience accessing web sites to obtain information.
- Because the OSC and Ohio ARNG have different budget priorities, the integrated EIMS should not depend on the availability of Ohio ARNG data to function.
- The U.S. Army already has a system for managing LCTA data. These data are not likely to be routinely needed for the environmental restoration program. Maps and documents that include LCTA data would be added to the integrated EIMS, but until there was a need, the raw LCTA data would not be included.
- The RVAAP EIMS should service the needs of both the Army and the Ohio ARNG.
- It should be flexible enough to change over time to meet the increasing and changing needs of the ultimate user, the Ohio ARNG.
- It should be structured so that improvements in hardware, software, logic, etc., can be efficiently implemented.

- If the Ohio ARNG chooses to utilize its own system of information management, efforts should be made to allow communication between the two information management systems.

The information flow for the environmental activities at RVAAP is summarized in Table 2-1 in terms of data users and data producers. Nearly all stakeholders may use all forms of information.

**Table 2-1. RVAAP Information Flow**

User	Environmental Data		Spatial Data		Documents		Decision Support	
RVAAP		↓	↑	↓	↑	↓	↑	↓
OSC		↓		↓	↑	↓	↑	↓
USACE	↑	↓	↑	↓	↑	↓	↑	↓
Ohio ARNG	↑	↓	↑	↓	↑	↓	↑	↓
Contractors	↑	↓	↑	↓	↑	↓	↑	↓
Ohio EPA/U.S. EPA	↑	↓	↑	↓	↑	↓	↑	↓
USACHPPM	↑	↓		↓	↑	↓	↑	↓
RAB/Public		↓		↓	↑	↓	↑	↓

↑ = Produce information.

↓ = Use information.

## 3.0 EIMS OVERVIEW

The EIMS is system of computer hardware, software, procedures, and people designed to make information readily available to fulfill the needs of the environmental activities of the Army and the Ohio ARNG at RVAAP. The information flow for the EIMS at RVAAP is diagrammed in Figure 3-1. The system provides for initial data input to the system, electronic storage of information, processing of new information, and analysis and reporting of information.

### 3.1 INFORMATION FLOW

The EIMS is designed around the three primary types of information management required by the stakeholders at RVAAP: environmental data, maps, and documents (Figure 3-1). Each type of information is addressed by a separate component of the EIMS. The information within each component has some unique storage and management requirements that make treatment of it separately from other types of information the most efficient approach. A decision support component serves to integrate the three types of information into a useful format for the user.

The needs assessment identified two user groups with significant differences in needs: the public and the RVAAP environmental working group. The public requires access to information that has been reviewed and approved for release. Information that has not been reviewed may contain errors that would cause unnecessary public concern. The public should require only a web browser to find and view information. The public access interface should be simple to use and have intuitive functionality.

The RVAAP environmental working team (made up of management, support, contractors, and regulators), however, requires access to information as soon as it is available. Immediate access allows the RVAAP team to make rapid decisions and to recognize and correct errors. The RVAAP team may



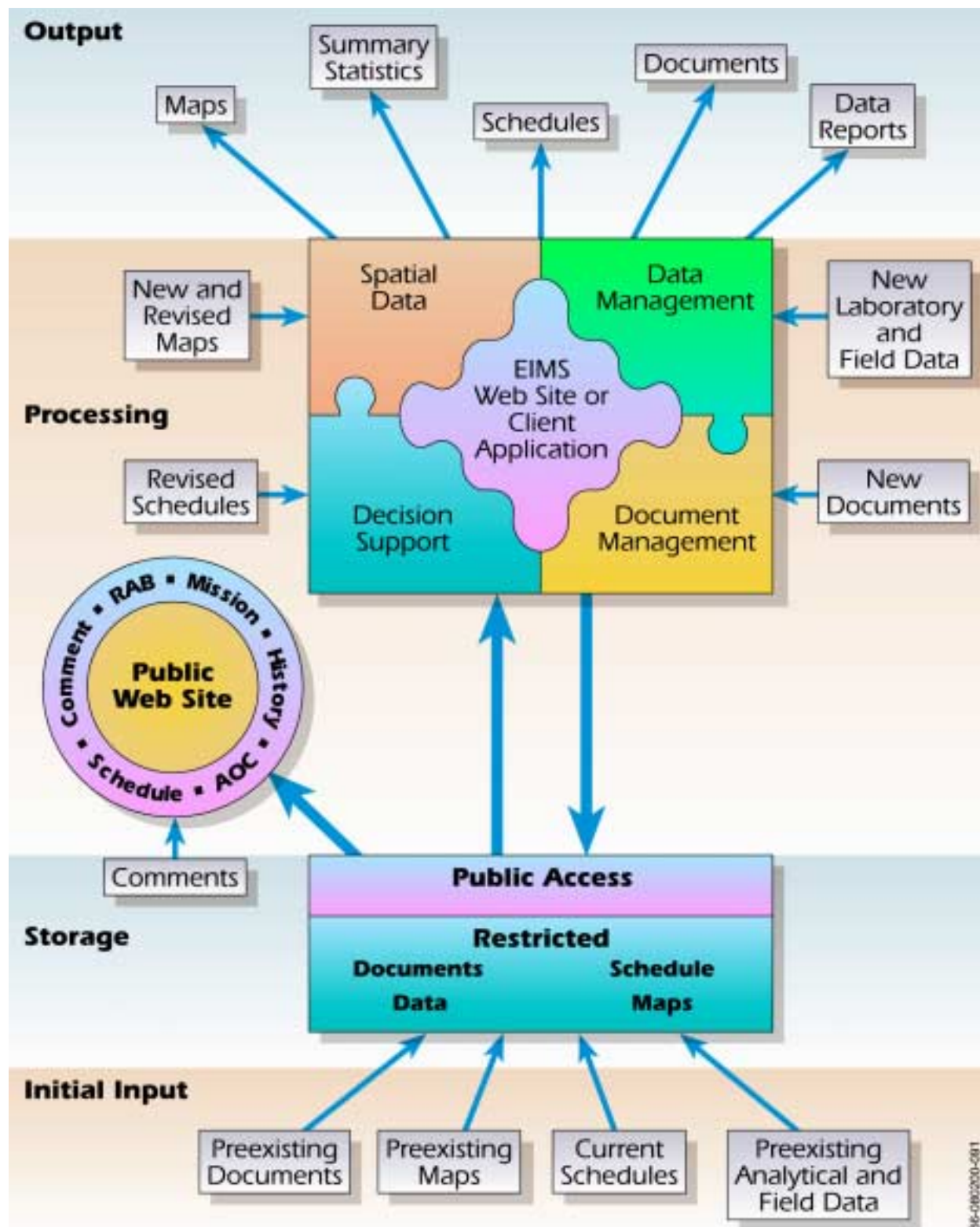


Figure 3-1. Information Flow for the RVAAP EIMS

need to access large amounts of information. Its members need an interface that can provide a rapid response, even for large information requests.

The EIMS has, therefore, been designed with two different access points to the information (Figure 3-1). A web site will be established that will allow anyone with Internet access to view RVAAP information. This web site will permit access to only information that has been reviewed and approved for release to the public. It will not allow information to be altered by the public.

For the IRP working team, information may be accessed through a computer program resident on the user's PC (client application) or through a web site, depending on the stage of EIMS development and the access requirements of the user. The access program will allow the user to select the type of information desired using simple point-and-click directions. The interface will not require knowledge of programming or a detailed understanding of the underlying databases. The interface will allow only authorized persons to access the information.

### **3.2 SYSTEM COMPONENTS**

All information will be located on one server. Consolidation of the information facilitates standardization of data structures and formats. Data can be backed up and archived most efficiently when it is all on the same server. Data consolidation simplifies the process of adding and changing data as well as the process of data distribution to the users. Information on the server will be flagged if it has been reviewed and approved for public release.

Each component of the EIMS is described below. The description of each component includes:

- system requirements, including a description of the required information input and output of the module and performance expectations;
- system design describing the proposed structure, contents, and location of the databases containing the required information and the type of data interface that will be used;
- test acceptance plan listing specific criteria that will be tested to ensure that the system requirements have been fulfilled;
- responsibilities of the managers and users; and
- proposed implementation schedule.

The EIMS components include:

1. server configuration, setup, and maintenance;
2. environmental data management-analytical and field database design, loading, and reporting;
3. spatial data standardization of maps, viewer, and geospatial query tool (GQT);
4. document management indexing, conversion to PDF, and search and view capabilities;
5. decision support application that integrates components and accesses reporting capabilities; and
6. public relations web site that provides public access to IRP information and facilitates public input.

Two additional tasks that would be part of EIMS implementation and maintenance are described below.

1. Site-specific implementation, which would include systems configuration to accommodate site-specific needs (for example, modifying the application for some users to store information on a local disk drive or CD, rather than the Internet, to improve response time).
2. Training provision for transferring from developing contractor to another service provider.

### **3.3 SYSTEM INPUT**

The functioning of the EIMS requires the input of information in an electronic format. The discussion of each component of the EIMS in the sections below addresses the conversion of legacy information into electronic format. Conversion costs can be avoided for newly acquired information if all new information were received in an electronic format that was compatible with the RVAAP EIMS. Section 13 (below) identifies the types of information that should be submitted to RVAAP in electronic format. It also specifies the specific formats that would be compatible with the proposed system.

### **3.4 EIMS RESPONSIBILITIES**

While software tools are essential for the functioning of the EIMS, people make the system run. The roles and responsibilities of each RVAAP team member must be defined.

#### **3.4.1 RVAAP Information Manager**

The RVAAP Information Manager is the Army representative at the site with direct responsibility for oversight of the RVAAP EIMS. Currently this role is filled by the RVAAP Remedial Project Manager, Mark Patterson. The RVAAP Information Manager has the following responsibilities:

- verifies that the EIMS contractor has produced an EIMS that works as specified in this Environmental Information Management Plan,
- approves changes to the structure and function of the EIMS with input from the RVAAP Information Team,
- approves information such as documents and data for public access, and
- identifies and approves information for addition to the EIMS.

#### **3.4.2 RVAAP Information Team**

The RVAAP Information Team is a committee representative of the RVAAP stakeholders that provides technical guidance on decisions regarding the EIMS at the request of the RVAAP Information Manager. It would be made up of representatives of the various user groups of the system (RVAAP, OSC, Ohio ARNG, USACE, Ohio EPA, EIMS contractor, other contractors, and RAB). Responsibilities of the RVAAP Information Team would include:

- review information management issues at the request of the RVAAP Information Manager,

- make recommendations for changes and additions to the EIMS, and
- prioritize system and information needs.

### **3.4.3 EIMS Contractor**

The EIMS contractor is the company responsible for assembling and maintaining the EIMS. The responsibilities on the EIMS contractor include:

- provide hardware, if necessary, that meets system server requirements,
- provide software that meets the system requirements of the EIMS, and
- provide personnel to configure, manage, and maintain the EIMS.

### **3.4.4 EIMS Manager**

The EIMS manager is the representative of the EIMS contractor with overall responsibility for the establishment and functioning of the EIMS. The responsibilities of the EIMS Manager include:

- meet implementation schedule for the EIMS,
- document that the requirements of test acceptance plan have been met,
- monitor functioning of the EIMS,
- represent the contractor on the RVAAP Information Team,
- respond to questions concerning the functioning of the EIMS,
- document EIMS problems through the use of nonconformance reports, and
- oversee implementation of changes in the EIMS approved by the RVAAP Information Manager.

### **3.4.5 Network Administrator**

The Network Administrator manages the hardware and software required by the network server. The Network Administrator:

- installs, configures, maintains server hardware,
- installs, configures, maintains server software,
- backs up data at specified intervals,
- assigns server user names and initial passwords, and
- monitors server for unauthorized access.

### **3.4.6 EIMS Database Manager**

The EIMS Database Manager is employed by the EIMS contractor to load data into the EIMS database. The database manager:

- identifies and resolves problems with data before loading,
- loads data into the EIMS, and
- issues change notices to inform users when data have been changed.

### **3.4.7 GIS Data Manager**

The GIS data manager is employed by the EIMS contractor to manage map information. The GIS data manager:

- converts preexisting spatial information into the EIMS format,
- adds new information to the EIMS, and
- prepares a user guide and systems manual for the GIS component of the EIMS.

### **3.4.8 Document Coordinator**

The document coordinator is employed by the EIMS contractor to manage the document component of the EIMS. The document coordinator:

- develops a classification and indexing scheme for RVAAP documents in coordination with the RVAAP Information Manager and applies them to documents,
- converts documents to PDF files,
- coordinates public release of documents with the RVAAP Information Manager, and
- prepares a user guide and systems manual for the document component of the EIMS.

### **3.4.9 Data Generator**

Data generators are contractors or government agencies that produce data as part of their tasks performed for the environmental program at RVAAP. Data generators either

- submit data to the RVAAP Information Manager in a standard electronic deliverable format,
- load data directly to the EIMS using the standard electronic deliverable format, or
- load data directly to the EIMS using laboratory electronic deliverables and the data management functions of the EIMS.

### **3.4.10 EIMS Users**

EIMS users are any of the RVAAP stakeholders who use the EIMS. EIMS users are responsible for:

- reporting any problems with information access, input, or retrieval to the EIMS Manager, and
- protecting user names and passwords if applicable.

The members of the RVAAP EIMS team together provide for the rapid and reliable exchange of information among all of the data users.

## **4.0 SERVER CONFIGURATION, SETUP, AND MAINTENANCE**

### **4.1 OVERVIEW**

The server functions as the central repository of all information: data, maps, documents, schedules, analysis software, etc. The server will contain the public-access web site and interfaces to the information management modules. It must provide security to prevent unauthorized access and manipulation of the information. It must be reliable and include components that reduce the potential for time out of service. The system must have data backup capabilities that allow the restoration of data in the event of a system failure. The system must be expandable to accept increasing amounts of data and usage in the future. The server must be connected to the Internet.

Several options are available for providing server capabilities:

1. A server could be purchased by the RVAAP for the exclusive use of the EIMS and operated by a contractor.
2. A server could be purchased by the RVAAP for the exclusive use of the EIMS and operated by the Army or other government agency.
3. Space on a server could be purchased from a contractor or commercial Internet service provider.
4. Space on a government-operated server could be used.

The option chosen will depend on the ability of the service provider to meet the system requirements and on cost. The option used may change over the life of the EIMS as needs, capabilities and costs change.

The first option has the advantages of flexibility and portability. The EIMS contractor would have the flexibility to configure the system specifically for the needs of RVAAP without having to consider other users. Using a server dedicated to RVAAP would avoid the potential for performance degradation caused by other users competing for server resources. The entire system could be moved to whatever site was needed to provide the best performance or maintenance support. This would allow a rapid transfer of support responsibilities if the EIMS contractor changed. The disadvantage of purchasing a dedicated server for RVAAP is that all of the support costs for purchasing the server and software, repairs and maintenance would need to be paid by RVAAP.

The second option has all of the advantages and disadvantages of the first as long as all system requirements can be met. There may be security restrictions at a government facility that may make access to the server by the EIMS contractor and the public more difficult than for a commercial contractor. This option may have cost advantages if computing costs may be charged to a different budget than RVAAP environmental projects.

The third option may be a more economical approach if the EIMS does not require all of the server resources. An Internet service provider provides server capacity, rather than a server. The service

provider may put multiple web sites and databases on the same server. The RVAAP EIMS, as a service provider customer, would be charged a rate based on the amount of data stored on the server. Because the service provider supports multiple customers, the cost of hardware and software maintenance is shared across the customers. A disadvantage of this option is that performance of the RVAAP EIMS could be affected by the demand of other customers. The cost of the service would increase as the amount of information increases.

The fourth option, like the third, may have cost advantages because server resources are shared by different users. On a government computer there may be more restrictions on who can access the server and what types of access are permitted. Access requirements would have to be carefully examined before this option was chosen. This option may have cost advantages if computing costs may be charged to a different budget than RVAAP environmental projects.

The server that holds the data and software for the functioning EIMS is called the production server. In addition to this server, the EIMS contractor will maintain a separate server, called a development server, that may be used for testing any changes or upgrades to the EIMS software, hardware, or the server operating system. New components and software will be tested on the development server so that testing and changes will not interfere with the day-to-day function of the EIMS.

## **4.2 SYSTEM REQUIREMENTS**

The configuration and maintenance of the server must meet the following requirements:

1. Server must have sufficient processor speed so that average requests (that do not require large data downloads) can be processed in less than one minute.
2. Server must have sufficient disk storage space to contain operating system; data management; networking and application software; and anticipated data, maps, and documents (estimated as 15 gigabytes) plus space for temporary files. The server disk storage space must be expandable. Storage requirements are estimated to increase 5 gigabytes/yr for the first eight years and then 1 gigabyte/yr for the next 20 years. The system should be designed to expand to at least 100 gigabytes.
3. Server must have connection to Internet sufficient so that average requests (that do not require large data downloads) can be processed in less than one minute.
4. Server must have device capable of making a backup copy of the entire database and software.
5. Data backup should be scheduled so that at most one day's work would be lost in the event of equipment failure. (Backup is temporary data storage that allows restoration in the event of a mechanical or software failure or inadvertent deletion through human error.)
6. Monthly backups of all system information, including data, web pages, and programs, will be sent to RVAAP (or its designee) to provide off-site storage for disaster recovery.
7. Server must have an uninterruptible power supply sufficient to allow safe shutdown in the event of a power outage.
8. Operating system must be capable of supporting data management and web sites.

9. The EIMS should be in continual operation, with downtime for maintenance or repairs not to exceed 10 percent.
10. The EIMS should be capable of handling up to ten concurrent users.
11. The EIMS contractor will use a separate server with software configuration equivalent to the production server for testing that software and hardware upgrades do not interfere with the function of the EIMS.
12. The EIMS contractor will document the version of each computer program in use and inform users when a new version of software is installed.
13. At the completion of EIMS implementation, the EIMS subcontractor will provide a manual that describes the specifications of server system hardware and software required for system operation. The manual shall include version numbers, patches, upgrades, and non-default settings required.
14. Server must have security provisions such as user names and passwords, so that only authorized users have access to the programs and information.
15. The server firewall must allow for access to the server by those authorized to view data and those authorized to make additions and changes.

#### **4.3 SYSTEM DESIGN**

The EIMS Internet service provider chosen (commercial or government) will supply disk space on a production server that can meet the system requirements.

EIMS data and software will be backed up on a regular schedule. New and revised items will be backed up daily. The entire system will be backed up weekly. Monthly a backup tape will be sent to RVAAP for storage. Backup tapes will be kept temporarily. Daily tapes will be recycled after one week. Weekly tapes will be recycled after one month. Monthly tapes will be recycled after one year.

At project milestones, such as the completion of data from specific sampling events, the data will be archived to compact disks for permanent storage.

The EIMS manager will assign user identification names and passwords to all users of the EIMS. The public web site will not require a user name or password.

The system will be checked at least weekly for attempts at unauthorized access to the database. Attempted unauthorized access will be reported to the EIMS manager and RVAAP Information Manager.

#### **4.4 TEST ACCEPTANCE PLAN**

After system configuration, the EIMS manager will test the system and document that the system meets all specifications listed in the system requirements.



## **4.5 RESPONSIBILITIES**

The EIMS contractor shall be responsible for managing a system of hardware and software that meets the system requirements.

The EIMS manager shall be responsible for verifying that test acceptance criteria have been met and that the system is operated as specified in the Environmental Information Management Plan (EIMP).

The Network Administrator shall be responsible for installing, configuring, operating, and maintaining the hardware and software. The network administrator shall also be responsible for performing system backup as specified, archiving information when requested, issuing user names and passwords, and checking for unauthorized access to the EIMS.

## **4.6 SCHEDULE**

Within two weeks of project initiation, space shall be appropriately configured and available on the development server and shall meet the system requirements.

Within four weeks of project initiation, space shall be appropriately configured and available on the production server and shall meet system requirements.

Servers will be incrementally backed up daily and completely backed up weekly.

Monthly backup tapes would be sent to RVAAP.

Data will be archived when requested by the EIMS manager.

Within one year of project initiation, provide manual that describes server hardware and software specifications.

# **5.0 ENVIRONMENTAL DATA MANAGEMENT**

## **5.1 OVERVIEW**

The environmental data management component of the EIMS must manage several data processes. Preexisting data must be standardized and consolidated into one database. Acquisition of new data must be managed to allow sample tracking and verification and validation of results. Users must be able to view results, query desired data, and extract the results electronically for use with other analysis tools. The entire data management process is described in detail in Appendix A.

## **5.2 SYSTEM REQUIREMENTS**

The environmental data management component of the EIMS must meet the following requirements:

1. The EIMS database shall be in an industry standard commercial off-the-shelf (COTS) product.

2. The EIMS shall be capable of storing all of the information listed in Table 5-1 in a database format.
3. The EIMS database shall be capable of storing up to 100 million analytical or field results.
4. The EIMS shall have the capability of performing the data management functions listed in Table 5-2.
5. The database must be Open Database Connectivity (ODBC) compliant. ODBC compliance allows for the easy access of data by many types of standard COTS database software.
6. Reports, queries, procedures, applications, and web pages programmed to load data into the database or retrieve data from the database shall be written in COTS programming languages.
7. Requests for changes to the structure and functioning of the EIMS database shall be made to the EIMS Database Manager and shall be made only with the approval of the RVAAP Information Manager.
8. Software configured or written to manage the EIMS database (including reports, queries, procedures, applications, and web pages) shall be delivered to RVAAP upon completion of the task. RVAAP shall retain the right to use all such software forever.

## **5.3 SYSTEM DESIGN**

### **5.3.1 Database Structure**

The database proposed for use by the EIMS is Microsoft SQL Server. This database system provides good security, functionality, low cost of operation and maintenance, and excellent accessibility and integration with other applications and software through ODBC. Attachment 1 to Appendix A contains the structure for the environmental database system. This structure can accommodate all of the pieces of information that need to be stored. Data that will be accessible electronically to the EIMS users must be stored in that format.

### **5.3.2 Database Access**

The use of SQL Server software makes the database accessible to any ODBC-compliant software application. Users with the technical capabilities to access a relational database could access the data directly via the Internet from applications such as Access, FoxPro, SAS, or ArcView to perform analyses or to generate reports. For users who want a simpler interface, data management functions will be implemented through a web site. This approach offers the flexibility of direct access to all data for users with complex needs and a simple user-friendly access that any user can employ. Users through the web site or through an ODBC connection would be required to supply valid user names and passwords to gain access to the data.

The database will reside on the production server at the site of the EIMS contractor. All of the potential data users (RVAAP, contractors, USACE, OSC, Ohio ARNG, Ohio EPA, and USACHPPM) may access the data across the Internet from different sites. Having Internet access means that the data could be available in the field via wireless phone connection. Placing the data on the contractor server avoids security issues of having nonmilitary users access data on the military network.

**Table 5-1. Data Items That Should Be Included in the RVAAP EIMS Database**

<b>DATA ABOUT FIELD SAMPLES</b>
<b>Description</b>
Sample ID.
The date the sample was collected.
The date the record was modified.
The starting depth of the sample.
The ending depth of the sample.
Unit for depth measurements.
Field sample type (e.g., grab, field duplicate).
Medium from which the sample was collected.
Project ID.
Code for the sampling method.
Sampling location.
<b>DATA ABOUT LABORATORY CHEMICAL RESULTS</b>
<b>Description</b>
Analysis type (e.g., volatile, semivolatiles).
The chemical name.
The data validator's qualifier.
The detection limit.
The dilution factor.
The error associated with the measurement.
Code indicating if the result is from a filtered sample.
Sample ID; key used to identify each sample record.
Qualifier assigned by the laboratory.
Code for the parameter, usually the CAS #.
The chemical result value.
The units for the analytical results.
<b>LABORATORY ANALYSIS INFORMATION</b>
<b>Description</b>
Sample ID.
Analysis type (e.g., volatile, semivolatiles).
The EPA analysis level.
ID of associated blank.
The date the sample was analyzed.
The date the sample was extracted.
The date the laboratory received the sample for analysis.
The dilution factor.
Sample ID assigned by the laboratory.
The matrix of the sample analyzed, typically soil or water.

**Table 5-1. Data Items That Should Be Included in the RVAAP EIMS Database (continued)**

The analytical method.
The percent solids.
Result type (e.g., regular, dilution, matrix spike, etc.)
The sample delivery group (SDG) number.
The units for the analytical results.
<b>SPATIAL INFORMATION</b>
<b>Description</b>
The name of the station.
Station type (e.g., well, boring)
The station's northing coordinate (NAD83).
The station's easting coordinate (NAD83).
<b>PROJECT INFORMATION</b>
<b>Description</b>
The project name.
The contractor performing the sample collection.
The project number.
A name where the site is located.
<b>WELL CONSTRUCTION DATA</b>
<b>Description</b>
Name of station.
Boring depth.
Liner material.
Screen type.
Screen start depth.
Screen end depth.
Top of casing elevation.
Screen material.
Date constructed.
<b>FIELD MEASUREMENTS</b>
<b>Description</b>
Sample ID.
Station ID.
Date measured.
Parameter.
Result.
Result qualifier.

NAD = North American Datum.

**Table 5-2. Data Management Functions**

Function
Load historical analytical data from electronic format.
Load field data from electronic file.
Load analytical data from laboratory EDD.
Load analytical data by hand.
Load field measurements by hand.
Prepopulate sample information: <ul style="list-style-type: none"><li>• for data tracking and</li><li>• for preprinting field forms and bottle labels.</li></ul>
Enter data validation flags.
Enter spatial information about sampling locations.
Print report to verify data entry.
View and print report on sampling status.
View and print report of summary statistics.
Subset and extract data electronically for use with other software.

The web site access to the database consists of two integrated components: a data query component and a data management component. The data management component provides all functions required for data entry and field sampling. The data query component may be used for generating reports concerning the status of data collection and reports on quality control parameters. The query component may also be used for viewing or extracting data from the system.

The web site access to the database is programmed as a series of active server web pages. These web pages are called SEIMS [Science Applications International Corporation's (SAIC's) Environmental Information Management System]. Appendix A presents detailed requirements for each step of the data management process and describes the components of SEIMS. SEIMS provides all of the functionality listed in the systems requirements. The SEIMS modules providing specific data management functions and the potential users of those functions are indicated in Table 1 in Appendix A. SEIMS would be provided to the RVAAP as part of the EIMS system configuration. The use of SEIMS would not be proprietary. SEIMS could be used by other contractors to load data into the RVAAP EIMS, and SEIMS would remain part of the RVAAP EIMS, even if management of the EIMS was transferred to another contractor.

The web pages will provide all team members with access to all analytical and field data. The web pages will provide simple point-and-click menus for identifying data of interest based on sample and analysis attributes such as medium, date collected, sample ID, and analysis type or location information such as the station or area in which the data were collected. Once the data have been identified, they may be printed, summarized in a selected report format, or downloaded to the user's computer for further analysis.

The Decision Support and Geospatial Query Tool components of the RVAAP EIMS will also access the EIMS database. The Decision Support and Geospatial Query Tool component will provide additional simple menu-driven query and reporting capability to the EIMS.

### 5.3.3 Data Input

Preexisting data, often called historical data, will need to be added to the EIMS database. Specific historical data to be loaded are listed in Table 5-3. The EIMS contractor will be responsible for loading the historical data. Data already in SQL Server format will be imported directly into the EIMS database. Other historical data sets will be provided by the collecting contractor to RVAAP in a standardized electronic deliverable format (see Appendix B). The standard electronic deliverable format is a set of data tables that includes all of the spatial, well construction, sample, field, and analytical information for each result. The data loading function of the environmental data management component will load these standardized files into the database. Additional historical data may be added at a later time, if a need is identified. Historical data would not be loaded into the EIMS unless they were required for a specific task and met the data quality objectives for the task.

**Table 5-3. Preexisting Data To Be Loaded into the RVAAP EIMS Database**

<b>Data Generator</b>	<b>Date Sampled</b>	<b>Action of Concern or Report</b>
SAIC	1996	<i>Phase I Remedial Investigation Report for 11 High-Priority Sites at Ravenna Army Ammunition Plant, Ravenna, Ohio.</i>
SAIC	1997	<i>RCRA Field Investigation for Deactivation Furnace Area, Building 1601, and OD/OB Area.</i>
SAIC	1998	<i>Phase II Remedial Investigation at Winklepeck Burning Grounds and Determination of Facility-Wide Background at the Ravenna Army Ammunition Plant, Ravenna, Ohio.</i>
SAIC	1998	<i>Initial Phase Report, Ramsdell Quarry Landfill Groundwater Investigation, Ravenna Army Ammunition Plant, Ravenna, Ohio.</i>
SAIC	1998	Winklepeck Phase II RI and Facility-wide Background Study.
SAIC	1999	Erie Burning Ground Phase I RI.
SAIC	1999	NACA Test Area Phase I RI.
SAIC	1999	Demolition Area #1 Phase I RI.
SAIC	1999	Load Line 1/Load Line 2 Potential Disposal Area.
MKM	2000	Load Line 11 Phase I RI.
VISTA	2000	Open Demolition Area #2 RI.
MKM	2000	Building 5301 Interim Remedial Action.
SAIC	2000	Load Line 1 Phase II RI.
SAIC	2000	Load Line 12 Phase II RI.
SAIC	2000	Winklepeck Burning Ground Feasibility Study.
SAIC	2000	Winklepeck Burning Ground Biological Sampling.

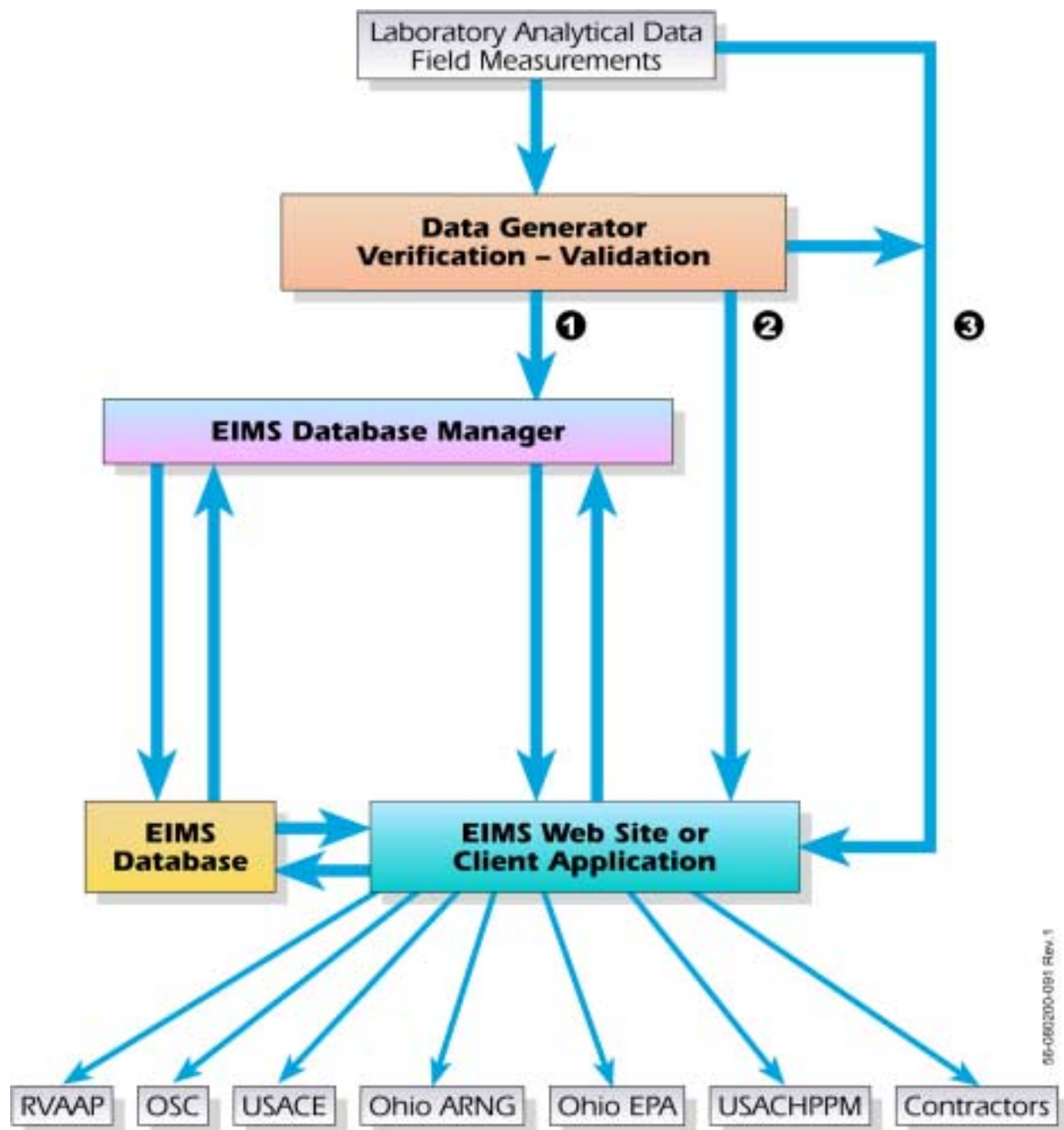
MKM = MKM Engineers, Inc.

NACA = National Advisory Committee on Aeronautics.

OD/OB = Open Detonation/Open Burning.

Three pathways for information flow for newly acquired environmental analytical and field data are diagrammed in Figure 5-1.

- Data may be loaded into the EIMS database by the EIMS Database Manager from the standard electronic deliverable format (Appendix B) provided by the contractor or government agency that generated the data.
- Data may be loaded into the EIMS database by the data generator from standard electronic deliverable files using the web page interface to the EIMS.



- ❶ Data loaded by EIMS Data Manager from standard electronic deliverable.
- ❷ Data loaded by data generator from standard electronic deliverable.
- ❸ Data loaded by data generator from laboratory electronic deliverable using all data management functions.

**Figure 5-1. Information Flow for Laboratory Analytical and Field Data**

- Data may be loaded into the EIMS database by the data generator using all of the data management functions that are part of SEIMS (pre-populating sample information, entering spatial information, printing logbooks and labels, tracking, loading laboratory electronic deliverables, verification, validation flagging, and input of field sampling information).

The first pathway would be used initially until all users are familiar with the EIMS. Centralization of the data loading by the EIMS Database Manager will provide oversight to maintain consistency in applying the database specifications.

Depending on the amount of data being generated, it may be advantageous to have the data generator load data directly into the EIMS database. Data generators who have their own fully functional data management systems may find it more efficient to submit data to the EIMS after they have verified and validated it in their own systems, rather than learning a new system. In this situation, the data generator would produce electronic files in the standard electronic data deliverable format as was used to load preexisting data (Appendix B). The data generator would be responsible for the data being correct and complete. The data generator would load the data files into the EIMS through the EIMS web site. This pathway is Pathway 2 in Figure 5-1.

Pathway 3 in Figure 5-1 represents data flow for data generators who wish to use all of the data management features of the EIMS. The environmental information management component of the EIMS supports all steps of the data management process from sample planning through reporting. Data generators may use the EIMS to

- count samples and analyses required and estimate costs,
- preprint field logbooks and sample labels for field sampling,
- enter field sampling information,
- track status as samples are shipped to the laboratory and results are received,
- load laboratory electronic data deliverables (EDDs),
- enter validation flags,
- print verification reports,
- view and print results, and
- view and print summaries of results.

All functions and options of the system are described in Appendix A. Data generators wishing to use all of these functions would be trained in the use of the system by the EIMS Database Manager and would be responsible for the entry of all data that they generated.

As indicated by the arrows on the flow lines in Figure 5-1, only the EIMS Database Manager and data generators will have the ability to load data into the EIMS. All other data users will have read-only access to the data. Data generators will be able to make additions and changes only to the data for which they are responsible.

#### **5.3.4 Data and System Changes**

Suspected errors in the database should be reported to the EIMS Database Manager, who will contact the data generator. Database change notices will be used to document any changes or additions to the database after the data have been validated. An electronic file of database change notices will be maintained and accessible as part of the system. The system will track when records have been changed and who changed them.



Requests for changes to the structure and functioning of the EIMS database shall be made to the EIMS Database Manager. Requests will be forwarded the RVAAP Information Manager for review and approval. Changes to the system structure or function will be made only after approval by the RVAAP Information Manager. Changes will be tested and successfully verified on a development server before being applied to the production server.

## **5.4 TEST ACCEPTANCE PLAN**

The EIMS Manager will verify and document that data may be loaded and accessed as specified in the system requirements.

## **5.5 RESPONSIBILITIES**

The EIMS contractor shall develop, install, test, and maintain the software required for storing and retrieving the environmental data.

The EIMS Database Manager shall

- convert preexisting electronic data into the EIMS format,
- load into the EIMS standard electronic deliverables produced by data generators, and
- generate database change notices to indicate that validated data have been changed.

The EIMS Manager shall use Nonconformance Reports to document software failure or improper data formats so that problems may be corrected.

The data generator (contractor or support agency) collecting environmental characterization data shall

- load data generated directly into the EIMS database by using SEIMS or submit electronic data in standard electronic deliverable format (Appendix B) to the EIMS data coordinator,
- verify and validate data collected, and
- verify proper data entry into the EIMS.

All EIMS users shall

- report problems with data entry or retrieval to the EIMS Manager.

The RVAAP Information Manager shall review and approve or reject requests for changes to the EIMS structure or function after consultation with the RVAAP Information Management Committee.

## **5.6 SCHEDULE**

Within six weeks of initiation, the EIMS contractor will initialize the database, load the database with preexisting electronic information, and provide a functioning prototype of the data management module.

Data collected by contractors and support agencies should be loaded into the EIMS as soon as possible but no later than the submittal date of the first draft of the report associated with the data collected or as defined in the statement of work for the task. Loading may begin as soon as the EIMS prototype is functional.

Within six months of project initiation, the EIMS contractor shall have a fully functional EIMS that meets all of the requirements specified in the EIMP.

## **6.0 SPATIAL INFORMATION**

### **6.1 OVERVIEW**

Spatial information is data that are most easily illustrated with a map. Spatial information includes natural and man-made features such as topography, water bodies, geologic features, buildings, roads, land use, and boundaries of political and functional areas. Spatial information may also be presented as aerial photographs. Spatial information is essential for the RVAAP IRP for identifying areas that require remediation. Spatial information is also essential for the Ohio ARNG for managing the use of areas at RVAAP.

Spatial information may be stored in many different electronic formats. The storage format will be standardized to ESRI ArcView-compatible formats to facilitate changing, viewing, and printing spatial information.

Spatial information may not be useful unless metadata are available. Metadata are data that describe when, how, and why information was collected. For example, a road map of RVAAP is not very useful unless such things as the time it represents (1990 or 1940), the source of the information (survey or aerial photo), and the precision (+/- 10 feet or +/- 1 foot) are known. Metadata will be documented as part of the standardization of the spatial information.

The EIMS contractor will standardize the preexisting spatial information listed in Table 6-1. The standardized spatial information will be stored on the EIMS server. The EIMS contractor will develop a computer application that will allow the query and display of spatial information. The flow of spatial information into and out of the EIMS is diagrammed in Figure 6-1.

The EIMS needs a spatial analysis component that can display spatial information, combine site characterization data from the environmental data management component with spatial information, and allow selection of site characterization data using spatial information. These functions will be available in the Geospatial Query Tool (GQT) described below (Section 6.3.2). The user will have the option of displaying the information on the computer screen, downloading selected data, or both.

### **6.2 SYSTEM REQUIREMENTS**

1. The EIMS shall use industry standard ESRI ArcView-compatible formats for storing spatial information.
2. The EIMS shall include the spatial information listed in Table 6-1.

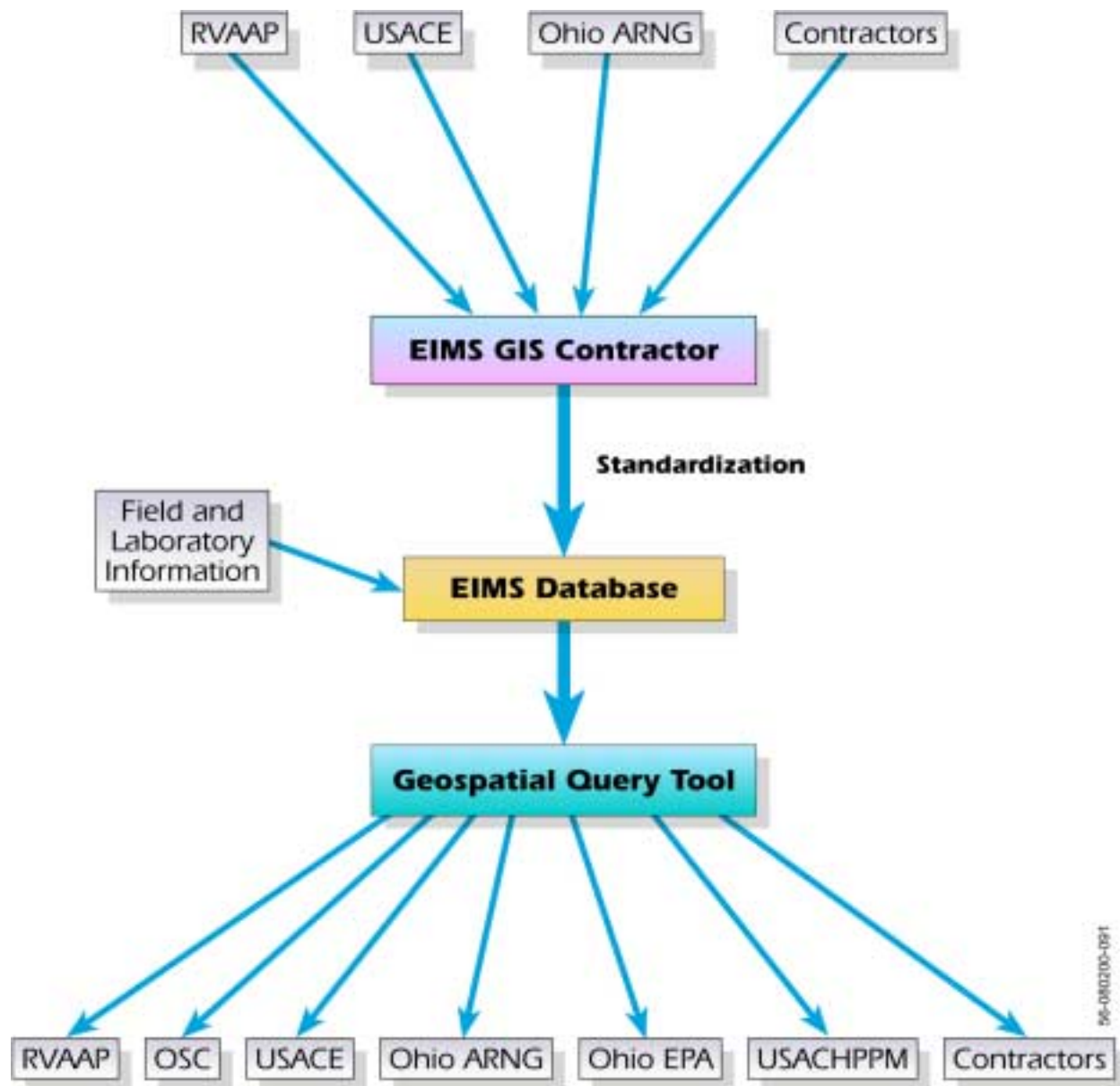


Figure 6-1. Information Flow for Spatial Data

**Table 6-1. Preexisting Spatial Information Layer To Be Included in RVAAP EIMS**

<b>Layer</b>
Site boundary
U.S. Geological Survey Topography – Newton Falls, Windham, and Ravenna quads
AOCs
2-foot elevation contours
1-meter elevation contours
Watershed boundaries
Monuments
Habitats
Wetlands
Utilities
Streams, creeks, water bodies
Soils – Trumbull and Portage counties
Buildings (current)
Buildings (removed)
Railroads (current)
Railroads (removed)
Roads
Vegetation
Storage tanks (current)
Storage tanks (removed)
Aerial photos from 1940s, 1980s, and 1990s
Ohio ARNG training boundaries
Hunting plot boundaries
Land use

3. The EIMS shall be capable of adding and modifying spatial information.
4. Where applicable, spatial information in the EIMS shall be standardized to the Tri-Services Standard.
5. All files shall use the Universal Transverse Mercator (UTM) North American Datum (NAD) 83 coordinate system with units of meters.
6. The EIMS shall include the capability for users to view spatial information, including the ability to
  - a. select the map attribute feature (layer) to view,
  - b. overlay and view multiple map layers, and
  - c. zoom and pan to change the section of the map viewed.
7. The EIMS shall include the capability for users to select and view data from the environmental database.
8. Data selection criteria shall include:
  - a. AOC,
  - b. medium,

- c. analysis type/analyte,
  - d. date collected,
  - e. sampling station name, and
  - f. sample ID.
9. Spatial data selection criteria shall include:
- a. geographic boundaries,
  - b. search radius around a point,
  - c. user-defined shape, and
  - d. land use.
10. Data output options shall include the ability to
- a. view or download selected data in ASCII format,
  - b. download GIS file of sampling points,
  - c. download GIS file of base map,
  - d. download graphics file of screen display, and
  - e. download graphics file of map image on screen
11. The EIMS shall provide documentation on how to configure and maintain software and hardware required for system operation.
12. The EIMS shall provide a user's guide that describes the functions of the EIMS features.
13. Software configured or written to manage the EIMS spatial data (including maps, reports, queries, procedures, applications, and web pages) shall be delivered to RVAAP upon completion of the task. RVAAP shall retain the right to use all such software forever.

## **6.3 SYSTEM DESIGN**

### **6.3.1 Spatial Database Management**

Spatial data will be acquired from the RVAAP site and its contractors. Where appropriate, previous and ongoing projects will provide data. Files will be standardized for efficient processing of information. All spatial data files and metadata should henceforth be standardized.

The following process will be performed on each file received:

- Files will be standardized according to the Tri-Services Standard, if applicable. This will include, but not be limited to, the standardization of file organization and naming, colors and pen width, attribute entities, and establishment of common grid and projections.
- Metadata for all files will be produced and maintained according to Federal Geographic Data Committee metadata standards.
- All files will be made topologically correct.
- Files will be converted to and stored in UTM NAD83 coordinate system in meters.

- Spatial features will be linked to tables in the data management and document management components.
- The spatial database design will allow for future growth and expansion.

Spatial data files will be stored on the server in a directory structure designed in accordance with the Tri-Services Standard. Files will be stored in ArcView-compatible formats, including, but not limited to, ESRI shapefiles, ARC/INFO coverages, and AutoCAD drawing files. Preexisting files to be included are listed in Table 6-1. The initial storage space required for the spatial database is 2 gigabytes.

The spatial database will be maintained by a designated GIS data manager, whose duties will include:

- receiving and processing spatial data files and
- updating the spatial database.

### **6.3.2 Geospatial Query Tool**

A geospatial query tool (GQT) will be developed to allow users to

- display maps and selected environmental data,
- select both spatial and environmental data based on spatial and tabular criteria
- use map-navigation and layer-selection tools to refine the display and to identify and locate features, and
- select spatial and tabular data for downloading.

An example display screen for the GQT is shown in Figure 6-2.

The GQT will provide tools with the features and functionality described below.

- **Navigation Tools**

Navigation tools will allow the user to change the scale or the area of the map displayed on the screen. Use of the navigation tools will not affect the selection of sample locations or map objects.

**Zoom**                Zooms the map display to the location centered on the point at which the user clicks.

**Pan**                 Moves the map sideways to center it on the point at which the user clicks.

**Zoom Extent**      Zooms the map to the extent of the selected theme or feature.

- **Display Options**

Display options will allow the user to customize the appearance of the map display. The user will use these options to select the map layers (roads, buildings, water, etc.) to be displayed. These options will have no effect on the selection of sample locations or other map objects.

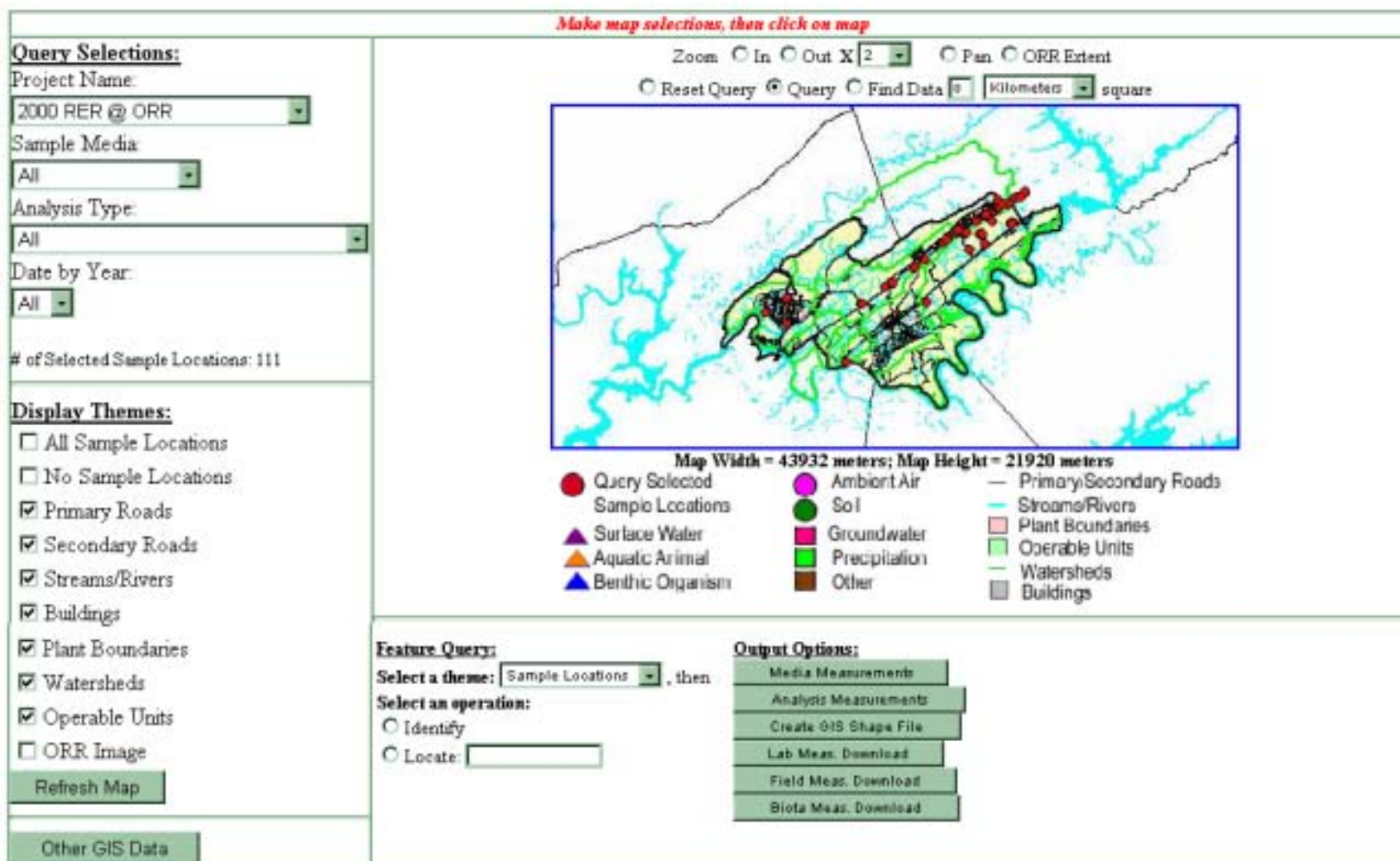


Figure 6-2. Example Display Screen for Geospatial Query Tool

No Sample Locations	Allows the display of the base map without showing any sample locations.
All Sample Locations	Displays a map showing all sample locations contained in the database.
Turning Layers On and Off	Layers can be turned on and off as desired.
Symbols and Annotation	Allows the symbolization of sample locations on the map display based on selected fields in the database. The user can assign different colors and/or symbols to sample locations based on the data or categories of data and can display data as text beside sample locations or other chosen map objects.

- Database Query Selections

Query selections are used to select sample locations or other map objects and the data associated with them. Query selections are designed to allow the user to select only the data of interest. The GQT will be customized to select sample locations (e.g., by specified fields that are contained in the database). Queries can be made on individual or multiple criteria. For example, sample locations can be selected by site only or by site, analysis type, and date.

Selecting the desired values from pull-down menus will establish query criteria. The selected sample locations are displayed on the map, and the display will automatically zoom to the extent of the selected locations.

- Spatial Selection

Area-of-interest selection is designed to help the user select only data within the extent of a specified geographic area or AOC. The spatial selection always takes the query criteria into account, and the map display zooms to the extent of the selected feature.

Geographic Feature	Allows the selection of a polygon feature such as a site boundary or an operable unit. Sample locations that meet the query criteria and fall within the boundary of the chosen feature are selected.
Search Radius	Allows the user to set a search radius within which selected samples must fall. Those sample locations meeting the query selection criteria and falling within the specified search radius box will be selected.
User-defined Shape	Allows the user to interactively draw a polygon on the screen or select a feature and specify a buffer distance around a selected feature. Samples that meet the query criteria and fall within the polygon or the buffer area are selected.
Reset Query	Removes the search radius box or selected feature, and resets the map display to the extent of the sample locations meeting the query selection criteria.



- Feature Identification and Location

**Identify Feature**      Allows the user to identify spatial features from specified themes such as sample locations, buildings, and AOCs. The user first selects a theme and then selects a feature to be identified. The selected feature will be drawn in a contrasting color and labeled with appropriate text.

**Locate Feature**      Allows the user to locate features by their identifiers from selected themes such as sample locations, buildings, and operable units.

**Hot Links**            Allow the user to display related files such as pictures, blueprints, or documents.

- Data Output Options

Output options will be designed to extract the spatial and attribute data associated with selected sample locations and download the data to the user's computer. Graphical output options, such as screen captures and image files, will also be available.

- Attribute Data Output Options

Data Summary: Data summary tables will show the number of records associated with the selected sample locations, listed by designated fields such as analysis type or date. This function will help the user determine file sizes to be downloaded and will give the user a download time estimate.

Download Data: Selected analytical results for selected sample locations can be viewed and downloaded. This function initiates the extraction of the selected data from the database in a specified format.

- Spatial Data Output Options

GIS Point File: Allows the creation and downloading of a GIS point file containing the selected sample locations.

GIS Coverages: Allows the selection and downloading of GIS base-map layers displayed on the map.

- Graphical Output Options

Graphical Output of Screen: Provides screen-capture capabilities to save a graphics file off the screen in a format that can be used with graphics or presentation software packages such as Adobe Illustrator or PowerPoint.

Graphics Map Files: Provides the ability to capture only the map portion of a screen. This function will allow the user to choose a format that is compatible with a favorite graphics package.

## 6.4 TEST ACCEPTANCE PLAN

The EIMS manager will verify and document that spatial data may be loaded and accessed as specified in the system requirements.

## 6.5 DOCUMENTATION

Two manuals will be provided at the time of full deployment.

Systems Manual: This manual will provide the network administrator with the organization of the system, the software packages used to develop the system, both server and workstation specifications, and instructions on how to reload the system if necessary.

User's Guide: This manual will be a guide for understanding the functionality that the system contains and how to use it. It will contain instructions for using all of the system's components. For example, the user's guide will instruct the user in how to query and download attribute data, generate reports, perform simple analysis, use the GQT to select and display spatial data, and to use the automatic data loaders.

## 6.6 RESPONSIBILITIES

The EIMS contractor shall develop, install, test, and maintain the software required for storing and retrieving the spatial data.

The EIMS manager shall

- test the EIMS GQT to document that the system requirements have been met,
- use Nonconformance Reports to document software failure or improper map formats so that problems may be corrected, and
- determine when additions or modifications to the spatial database are required.

The GIS data manager shall be responsible for

- converting preexisting spatial data into the EIMS format and creating the spatial database,
- adding information as requested by the EIMS manager, and
- preparing user's guide and systems manual.

The data generator (contractor or support agency) shall be responsible for supplying new spatial data in the specified standard format.

## 6.7 SCHEDULE

Within six weeks of initiation, the EIMS contractor will standardize the existing map data listed above, load the standardized spatial data on the production server, and provide a functioning prototype of the GQT.

Within six months of project initiation, the EIMS contractor shall have a fully functional EIMS that meets all of the requirements specified in the EIMP.

The systems manual and user's guide will be delivered within six months of project initiation.

## **7.0 DOCUMENT MANAGEMENT**

### **7.1 OVERVIEW**

All of the RVAAP stakeholders use and produce documents. The RVAAP EIMS will provide a computer application that will allow the users to search for documents of interest using title, author, publication date, key words, AOCs, or other specified document attributes. The system will identify the names of the documents that meet the user's search criteria. The user can then view or print the document if it is available in standard electronic format. If the document is not available electronically, the system will indicate the size and physical location of the document. Information flow for documents is diagrammed in Figure 7-1.

The initial document list database will include all items in the electronic inventory of the documents, maps, and drawings housed at RVAAP. Documents listed in Table 7-1 will be available for viewing as PDF files. All documents to be reviewed by the RAB and the public will be available as PDF files.

New documents in electronic form will be submitted by the document generator directly to the EIMS document coordinator. The document coordinator will classify and index each document. Documents not available electronically will be submitted in hard copy. The RVAAP Information Manager will review the document list to check for correct classification and approve documents for release. If a document is submitted in hard copy, the RVAAP Information Manager will decide if the document is needed electronically and, if so, will approve scanning of the document. The EIMS document coordinator will load the documents on the server and make released documents available to the public web site.

Hard-copy documents will continue to be housed at RVAAP.

The public will view documents through links on the public web site. The RVAAP team will access document management functions through the EIMS computer application.

### **7.2 SYSTEM REQUIREMENTS**

1. The EIMS shall include a computer application that allows the user to identify all documents that fit the user-supplied search criteria. The user shall be able to search on criteria for any of the fields listed in Table 7-2.
2. The user shall be able to print the list of documents identified or produce the list in an electronic format.
3. The user shall be able to view the documents if they are in PDF files or determine the location of the files if they are available in hard copy only.
4. The EIMS shall have the capacity to add new documents.
5. The EIMS shall be able to accommodate at least ten concurrent users.

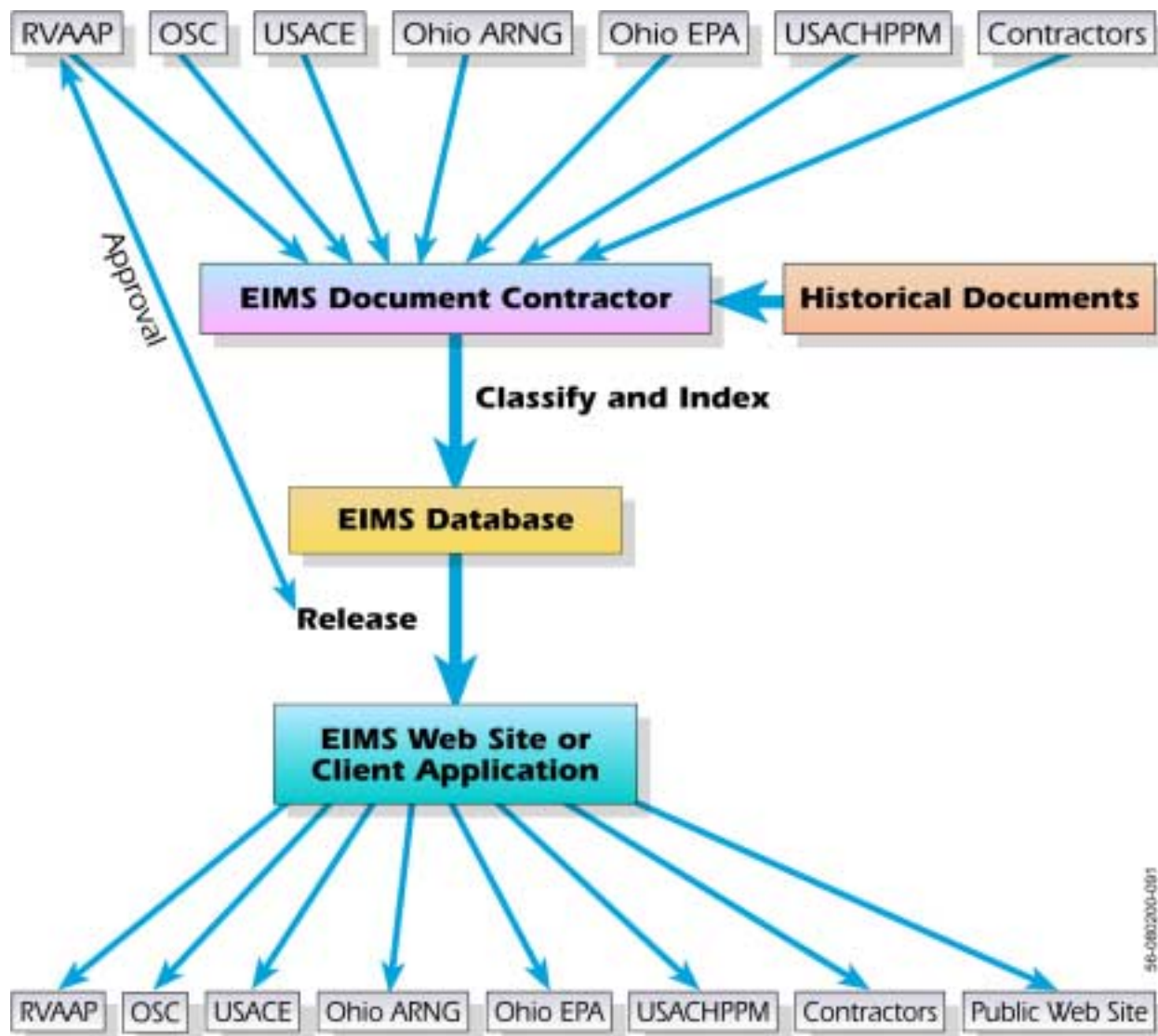


Figure 7-1. Information Flow for Documents

**Table 7-1. Preexisting Documents To Be Loaded into RVAAP EIMS**

<b>Status<sup>a</sup></b>	<b>Report Title</b>
H	USATHAMA (U.S. Army Toxic and Hazardous Materials Agency). 1978. <i>Installation Assessment of Ravenna Army Ammunition Plant</i> . Report No. 132.
EH	USACE (U.S. Army Corps of Engineers). 1996. <i>Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> . DACA62-94-D-0029, DO 0009, Final. February 1996.
EH	USACE (U.S. Army Corps of Engineers). 1996. <i>Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0009, Final. March 1996.
EH	USACE (U.S. Army Corps of Engineers). 1996. <i>Facility-Wide Sampling and Analysis Plan and Facility-Wide Health and Safety Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0009, Final. April 1996.
EH	USACE (U.S. Army Corps of Engineers). 1996. <i>Phase I Remedial Investigation Sampling and Analysis Plan and Site Safety and Health and Plan Addendum for High Priority Areas of Concern for the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0010, Final. July 1996.
EH	USACE (U.S. Army Corps of Engineers). 1997. <i>Investigation-Derived Waste Characterization and Disposal Plan for the Phase I Remedial Investigation of High Priority Areas of Concern at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0009. May 1997.
EH	USACE (U.S. Army Corps of Engineers). 1997. <i>Phase I Remedial Investigation Report for 11 High-Priority Sites at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> . DACA62-94-D-0029, DO 0010 and 0022, Final. September 1997.
EH	<i>Closure Plan for the Deactivation Furnace Area, Hazardous Waste Treatment Unit, Ravenna Army Ammunition Plant, Ravenna, Ohio</i> . Draft Revised. October 1997.
EH	USACE (U.S. Army Corps of Engineers). 1998. <i>Quality Control Plan for the Phase I Remedial Investigation for Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0060, Draft. January 1998.
EH	USACE (U.S. Army Corps of Engineers). 1998. <i>Sampling and Analysis Plan Addendum for the Phase II Remedial Investigation at Winklepeck Burning Grounds and Determination of Facility-Wide Background at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-94-D-0029, DO 0060. Final. April 1998.
EH	USACE (U.S. Army Corps of Engineers). 1998. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0003, Final. June 1998.
EH	USACE (U.S. Army Corps of Engineers). 1998. <i>RCRA Field Investigation Report for Five Sites at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> . Final. June 1998.
EH	USACE (U.S. Army Corps of Engineers). 1998. <i>October 1998 Quarterly Monitoring Report, Ramsdell Quarry Groundwater Investigation, Ravenna Army Ammunition Plant, Ravenna Ohio</i> , DACA27-97-D-0025, DO 0003. December 1998.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>Initial Phase Report, Ramsdell Quarry Landfill Groundwater Investigation, Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0003, Final. January 1999.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>February 1999 Quarterly Monitoring Report, Ramsdell Quarry Groundwater Investigation, Ravenna Army Ammunition Plant, Ravenna Ohio</i> , DACA27-97-D-0025, DO 0003. April 1999.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>April 1999 Quarterly Monitoring Report, Ramsdell Quarry Groundwater Investigation, Ravenna Army Ammunition Plant, Ravenna Ohio</i> , DACA27-97-D-0025, DO 0003. June 1999.
PDF	USACE (U.S. Army Corps of Engineers). 1999. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No.1 for the Phase I Remedial Investigation of the Erie Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0072, Final. July 1999.

**Table 7-1. Preexisting Documents To Be Loaded into RVAAP EIMS (continued)**

Status <sup>a</sup>	Report Title
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>Phase II Remedial Investigation at Winklepeck Burning Grounds and Determination of Facility-Wide Background at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> . DACA62-94-D-0029, DO 0060, Draft Final. August 1999.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No. 1 for the Phase II Remedial Investigation of Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0005. August 1999.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>Environmental Information Management Needs Assessment at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0009, Final. September 1999.
PDF	USACE (U.S. Army Corps of Engineers). 1999. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No.1 for the Phase I Remedial Investigation of Demolition Area 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0076, Final. October 1999.
PDF	USACE (U.S. Army Corps of Engineers). 1999. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No.1 for the Phase I Remedial Investigation of the NACA Test Area at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-94-D-0029, DO 0077, Final. October 1999.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>Small Mammal Methods for Ground-Truthing of Ecological Risk at Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0014, Draft. December 1999.
EH	USACE (U.S. Army Corps of Engineers). 1999. <i>Vegetation Methods for Ground-Truthing of Ecological Risk at Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0014, Draft. December 1999.
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Phase I Remedial Investigation Report for the Erie Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-97-D-0029, DO 0072, Draft. April 2000.
EH	USACE (U.S. Army Corps of Engineers). 2000. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No. 2 for the Biological Measurements at Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CK01, Draft. May 2000.
PDF	U.S. Army Industrial Operations Command. 2000. <i>Installation Action Plan for Ravenna Army Ammunition Plant</i> . March 2000.
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Phase I Remedial Investigation Report for Demolition Area 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-97-D-0029, DO 0076, Draft. June 2000.
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Phase I Remedial Investigation Report for the NACA Test Area at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-97-D-0029, DO 0077, Draft. June 2000.
EH	USACE (U.S. Army Corps of Engineers). 2000. <i>Summary and Technical Assumptions for Area, Volume, and Cost Estimations for the Winklepeck Burning Grounds Strategic Plan, Ravenna Army Ammunition Plant</i> , DACA62-00-D-0001, DO CY07, Draft. June 2000
EH	USACE (U.S. Army Corps of Engineers). 2000. <i>Facility-Wide Sampling and Analysis Plan and Facility-Wide Health and Safety Plan for Environmental Investigations the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CY02, Draft. July 2000
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Final Report on the Groundwater Investigation of the Ramsdell Quarry Landfill, Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0003, Final. August 2000
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Environmental Information Management Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CY02, Draft. August 2000.

**Table 7-1. Preexisting Documents To Be Loaded into RVAAP EIMS (continued)**

Status <sup>a</sup>	Report Title
EH	USACE (U.S. Army Corps of Engineers). 2000. <i>Sampling and Analysis Plan Addendum No. 2 for the Phase II Remedial Investigation of Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA27-97-D-0025, DO 0003, Final. September 2000.
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No. 1 for the Phase II Remedial Investigation of Load Line 12 at the Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CY06, Final. September 2000
PDF	USACE (U.S. Army Corps of Engineers). 2000. <i>Sampling and Analysis Plan and Site Safety and Health Plan Addendum No. 1 for the Winklepeck Burning Grounds Feasibility Study, Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CY08, Final. October 2000.
EH	USACE (U.S. Army Corps of Engineers). 2001. <i>Results of the Biological Field-Truthing Effort at Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CK01, Draft. January 2001.
EH	USACE (U.S. Army Corps of Engineers). 2001. <i>Technical Memorandum, Human Health and Ecological Risk Assessment Approach for the Load Line 1 and Load Line 12 Phase II Remedial Investigations, Ravenna Army Ammunition Plant, Ravenna, Ohio</i> , DACA62-00-D-0001, DO CY06, Draft. January 2001.

<sup>a</sup>EH = Electronic format with hard-copy figures and attachments. Text requires conversion to PDF. Hard-copy requires scanning and conversion to PDF and linking.

H = Hard-copy only. Requires scanning and conversion to PDF and linking.

NACA = National Advisory Committee on Aeronautics.

PDF = PDF files. May be directly loaded into EIMS.

**Table 7-2. Search Criteria Fields for RVAAP Document Management**

<b>Bibliographic Information</b>
Title
Author (name, organization)
Publication date
Recipient (name, organization)
Document type (report, letter, review comments, map, photo, blueprints, etc.)
Document number
Publication data
Number of pages
<b>Location Information</b>
Pointer to PDF file
Location of hard copy
<b>Index and Classification Information</b>
Released for public use (Y/N)
AOC
Comments
Key words
Administrative Record (Y/N)

6. A manual describing the programs used to access documents and the steps required to prepare documents shall be produced.
7. The initial document database shall index all documents, maps, and drawings relevant to the environmental work at RVAAP and housed at the RVAAP Bldg. 1037 or the Ohio ARNG Headquarters Building at RVAAP.
8. Software configured or written to manage the EIMS document database (including reports, queries, procedures, applications, and web pages) shall be delivered to RVAAP upon completion of the task. RVAAP shall retain the right to use all such software forever.

### **7.3 SYSTEM DESIGN**

A document classification and indexing scheme will be developed in consultation with the RVAAP Information Manager. Proposed fields for indexing and classification are listed in Table 7-2. The information in some fields would be mandatory. Documents will not be included in the list unless the mandatory information is available. Optional data will be included if available, but can be filled in later if necessary. While missing information is not desirable, allowing missing data permits the system to be initialized quickly with minimal expense.

The classification and indexing database will be set up in SQL Server 7.0 software for compatibility with other system components. The database will reside on the production server managed by the EIMS contractor.

Electronic documents will be stored in PDF so that special viewing software need not be purchased.

A computer program called *FIND-IT* will be used to search the document index database. *FIND-IT* allows the document coordinator to enter classification and indexing information into the database. *FIND-IT* also allows the user to search the document database using any of the criteria listed in Table 7-2.

### **7.4 TEST ACCEPTANCE PLAN**

The EIMS manager will verify and document that document data may be loaded and accessed as specified in the system requirements.

### **7.5 RESPONSIBILITIES**

The EIMS contractor shall develop, install, test, and maintain the software required for storing and retrieving the documents and document index information.

The EIMS manager shall

- test the EIMS document module to document that the system requirements have been met,



- use Nonconformance Reports to document software failure or improper document formats so that problems may be corrected, and
- determine when additions or modifications to the document database are required.

The document coordinator is responsible for

- developing a classification and indexing scheme for RVAAP documents in coordination with the RVAAP Information Manager,
- classifying and indexing preexisting documents,
- converting specified preexisting documents into PDF files,
- classifying and indexing new documents,
- notifying the RVAAP Information Manager when documents need approval for system entry and public release,
- adding approved documents to the EIMS database, and
- preparing the systems manual.

The document generator is responsible for supplying new documents to the document coordinator as PDF files.

System users are responsible for reporting any EIMS problems to the EIMS manager.

## **7.6 SCHEDULE**

Within six weeks of initiation, the EIMS contractor shall define document classification and indexing rules, start to classify and index preexisting documents starting with most the recent and working backwards in time, load preexisting PDF files on the production server, start conversion of requested non-PDF files into PDF files, and provide a functioning prototype of the *FIND-IT* document query tool.

Within six months of project initiation, the EIMS contractor shall complete indexing of preexisting documents requested, complete conversion of requested documents to PDF files, have a fully functional document query tool that meets all of the requirements specified in the EIMP, and have a manual describing the system.

# **8.0 DECISION SUPPORT**

## **8.1 OVERVIEW**

The stakeholders at Ravenna need information to make decisions that affect the IRP process. They want rapid access to the information without needing to know how to program or in what database the required

information resides. The Decision Support Module (DSM) of the EIMS is a computer program designed to fill this need.

The DSM presents the user with simple pick lists that provide the needed information or initiate other system modules that will provide the information. The DSM is the gateway program to the EIMS. It initiates the security provisions by requiring a valid user name and password. It will start the data management, GQT, or document management modules, depending on the information requested. It will also link to project information such as the schedule of activities and the organizational chart with a contact list of phone numbers and e-mail addresses. It will have links to the RVAAP public web site as well as the web sites of RVAAP stakeholders' organizations. This module allows for future expansion of analysis tools such as risk assessment, compliance monitoring, or trend analysis.

## **8.2 SYSTEM REQUIREMENTS**

1. The EIMS shall include a computer program that will allow the user to search for, view, print, or download data, maps, and documents from the RVAAP EIMS.
2. The EIMS shall provide access to schedules of RVAAP environmental activities.
3. The EIMS shall provide access to the RVAAP IRP organizational chart.
4. The EIMS shall provide access to a contact list of RVAAP stakeholders.
5. The EIMS shall provide links to web sites of RVAAP stakeholders and IRP-related information.
6. Typical requests should take the user to three or fewer menu screens to obtain the desired information.
7. Typical requests should take three or fewer minutes to obtain the desired information.
8. The EIMS should be capable of retrieving information from the EIMS server across the Internet to the user's PC.
9. Software configured or written to manage the EIMS decision support functions (including reports, queries, procedures, applications, and web pages) shall be delivered to RVAAP upon completion of the task. RVAAP shall retain the right to use all such software forever.

## **8.3 SYSTEM DESIGN**

The DSM is a Visual Basic program that would reside on the user's PC. Implementing the DSM as a Visual Basic program provides flexibility in how data are accessed. Data could be accessed directly across the Internet or through a web site or could reside on a disk drive in the user's PC. As a Visual Basic program rather than a web site, the DSM may be easily adapted to the access needs of specific users.

A prototype of the DSM will be distributed on compact disks to all users. The program will self-install from the disk. The prototype will access the data, spatial, and document databases across the Internet. Users will then use the system and determine whether information access speeds are acceptable for their purposes. DSM response time depends on some factors that cannot be controlled by the RVAAP EIMS such as the

number and type of Internet links between the users and EIMS server and Internet traffic at any given time. These factors will differ from user to user and from time to time.

Within six months of project initiation, a fully functional DSM will be distributed to all users. The DSM will be configured to provide the best system response for the average user. Other configurations will be addressed below under “Site-specific Implementation” (Section 10).

## **8.4 TEST ACCEPTANCE PLAN**

The EIMS manager will verify and document that the DSM can access all of the information and fulfills the specifications of the system requirements.

## **8.5 RESPONSIBILITIES**

The EIMS contractor shall develop, install, test, and maintain the software required by the DSM.

The EIMS manager shall

- test the DSM to document that the system requirements have been met,
- use Nonconformance Reports to document software failure so that problems may be corrected,
- determine when additions or modifications to the DSM are required, and
- specify which users have which levels of privileges (read only, read/write, etc.) according to direction from the RVAAP site manager.

The RVAAP Information Manager will be responsible for supplying updated schedules and revised organizational charts and contact lists to the EIMS manager as PDF files.

System users will be responsible for reporting any DSM problems to the EIMS manager.

## **8.6 SCHEDULE**

Within six weeks of initiation, the EIMS contractor will develop and distribute prototype DSM software to EIMS users. The prototype version of the DSM will provide access to data, maps, documents, schedules, and contact lists.

Within six months of project initiation, the EIMS contractor shall supply a fully functional DSM that meets all of the requirements specified in the EIMP.

## **9.0 PUBLIC WEB SITE**

The objective of the U.S. Army at Ravenna's web site is to inform interested readers, both the public and contracted workers, of the activities and decisions related to the restoration of RVAAP. This web site will provide authorized information in a simple, easy-to-use format that will allow the reader to work from general site information to specific areas of investigation and then to actual scientific reports and summaries. Links to other relevant web pages (such as the U.S. Army's OSC) will also be incorporated and may be added/updated as necessary with the approval of the RVAAP Information Manager.

### **9.1 SYSTEM REQUIREMENTS**

1. The EIMS shall include a web site containing information of public interest concerning activities at RVAAP.
2. The public web site shall be accessible to anyone with Internet access and web-browser software with capabilities equivalent to those of Netscape Navigator 4.0 or Internet Explorer 4.0.
3. Information for the public web site must be approved by the RVAAP Information Manager before it is posted on the web site.
4. The public web site shall include at least the following information:
  - a. a summary of the mission of and activities at RVAAP,
  - b. a schedule of RVAAP activities,
  - c. RVAAP newsletters,
  - d. final reports and documents for public review,
  - e. the capability to receive comments on documents via e-mail, and
  - f. links to relevant web sites (USACE, U.S. EPA, Ohio EPA, Ohio Department of Health, Defense Environmental Network and Information Exchange (DENIX), OSC, Army Environmental Center, Army Material Command, RVAAP Installation Action Plan, and Risk Advisory Board).
5. The public web site information is secured so that only authorized persons may make changes or additions to the content.
6. The public web site will be made available to the RVAAP project team for a period of at least two weeks before it is made accessible to the public. The project team will review and comment on the content and function of the web site during this period. Comments will be resolved with the RVAAP Information Manager before the web site is made accessible to the public.
7. Software configured or written to manage the EIMS public web site (including reports, queries, procedures, applications, and web pages) shall be delivered to RVAAP upon completion of the task. RVAAP shall retain the right to use all such software forever.

## 9.2 SYSTEM DESIGN

The web site will initiate its readers with a straightforward opening page that features an attractive montage of several environmental management photos, as used in the RVAAP newsletters (fall and summer 1999 issues). A series of bulleted phrases on this page will allow readers to follow their general interests. These phrases will include those listed below.

- *Today's Mission at Ravenna Army Ammunition Plant*
- *History of RVAAP*
- *Areas of Concern*
- *RVAAP Newsletters*
- *Other News Coverage and Information*
- *Final Reports*
- *Reports Under Review*
- *Links to Other Web Sites*
- *Restoration Advisory Board*
- *Schedule of Events*
- *What Do You Think?*

Each of these phrases leads the reader to the next level of information. The web site is diagrammed in Figure 9-1.

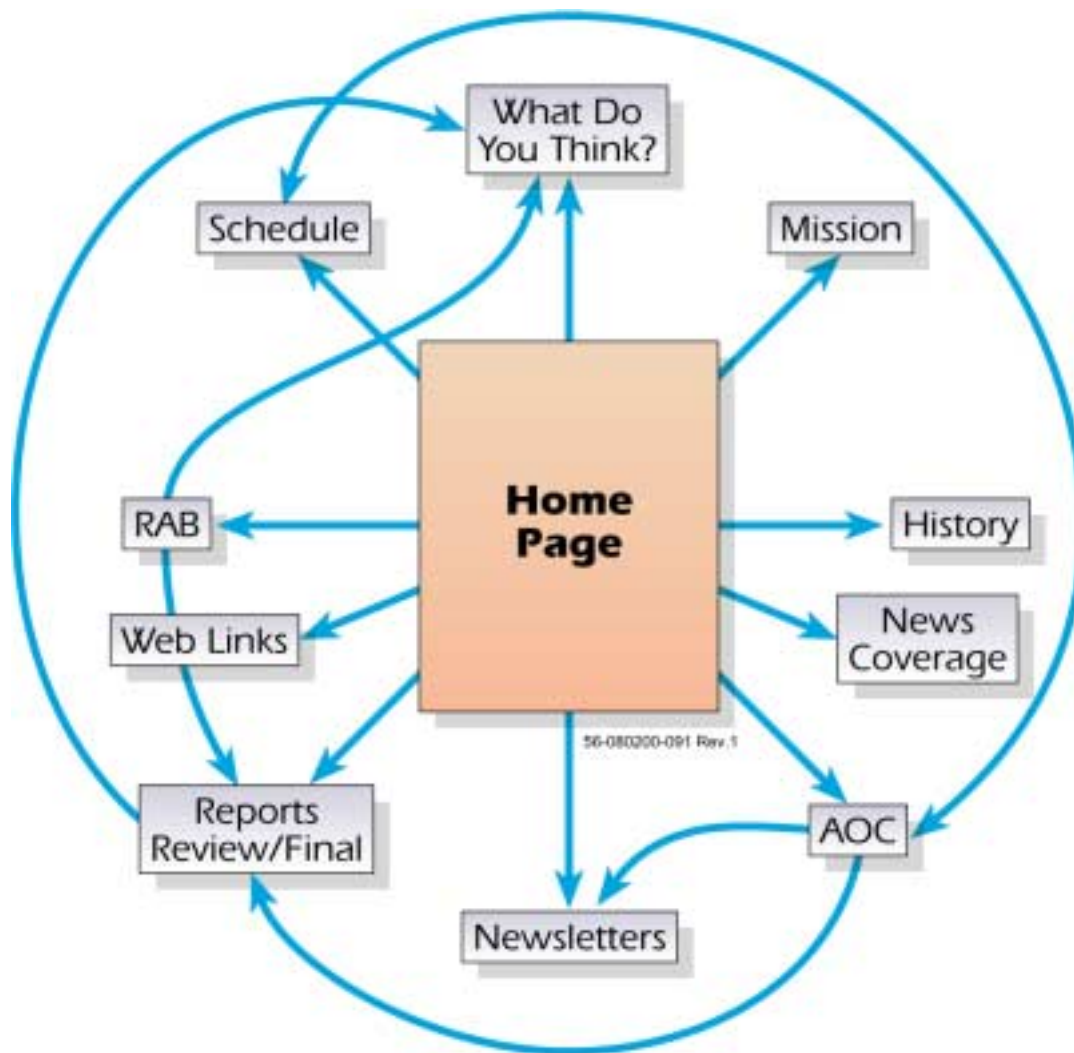
For the *Today's Mission* link, a page may include a one-paragraph description of the U.S. Army's mission at the site. Photographs of RVAAP site managers could be included so that they will be familiar faces at community involvement events. Names, job titles, and contact information for those people who may serve as information sources may also be included. U.S. Department of Defense (DoD) and U.S. Army OSC logos may also be used on this page. Links to the OSC web page and to the DoD web page may also be incorporated here.

The *History of RVAAP* page could include a one-paragraph introduction to the former site as one of the largest large-caliber facilities in the world. Its production and testing history from 1941 to 1993 could be illustrated using vintage photographs and short captions.

The *Areas of Concern* page would list the priority and status of each AOC and could highlight coverage of specific remediation sites. The following AOCs would be highlighted:

- Demolition Area #1,
- the Former Erie Burning Ground,
- the National Advisory Committee on Aeronautics Test Area,
- Winklepeck Burning Grounds,
- Load Line 1, and
- Load Line 12.

Pages for each of the highlighted AOCs could include a one-paragraph description of the specific project and at least one photograph to illustrate the investigation. An internal link to the RVAAP newsletter coverage of that AOC will be incorporated when possible.



**Figure 9-1. Public Web Site Map**

The *RVAAP Newsletters* page will offer PDF files of already published RVAAP newsletters and anticipated publication dates for upcoming issues. This page will expand as additional newsletters are published.

The *Other News Coverage and Information* page will provide readers with an immediate link to the Akron Beacon Journal, Record-Courier, and the Ravenna and Newton Falls newspaper coverage of remediation activities and the well-publicized RAB activities from the site. Links to PDF files of the executive summaries of specific investigation documents could also be given here. These executive summaries could contain links that would allow the entire document to be read or printed. The documents will include:

The *Final Reports* page will include a list of all documents received by RVAAP as PDF files and approved for public release by the RVAAP Information Manager. The list will be linked to the PDF files of the executive summaries. The executive summaries would have links that allow each entire document to be read or printed.

The *Reports under Review* page will list documents currently under public review. Links to PDF files will allow these documents to be read or printed. Links will also be provided for submitting comments to the documents.

The *Links to Other Websites* page will include links to the following:

- USACE,
- U.S. EPA,
- Ohio EPA,
- Ohio Department of Health,
- Defense Environmental Network and Information Exchange (DENIX),
- Army OSC,
- Army Environmental Center,
- Army Material Command,
- RVAAP Installation Action Plan,
- Risk Advisory Board.

The *Restoration Advisory Board* page will need a short introduction and illustration of the Board, followed by headings such as those listed below.

- *Why Have a RAB?*
- *RAB Activities*
- *RAB Meeting Schedule*
- *RAB Meeting Minutes*

Here again, photos that show RAB members and attractive graphics that post Board schedules would make this page attractive and user friendly. SAIC suggests that the RAB designate one of its members to manage a quarterly update to the information on this page. SAIC will post these updates. That same RAB member might also agree to be listed as a point of contact for web readers interested in knowing more about RAB activities.

The *Schedule of Events* page will be similar in format to the schedules posted at the end of each newsletter. Ongoing projects will be listed, and approximate time schedules will be given. New projects for the year ahead will also be listed. These schedules will be attractively presented.

The *What Do You Think?* Page will be the final page and will reiterate the underlying message of the entire web site. The U.S. Army is interested in communicating issues related to area cleanup activities to the community and welcomes community involvement in these activities. This page will encourage community involvement by listing sites of the already established information repositories at the public libraries in Ravenna and Newton Falls. To encourage feedback from web readers, an RVAAP site manager will be designated as a point of contact, and his phone number and e-mail link will be provided.

### **9.3 RESPONSIBILITIES**

The RVAAP Information Manager will be responsible for approving all material that is available on the public web site.

The EIMS manager will be responsible for making all approved materials available for access from the web site within one week of approval.

## **9.4 SCHEDULE**

Within six weeks of project initiation, a functioning prototype of the public web site shall be available for review by the RVAAP team on the development server.

Within one week after approval by the RVAAP Information Manager, the EIMS manager shall have the public web site functioning on the production server.

Within one week after approval by the RVAAP Information Manager, the EIMS manager shall delete, add, or revise material on the public web site.

## **10.0 SITE-SPECIFIC IMPLEMENTATION**

The EIMS has been designed to consolidate information on one server. This approach has advantages because of the efficiency of managing data in one location. The RVAAP stakeholders, however, are dispersed at several different locations. The EIMS, therefore, faces the challenge of efficiently dispersing data to each user.

The goals for system performance as stated in the system requirements for the server and DSM are to have the average response time for requests to be less than one minute and to be able to obtain desired information in less than three minutes. In the initial configuration of the EIMS, users will access the information from the EIMS server across the Internet. The performance goals should be readily achievable for users with high-speed Internet access. Even users with slower access via telephone lines (56K bytes/sec) should see acceptable performance for most requests. Requests that require large amounts of information to be transferred from the server to the user's PC, however, might take far longer than one minute. Transfer times will depend on the slowest link between the user and the server and the amount of data transfer by other users using the same links. These factors will differ from user to user and from time to time.

The components of the EIMS have been designed so that the location of the information source can be changed from the EIMS server to the user's PC (client). Information that may take a long time to retrieve across the Internet, such as large maps or large documents, could be stored on the hard drive of the client or be available on compact disks. Storing information on the client's computer would make access quicker but would require more disk space on the user's PC. Storage on the client's computer would also present a challenge to the efficient distribution of new and revised information.

The site-specific implementation task includes the following activities:

1. identify users who would benefit from using client rather than server information sources,
2. distribute reconfigured EIMS software to users to test performance, and
3. visit user's site if needed to configure EIMS software for best performance.



## **10.1 SCHEDULE**

Within six weeks of project initiation, the EIMS contractor will develop and distribute prototype DSM software to EIMS users. The prototype version of the DSM will provide access to data, maps, documents, schedules, and contact lists via the Internet.

Users will use the prototype system and report operations that are unacceptably slow to the EIMS manager.

Four weeks after prototype implementation, the EIMS manager will summarize performance reports from users and recommend to the RVAAP Information Manager users who would benefit from site-specific implementation.

Upon approval by the RVAAP Information Manager, the EIMS contractor shall develop customized configurations for specified users.

Within six months of project initiation, the EIMS contractor shall supply a fully functional EIMS that meets the site-specific needs of the specified users.

## **11.0 TRAINING**

Use of the integrated EIMS through the DSM should require little or no training. Menus in the interface will give the user directions. Most input from the user will be to select push buttons and items from pick lists on the screen. Training will be needed, however, for those who will be loading data into the databases. The initial data loading required to initialize the EIMS database will be performed by the EIMS contractor's personnel. The EIMS contractor will not require training, but additional and subsequent contractors will.

Training will be available in four areas:

1. data management,
2. document management,
3. spatial data management, and
4. EIMS administration.

The data management training will be for contractors who will use the environmental data component of the EIMS to handle all aspects of data management, from project planning to data reporting. This training will cover:

1. creating a project,
2. loading historical data,
3. defining sampling parameters,
4. entering laboratory statement of work information,
5. entering sample location information,
6. prepopulating the database with sample information,
7. printing field forms and bottle labels,
8. entering field sampling information,
9. entering sample tracking information,
10. loading laboratory electronic deliverables,

11. manually entering laboratory data,
12. entering data validation information,
13. verifying data entry,
14. retrieving data, and
15. reporting data.

Document management training will be for a contractor who will assume responsibility for classifying, indexing, and making documents available on the EIMS. Training will cover:

1. rules for classification and indexing,
2. updating the document index database,
3. formatting and linking within PDF files, and
4. making PDF files accessible to the EIMS.

Spatial data management training will be for a contractor who will assume responsibility for standardizing maps and linking them to the EIMS. Persons to be trained should have previous working experience with CAD and/or GIS systems. Training will include:

1. the geocoding process,
2. metadata standards,
3. dynamic linkages used in the EIMS, and
4. presentation of all layers and their interdependencies for a better understanding of the basis for spatial analysis.

EIMS administration training will be for a contractor who will assume responsibility for operating the RVAAP EIMS. Personnel to be trained should have previous computer systems administration and database administration experience. Training will include:

1. server configuration,
2. operating system configuration,
3. database configuration,
4. backup procedures, and
5. security procedures.

## **11.1 SCHEDULE**

Training will be scheduled on an as-needed basis at the request of the RVAAP Information Manager. Training for data management could begin as soon as the prototype EIMS is functioning (six weeks after project initiation). Training for document management, spatial data management, or EIMS administration could begin after the full EIMS implementation is completed (six months after project initiation).

## **12.0 SCHEDULE**

Within six weeks of project initiation, a prototype of the DSM software will be distributed to the users. The prototype will provide access to the data, maps, and documents on the EIMS server via the Internet. It will access the RVAAP production database and, therefore, may be used to perform RVAAP IRP

work. At that time it might not have all functions, such as selecting analytical and field data from maps, but it will provide at least one way to access data, maps, and documents that are in the database at that time.

Once the prototype EIMS is functioning, new data, maps, and documents will be added to the system as they are generated.

Within six months of project initiation, the EIMS contractor shall have a fully functional EIMS that meets all of the requirements specified in the EIMP. The implementation schedule is shown in Figure 12-1.

The systems manual and user's guide will be completed within six months of project initiation.

<b>Time after Initiation</b>	<b>Task</b>
<b><i>Initial Implementation</i></b>	
One week	Development server configured
Two weeks	Production server configured
Six weeks	Prototype EIMS functional
Six months	Full EIMS functional
<b><i>Ongoing Functions</i></b>	
Daily	Incremental system backup
Weekly	Full system backup
One week after approval	Information added to public web site
Thirty days after receipt from laboratory	Analytical data added to EIMS
Thirty days after collection	Field measurements added to EIMS
One week after approval	New documents added to EIMS
As needed after prototype functional	Data management training
As needed after full EIMS functional	Spatial data management training
As needed after full EIMS functional	Document management training
As needed after full EIMS functional	EIMS administration training

## 13.0 ELECTRONIC DATA DELIVERABLES

It is important that all newly acquired information be received by RVAAP in an electronic format that is compatible with the EIMS. The costs of producing an electronic deliverable may be reduced considerably if the required format is designed into the information collection process. All information collected to characterize the environmental conditions at RVAAP must be submitted in an electronic format to the RVAAP Information Manager at the conclusion of the project or at regular intervals specified by the RVAAP Information Manager for ongoing monitoring projects.

Three different electronic formats may be used depending on the type of information produced:

1. maps,
2. documents and drawings, or
3. data.



### **13.1 MAPS**

Information that is best presented as maps (such as topographic features, sampling locations, contour plots, geophysical data or UXO locations) must be submitted in an ArcView compatible format. Map formats such as ESRI shape files, ArcInfo coverages, or AutoCad drawings (.DWG files) are acceptable. Map information is placed in a geographic context that is known as a coordinate system. The Ohio State Plane NAD 83 coordinate system in meters is the preferred coordinate system to provide consistency with spatial information already produced for the Ohio ARNG. Other coordinate systems are acceptable as long as the system is specified.

### **13.2 DOCUMENTS AND DRAWINGS**

Drawings, figures, diagrams, and photographs that are produced as deliverables for tasks at RVAAP should be submitted as PDF files. These items are images that do not have a geographic context. These items may include such things as boring logs, well construction diagrams, site photographs, etc.

Document deliverables must be submitted as PDF files. The PDF files for a document must contain all of the information in the hard copy document including text, graphics, maps and tables. All components of the document should be electronically hyperlinked to the document table of contents. Completed PDF versions of documents should mirror the hard copy deliverable.

### **13.3 DATA**

Field and laboratory measurements made during the performance of an environmental task at RVAAP must be submitted to the RVAAP Information Manager in electronic format on or before the delivery of the first draft of the report associated with the data or when specified in the statement of work for the task. Delivery of data with the report will provide the information needed by the RVAAP team to perform a thorough review of the document.

Field and laboratory measurements of discrete media such as soil, sediment, surface water, groundwater, air, building materials, biological tissues, etc. must be submitted in the standardized electronic format described in Appendix B. A standardized electronic format facilitates the storage, retrieval and exchange of information. Data must be submitted in tabular format (rows and columns). Each column is called a field. The name of each field and a description of its contents may be found in the tables in Appendix B. Some fields are required and some are optional as indicated. If the field is marked as required, then the field must have a valid value. Some fields are required conditionally as indicated in the field description. Fields that do not have values should be left blank. Some fields require coded values. Codes currently defined are listed in Appendix B. Coded fields should include only entries chosen from the codes tables. If there is no value in the codes table that accurately represents the measurement, new codes may be added with the approval of the RVAAP Information Manager. The current codes table will be posted electronically as part of the EIMS.

Four different table formats are available for data submittal. The Station Table contains information that describes each location that was sampled. The Well Construction Table includes information on the location, depth and type of well developed. The Sample Table includes measurements made on discrete samples. The Field Measurement Table includes information about measurements made directly in the environment. Data should be submitted using the appropriate table or tables. Tables should include a

header line with the name of each field. Each table should be submitted as a file in tab-delimited ASCII format

An electronic deliverable is not required if data are loaded directly into the RVAAP EIMS.

### **13.4 MEDIA**

All electronic information should be submitted on 3.5 inch diskettes or CDs to the RVAAP Information Manager.

## **14.0 REFERENCES**

USACE (U.S. Army Corps of Engineers) 1999. *Environmental Information Management Needs Assessment at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, September.

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**APPENDIX A**

**ENVIRONMENTAL DATA MANAGEMENT**



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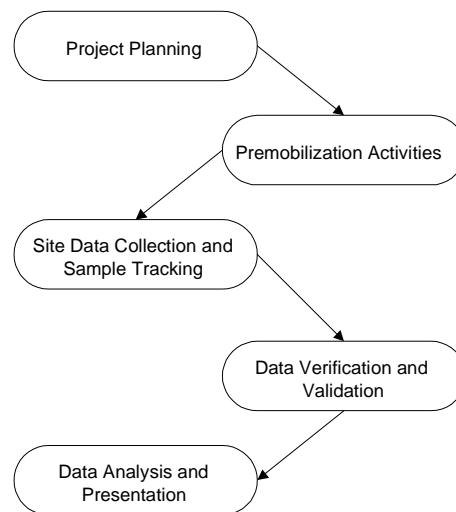
## ACRONYMS

CAD	computer-aided design
CLP	Contract Laboratory Program
COC	chain-of-custody
EDD	electronic data deliverable
EIMS	Environmental Information Management System
GIS	geographic information system
GPS	Global Positioning System
ID	sample identifications
LIMS	Laboratory Information Management System
LOR	letter of receipt
NCR	Nonconformance Report
ODBC	open database connectivity
QC	quality control
SDG	sample delivery group
SOW	statement of work
SWMU	solid waste management unit
WAG	waste area grouping

# DATA MANAGEMENT

Every environmental restoration decision is based on the analysis and interpretation of environmental measurement data. The proper management of these data and information has become crucial as the scale of remedial activities has increased and the need to share data and resources to improve programmatic efficiency has grown. By identifying the processes performed in data management, the requirements for an environmental information system can be determined.

The environmental information management and analysis process consists of the steps shown in Figure 1. Each step will be discussed in the text that follows, highlighting the people who are involved as well as the tasks that will be performed and identifying data tools that will be used in performing these tasks. These tools will then be discussed in the form of system requirements.



**Figure 1. Environmental Information Management Process**

## PROJECT PLANNING

Project planning requires team members to develop a conceptual model of the project site. Based on this model, they determine if more information is needed to make decisions about the site. If more samples and analyses are needed, the team develops a work plan or sampling plan to acquire that information. During the process the team will need to review information that has been previously collected for the area. This may include identifying documents with data from prior studies or consulting the environmental information. Historical information found in documents or data collected by other parties that were not previously loaded into the environmental database may be loaded at this time for analysis, reporting, or document preparation.

Data Tools: Records system capable of identifying relevant documents  
Data query tools  
Spatial query tools  
Data loading mechanisms

## **PREMOBILIZATION ACTIVITIES**

Premobilization activities use the sampling and analysis plan in preparation for going into the field. The environmental database will be used several ways during this process. The analytical laboratory coordinator who prepared the laboratory statement of work (SOW) will enter the laboratory information into the database. This information will include the types of analyses to be performed and the analytical method to be used, the collection container and preservative, and the laboratory cost per analysis. The analysis cost information can be used for project cost tracking.

The project's data coordinator will work with the project's field team leader to prepopulate the database with the sample collection information. This information includes where samples should be collected, sample identifications (IDs), media, depth, sample types, and the analyses to be performed for each sample. This information can then be used to develop preprinted logbooks, sample bottle labels, and other forms. Prepopulating the database is not absolutely necessary for a field project. However, it helps ensure that all required samples and analyses are collected and reduces transcription errors as well as subsequent data entry errors of database primary keys such as the sample or station ID. Another benefit of prepopulation is that it enables sample tracking via the database by initially identifying what you expect to collect and that it will later be used to verify that you collected and received from the laboratory everything that was planned.

If the station names are prepopulated, the computer-aided design (CAD) or geographic information system (GIS) analyst can enter the station coordinates when the map is made.

Data Tools:   Laboratory SOW data entry  
                  Sample container data entry  
                  Sample prepopulation data entry  
                  Data query tools  
                  Spatial coordinate data entry

## **SITE DATA COLLECTION AND SAMPLE TRACKING**

During sample collection, the field team records the sample date and time, field measurements, and comments in the field logbooks. Several other types of information may also be collected. These include field laboratory analyses, soil boring or well construction information, water levels, and spatial surveys. Any information that was collected should either be entered into the database or made available to project members in other appropriate formats. If sample coordinates were surveyed or determined by Global Positioning System (GPS), these coordinates should also be loaded into the database at this time. A field team member or the data coordinator can perform the data entry. However, other personnel may be required for specialized tasks such as loading electronic data from field laboratory systems or preparing maps based on the results of spatial surveys.

The field team is also responsible for filling out a chain-of-custody (COC) form that records what analyses were requested and when they were shipped to the laboratory. When the laboratory receives the samples, it returns a letter of receipt (LOR), which is a listing from their Laboratory Information Management System (LIMS) that shows the samples received, the analyses to be performed, and whether there were any problems with the samples such as broken bottles. The laboratory coordinator reviews the LOR to ensure that the laboratory has logged all analyses requested into its system. If there are analyses that will not be performed by the laboratory, this information is entered into the database for sample tracking.

The field logbook information and the COC information are normally entered simultaneously. Once this information has been entered, any user of the system should be able to generate sample tracking status reports to see how the project is coming along. In addition, the users should have access to any other data or information that has been entered into the database through data or spatial query tools.

Data Tools:     Sample data entry  
                  Field measurement data entry  
                  Laboratory COC entry  
                  Sample tracking  
                  Water level data entry  
                  Field laboratory data loading.  
                  Spatial coordinate data entry  
                  Well information data entry  
                  Data query tools

## **DATA VERIFICATION AND VALIDATION**

The laboratory data package is delivered to the analytical coordinator. The data package will, at a minimum, contain a hard-copy or electronic media with a record of the results. When the data package is received, it is logged into the database system as part of the sample tracking process. It is logged through each step of the verification and validation process to ensure that all procedures are performed.

The analytical coordinator should review the data package for completeness and legibility, verifying that the analyses were performed for the desired parameters using proper analytical methods, verifying that the results are reported in proper measurement units, are within known method-specific ranges, and contain all required quality control (QC) forms and documentation. The laboratory should be notified of any problems.

The project should have requested an electronic data deliverable (EDD). If it is present, then the EDD should be loaded into the database. If it is not present, the data will need to be entered manually into the database. The laboratory should be notified about any problems with the EDD.

All information loaded into the database (sample information, analytical results, field measurements, etc.) should be verified to ensure content, accuracy, and completeness. Verification is performed to ensure the accurate transcription, recording, and entry of data. Evidence of the verification performed should be documented with the original measurement data and maintained with the project file.

Data validation is the review of field measurements and analytical results against a defined set of QC criteria to determine if the data are acceptable. It includes verifying that the samples were analyzed within the proper holding times, checking that the accuracy and precision for the analytical and field results are within specified limits, and assigning data qualifiers that indicate the usability of the results.

Another component of the validation process is determining data usability. Frequently the laboratory reports reanalyses or dilutions. The data validator is responsible for determining the “correct” result that should be used for subsequent reporting and analysis. Data qualifier and validation codes are assigned to the results based on the validation. The data qualifier codes indicate acceptability, and the validation codes define why that level of acceptability was chosen.

Data Tools:     Data package tracking  
                  Laboratory EDD loading

Laboratory manual data entry  
Data validation qualifier data entry  
Data verification tracking data entry

## **DATA ANALYSIS AND REPORTING**

The first analysis performed after validation is to assess the reasonableness of the data as compared to (1) the conceptual understanding of the site, (2) data from similar sites, (3) historical data, or (4) other criteria based on the reviewer's professional judgement. He or she may use tables, graphs, spatial analysis tools (such as GIS), and various statistical techniques to help in the review. The project leader decides the extent and nature of this analysis.

## **SYSTEM REQUIREMENTS**

Based on the previous discussion, Table 1 summarizes the data management process, identifying the tasks performed for each step, the type of person most likely to perform the task, and the tools needed for each task.

The database used by the environmental information system will be Microsoft SQL Server. This database system provides good security, functionality, low cost of operation and maintenance, and excellent accessibility and integration with other applications and software through open database connectivity (ODBC). Attachment 1 contains the structures for an environmental database system that could be used for environmental data management.

Data management functions are implemented through a web site, which offers the flexibility of client-server tools and convenient access for most users. This web site consists of two integrated components, a data query component and a data management component. The data query component is primarily used for data reporting; however, it is also used for some data selection within the data management component.

The data management system described here is one component of an integrated Environmental Information Management System (EIMS). The data management component includes the tools required for standardizing and consolidating data. The EIMS will include other components for extracting, downloading, and reporting data.

## **PROJECT PLANNING**

The following data management tasks need to be performed as part of the project-planning step:

1. Determine documents related to a site.
2. Assign a unique project code for relating database information to the specified project (Project Management).
3. Load historical data manually (Manual Data Entry).
4. Load historical data electronically (Historical Data Entry).
5. Data analysis and reporting (Reporting).

Each task is discussed in the following sections.

**Table 1. Data Management Process, Tasks, and Tools**

Process Step and Tasks Performed	Data Tools Used for Tasks by Type of User					
	Project Leader	Field Team	Analytic Coordinator	Data Coordinator	Data Users	Spatial Analysts
<b>Project Planning</b>						
Identify documents and projects containing relevant information	RM	RM				
Create project in the database				PM		
Load historic data from documents				MDE		
Load historic data from electronic sources				HEDL		
Data analysis and reporting	DQT, SQT	DQT, SQT		DQT		SQT
<b>Pre-Mobilization Activities</b>						
Define sampling parameters		FSMPL, SMETHODL, MEDIAL, DEVICEL, COMPL				
Enter lab SOW information			LABL, METHODL, ANAL, LSOW			
Enter container information			BOTTLE			
Enter station names and associate with sites		SM, AREAL		SM, AREAL		
Pre-populate sample information		SDE,EVENTL		SDE,EVENTL		
Printing forms and labels		DQT		DQT		
Geospatial coordinate data entry		SM, SCEDL		SM, SCEDL		SM, SCEDL
<b>Data Collection and Sample Tracking</b>						
Enter field sample collection information				SDE		
Enter field measurements				FMDE		
Enter lab shipment information			SDE	SDE		
Perform sample tracking	SDE, RPTS, COST		SDE, RPTS, COST			
Water level data entry				FMDE		
Well construction data entry				WCDE		
Geospatial coordinate data entry				SCDE		
Data analysis and reporting	DQT,SQT	DQT,SQT				
<b>Data Verification and Validation</b>						
Data package tracking			DPT	DPT		
Laboratory EDD loading				LEDL		
Laboratory manual data entry				MDE		
Data validation qualifier entry				DQDE		
Data entry verification				DPT		
<b>Data Analysis and Presentation</b>						
Data summaries				DQT	DQT, SQT	DQT, SQT
Extract data sets				DQT	DQT, SQT	DQT, SQT

ANAL	Define laboratory analyses	FMDE	Field measurement data entry	PM	Project management
AREAL	Associate sampling location with areas	FMEDL	Field measurement electronic data loading	RM	Records management
BOTTLE	Enter bottle requirements	FSMPL	Define field sample types	RPTS	Tracking reports
COMPL	Define sampling composites	HEDL	Historical electronic data loading	SCDE	Spatial coordinate data entry
COST	Estimate current lab costs	LABL	Define analytical laboratory	SCEDL	Spatial coordinate electronic data loading
DEVICEL	Define sampling devices	LEDL	Electronic data deliverable loading	SDE	Sample Data Entry
DPT	Data package tracking	LSOW	Enter Laboratory SOW	SM	Station management
DQDE	Data qualifier data entry	MDE	Manual data entry	SMETHODL	Define sampling methods
DQT	Data query reporting tools	MEDIAL	Define sampling media	SQT	Spatial query tools
EVENTL	Define sampling events	METHODL	Define analytical methods	WCDE	Well construction data entry



## Records Management

Records management requirements will be discussed elsewhere in the Environmental Information Management Plan.

## Project Management

A project conceptually identifies a set of information that is related by a common set of data quality objectives. The project code and name are used to limit subsequent actions and select those related records. Most inputs are provided only for documenting information about the project and are not required.

Function	<b>Add</b> Adds new project to the database
Selection Criteria	NA
Required Inputs	Project code Project name
Optional Inputs	Contractor Contract number Project number Program manager's name Program manager's phone number Comment
Outputs	Message saying project was added.
Restrictions	Cannot use the same project name or code.

Function	<b>Select</b> Sets the project used for future database functions
Selection Criteria	Project name
Required Inputs	NA
Optional Inputs	NA
Outputs	Message saying project was selected.
Restrictions	NA

Function	<b>Edit</b> Modifies project information
Selection Criteria	Project name
Required Inputs	NA
Optional Inputs	Project name Contractor Contract number Project number Program manager's name Program manager's phone number Comment
Outputs	Message saying information was saved.
Restrictions	Cannot change project code, although can modify the name as long as it does not match any other project name.

Function	<b>Delete</b> Deletes project information
Selection Criteria	Project name
Required Inputs	NA
Optional Inputs	NA
Outputs	Message saying project was deleted or the project could not be deleted.
Restrictions	Cannot delete any project that has any information in the database.

## Load Historical Data Manually

Loading historical data manually implies that data entry systems are available in which to enter every type of information that the database can hold; therefore, historical data entry simply requires that systems be available for each data type. These systems are discussed in the data collection and sample tracking step and the data verification and validation step.

## Load Historical Electronic Data

Data from past projects may be available electronically in a variety of application formats: databases (such as Oracle, SQL Server, Access, FoxPro, or dBase), spreadsheets (such as Excel, Lotus-123), and other application-specific formats (such as SAS data sets). A further complication is that the table structure will be different for every system that is encountered; therefore, loading historical data requires that a common structure be specified that can be generated from any system.

All systems that have been mentioned can generate a tab-delimited ASCII file. Relational databases can easily join tables with a specified field order for data exporting. Data stored in spreadsheets can be manipulated to have a simple structure of fields in a specified order. ASCII files are a convenient format when used in conjunction with a spreadsheet to review a file or manually fix problems.

Because we would like to capture as much information as possible from other sources, the resulting required file structure contains a lot of fields that will probably be blank from many data sources. However, the extra fields are only a nuisance and will not prevent data conversion into this format.

Fields that are coded within most database systems can be reported using either the coded or descriptive field values. Using coded values may help in reducing file bloat. However, if coded values are submitted, additional documentation must be provided that maps the coded values to their descriptive counterparts. Historical electronic data loading has been broken into four components: station (coordinate) data, well construction data, sample data, and field measurement data. The format and information loaded are the same as for the electronic data deliverable listed in Appendix B.

## Coded Field Alias Management

Coded fields are used to standardize valid values and reduce database space usage. Coded field alias management is used to map field values received from other systems to the correct codes required by the destination database. For a variety of reasons, it is often easier to map the values on the loading end instead of the source end. With alias mapping, someone needs to determine how values between the systems relate to each other and then load the translation values. While only a single set of functions is listed below, these functions need to be duplicated for all fields listed in the selection criteria section.

Function	View Views all of the aliases that have been identified for a coded field.			
Selection Criteria	Station type	Field sample type	Laboratory	
	Project name	Sampling method	Matrix	
	Area	Sample media	Analysis Type	
	Area viewpoint	Sampling device	Analytical Method	
			Reported basis	
	Chemical name			
Required Inputs	NA			
Outputs	List of known aliases for each valid value.			
Restrictions	Should be able to filter on a specific code or show the entire code and alias list.			

Function	Add Adds new alias value for a coded field.		
Selection Criteria	Station type	Field sample type	Laboratory
	Project name	Sampling method	Matrix
	Area	Sample media	Analysis type
	Area viewpoint	Sampling device	Method
			Reported basis
			Chemical name
Required Inputs	Valid destination system code		
	Value from input system		
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.		
Restrictions	Cannot allow the same input value to be associated with different codes.		

Function	<b>Edit</b> Modifies alias values for a coded field.		
Selection Criteria	Station type Project name Area Area viewpoint	Field sample type Sampling method Sample media Sampling device	Laboratory Matrix Analysis type Method Reported basis Chemical name
Required Inputs	The coded value to be modified.		
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.		
Restrictions	Cannot allow the same input value to be associated with different codes.		

Function	<b>Delete</b> Removes an alias value from the list of aliases for a coded field.		
Selection Criteria	Station type Project name Area Area viewpoint	Field sample type Sampling method Sample media Sampling device	Laboratory Matrix Analysis type Method Reported basis Chemical name
Required Inputs	The coded value to be modified.		
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.		
Restrictions	NA		

## PREMOBILIZATION ACTIVITIES

This step has the following four data management purposes:

1. Define basic values about the samples that will be collected.
2. Define sampling locations at which samples will be collected.
3. Allow the user to enter planning information for a project or sampling event within a project.
4. Extract information for field mobilization assistance.

The premobilization modules will be organized based on these purposes.

### Define Basic Values

The basic information relates to defining attributes about the samples and analyses that will be performed. These attributes include the types of samples that will be collected, the media from which the samples will come, the sampling method and devices that will be used to collect samples, the laboratories that will perform the analyses, the types of analyses that may be done, and the methods that will be used for analysis. These attributes are usually coded and are common to all projects in the database. These attributes may be simple lookup codes; however, others are more complex and have some additional requirements.

Some common attributes are needed to manage a relationship between two or more values. For example, you may define a medium, such as soil or groundwater, but want to know more about the medium. Soil could be further divided into surface and subsurface, or groundwater could be related to the type of well from which it came (residential, monitoring, leachate, etc.).

Some basic information is specific to the project, such as the current sampling event, the cost per analysis by the laboratory, which analyses can be performed on the containerized sample to reduce project costs and laboratory problems, and the labeling requirements for those containers.

## Simple Coded Values

This module manages simple codes that do not have any special requirements. They are codes for attributes such as sampling devices and composite types or for managing simple pick-list values such as container type and preservative.

Function	<b>View</b> Views all of the codes and descriptions for a given attribute.
Selection Criteria	Choose the attribute to be viewed: Sample device                      Container type                      Analytical method Composite type                      Preservative
Required Inputs	NA
Outputs	List of codes and code descriptions for the selected criteria.
Restrictions	NA

Function	<b>Add</b> Adds new code and description for an attribute.
Selection Criteria	Choose the attribute to be viewed: Sample device                      Container type Composite type                      Preservative
Required Inputs	The new code and description for it.
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate code or description to occur.

Function	<b>Edit</b> Modifies the description for a coded attribute.
Selection Criteria	Choose the attribute to be viewed: Sample device                      Container type Composite type                      Preservative The code or description to be modified.
Required Inputs	The new description.
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate description to occur.

Function	<b>Delete</b> Deletes a value for a coded attribute.
Selection Criteria	Choose the attribute to be viewed: Sample device                      Container type Composite type                      Preservative
Required Inputs	The code or description to be deleted.
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.
Restrictions	Should not allow values to be deleted that are currently in use within the database.

## Complex Coded Values – Sample Type

This module manages the grouping of sample types. Grouping allows applications to include or exclude types of samples without hard-coding specific values, allowing more freedom in the applications to change what values are used and reducing maintenance costs. Three basic sample types exist: environmental samples, QC samples, and some types of duplicates. However, more specific values are known for all of these sample types. For example, QC sample types include field blanks, source blanks, trip blanks, and equipment rinsates.

Function	<b>View</b> Views all of the codes and descriptions for a sample type.
Selection Criteria	The primary sample type grouping value (QC, environmental, or duplicate).
Required Inputs	NA
Outputs	List of codes and code descriptions for the selected criteria.
Restrictions	NA

Function	<b>Add</b> Adds new code and description for sample type.
Selection Criteria	The primary sample type grouping value (QC, environmental, or duplicate).
Required Inputs	The new code and description for it.
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate code or description to occur.

Function	<b>Edit</b> Modifies the description for a sample type.
Selection Criteria	The primary sample type grouping value (QC, environmental, or duplicate).
Required Inputs	The new description.
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate description to occur.

Function	<b>Delete</b> Deletes a value for a sample type.
Selection Criteria	The primary sample type grouping value (QC, environmental, or duplicate).
Required Inputs	The code or description to be deleted.
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.
Restrictions	Should not allow values to be deleted that are currently in use within the database.

## Complex Coded Values – Sample Media

This module manages the grouping of media types. Grouping allows applications to include or exclude types of media without hard-coding specific values, allowing more freedom in the applications to change what values are used and reducing maintenance costs. The relationship between sampling media and analytical medium may also be critical for application-specific reasons. This module maintains those relationships. Several basic media types exist: soil, groundwater, surface water, etc. However, more specific values are known for most media types. For example, groundwater may also be known as Geoprobe water, monitoring well water, or groundwater leachate. In addition, water is a more basic grouping in this example. This basic grouping of solid or liquid is important in maintaining accurate relationships for data management applications. This module maintains these relationships.

Function	<b>View</b> Views all of the codes and descriptions for a media type.
Selection Criteria	The primary media type grouping, e.g., groundwater.
Required Inputs	NA
Outputs	List of codes and code descriptions for the selected criteria.
Restrictions	NA

Function	<b>Add</b> Adds new code and description for media type.
Selection Criteria	The primary media type grouping, e.g., groundwater.
Required Inputs	The new code and description for it. The basic matrix (solid or liquid).
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate code or description to occur.

Function	<b>Edit</b> Modifies the description for a media type.
Selection Criteria	The specific media type.
Required Inputs	The new description and basic matrix (solid or liquid).
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate description to occur. Cannot allow changes to the base matrix if media code is already used by the database in other tables.

Function	<b>Delete</b> Deletes a value for a media type.
Selection Criteria	The primary media type grouping, e.g., groundwater.
Required Inputs	The specific media type to be deleted.
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.
Restrictions	Should not allow values to be deleted that are currently in use within the database.

## Complex Coded Values – Sample Method

The sample method is usually considered a basic coded value. However, for data selection purposes it can be important to know if the sampling method represents a composite sampling method. This module manages the sample method coded values and the question of whether it is a composite sampling method.

Function	<b>View</b>	Views all of the sample method codes and descriptions.
Selection Criteria	NA	
Required Inputs	NA	
Outputs	List of codes and code descriptions for the selected criteria.	
Restrictions	NA	

Function	<b>Add</b>	Adds new sample method code and description.
Selection Criteria	NA	
Required Inputs	The new code and description for it and whether the method is a type of composite sample.	
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate code or description to occur.	

Function	<b>Edit</b>	Modifies the sample method and code.
Selection Criteria	NA	
Required Inputs	The new description or modification to whether it is a composite.	
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate description to occur.	

Function	<b>Delete</b>	Deletes a sample method value.
Selection Criteria	The sample method to be deleted.	
Required Inputs	NA	
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.	
Restrictions	Should not allow values to be deleted that are currently in use within the database.	

## Complex Coded Values – Analysis Types

This module manages the grouping of analysis types. Grouping allows applications to include or exclude large groups of analysis types of media without hard-coding specific values. Grouping also allows convenient subsetting of analysis pick lists, allowing more freedom in the applications to change what values are used and reducing maintenance costs. Several basic analysis types exist: organics, inorganics, radionuclides, etc. However, more specific values are known for most analysis types. For example, organics can be divided into volatiles, semivolatiles, pesticides, etc. This module maintains these relationships.

Function	<b>View</b>	Views all of the analysis type codes and descriptions.
Selection Criteria	NA	
Required Inputs	NA	
Outputs	List of codes and code descriptions for the selected criteria.	
Restrictions	NA	

Function	<b>Add</b>	Adds new analysis type code and description.
Selection Criteria	NA	
Required Inputs	The new code and description.	
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate code or description to occur.	

Function	<b>Edit</b>	Modifies the analysis type description.
Selection Criteria	The major analysis group.	
Required Inputs	The new description.	
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate description to occur.	

Function	<b>Delete</b>	Deletes an analysis type.
Selection Criteria	The analysis type to be deleted.	
Required Inputs	NA	
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.	
Restrictions	Should not allow values to be deleted that are currently in use within the database.	

## Enter Laboratory SOW Information

The analytical coordinator contracts with a laboratory for the analyses that will be performed. Other information specified with the contract includes the analytical methods, the media that will be collected (summarized as solid samples or liquid samples), the turnaround times for data packages, the analytical costs per analysis, and the analysis-specific extraction and holding time limits. This information is in turn used by several application modules. The analysis type and method are required for data loading and sample tracking, and the analysis price is required for project cost estimating. This module allows the user to enter the minimum SOW information into the database.

Function	<b>View</b>	Lists all of the SOW information for the project.	
Selection Criteria	Laboratory Major analysis type		
Required Inputs	NA		
Outputs	List of SOW information.		
Restrictions	NA		

Function	<b>Add</b>	Adds new SOW information for the project.	
Selection Criteria	Laboratory Major analysis type		
Required Inputs	Specific analysis type Basic analytical media, e.g., solid, liquid		
Optional Inputs	Method Analysis cost Validation cost	Extraction holding time limit (days) Analysis holding time limit (days) Data package turnaround limit (days)	Comment
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.		
Restrictions	Cannot allow a duplicate value (laboratory, analysis type, medium) for a project.		

Function	<b>Edit</b>	Modifies the SOW information.	
Selection Criteria	Laboratory Major analysis type		
Required Inputs	Specific analysis type Basic analytical media, e.g., solid, liquid		
Optional Inputs	Method Analysis cost Validation cost	Extraction holding time limit (days) Analysis holding time limit (days) Data package turnaround limit (days)	Comment
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.		
Restrictions	Cannot allow a duplicate value (laboratory, analysis type, medium) for a project.		

Function	<b>Delete</b>	Deletes a sampling event.
Selection Criteria	Laboratory Specific analysis type Analytical media	
Required Inputs	NA	
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.	
Restrictions	Should not allow data to be deleted that are currently in use within the database.	

## Enter Container Information

The analytical coordinator also determines the container requirements for the project. These requirements specify what analyses will be performed (what should be printed on a label), the preservative that should be used, and the number of containers of that size that should be collected for that set of analyses for a given container type (and size). In addition, if the samples are for groundwater, the requirements should also specify whether the samples should be filtered.

The container information can be linked to the SOW information to initiate project-level sample tracking at the analysis level. This module allows the user to enter the container information and link it to the SOW information.

Function	<b>View</b>	Lists all of the container information for the project.
Selection Criteria	Laboratory Analytical media (solid, liquid)	
Required Inputs	NA	
Outputs	List of container information.	
Restrictions	NA	

Function	<b>Add</b>	Adds new container information for the project.
Selection Criteria	Laboratory Analytical media (solid, liquid)	
Required Inputs	Label Container type Preservative	
Optional Inputs	Container size Number of containers Units	Filtered/unfiltered Analysis type
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Selection criteria are based on the SOW information. Cannot add duplicates between laboratory, analytical media, label, and filtered	

Function	<b>Edit</b>	Modifies the container information.
Selection Criteria	Laboratory Analytical media (solid, liquid)	
Required Inputs	Label Container type Preservative	
Optional Inputs	Container size Number of containers Units	Filtered/unfiltered Analysis type
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Selection criteria are based on the SOW information.	

Function	<b>Delete</b>	Deletes the container label.
Selection Criteria	Laboratory Analytical media (solid, liquid) Label Container type Preservative Filtered	
Required Inputs	NA	
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.	
Restrictions	Should not allow data to be deleted that are currently in use within the database.	

## Sample Planning

Sample planning and prepopulation occur when you actually bring all of this information together. You specify that the following sample IDs will be collected at this location, in this medium, using this method or device and will be analyzed for a specific set of parameters. This process can be performed relatively quickly with good tools. The planning may be done long before going into the field, or it may be used to generate the information that will be used the next day.

## Project Sampling Events

Sampling events are used in data management to define a sample subset in a long or complex project. The sampling event names should be defined by the field sampling team or be based on a relative period of time for the most usefulness. Making the names project specific means that the same event name can be used by multiple projects without conflict in the implied meaning.



Function	<b>View</b>	Views all of the sampling event names for a project.
Selection Criteria	Project name	
Required Inputs	NA	
Outputs	List of sampling event names.	
Restrictions	NA	

Function	<b>Add</b>	Adds new sampling event name for a project.
Selection Criteria	Project name	
Required Inputs	The new sampling event name.	
Outputs	Message saying that the value has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate value to occur within a project.	

Function	<b>Edit</b>	Modifies the sampling event name.
Selection Criteria	Project name Sampling event	
Required Inputs	The new sampling event name.	
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate name to occur for a project.	

Function	<b>Delete</b>	Deletes a sampling event.
Selection Criteria	Project name Sampling event	
Required Inputs	NA	
Outputs	Message saying the value was deleted. Should also show the list of values again for verification.	
Restrictions	Should not allow events to be deleted that are currently in use within the database.	

## Sampling Station Attributes

A sampling station refers to a specific place at which a sample was collected. At a minimum, the station should have a name. However, if you want to show the station on a map, you also need the station's coordinates. If you have coordinates, you should also know other attributes about the coordinates. For example, are they in units of feet or meters, in latitude and longitude, or in a state plane coordinate system? Two modules are provided that allow you to enter this information. One module is used for manual data entry, while the other is used for electronic data loading.

## Station Data Entry

A logical assumption about sampling stations is that if there is one sampling station, there should be one physical record in the database for that station. Another assumption is that each station should have a unique name. However, as a database grows with data from multiple sampling events and different subcontractors, it is likely that these two assumptions will fail. Multiple stations will be called SW-01 because they were located in different areas and sampled by different contractors or during different projects. In this case the names are valid because they were collected for different projects. If you use the same name for two different stations in the same project, however, you will have problems at some point in your project; therefore, station data management needs to prohibit duplicate stations with the same name unless they are associated with different projects. Another requirement is that if a station (e.g., a monitoring well) is sampled by different projects, then all of these projects should refer to the same physical record in the database.

This requirement is especially important when the data will be displayed spatially. Having multiple records will undoubtedly lead to different coordinates being entered or possibly different but equivalent names being assigned. Different coordinates will occur because projects will not resurvey preexisting, well-defined locations (e.g., a monitoring well); therefore, one project will have coordinates and another won't. Another coordinate problem occurs when the same station should be sampled, but it has a slightly different location. For example, assume a surface water point should be periodically resampled using a

The second problem with multiple spatial records for the same physical location is that the name may change. For example, a well may be referred to as MW-1, MW-01, or MW-001 and still be the same well. Similarly, even if the well is referred to by the same name, interfaces to the data that use the station name for data selection criteria will be affected when the name occurs multiple times in a list. The user will be confused, to say the least. Based on these problems, another station requirement is that a single record should represent the same station between projects. The following module allows the entry of stations and their coordinates and supports these other requirements.

Function	<b>Combine Records</b> Resolves problems when accidents occur and multiple records are created for the same station. Allows the user to select what stations in the database are actually the same, and then specify what the correct information should be. After the correct information has been entered, the application updates all tables in the database to point to the new correct record.
Selection Criteria	Multiple station names
Required Inputs	New station name

Optional Inputs	Easting Northing Coordinate grid system Coordinate grid units Method for determining coordinates Other projects that use this station	Elevation Elevation units Method for determining the elevation Station description Comments about the station	Station type
Outputs	Message saying the station was saved along with a list of projects that use the station.		
Restrictions	Require verification that this should be performed. Limit users who have access to this function.		

## Station Electronic Data Loading

The capability to add or update station and coordinate information from an electronic file is useful for several reasons. It is easy to populate the database with station names and then use the output from a GPS logging device to update the coordinates at a later time. A user may want to add new stations for a project but not have access to the system at the time he or she is doing his or her planning. This module allows the user to load a file that updates or adds new stations to the database. The module is flexible enough to be used in different ways without affecting database integrity.

Function	<b>Load Stations</b>	Loads station names and coordinates for a project from an ASCII file. Can be used to add new stations for a project or update preexisting information. See Attachment 2 for complete file specification.
Selection Criteria	File name Current project	
Required Inputs	If station previously exists, should preexisting coordinate information be overwritten with those in the file? (Yes - always; Yes - if new information is not blank; No - never) If the station is not found among the specified projects, should it be added to the current project? Yes/No	
Optional Inputs	Additional projects with which the station can be shared if not found in the current project.	
Required Data	Station	
File Inputs		
Optional Data		
File Inputs	Spa_serial Easting Northing Coordinate grid system Coordinate grid units Coordinate method	Elevation Elevation units Elevation method Station type Station description Comments
Outputs	Summary listing of what occurred, identifying updated and original values, projects to which station is assigned, etc.	
Restrictions	If a spa_serial is present, that value is used to identify the records that should be updated. If the station names do not match, the user should be required to confirm that the update should occur.	

## Areas and Viewpoints

Sampling stations are often assigned to a larger spatially defined area such as a plant, waste area grouping (WAG), or solid waste management unit (SWMU). Most data systems have these fields defined as part of their data structure. While this is adequate, it means that applications and data structures must be modified to add additional areas, which becomes an expensive maintenance cost and limits most data systems. However, with relational databases it is possible to overcome this limitation using views. The method described below allows data users, not database administrators, to define and assign stations to an unlimited number of groups. These groups can have the typical names mentioned earlier, may be related to map layers and stations within polygons in it, may be based upon analysis-specific concerns of watersheds or risk-study areas, or may simply provide a method for identifying stations as being background stations.

The following three steps are required to implement this system:

1. Define a field name that represents the new data entity (e.g., watershed). This is called a "viewpoint," and it creates a new view within the database.

2. Define the list of values for that field. This is called an “area,” and it will become the watershed name that would normally be in the watershed field.
3. Assign stations to the new field values (or assign the new field values to the stations).

As part of step one, the user needs to decide if stations can be assigned to more than one value within a viewpoint. If the viewpoint is considered as a normal field, you would only want a single value (a station couldn't be located at more than one plant). However, if the viewpoint is considered as a scenario grouping tool, you would want a station to be allowed in multiple scenarios. It is important to understand how a viewpoint is defined and to use it appropriately.

There are some limitations to this method. For example, viewpoints are not project specific, although it is possible to select only stations related to a specific project for a given viewpoint.

## Manage Viewpoints

Function	<b>View</b>	Lists all of the viewpoints defined in the database.
Selection Criteria	NA	
Required Inputs	NA	
Outputs	List of viewpoint codes and descriptions.	
Restrictions	NA	

Function	<b>Add</b>	Creates a new view for the viewpoint and the first area for the viewpoint. Because of a database limitation, the view cannot be created unless both the viewpoint and at least one area are available.
Selection Criteria	NA	
Required Inputs	Viewpoint code – internally used as the view name. Viewpoint description – known as the field name by the user. Area – the first value. Whether stations are limited to a single area within a viewpoint.	
Outputs	Message saying that the view has been created or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate viewpoint or description to be defined. Applications adding stations to an area must test if the station was added successfully.	

Function	<b>Edit</b>	Modifies the descriptive viewpoint name
Selection Criteria	Viewpoint	
Required Inputs	Modified viewpoint name	
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.	
Restrictions	Cannot allow a duplicate name.	

Function	<b>Delete</b>	Drops a viewpoint from the database.
Selection Criteria	Viewpoint	
Required Inputs	Confirmation to delete the viewpoint.	
Outputs	Message saying the viewpoint was deleted. Should also show the list of values again for verification.	
Restrictions	Restrict access to data coordinator users.	

## Manage Viewpoint Areas

This module is responsible for managing the area names associated with a viewpoint.

Function	<b>View</b>	List all of the areas for a viewpoint.
Selection Criteria	Viewpoint	
Required Inputs	NA	
Outputs	List of areas assigned to the viewpoint.	
Restrictions	NA	

Function	<b>Add</b>	Adds a new area to a viewpoint.
Selection Criteria	Viewpoint	
Required Inputs	Area – the name of the area to be added.	

Outputs	Message saying that the area was added or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate area to be defined.

Function	<b>Edit</b> Modifies the area name.
Selection Criteria	Viewpoint Area
Required Inputs	Modified area name
Outputs	Message saying the information has been saved or what error occurred. Should also show the list of values again for verification.
Restrictions	Cannot allow a duplicate area to be defined.

Function	<b>Delete</b> Drops an area from a viewpoint.
Selection Criteria	Viewpoint Area
Required Inputs	Confirmation to delete the area name.
Outputs	Message saying the area was deleted. Should also show the list of values again for verification.
Restrictions	Restrict access to data coordinator users.

## Manage Stations Assigned to an Area

After creating a viewpoint and areas associated with it, stations need to be assigned to the appropriate areas. This will be done using two methods. The first method can be used to easily add a large number of stations to a single area. The second method allows the user to add a single station to multiple viewpoints.

Function	<b>Add</b> Adds stations to an area.
Selection Criteria	Use the data query tool to define the stations that should be added. The following criteria groups are considered: Project, Spatial Areas, Stations, and Sample Information.
Required Inputs	The area to which the stations should be added.
Outputs	Message saying that the following stations were added and what errors occurred.
Restrictions	Stations added cannot have previously been defined in the area. These should be ignored to avoid causing an error. Stations previously defined in a restricted viewpoint should be reported to the user and not be added to the selected area.

Function	<b>Delete</b> Removes stations from an area.
Selection Criteria	Use the data query tool to define the stations that should be removed. The following criteria groups should be considered: Project, Spatial Areas, Stations, and Sample Information.
Required Inputs	The area from which stations should be removed.
Outputs	Summary list reporting what stations were removed.
Restrictions	Restrict access to data coordinator users. An error should not be generated if removal of extraneous stations was requested.

## Manage Areas Assigned to a Station

This function should be applied to the existing station data entry module. This would be a convenient access point because the starting point for this function is to select the station. After the user has selected the station, he or she should be provided with a list of viewpoints in the system and information on with which of the those viewpoints the station is associated. Selecting one or more viewpoints displays the area lists for each viewpoint. The user can then click on the areas that should be added to or removed.

Function	<b>Modify Areas</b> Allows the user to modify to what areas a station is assigned.
Selection Criteria	Station Viewpoints with which relationship should be modified.
Required Inputs	Area to which the stations should be added.
Outputs	List showing with what areas the station is associated after the database has been updated.
Restrictions	When the list of areas is displayed, choose appropriate interface object to limit selections. Use combo box if the viewpoint allows only a single value, or use a list box if the station can be assigned to multiple values.

## Sample Data Entry

This module is used to enter the sample information. The same module can be used for sample planning as well as sample tracking. The difference is that during the planning phase, the samples will be added to the database, whereas during the sample tracking phase, the information will be updated.

Function	View			Displays the descriptive information for a sample.		
Selection Criteria	Project name					
	Sample ID					
Required Inputs	NA					
Optional Inputs	NA					
Outputs	Sample ID		Sampling depth units		Logbook #	
	Alternate ID		Comment		Container label information	
	Date collected		Sample device		# Bottles shipped	
	Time collected		Sampling method		Container lot #	
	Sample type		Composite status		Shipment/receipt status	
	Sample media		Station		COC #	
	Sampling depth interval		Sampling event			
Restrictions	NA					

Function	<b>Add</b> Adds new samples to the project and the requested analyses. By entering a list of sample IDs, will add a new set of records for each ID. Module offers direct link for adding new stations.		
Selection Criteria	Project name		
Required Inputs	Sample ID Station Media Sample type Sampling event	Depth units (NA if left blank) Sample device Sampling method Composite status	
Optional Inputs	Alternate ID Date collected Time collected Sampling depth interval Comment	Logbook #	Container label information # Bottles shipped Container lot # Shipment/receipt status COC #
Outputs	Message saying that the value(s) has (have) been saved or what error occurred.		
Restrictions	“Station” is a list of stations that have previously been identified for the project. “Container label information” is based on previously defined values. All other required fields are based on previously defined lists.		

Function	<b>Edit</b> Modifies the descriptive sample information and the requested analytical information.		
Selection Criteria	Project name Sample ID		
Required Inputs	Sample ID Station Media Sample type Sampling event	Depth units (NA if left blank) Sample device Sampling method Composite status	
Optional Inputs	Alternate ID Date collected Time collected Sampling depth interval Comment	Logbook #	Container label information # Bottles shipped Container lot # Shipment/receipt status COC #
Outputs	Message saying the information has been saved or what error occurred. Should display the information for verification.		
Restrictions	If the station is modified, all references in the database must be modified. Container labels cannot be modified if data have already been received for the container. All other required fields are based on previously defined lists.		

Function	<b>Delete</b>	Deletes the sample from the database.
Selection Criteria	Project name Sample ID	
Required Inputs	NA	
Outputs	Message saying the sample was deleted.	
Restrictions	Should not allow samples to be deleted that have associated analytical results.	

## Data Usage

The final goal of this phase is to use the data that you have entered. One way to use a prepopulated database is preprinting labels and forms, which benefits data management because it helps to eliminate transcription errors and duplicate or invalid keys such as sample IDs or station names. It benefits the field personnel by reducing the amount of information that they need to write and eliminates errors caused by bad handwriting or transposition of information between forms. It also benefits the field personnel by providing them with a checklist of what should be done and where.

Another way to use the information is for next-day sampling preparation. Choose the stations that will be sampled, and you can print summaries of how many containers of each type will be required, what will be analyzed, and where. With large, multi-team assignments, this can help define what needs to be done by whom on a routine basis.

The following specifications are for various data downloads and reports that should be available through the data query tool. Data downloads are recommended for most reports because they allow the user to format the information according to his or her needs. Data may be formatted directly in spreadsheet programs, used with specialized equipment such as label printers, or used with form software or word processing programs in merge operations.

Function	<b>Download container information</b>	This report allows the user to download the container label information that has been entered or merge it with the sample information for what will be analyzed and where.																								
Selection Criteria	Data query tool Sample labels (not part of the data query tool)																									
Optional Inputs	User selects which of the following fields should be downloaded: <table border="0"> <tr> <td>Project number</td><td>Laboratory code</td><td>Sample ID</td></tr> <tr> <td>Project name</td><td>Laboratory name</td><td>Alternate ID</td></tr> <tr> <td>Contract</td><td>Analysis label</td><td>Media code</td></tr> <tr> <td>Area</td><td>Container volume</td><td>Media description</td></tr> <tr> <td>Station</td><td>Container units</td><td>Sample type code</td></tr> <tr> <td>Station description</td><td>Container type</td><td>Sample type description</td></tr> <tr> <td>Event name</td><td>Number of containers</td><td>Sample Interval with units</td></tr> <tr> <td></td><td>Preservative</td><td>Sample comments</td></tr> </table> Sorting order: sample ID or station then sample ID		Project number	Laboratory code	Sample ID	Project name	Laboratory name	Alternate ID	Contract	Analysis label	Media code	Area	Container volume	Media description	Station	Container units	Sample type code	Station description	Container type	Sample type description	Event name	Number of containers	Sample Interval with units		Preservative	Sample comments
Project number	Laboratory code	Sample ID																								
Project name	Laboratory name	Alternate ID																								
Contract	Analysis label	Media code																								
Area	Container volume	Media description																								
Station	Container units	Sample type code																								
Station description	Container type	Sample type description																								
Event name	Number of containers	Sample Interval with units																								
	Preservative	Sample comments																								
Outputs	Data file with selected information.																									
Restrictions	NA																									

Function	<b>Container Counts</b>	Reports the number of containers based on the query criteria. Counts are grouped based on the additional fields the user selects.									
Selection Criteria	Data query tool Sample labels (not part of the data query tool)										
Optional Inputs	User selects which of the following fields should be used in providing the counts: <table border="0"> <tr> <td>Project name</td><td>Laboratory</td><td>Media</td></tr> <tr> <td>Area</td><td>Analytical matrix (solid/liquid)</td><td></td></tr> <tr> <td>Event name</td><td>Container type and units</td><td></td></tr> </table>		Project name	Laboratory	Media	Area	Analytical matrix (solid/liquid)		Event name	Container type and units	
Project name	Laboratory	Media									
Area	Analytical matrix (solid/liquid)										
Event name	Container type and units										
Outputs	Data file with counts based on the selected criteria and grouped by the input fields.										
Restrictions	NA										

Function	<b>Estimated Analysis Cost</b>	Calculates the estimated analysis costs based on user criteria.									
Selection Criteria	Data query tool										
Optional Inputs	User selects which of the following fields should be used in providing the counts: <table border="0"> <tr> <td>Project name</td><td>Laboratory</td><td>Report count of analyses</td></tr> <tr> <td>Area</td><td>Analysis</td><td></td></tr> <tr> <td>Event name</td><td>Media</td><td></td></tr> </table> User must also specify if he or she wants the report based on planned samples regardless of status or only samples that have been shipped to the laboratory.		Project name	Laboratory	Report count of analyses	Area	Analysis		Event name	Media	
Project name	Laboratory	Report count of analyses									
Area	Analysis										
Event name	Media										
Outputs	Data file with counts based on the selected criteria and grouped by the input fields.										
Restrictions	NA										

Function	<b>Detailed Sampling Report</b>	Prints a sampling report for a group of samples.
Selection Criteria	Data query tool	
Optional Inputs	NA	
Outputs	User selects which of the following fields should be downloaded: Project name                      Sample ID                      Sampling device Area                                  Alternate ID                      Sampling method Station                              Sample type                      Composite information Event name                          Media Laboratory                          Sample interval with units Analysis label	
Restrictions	If a viewpoint or area was specified in the query criteria, then the area will be reported; otherwise, an area will not be reported.	

## Data Collection and Sample Tracking

This step of the data management process occurs during the field investigation. Information from logbooks about what samples have been collected and shipped to the laboratory should be entered. Field measurements associated with samples should be loaded into the database. Other measurements that may have been collected also should be entered.

Information from logbooks or COC forms is entered from the sample data entry module, which has been discussed previously. Field measurements that need to be added are either related to a specific sample or a specific station. In either case the sampling event and project associated with the information are also tracked. Eliminating the sample ID, if it is not required, allows use of the same data entry module. Pre-specifying the measurements that need to be entered can speed data entry; therefore, a setup routine needs to be part of the data entry process.

## Define Field Measurement Parameter Lists

This module allows the user to specify the parameters that will be entered, the units that should be used, and the order in which they should be listed for data entry. Parameter lists should be stored based on project; however, the user may define multiple sets of groups for varying data entry needs. In addition, the groups can be copied between projects to speed data definition.

Function	<b>View</b>	Displays lists of parameters for selected definitions.
Selection Criteria	Project name List of saved definition files	
Required Inputs	Definition file	
Optional Inputs	NA	
Outputs	List of parameters for each definition selected.	
Restrictions	Should allow the user to select multiple definition files so he or she can quickly determine the set he or she wants.	

Function	<b>Add</b>	Creates a new parameter definition list.
Selection Criteria	Project name	
Required Inputs	Step 1: User selects an analysis type that probably has the analytes he or she wants associated with it. The list cannot be limited to just typical field parameters because more frequent field measurements are being made for inorganic and organic analytes. Step 2: The user should be able to select the analytes in which he or she is interested or remove choices he or she made previously and return to a modified step 1. Step 3: At this point the user can choose a new analysis type and go back to step 2 where he or she can add to the list he or she had before (or remove selections). Instead of choosing another analysis type, the user should have the option of continuing to the next step. Step 4: This step displays the list of selected parameters and allows the user to specify units for each analyte. Step 5: The user should save the data. He or she should define a recognizable name by which these measurements should be known .	
Optional Inputs	NA	
Outputs	Modified list of parameter definition lists for the project.	
Restrictions	Only analytes previously associated with a analysis type will be displayed. The user may need to add analytes to desired parameter lists.	



Function	<b>Edit</b> Allows the user to add parameters to or remove parameters from a definition list or to specify new units.
Selection Criteria	Project name Parameter definition list name
Required Inputs	The user should start at step 2 of the add routine, with all of the previously selected parameters listed. From here he or she may proceed to either choose a new analysis type or specify the units. When he or she is done, he or she should have the choice of saving the values under the old name or a new name.
Optional Inputs	NA
Outputs	Modified list of parameter definition lists for the project.
Restrictions	Only analytes previously associated with an analysis type will be displayed. The user may need to add analytes to desired parameter lists.

Function	<b>Copy</b> Copies an analyte list from one project to another.
Selection Criteria	Originating project Name of the definition list
Required Inputs	The name of the project to which the list should be copied, along with the option for a new name.
Outputs	Message saying the information was copied or why it was not.
Restrictions	An error should be generated if the name that was selected previously existed in the new project.

Function	<b>Delete</b> Deletes a definition list from a project.
Selection Criteria	Project name Name of the definition list
Required Inputs	Confirmation to delete the list.
Outputs	Message saying the sample was deleted.
Restrictions	None

## Perform Field Measurement Data Entry

This routine allows the user to add new measurements to the database or modify preexisting measurements. As part of the modification process, previously entered measurements can be deleted. Entry into this module can occur from the sample data entry module or directly from the interface.

### Sample-Specific Field Measurements from the Data Entry Screen

If the user comes to this module from the data entry module, the system will know the station name and sample ID associated with the measurements. From the data entry module, the user should select the desired definition list followed by a “Field Measurements” button. If no measurements previously existed, a data entry screen is displayed with the preselected parameters and all fields other than the result filled in. The user should enter the information, press save, and be returned to the sample data entry module. The definition pick list should be set to the option previously selected. If the data already exist, the previous data should be displayed along with any additional parameters from the definition list that were not previously saved. Any time a result field is left blank, the value is either not saved (if the parameter was new) or is deleted (if it previously existed). The definition list should have a “none” option to display only the parameters previously saved.

Function	<b>Field Measurements</b> Allows the user to add or edit field measurements from a sample.
Selection Criteria	Sample ID Parameter definition list name
System-Controlled Inputs	The following values will be entered by the system and cannot be modified: Sample ID                      Sampling event Station name                      Logbook Date collected Measurement
Required Inputs	Result Units
Outputs	Return to calling form with message indicating what was saved or updated.



Function	<b>Field Measurements EDL</b> Allows the user to load field measurements from an ASCII file. See Attachment 2 for complete file specification.
Selection Criteria	Project name Sampling event Data file name
Required Inputs	Station Date collected Measurement Result Units
Optional Inputs	Project name. If specified, it would override the selection criteria project name. Spa_serial. If specified, it would override the station name lookup.
Outputs	Report summarizing how many records loaded or error messages specifying problems that were encountered.
Restrictions	Measurement names will be standardized against the internal list of parameter names.

## Well Construction Data Entry

Wells are stations with additional attributes. As such, the entry point to entering well information is the Station Data Entry. Setting the station type attribute to “Well” will allow entry to the well construction information for that well. A minimal amount of well construction information will be maintained in the database. Instead, well construction diagrams will be available on a web site from which the user can download information. The data entry page should have a link to the well construction diagram.

Function	<b>Well Construction</b> Allows the user to enter or modify well construction information.
Selection Criteria	Station. Must have station type of well.
Required Inputs	NA
Optional Inputs	Total depth                      Geologist                      Beginning screen interval Reference point elevation      Start date                      Ending screen interval Well type                          End date                          Screen type
Outputs	Report summarizing how many records loaded or error messages specifying problems that were encountered.
Restrictions	Measurement names will be standardized against the internal list of parameter names.

## Sample Tracking

Sample tracking is accomplished when the logbook and COC information is entered via the sample data entry screen. Entering the date collected indicates that the sample was collected. Modifying the shipment status and the COC begins the container and analysis tracking process. From a project management perspective, sample tracking is reporting. The following reports provide various sample-tracking options. They all use the data query tool to specify the data selection criteria.

### Sample Analysis Status by Sample ID

For each sample that has been collected, this report lists the collection date, shipment status for each analysis, and whether the results of the analysis have been received from the laboratory.

Function	<b>Sample Analysis Status by Sample ID</b> Allows the user to report on project status.
Selection Criteria	Performed by user using data query tool.
Optional Selection Criteria	Show only analyses that have not been received from the laboratory. Can filter on the shipment status field to eliminate undesired analyses.
Required Inputs	List of fields that the user wishes to see. At a minimum these should include: Sample ID Date collected Container label Analysis type Analysis status

Optional Inputs	Additional fields the user may choose: Project Areas Station Alternate ID Sample type Media Sample depth Laboratory SDG number COC number
Outputs	Report lists the previously selected fields.
Restrictions	Only samples that were collected are reported. Requires database to use analysis-linked container information.

## Sample and Analysis Summary

This report summarizes the number of samples collected and analyses performed by medium and sample type. For each medium, the number of samples collected by sample type is reported along with the number of analyses received from the laboratory per sample type for each analysis type. This report does not require premobilization data entry (i.e., can be used with historical data).

Function	<b>Sample Analysis Summary</b> Allows the user to report on sample collection and analysis status.
Selection Criteria	Performed by user using data query tool.
Required Inputs	NA
Optional Inputs	NA
Outputs	Table by medium containing the following information: Number of samples collected per sample type. Number of analyses performed by sample type and analysis type.
Restrictions	Only samples that were collected are reported. Does not require use of analysis-linked container information.

## Summary of Sampling Performed by Station

Function	<b>Summary of Sampling Performed by Station</b> For each station selected, lists the dates the station was selected and provides a summarized list of analyses that were performed.
Selection Criteria	Performed by user using data query tool.
Required Inputs	NA
Optional Inputs	NA
Outputs	Table listing station name, date collected, and analyses performed.
Restrictions	Does not require use of analysis-linked container information. Sample collection will be included only if received from the laboratory.

## DATA VERIFICATION AND VALIDATION

The next step of the data management process occurs with the receipt of a sample delivery group (SDG) from the analytical laboratory. At this point data package tracking is initiated. This process will track when the data package was received and its progress through data loading, verification, validation, and data qualifier process. For this reason the user accesses all of these modules through the Data Package Tracking module.

### Data Package Tracking

When data are received from the laboratory, their receipt should be logged, noting the following information: the records system accession number, laboratory, SDG number, date the hard copy was received, and when the EDD was received. Then the data package should be verified to determine if the package is sufficiently complete for data entry and validation. The person performing the verification, when it was started, and when it was completed should also be logged. Next, the data should be loaded. Once again, who performed the data loading, when it was started, and when it was completed should be logged. After the data have been loaded, the analytical coordinator or data validator is responsible for validating the data. Again, the person validating the data, when it was started, and when it was completed will be logged. After the data have been validated, the validation package is returned to the analytical or

data coordinator for data entry of the flags. Again, who entered the flags, when this was started, and when it was completed is logged. If any problems with the laboratory arise during the process, a Nonconformance Report (NCR) may be initiated, the NCR for the data package can also be tracked and logged. All of the information that is logged is tracked with this module.

Function	<b>View</b>	Displays information for a data package. From the view mode can access EDD loading, manual data entry, or data qualifier data entry.
Selection Criteria	Project name Laboratory SDG number	
Required Inputs	NA	
Optional Inputs	NA	
Outputs	Form listing the following information: Laboratory SDG number Date data package due, date hard copy received, date EDD received Verification: performed by, assigned, completed Data entry: performed by, assigned, completed Validation: performed by, assigned, completed Data flagging: performed by, assigned, completed Comments Accession number for data package NCRs	
Restrictions	NA	

Function	<b>Add</b>	Creates a new data package tracking record.
Selection Criteria	Project Name	
Required Inputs	Laboratory SDG number	
Optional Inputs	Form listing the following information: Laboratory SDG number Date data package due, date hard copy received, date EDD received Verification: performed by, assigned, completed Data entry: performed by, assigned, completed Validation: performed by, assigned, completed Data flagging: performed by, assigned, completed Comments Accession number for the data package NCRs	
Outputs	Message saying the information was added and form showing the data.	
Restrictions	It is possible to have more than one record for the same SDG because laboratories sometimes submit parts of the data package in pieces, typically based on different analytical fractions. User should use comments section to differentiate between multiple records when this occurs.	

Function	<b>Edit</b>	Allows the user to modify data package tracking information.
Selection Criteria	Project name Laboratory SDG number	
Required Inputs	NA	
Optional Inputs	Date data package due, date hard copy received, date EDD received Verification: performed by, assigned, completed Data entry: performed by, assigned, completed Validation: performed by, assigned, completed Data flagging: performed by, assigned, completed Comments Accession number for the data package NCRs	
Outputs	Message saying the information was added and form showing the data.	
Restrictions	NA	

Function	<b>Delete</b> Deletes a data package tracking record.
Selection Criteria	Project name Laboratory SDG number
Required Inputs	Confirmation to delete data package.
Outputs	Message saying the data package was deleted.
Restrictions	Cannot delete if information for the SDG record exists in laboratory sample table.

## EDD Loading

Loading the analytical results from the data package completes the sample tracking process. Usually the project will request an EDD from the laboratory. The data will have to be entered manually if an EDD is not available. Many things should occur during data loading. These activities include:

- Standardizing analytical method numbers to match the same format used by the database.
- Standardizing chemical names for consistent data reporting.
- Verifying dates (data received after shipped, extracted after received, and analyzed after being analyzed).
- Determining the analysis type.
- Verifying that sample weight units are present if the sample weight was reported.
- Verifying that the units are present.
- Verifying that the sample ID was found in the database.
- Creating an internal qualifier field based on the laboratory qualifier.
- Modifying sample tracking fields to record data that have been received.

Errors must be reported so the user can take the appropriate action. These actions may include:

- Adding new samples to the database.
- Correcting the EDD to have the correct sample ID.
- Updating method alias lists to reflect differences between what the laboratory is reporting and what we were expecting.
- Updating the chemical alias lists to reflect differences between what the laboratory is reporting and what we were expecting.
- Assigning chemicals to the appropriate analysis codes.
- Notifying the laboratory if it has a serious problem and needs to resubmit all or part of the data.

When the data are loaded, the user should be informed about the number of records that were added to the database, and the data package tracking log should be updated. Occasionally, data may be loaded but errors be found during validation, requiring that the laboratory submit a revised data package. A data unloading module must also be available for this reason.

Function	<b>EDD Loading</b> Loads an EDD into the database. See Attachment 2 for complete EDD file specification.
Selection Criteria	Project Laboratory SDG number
Required Inputs	Filename
Optional Inputs	NA
Outputs	Message saying data loading was completed and reporting number of records loaded or report detailing errors.
Restrictions	EDD must be in appropriate structure.

## Analytical Manual Data Entry

Manual data entry is a time-intensive process; therefore, it is important to design data entry systems that help speed the process. Two requirements can help significantly.

1. Design the data entry form similar to the form from which data may taken.
2. Have the application enter as much information for the user as possible.

By having the data entry form similar to the source form, the user can quickly find the appropriate fields. Having the analytes in the same order as found on the source form will fulfill item 1. Having the computer enter all of the analyte names will handle item 2. The manual data entry form's design should be laid out according to a Contract Laboratory Program (CLP) Form 1. This is still a standard format for most laboratories. As with field measurements, a helper module will allow the user to select the analytical parameters that will be loaded and specify the default detection limits. Pre-specifying the detection limits makes one less item the data entry operator will have to enter. The module specified below is only used for adding new records to the database. Once the samples have been saved, minor changes can be made from the data qualifier entry form.

Function	<b>Manual Data Entry</b> Allows manual data entry of laboratory results.		
Selection Criteria	Project Laboratory SDG number		
Required Inputs	Analytical media (solid/liquid) Analysis type Analytical method Sample ID CAS number Analyte name Units	Matrix Result type Filtered status Dilution Result Laboratory qualifier	
Optional Inputs	Sample weight Sample volume Level Percent moisture Instrument number	Laboratory sample ID Date received Date extracted Date analyzed	Data qualifier Validation code Detection limit Rad error
Outputs	Message saying data were saved. Automatically continues to add new sample.		
Restrictions	Enters Only analytes specified earlier. Analytes without results will not be entered.		

## Define Manual Data Entry Template

This module allows the user to specify the parameters that will be entered, their default detection units, and the order in which they should be listed for data entry. Templates should be stored based on project and by analysis type. Templates can be created in several ways, including the following:

- Enter everything from scratch.
- Use a preexisting sample as a template.
- Copy a template from another project.

Function	<b>New</b> Creates a new parameter template from scratch.
Selection Criteria	Project name
Required Inputs	Step 1: User selects the analysis type for which he or she wants to enter data. Step 2: A form is displayed showing all of the analytes in the database that have been defined for that analysis. The user selects all of the analytes he or she wants and sets their order as displayed in the form. Step 3: The user enters the appropriate default detection limits for each analyte and saves the information.

Optional Inputs	Detection limits.
Outputs	Message stating the information was saved.
Restrictions	Only analytes previously associated with the analysis type will be displayed. The user may need to add analytes to desired parameter lists.

Function	<b>Copy Sample</b>	Creates a new parameter template from a preexisting sample. The samples' detection limits are used as the default limits for the appropriate media.
Selection Criteria	Project name	
Required Inputs	Sample ID	
	Analysis type	
Optional Inputs	NA	
Outputs	Message stating the information was saved.	
Restrictions	NA	

Function	<b>Copy Template</b>	Copies a preexisting template from a different project.
Selection Criteria	Project name	
Required Inputs	A list of all the templates available in the database is displayed from which the user may choose.	
Optional Inputs	NA	
Outputs	Message stating the information was saved.	
Restrictions	NA	

Function	<b>Edit Template</b>	Allows the user to modify a template created using one of the previous methods.
Selection Criteria	Project name	
	Template analysis name	
Required Inputs	A list of all analytes selected previously and all analytes known for the template. The user can add or remove analytes from the template. After ordering the analytes, the user can specify the detection limits and then save the information.	
Optional Inputs	NA	
Outputs	Message saying the information has been saved.	
Restrictions	Only analytes previously associated with a analysis type will be displayed. The user may need to add analytes to desired parameter lists.	

Function	<b>Delete</b>	Deletes a data entry template for a project.
Selection Criteria	Project name	
	Analysis type	
Required Inputs	Confirmation to delete template.	
Outputs	Message saying the template was deleted.	
Restrictions	None	

## Data Qualifier Data Entry

After loading the data, validation flags must be assigned. The user gains access to the data qualifier module through the data package tracking module. A list of all the samples in the data package, the analysis type, and the result type is displayed from which the user may choose. After selection of a sample, a data entry form is displayed in which the user can modify the desired fields. Fields other than the data qualifier can be modified in this form. A button is available to the user that will copy the laboratory qualifier as the data qualifier if the validation did not change the value. The qualifier may be modified slightly during the copying because the data qualifier field limits the accepted values. In addition to the normal fields that you would expect, an “okay to use” flag should be set in this screen. This field is automatically set to “yes” when the data are loaded. However, if there are multiple sets of results for a sample (from dilutions or reanalyses), this field is used to define which set of results should (“yes”) or should not (“no”) be used. It is possible to use some analytes from one set and others from a different set for the same sample. This is necessary because only the analytes that needed to be diluted should be included in the final set of “good” data. The user can also delete analytes from this screen.

Function	<b>Edit Information</b>	Allows the user to modify analytical results for a sample.
Selection Criteria	Project name	Sample ID
	Laboratory	Laboratory sample ID
	SDG number	Result type
		Analysis type



Required Inputs	Result Units Laboratory qualifier Data qualifier	Validation code Okay to use Detection limit Rad error	Filtered
Optional Inputs	NA		
Outputs	Message saying the information has been saved.		
Restrictions	NA		

## Data Verification Reporting

As part of the verification process, all data that are entered into the system should be verified against the original data source (logbook, forms, etc). The data query tool is designed to handle selecting almost any type of information in that database if there is a report that will recognize the desired tables. The following reports allow the verification of any information previously entered.

## Field Measurement Report

Function	<b>Field Measurements</b>	Lists the field measurements.
Selection Criteria	Performed by user using data query tool.	
Required Inputs	Select the fields that should be downloaded: Project Sampling event Station Sample ID Date collected Measurement Result Units	
Optional Inputs	NA	
Outputs	Table containing the specified information.	
Restrictions	Selecting sample-specific information other than sampling event or date collected will result in only field measurements that are associated with samples being downloaded.	

## Well Construction Information

Function	<b>Well Construction</b>	Lists the well construction information.
Selection Criteria	Performed by user using data query tool.	
Required Inputs	Select the fields that should be downloaded: Project Sampling event Station Sample ID Date collected Measurement Result Units	
Optional Inputs	NA	
Outputs	Table containing the specified information.	
Restrictions	Selecting sample-specific information other than sampling event or date collected will result in only field measurements that are associated with samples being downloaded.	

## Data Qualifier Verification

This report is used to verify all the information that has been entered. This report is accessed through the data management module instead of the data query tool because of the specific format desired for verifying data entry.

Function	<b>Data Qualifier</b>	Lists the analytical results and qualifiers for a data package.
Selection Criteria	Project name Laboratory SDG number Analysis type	

Required Inputs	NA
Optional Inputs	NA
Outputs	Report listing the specified information.
Restrictions	NA

## DATA ANALYSIS AND REPORTING

The final step of the data management process is analysis and reporting. This is the point at which the process moves from the data management staff to the end-user. These users will have specialized needs and tools that they will use with the data. The EIMS will have a geospatial query tool that will be capable of querying the database spatially or by data attributes. Reporting will be performed spatially or through reports or data downloads.

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**ATTACHMENT 1**  
**SEIMS DATA DICTIONARY**

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# **SEIMS Data Dictionary**

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A guide to data management using SAIC's Environmental Information Management System (SEIMS) structures and relationships.

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# Overview

## How to Find What You're Looking For

### What is this Document?

Data dictionaries normally define the tables, indexes, and relationships between tables in a database. However this document attempts to inform the user about data management concepts, and how they are supported with SEIMS.

The document is organized along functionally related tables in the database. Each section summarizes data management practices and how they are supported. Appendices located at the end of the document define the fields in each table.

### What is SEIMS?

The SEIMS database contains environmental data typically collected during remedial investigations. It provides structures useful for sample planning, sample tracking, data management, data analysis and reporting. The database is organized on the concept of projects defining sets of related data.

Each project collects data found at multiple locations that may (or may not) be associated with sample collection. Multiple samples can be collected at a given location varying in media, sample type, depth, or collection date. Each sample may have multiple analyses performed for different chemicals and properties.

Projects are required for data management. They provide a handle into the database to conveniently subset data. While projects are required for data management purposes, they are not necessary for data analysis. Therefore, the user may subset data on criteria other than the projects responsible for its collection.

Most users of this document are learning about the database and what tables should be used to obtain specific information. Think about what it is you want to accomplish (i.e., data management practice or data extraction) and how it relates to the database's functional groups. Look-up that section of the document for the functional group and you will see what tables are used along with why the tables are part of that group. If you need information about the table structures, look-up the table in the appendices.

### What are the Functional Groups?

The tables in SEIMS can be organized into the following functional groups:

- Sample planning and tracking tables
- Spatial tables

- Core information tables
- Data entry tables
- Lab QC information
- Code definition tables
- System tables

Typically all of the tables in these groups are used by the database; however some projects may not use all of the groups listed. For example, the sample planning and tracking tables are not required if the data in the database was imported from external data sources instead of being added as part of managed field operations. Similarly, lab QC may not be available with imported data, or it may not have been electronically available for a project. Therefore the user of the database should have some knowledge about the database contents when examining data from non-core groups. Each of these groups are discussed in the following sections.

Remember: Not all groups are required for all projects. Some data queries and reports may not work if required information is missing.

---

# Sample Planning and Tracking Tables

## How to Know Everything is There

### Why do sample planning and tracking?

"Is anything missing" can be the most frustrating question asked without a good data management system. It is impossible to know what is missing if you don't know what you should have. Therefore, SAIC recommends using a proactive approach when collecting data during field investigations. This involves populating the database with the information from the sampling and analysis plan (SAP) before the going to the field to collect the samples.

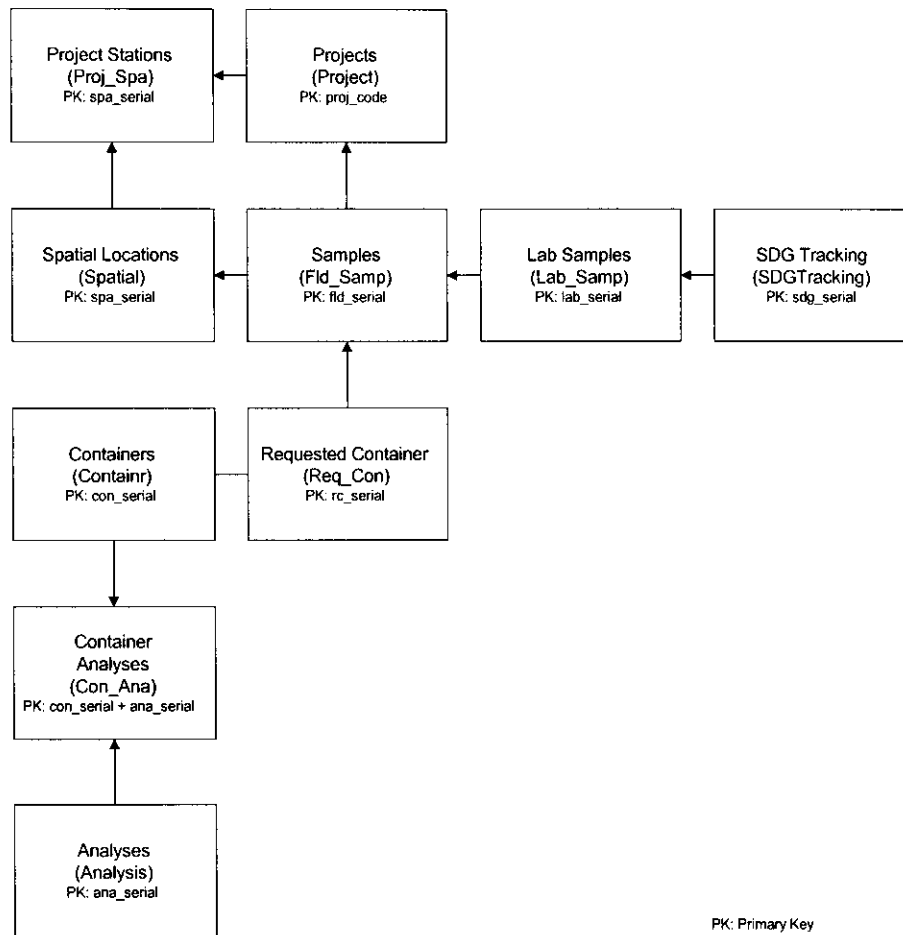
Pre-populating the database has many benefits. With this information, forms, logbooks, and sample container labels can be pre-printed with the stations, samples, media and required analysis. This allows the project manager and field crew to know what is expected and offers a way to verify that everything has been collected. From a data management perspective, it guarantees that key fields are populated correctly and will match between all related forms, and sample identifiers cannot accidentally be duplicated or transposed. From a data entry perspective illegible forms and incorrect or missing key information is eliminated. Most importantly this starts the database's sample tracking mechanism.

Sample tracking is possible because the database contains what samples and analyses were planned to be collected. As samples and analyses are collected, the database then can be used to identify the differences between what was planned and what occurred. When the samples are shipped to a laboratory, it tracks what was shipped and what was received. After the samples are received, it can track the verification and validation process used to ensure the data is complete and correct.

### How do you do that?

Figure 1 shows the tables used in sample planning and tracking, and the relationships between them.

• Figure 1 - Sample Planning and Tracking Table Relationships



Sample planning and tracking is performed on a project basis and requires that all tables in this group are used by the project. During planning, the user will populate the tables in the following order:

- 1) *Project*
- 2) *Analyses*
- 3) *Containers*
- 4) *Spatial* (and optionally other spatial group tables)
- 5) *Field Samples* and *Requested Containers*

Tracking starts with sample collection. During this phase the user will populate the COC and add additional information to the *Field Samples* tables. As samples are received from the laboratory, the *Laboratory Samples* and *SDG Tracking* table will be populated.

### What goes on in the Sample Planning Tables

The project is the center for all data management activities. The *Project* table contains identifiers about who is in charge of the project, where it occurred and some other general information. This information is typically used for reference or may be used in printing log book forms.

Projects typically collect two types of information: field measurements and analytic concentration results. Field measurements are not pre-planned in SEIMS; however, analytic requirements are. The *Analysis* table lists the analysis names and analytic methods and laboratories required for the project. In addition, the table lists the costs and time limits for each of these analyses. The limits include both standard holding times and tracking limits such as laboratory data turnaround and validation.

The *Containers* table is used to print labels for the samples that will be collected. It contains information such as the type of container, its volume and preservatives that should be used; the lab the container should be delivered to; and a description of the analyses to be performed.

The *Container Analyses* table links the container requirements to the actual analyses that will be performed identified in the *Analysis* table.

*Field Samples* lists the samples that are expected to be collected along with their media and type (environmental, duplicates, or field QC types).

The *Requested Containers* table links the samples in *Field Samples* with the *Containers*. This identifies all the samples and analyses that should be performed for the project.

The *Spatial* table and other spatial tables may also be populated during planning. This allows the user to associate a specific sample with the location where a sample was collected. The other spatial tables are used to group locations into geographically or project related areas which will be used for sample queries later.

## **What goes on in the Tracking Tables**

As samples are collected in the field, the database is populated with information about when the samples were collected and what has happened to the samples and the analytical results.

*Fld\_Samp* is used to track when a sample is collected.

*Requested Containers* is updated to track the COC, and shipment date for each analysis sent to the laboratory. Reasons why an analysis will not be received from the lab (e.g., container not collected, container broken, insufficient sample for analysis) are also tracked in this table.

Sample delivery groups (SDGs) that consists of hardcopy forms and electronic data deliverables (EDDs) are received from the lab. The EDD is used to load the analytic results into the database; or if not present, the data can be entered manually. After the data has been loaded it is reviewed to verify that the EDD or data entry matched the hardcopy forms provided by the laboratory. The data also undergoes review by a data validator to ensure that the data meets the necessary criteria. Additional qualifiers are entered into the database based on this validation.

*SDG Tracking* tracks the receipt of data packages and the processes performed on the samples after receipt (verification, validation, and flag entry).

*Lab Sample* tracks information such as when the analysis was performed by the laboratory and links the analytic results to the SDGs.



---

# Spatial Tables

## How to Keep Everything in its Place

### Why do you need to know where it came from?

Everything has a reason. Samples are collected to answer the following questions:

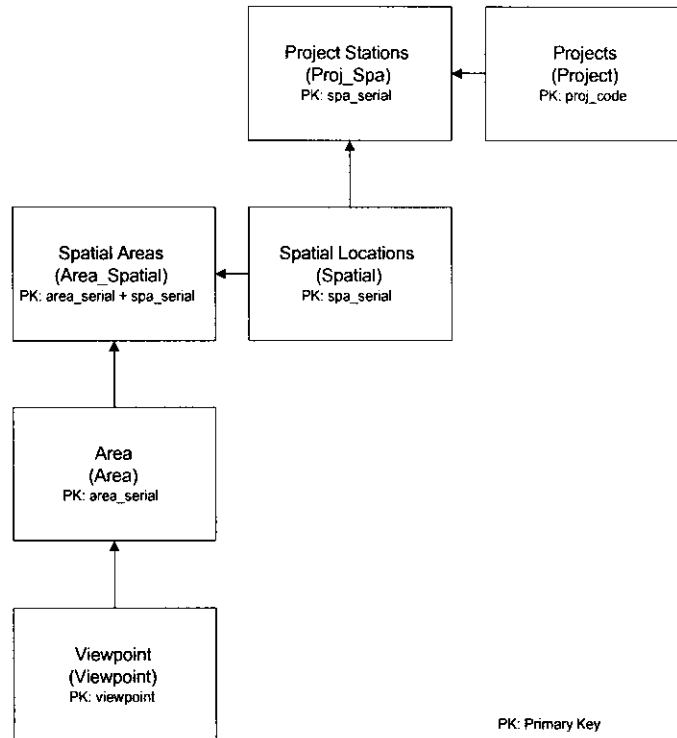
- Is the site contaminated?
- How bad are the contamination levels?
- Where is the site contaminated?
- Is the contamination migrating?
- Where do we need to clean-up?

If you cannot identify where measurements came from, you cannot answer most of these questions. Therefore you need a mechanism to track where samples are located. Spotting the samples on a site map is not sufficient. During the lifetime of a site, many maps may be made. It is unlikely that all information will be added to the same map. What happens when maps are based on different sampling grid? A repository must be available to identify the physical location for a sample.

In addition to identifying a location, spatial tables provide handles for users to associate locations into groups for analysis and reporting. SEIMS allows the users to identify an unlimited number of groups. These groups can be based on any criteria the project desires. The groups can be thought of boundaries on a map, or as layers of boundaries on a map. This allows spatial relationships between locations to be established within the database as well as on a map. These groups can then be used in reports or any type of analysis.

Figure 2 shows the tables used to define the spatially related tables.

• Figure 2 - Spatial Group Tables



## Where do the coordinates go?

The *Spatial* table identifies the name for a location, its coordinates, elevation and error associated with those measurements. Each geographic point where a sample is collected corresponds to a record in the table. This table is normally standardized to a single coordinate system. However the coordinate system for each record is recorded.

Because the data management is performed based on projects, the *Project Spatial* table relates locations to the projects that use them. This allows a single location record in the database to be associated with multiple projects (i.e., a well might be sampled during different projects).

## How do you relate the locations?

Three tables are used to relate stations to each other. The *Viewpoint* table is used to identify the primary groupings that you want to perform. Think of it as a field that will have several possible values.

The *Area* table defines what values the viewpoint has.

The *Spatial Areas* table links those areas to specific locations. Each location may be linked to one or more area within a viewpoint. In addition, a table is probably related to multiple viewpoint/area combinations.

Views of these tables are created in the database to simplify use. The coded viewpoint name will become the name of the view, with a field of the same name (as the coded viewpoint) containing the areas names and the internal key (spa\_serial) that links to the *Spatial* table. For example, assume the user defines a *Viewpoint* called WAG; and associated *Areas* WAG-1 and WAG-2 and links five locations to these areas. Then the database will contain a view called WAG that contains information something like what is shown below.

Area_Serial	WAG	Spa_serial
1	WAG-1	1
1	WAG-1	2
2	WAG-2	3
2	WAG-2	4
2	WAG-2	5

The location is represented by the internal key spa\_serial, which must be linked back to the *Spatial* table to determine the name or coordinates for the location.

This feature is extremely powerful and allows a unlimited spatial groupings to be created in this manner. However there are also is a limitation with the current implementation. A problem may arise when a location is assigned to multiple areas within the same viewpoint. In the WAG example, you normally would not expect a well in two different WAGs. However if you defined a view of Scenarios for analysis you would expect that a well could occur in multiple scenarios. Therefore it is important that the person linking the location to a spatial area understand how the group is expected to be used.

Remember: It is important to know how a viewpoint is intended to be used. Locations must be assigned to a viewpoint based on that intent. The database does not limit how viewpoints are used and the data they contain.

A modification has been proposed to create a trigger on the tables that would prevent adding locations to multiple areas of the same viewpoint. This is not currently implemented.

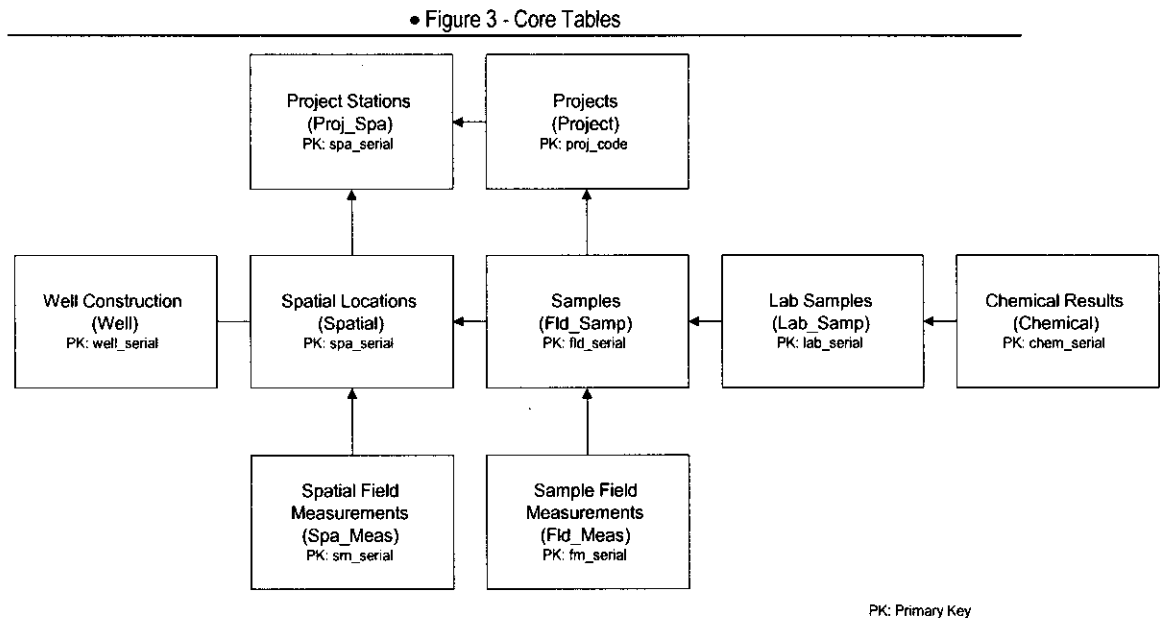
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# Core Information Tables

## How to Get the Good Stuff

### Why should I care about where it comes from?

You need to know where the data is if you are required to get data out of the database. The core tables represent the tables that most users think about when they refer to the database. [Figure 3](#) shows the core tables.



---

There are four primary sets of relationships in the core tables:

- 1) Analytic results
- 2) Sample Related Field Measurements
- 3) Spatial Related Field Measurements
- 4) Well Construction Information

Secondary relationships represent subsets or supersets of these relationships. For example, you may be interested in only the sample information without the field measurements or analytic results. This would be a subset. A superset would occur by linking additional tables such as the lookup tables or spatial grouping tables with these relationships to enhance the results.

Understanding what's in these tables and how they got there are critical in extracting the information.

## What's in the analytic results?

End-users most frequently request analytic results from the database. This combines the sample information with laboratory information and the chemical analytic results.

Sample information originates during either pre-population or from entering sample collection forms. Data management procedures should ensure that the forms are complete and data entered correctly. Sources for errors occur when the information was not correctly identified on the form. This is due to poor training of field personnel or data management staff. Data management staff must always be on the lookout for problems that may affect future data integrity. Notify the field manager when problems are identified and take actions to correct them.

**Need for Training Example:** A project was encountered that did not clearly identify where samples were to be collected in the SAP. The database was pre-populated with a "Unknown" station identifier for all samples. The field crew was instructed to collect samples along a series of trenches in 10 foot intervals. As samples were collected, the field crew recorded the trench name on the sample collection form for the station identifier. The data entry person realized that it was unlikely multiple soil samples were being collected at the same depth for the same location. When the crew was questioned they did not understand that they needed to generate a unique station identifier for each hole they dug. Good training of the data management staff recognized the problem and training the field crew eliminated the problem in the future.

In addition to the sample information, the analytic information from *Lab Samples* and *Chemical* tables is required. Depending on what the user needs, the *Lab Samples* table may be excluded. The *Chemical* table contains the fld\_serial field for linking directing to the *Sample* table. The data in the *Lab Samples* and *Chemical* tables originates when analytic data is loaded into the database. Chemical names should have been standardized during the loading process.

The *Chemical* table contains sets of fields for both received and final results, detection limits, rad error, and units. This allows the data to be standardized in the database for reporting or analysis purposes. The received values can be used for verifying lab deliverables, but the end-user should only use the final fields which would reflect any standardization that occurred during the project.

The *Chemical* table contains three qualifier code fields. Labqual represents the qualifier applied by the analytic laboratory. Dataqual contains the codes assigned by the data validator. Qual should have been set by the loading or editing programs. The field should contain a value based on either the labqual or dataqual field, depending on whether or not the sample had been validated. This allows users to look at a single field to determine if a sample has been detected, rejected, or some other qualifier was applied.

## What's in the field measurements?

Two types of field measurements are recorded in the database. These are the sample related measurements and location related measurements. Sample related measurements are collected when a sample was collected at a location. For example, several water quality parameters are typically collected when samples are collected from wells. Location parameters are the same except that they are not collected along with a sample. Instead these field measurements were performed as an independent event. For example, ground water levels may be periodically collected even though samples are not collected. The only difference between the data in these tables is the relationship to the *Sample* table.

## What's in the well construction information?

The *Well Construction* table is very simple in its current implementation. Based on past experience little well construction information is normally required for data analysis. However users often want to see the original well construction diagram. For this reason, well construction forms are provided on-line through a web site. Minimal information such as installation date, status, measuring point, elevation and screened interval is provided online.

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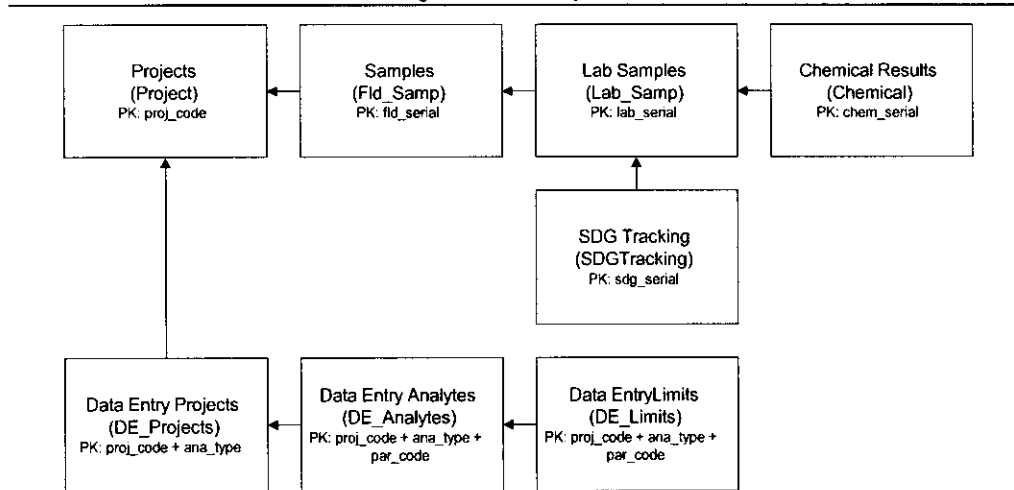
# Data Entry Tables

## How to Enter Data the Hard Way

### Why do you need tables for this?

Normally data from a laboratory is received as electronic data deliverable (EDD). However, occasionally a project may not have contracted with the lab for EDDs or for some reason a EDD is not available. In these instances, it is necessary to add results to the database manually. Manual data entry has one primary end-user requirement: it must be quick and easy. [Figure 4](#) shows the tables required for data entry.

• Figure 4 - Data Entry Tables



During the data entry process the *Lab Samples*, *Chemical Results*, and *SDG Tracking* tables are updated. The *Samples* table is required to identify field values used to link tables.

The following tables are unique to the data entry process and are simplify data entry:

- *DE\_Projects*
- *DE\_Limits*
- *DE\_Analytes*

*DE\_Projects* defines the analyses that are available for data entry.

*DE\_Analytes* defines a standardized list of analytes that should be entered for each analysis type.

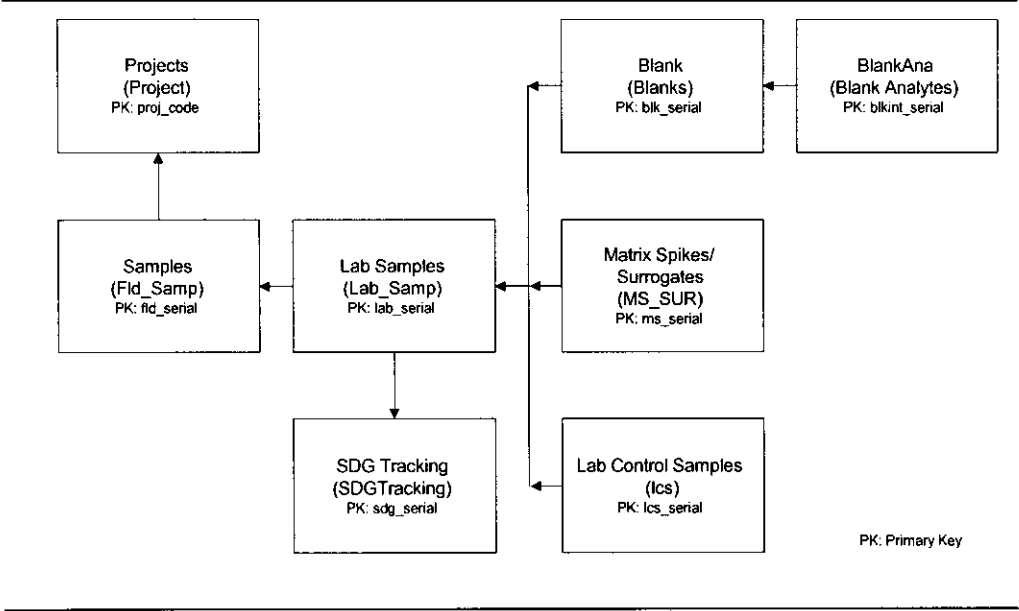
*DE\_Limits* allows the user to preset the requested detection limits based on media for each analyte.

Programs can be developed using these tables to easily collect a temporary list of analytes that can have the results set, and then appended into the database.



# Lab QC Information

• Figure 5 - Lab QC Tables



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## Code Definition Tables (Lookup Tables)

You Call it Analysis Type I Call it ANA\_TYPE

### Where are the definitions for codes in the database?

The database uses many tables to define codes. A table exists for every coded field. The table that defines the code has the same name as the coded field and usually consists of simply the code field and a description field.

In some instances an additional coded field is found. This field can be used for data reduction or grouping in reports.

Example: The *Analysis Type* table defines the codes for ANA\_TYPE. However this table also contains the ANA\_GROUP field. This field groups the various analysis types into larger groups (e.g., organic, inorganic) which might be useful for reporting purposes.

### How do you standardize values in the database?

Chemicals, analytic methods, and lab qualifiers are often received with different values from different laboratories. These values may all be equivalent and understood by a person as being the same; however the database thinks they are different. SEIMS standardizes these values using alias tables to simplify queries and enhance reporting.

Each alias tables consists of values received from the laboratory and what a user has identified as an appropriate equivalent value. It is important that the user has been trained and understands the importance of entering this information.

*Chemical Alias* is used to standardize chemical names and parameter codes.

*Lab Qual Alias* is used to standardize lab qualifiers into the following set of qualifiers: U, UJ, R, J, =. The labqual field in the *Chemical* table is unaffected by the standardization, and the standardized value is stored in the Qual field until it is overwritten after data validation is performed.

*Laboratory Method Alias* is used to standardize the analytic methods that are received from a laboratory into a consistent method code used by the database.

---

# System Tables

## What You Don't Know Can't Hurt You

### What's the secret?

The following tables are defined as system tables and are not directly available to end-users.

*Serial* is used to assign internal keys for many of the tables.

*Save\_SQL* is used to save queries developed in the Data Wizard.

---

## Table Structures

Each table name is listed below with a descriptive name and the actual database name in parentheses. The fields for each table is listed along with a brief description about their content, type and size.

### Analysis Group (ana\_group)

This table defines the large grouping for analysis types.

Field Name	Description	Data Type	Length
ana_group	Code describing the type of chemical (Organic, inorganic, rad, etc)	varchar	10
group_desc	Description for the analysis group code.	varchar	50

### Analysis Types (ana\_type)

This table defines the codes used to classify the analyses for reporting purposes.

Field Name	Description	Data Type	Length
ana_desc	Description of the analysis code.	varchar	50
ana_group	Code describing the type of chemical (Organic, inorganic, rad, etc)	char	1
ana_type	Code used for grouping data for reporting indicating the type of analysis (volatile, semivolatiles)	varchar	6

### Analyses (analyses)

Field Name	Description	Data Type	Length
ana_cost	The cost of analysis for a single sample.	varchar	10
ana_level		varchar	3
ana_serial	Key field identifying the analysis record.	varchar	7
ana_type	Code used for grouping data for reporting indicating the type of analysis (volatile, semivolatiles)	varchar	6
analysis		varchar	10
b_matrix	The sample matrix that was collected in a bottle.	varchar	1
comments		varchar	40
extracted		varchar	10
extraction		varchar	10
lab_code	Code for the laboratory.	varchar	6
method	The analytic method.	varchar	21
pay_item		varchar	10
priority		varchar	50
tumaround		varchar	10
val_cost	The cost for a single sample to be analyzed.	varchar	10

## Area (Area)

This table defines area codes and their descriptions used in spatial groups.

Field Name	Description	Data Type	Length
area	The name for a spatial area.	varchar	50
area_serial	Key field identifying an area record.	float	8
viewpoint	User specified code that will become the name of a spatial view.	varchar	10

## Area Spatial (Area\_spatial)

This table relates stations to areas.

Field Name	Description	Data Type	Length
area_serial	Key field identifying an area record.	float	8
spa_serial	Internal key for the spatial table.	float	8

## Lab Blanks (Blanks)

This table contains lab blank information.

Field Name	Description	Data Type	Length
blankid	The sample id for a blank.	varchar	20
blk_serial	Key field identifying the blank record.	intn	4
det_limit	The detection limit.	varchar	12
error	The error associated with the measurement.	varchar	12
labqual	Qualifier assigned by the laboratory.	varchar	6
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15
results	The blank result value.	varchar	12
sdg_num	The sdg number.	varchar	15
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1

## Chemical (Chemical)

This table contains the analytic results.

Field Name	Description	Data Type	Length
ana_type	Code used for grouping data for reporting indicating the type of analysis (volatile, semivolatiles)	varchar	6
chem_serial	Key field identified the chemical result record.	int	4
chemical	The chemical name.	varchar	50
cleared	Y/N value indicating that the record has been cleared for public use.	varchar	1
dataqual	The data validator's qualifier.	varchar	6
date_add	The date the record was added to the table.	datetime	4
date_mod	The date the record was modified.	datetime	4
det_lim	The detection limit.	floatn	8
dilution	The dilution factor.	numeric	9
error	The error associated with the measurement.	floatn	8
filtered	Y/N indicating if the result is filtered.	varchar	1
fld_serial	Fld_samp internal key used to identify each sample record.	intn	4
lab_serial	Internal key for the lab_samp table.	intn	4
labqual	Qualifier assigned by the laboratory.	varchar	6
ok_to_use	Y/N indicating a specific record should be used. Used to identify a single result that should be used when multiple analyses have been performed.	varchar	1
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15
qual	Qualifier assigned based on a review of the laboratory and data validation qualifiers. Used so that if not all data has been validated, only have a single field to test for detects.	varchar	6
rcvd_det_limit	The received detection limit.	floatn	8
rcvd_error	The received rad error.	floatn	8
rcvd_results	The received results.	floatn	8
rcvd_units	The received units for the analysis.	varchar	15
results	The chemical result value.	floatn	8
source_serial	The internal key for the source table.	intn	4
spa_serial	Internal key for the spatial table.	intn	4
trans_id		intn	4
units	The units for the analytic results.	varchar	15
val_code	Codes assigned during validation indicating why qualifiers were assigned.	varchar	20
validated	Y/N indicates if the sample was analyzed. Not always filled in.	varchar	1

## Field Samples (fld\_samp)

This table contains information about the samples that are planned or collected.

Field Name	Description	Data Type	Length
alt_id	An alternate sample id.	varchar	22
cleared	Y/N value indicating that the record has been cleared for public use.	varchar	1
collected	Y if the sample was collected.	varchar	1
comment	A comment about the sample collection.	varchar	50
date_add	The date the record was added to the table.	datetime	8
date_col	The date the sample was collected.	datetime	8
date_mod	The date the record was modified.	datetime	8
dep_unit	The depth unit the sample was collected. NA if not applicable.	varchar	2
esmp_dep	The ending depth of the sample.	floatn	8
fld_serial	Fld_samp internal key used to identify each sample record.	int	4
fsmp_typ	Code for the field sample type.	char	2
med_code	Code indicating the media the sample was collected from.	char	2
proj_code	Internal key for the project table indicating a specific project.	varchar	10
s_method	Code for the sampling method.	varchar	10
smp_id	The sample id.	varchar	15
source_serial	The internal key for the source table.	intn	4
spa_serial	Internal key for the spatial table.	int	4
ssmp_dep	The starting depth of the sample.	floatn	8
time_col	The time the sample was collected.	varchar	5
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1
version		intn	4

## Field Sample Type (Fsmp\_typ)

This table defines codes for the field sample type.

Field Name	Description	Data Type	Length
env_qc_dup	Indicates if the fsmp_typ is environmental, QC, or a duplicate.	varchar	3
fsmp_desc	Description of the field sample type code.	varchar	35
fsmp_typ	Code for the field sample type.	char	2

## Laboratory Analysis Information (lab\_samp)

This table contains laboratory information about the samples analysis.

Field Name	Description	Data Type	Length
ana_serial	Key field identifying the analysis record.	intn	4
ana_type	Code used for grouping data for reporting indicating the type of analysis (volatile, semivolatiles)	varchar	6
analevel	The EPA analysis level.	varchar	3
blk_serial	Key field identifying the blank record.	intn	4
date_ana	The date the sample was analyzed.	datetime	8
date_ext	The date the sample was extracted.	datetime	8
date_rec	The date the laboratory received the sample for analysis.	datetime	8
dilu_fac	The dilution factor.	floatn	8
ext_meth	The extraction method.	varchar	4
filtered	Y/N indicating if the result is filtered.	varchar	1
fld_serial	Fld_samp internal key used to identify each sample record.	intn	4
inst_num	The instrument number for the instrument the sample was analyzed on.	varchar	16
lab_code	Code for the laboratory.	varchar	6
lab_serial	Internal key for the lab_samp table.	int	4
labsmpid	Sample id assigned by the laboratory.	varchar	15
lcs_serial	Internal key for the LCS table.	intn	4
matrix	The matrix of the sample analyzed. Typically soil or water.	varchar	10
method	The analytic method.	varchar	21
pct_sol	The percent solids.	floatn	8
res_type	Code for the laboratory result type.	varchar	3
sdg_num	The sdg number.	varchar	15
sdg_rec	The date the SDG was received.	datetime	8
smp_ph	Sample pH.	floatn	8
time_ana	The time the sample was analyzed.	varchar	4
units	The units for the analytic results.	varchar	15
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1
version		intn	4
wgt_vol	The weight or volume of the sample when analyzed.	floatn	8
wv_unit	The units for wgt_vol field.	varchar	2

## LCS (Lcs)

This table contains lab control sample information.

Field Name	Description	Data Type	Length
lcs_serial	Internal key for the LCS table.	int	4
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15
recovery	The percent recovery.	numericn	6
sdg_num	The sdg number.	varchar	15
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1



## Matrix (Matrix)

This table defines the matrix codes.

Field Name	Description	Data Type	Length
b_matrix	The sample matrix that was collected in a bottle.	varchar	1
descript	Description of the matrix code.	varchar	35
matrix	The matrix of the sample analyzed. Typically soil or water.	varchar	10

## Analytic Method (Method)

This table defines the analytic method codes.

Field Name	Description	Data Type	Length
method	The analytic method.	varchar	21
method_desc	The title for the analytic method.	varchar	100

## MS (msdup)

This table contains matrix spike information.

Field Name	Description	Data Type	Length
datatype		varchar	1
fld_serial	Fld_samp internal key used to identify each sample record.	intn	4
lab_serial	Internal key for the lab_samp table.	intn	4
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15
rpd	The relative percent difference (RPD).	numericn	5
sq		varchar	12
sr		varchar	12
srq		varchar	5
ssr		varchar	12
ssrq		varchar	5
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1

## Parameter Group (par\_group)

This table defines all the parameter analysis groups (large subgroups) a chemical has been assigned.

Field Name	Description	Data Type	Length
ana_group	Code describing the type of chemical (Organic, inorganic, rad, etc)	varchar	1
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15
pg_serial	Internal key for the par_group table.	int	4

## Result Type (Res\_type)

This table defines the laboratory result type codes.

Field Name	Description	Data Type	Length
descript	Description of the res_type code.	varchar	35
res_type	Code for the laboratory result type.	varchar	5

## Spatial (Spatial)

This table defines the spatial information.

Field Name	Description	Data Type	Length
comments	A comment about the spatial location.	varchar	255
date_mod	The date the record was modified.	datetime	4
easting	The station's easting coordinate.	floatn	8
elevation	The station's ground surface elevation.	floatn	8
elevation_units	The units (ft, meters) that the elevation is in.	varchar	2
grid_system	Identifies the grid system for the coordinates	Varchar	10
northing	The station's northing coordinate.	floatn	8
source_serial	The internal key for the source table.	intn	4
spa_serial	Internal key for the spatial table.	int	4
spatial_source	Indication of how the coordinates were determined (survey, GPS, estimate, etc). This value implies the error associated with the measurements.	varchar	10
sta_desc	Description of the station.	varchar	50
sta_type	Code for the station type.	varchar	2
station	The name of the station.	varchar	50
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1

### Station Type (Sta\_type)

This table defines the station type codes.

Field Name	Description	Data Type	Length
descript	Description of the sta_type code.	varchar	35
sta_type	Code for the station type.	varchar	2

### Version (version)

Field Name	Description	Data Type	Length
description	Description of the version code.	varchar	100
version	Code	numeric	8

### Assoc. Blank Information (Blankass)

This table contains lab blank (child/detail) information.

Field Name	Description	Data Type	Length
blankid	The sample id for a blank.	varchar	10
blk_date	The date the blank was analyzed.	datetime	8
blk_serial	Key field identifying the blank record.	numeric	6
blk_time	The time the blank was analyzed.	varchar	4
sdg_num	The sdg number.	varchar	15

### Chem. Alias (ChemAlias)

This table is used to translate between the chemical names reported by the laboratory vs what is required in the database.

Field Name	Description	Data Type	Length
chemalias	The chemical name as reported by the laboratory.	varchar	60
chemalias_ser	Internal key for chemalias table.	int	4
lab_code	Code for the laboratory.	varchar	6
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15

### Container's Analyses (con\_ana)

This table defines the analyses required for a given container.

Field Name	Description	Data Type	Length
ana_serial	Key field identifying the analysis record.	varchar	10
con_serial	Internal key for the container table.	varchar	10

### Container Information (containr)

This table defines information about containers used to collect samples for analyses.

Field Name	Description	Data Type	Length
b_matrix	The sample matrix that was collected in a bottle.	varchar	1
bana_type	The bottle's analysis type.	varchar	6
con_serial	Internal key for the container table.	varchar	10
con_type	The container type used to collect samples for analysis.	varchar	20
con_unit	The units for the container's volume used to collect samples.	varchar	5
con_vol	The container's volume used to collect samples.	numeric	5
filtered	Y/N indicating if the result is filtered.	varchar	1
lab_code	Code for the laboratory.	varchar	6
label	The label indicating the analyses that will be performed on the sample in the bottle.	varchar	40
lot	The container's lot number. Used for prepopulating the database.	varchar	15
n_bottle	The number of containers that should be collected for an analysis.	numeric	5
preserv	The preservative used in a container.	varchar	17
proj_code	Internal key for the project table indicating a specific project.	varchar	10

### Laboratories (lab\_code)

This table defines codes and information about laboratories.

Field Name	Description	Data Type	Length
address	The address of the laboratory.	varchar	4
contact	The contact person for a laboratory.	varchar	30
descript	The laboratory name.	varchar	35
fax	The fax number for the laboratory.	varchar	14
lab_code	Code for the laboratory.	char	6
lab_desc	Description for the laboratory code. The name of the laboratory.	varchar	35
phone	Phone number for the laboratory contact.	char	14

## Lab Qual (labqual)

This table defines the qualifier codes assigned by the laboratory.

Field Name	Description	Data Type	Length
descript	Description of the lab qualifier code.	varchar	50
labqual	Qualifier assigned by the laboratory.	varchar	6

## LSC Assoc. Information (Lcsass)

This table contains additional lab control sample information (child/detail).

Field Name	Description	Data Type	Length
lcs_serial	Internal key for the LCS table.	int	4
source		varchar	25

## Media Code (Med\_code)

This table defines the media codes.

Field Name	Description	Data Type	Length
b_matrix	The sample matrix that was collected in a bottle.	varchar	1
matrix	The matrix of the sample analyzed. Typically soil or water.	varchar	10
med_code	Code indicating the media the sample was collected from.	char	2
med_desc	Description of the med_code.	varchar	35
med_group	Used to group med_codes into larger distinct media definitions (soil, groundwater, sediment).	varchar	50

## Laboratory Method Aliases (MethodAlias)

This table is used to translate between the methods reported by the laboratory vs what is required in the database.

Field Name	Description	Data Type	Length
lab_code	Code for the laboratory.	varchar	10
lab_method	Method code reported by the laboratory on the EDD.	varchar	21
ma_serial	Internal key for the methodalias table.	int	4
method	The analytic method.	varchar	21
proj_code	Internal key for the project table indicating a specific project.	varchar	10

## Surrogates (Mssur)

This table contains surrogate information.

Field Name	Description	Data Type	Length
datatype		varchar	1
fld_serial	Fld_samp internal key used to identify each sample record.	intn	4
lab_serial	Internal key for the lab_samp table.	intn	4
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15
recovery	The percent recovery.	numericn	6
verified	Y/N indicates if the results have been verified. Not always filled in.	varchar	1

## Parameter Analysis Types (par\_ana)

This table defines all analysis types used by a given chemical.

Field Name	Description	Data Type	Length
ana_type	Code used for grouping data for reporting indicating the type of analysis (volatile, semivolatiles)	varchar	6
pa_serial	Internal key for the par_ana table.	int	4
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15

## Parameter Codes (Par\_code)

This table defines the parameter codes. Parameter codes are usually CAS numbers. If not available, then OREIS parameter codes are used.

Field Name	Description	Data Type	Length
chemical	The chemical name.	varchar	60
label	Code for the parameter. Generally a CAS #. If CAS # is not available, use OREIS par_code.	varchar	20
par_code	Code for the parameter. Usually the CAS #. If not available use OREIS par_codes.	varchar	15

## Project (Project)

This table defines the projects in the database.

Field Name	Description	Data Type	Length
cnt	Internal use only.	varchar	6
contract	The contact person for a project.	varchar	30
contractor	The contractor performing the sample collection.	varchar	30
manager	The project manager.	varchar	30
phone_no	Phone number for the project's contact.	varchar	15
proj_code	Internal key for the project table indicating a specific project.	varchar	10
project	The project name.	varchar	50
projno	The project number.	varchar	10
site_loc	A name where the site is located (e.g., Oak Ridge, TN).	varchar	4
worksite	A name for the site.	varchar	4

## Requested Containers (Req\_con)

This table defines the containers and requirements that are planned to be collected for a sample.

Field Name	Description	Data Type	Length
bottle	The number of bottles that were shipped for analysis.	varchar	1
con_serial	Internal key for the containr table.	varchar	7
fid_serial	Fid_samp internal key used to identify each sample record.	numeric	6
lot	The container's lot number.	varchar	15
n_bottle	The number of containers that should be collected for an analysis.	numeric	3
proj_code	Internal key for the project table indicating a specific project.	varchar	10
rc_serial	Internal key for the req_con table.	varchar	7
status	Status of the analysis. Indicates if the sample was shipped, or if container somehow lost for analysis.	varchar	3

## Sampling Method (S\_method)

This table defines the sampling method codes.

Field Name	Description	Data Type	Length
descript	Description of the s_method code.	varchar	35
s_desc	Description of the s_method code.	varchar	35
s_method	Code for the sampling method.	varchar	2

### Source (Source)

This table defines the source data files that are loaded into the database.

Field Name	Description	Data Type	Length
data_source	Where did the data originate from. May refer to specific file that was loaded.	varchar	50
source_serial	The internal key for the source table.	numeric	8

### Viewpoint (viewpoint)

This table defines categories that will be used for views.

Field Name	Description	Data Type	Length
description	Description of the viewpoint.	varchar	100
viewpoint	User specified code that will become the name of a spatial view.	char	10



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**ATTACHMENT 2**

**LABORATORY ELECTRONIC DATA LOADING FILE  
SPECIFICATIONS**

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## SEIMS Electronic Data Loading Laboratory Measurement Data

This format is used to transfer analytical laboratory data to SEIMS.

The file should be a tab-delimited ASCII file with the following fields contained in the specified order. Ideally, the laboratory should fill in all the fields. If the field is marked as required ("Y"), then the field must have a valid value to be loaded. Required fields marked as Y\* usually must be filled in, but may be blank for certain reasons. See the definition/comments section for further information.

Fields without applicable values should be left blank instead of having some invalid code entered (e.g., "NA").

The file should not have a header row that identifies the field names.

The file name must include the sample delivery group (SDG) number but does not have to be the SDG number. For example, if multiple files were submitted for the same SDG, the file name could be the SDG number followed by a sequential number for each file in the SDG.

A file cannot contain more than one SDG; however, it may contain multiple analytical fractions for the same SDG.

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
1 A	Client Sample ID	15	The original client sample identification number. <i>*For laboratory QC samples, this field may be left empty or filled with a placeholder like "QC" or "NA" for LCSs and blanks. The original client sample ID should be used for MS, MSD, and SUR samples.</i>	Y*
2 B	Lab Sample ID	15	The laboratory's sample identification number.	Y
3 C	Date Received	10	The date the sample was received by the laboratory formatted as MM/DD/YYYY. Not required for QC samples.	Y*
4 D	Date Extracted	10	The date the sample was extracted formatted as MM/DD/YYYY. The extraction refers to any preparatory techniques such as extraction, digestion, and separation.	Y
5 A	Date Analyzed	10	The date the sample was analyzed formatted as MM/DD/YYYY.	Y
6 E	Time Analyzed	5	The time the sample was analyzed formatted as HH:MM.	
7 F	Matrix	5	The analytical matrix. Valid values are water, solid, or filter for filtered air samples.	Y
8 G	Method	21	The method requested by the client (e.g., SW846 8080). This should not be the laboratory procedure number.	Y
9 H	Method Batch	20	A group of samples with similar matrices analyzed by one method and treated as a group for QC purposes. Operationally, this batch associates sample-dependent QC such as duplicates and MSs within a group of samples.	
10 I	QC Result Type	5		Y

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
11 J	CAS Number	15	The CAS number for the analyte. Should be left blank if a CAS number is not available or if correct CAS number is not known.	Y*
12 K	Analyte Name	50	Chemical name for the analyte.	Y
13 L	Result	10	Reportable numeric result for the analyte.	Y
14 M	Units	15	The units for the result.	Y
15 N	Lab Qualifiers	5	The qualifier assigned by the laboratory. *Leave blank if no qualifier is applicable.	Y*
16 O	MDL or MDA	10	For nonrads, the method detection limit reported in the same units as the result. For rads, the minimum detectable amount for radiochemistry or method reported in the same units as the result.	Y
17 P	Counting Error	10	For rads this should be the 2 sigma error in the net count rate reported in the same units as the results. *Leave blank for nonrads.	Y*
18 Q	Dilution	10	The overall dilution of the sample aliquot. A value of 1 should correspond to nominal conditions for the method. Values less than 1 correspond to concentrations.	Y
19 R	Sample Weight	10	The weight or volume of the sample used for the analysis.	
20 S	Sample Weight Units	2	The units for the sample weight or volume. *Must be present if the sample weight is present.	Y*
21 T	Filtered/Unfiltered	1	Must have "F" if the sample was filtered, either by the laboratory or in the field.	Y*
22 U	Percent Solids	3	Percent solids represented as an integer amount (e.g., 25% = 25, not 0.25).	
23 V	Reporting Basis	3	A flag indicating the sample results have been corrected to a dry-weight basis. Any of the following will be interpreted as "Yes," corrected: "Y," "YES," "DRY" Any of the following will be interpreted as not corrected, processed on an "as received" reporting basis: "N," "NO," "WET."	
24 X	TIC Retention Time	10	Flag indicating the analyte is a TIC. Any value present in the field will mean the analyte should be interpreted as a TIC. Recommend using the TIC retention time.	Y*
25 Y	Surrogate or Tracer Flag	1	"Y" indicates the analyte is a surrogate compound or radioactive isotope. Blank field will be interpreted as "N."	Y*
26 Z	TCLP	1	"Y" or "T" indicates the analyte is for a TCLP extraction or reactivity analysis. Otherwise, leave blank or use "N."	Y*

CAS = Chemical Abstracts Service

LCS = laboratory control standard

MDA = minimum detectable amount

MDL = method detection limit

MS = matrix spike

MSD = matrix spike duplicate

SUR = surrogate spike

TCLP = Toxicity Characteristic Leaching Procedure

TIC = tentatively identified compound

**APPENDIX B**

**ELECTRONIC DATA DELIVERABLE FILE SPECIFICATIONS**

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## General Guidelines

All data collected to characterize the environmental conditions at RVAAP must be submitted to the RVAAP Information Manager at the conclusion of the project or at regular intervals specified by the site manager for ongoing monitoring projects.

Information that is best presented as drawings (such as boring logs and well construction logs) or on maps (such as geophysical data or UXO locations) should be submitted to the RVAAP Information Manager in electronic format. Drawings should be submitted in PDF format. Maps should be submitted in an ArcView compatible format. Map formats such as ESRI shape files, ArcInfo coverages, or AutoCad drawings (.DWG files) are acceptable. Electronic files containing the maps or drawings should be submitted on 3.5 inch diskettes or CDs.

Field and laboratory measurements of discrete media such as soil, sediment, surface water, groundwater, air, building materials, biological tissues, etc., must be submitted in a standardized electronic format, as described below. A standardized electronic format facilitates the storage, retrieval, and exchange of information.

Data must be submitted in tabular format (rows and columns). Each column is called a field. The name of each field and a description of its contents may be found in the tables below. Some fields are required and some are optional as indicated. If the field is marked as required ("Y"), then the field must have a valid value. Fields marked as Y\* are required conditionally as indicated in the field description. Fields that do not have values should be left blank.

Entries in each field should be limited to the maximum length indicated. Numeric fields indicated with an 'N' after the length should contain only numeric entries. Data qualifier fields and comment fields are available for annotation of results. Dates should be written in mm/dd/yyyy format. Time is represented in HH:MM format. Coded fields should include entries chosen from the attached codes tables. New codes may be added with the approval of the RVAAP Information Manager.

Tables should include a header line with the name of each field. Tables should be submitted on 3.5 inch diskettes or CDs in tab-delimited ASCII format.

Four different table formats are available for data submittal. The Station Table contains information that describes each location that was sampled. The Well Construction Table includes information on the location, depth, and type of well developed. The Sample Table includes measurements made on discrete samples. The Field Measurement Table includes information about measurements made directly in the environment. Data should be submitted using the appropriate table or tables.



Table B-1. Station Table

Field #/ Column	Field Name	Maximum Width/ Type	Definition/Comments	Required
1 A	Project Name	50	Name to describe sampling effort associated with the station.	Y
2 B	Station	50	The station name should be unique within a project, although it may be shared between projects.	Y
3 C	Functional Area	50	A name that describes the general area where the station is located. (For example: building number, stream name, pad number, etc.)	
4 D	Easting	14N	The numeric horizontal plane coordinate. *Required for any location that can be mapped at the RVAAP site.	Y*
5 E	Northing	14N	The numeric vertical plane coordinate. *Required for any location that can be mapped at the RVAAP site.	Y*
6 F	Grid Units	3	The measurement units for the coordinates (e.g., ft, m, yd). *Must be present if coordinates are present.	Y*
7 G	Grid System	15	Identifier for grid system. Geographic data should be in Ohio State Plane NAD83 meters.	
8 H	Coord Method	15	Method identifying how the coordinates were obtained (e.g., Global Positioning System, survey, estimated).	
9 I	Coord Accuracy	10N	Estimate of the accuracy of the coordinates in the units reported.	
10 J	Elevation	10N	The ground surface elevation for the station.	
11 K	Elevation Units	2	Units for measuring elevation (FT, M, etc.). *Must be present if the elevation is present.	Y*
12 L	Elevation Method	10	The method identifying how the elevation was determined (e.g., survey, estimate, contours).	
13 M	Elevation Accuracy	10N	Estimation of the elevation accuracy in the units reported.	
14 N	Station Type	20	The station type: well, borehole, surface, etc.	
15 O	Station Description	50	Additional information about the station.	
16 P	Comments	254	Any desired comments.	

Table B-2. Well Construction Table

Field #/ Column	Field Name	Maximum Width/ Type	Definition/Comments	Required
1 A	Project Name	50	Name to describe sampling effort associated the well development.	Y
2 B	Station	50	The station name should be unique within a project, although it may be shared between projects. This is the name that will be used to identify the well. Location information for the well must be in the Station Table.	Y
3 C	Functional Area	50	A name that describes the general area where the station is located. (For example: building number, stream name, pad number, etc.)	
4 D	Well Type	20	The well type: monitoring well, piezometer, recovery well, etc.	Y
5 E	Vertical RP	20	Vertical reference point (RP) for vertical measurements. For example, top of well casing, top of pad, ground surface, etc. *Required for monitoring wells.	Y*
6 F	RP Elevation	10N	Elevation of vertical reference point (RP). *Required for monitoring wells.	Y*
7 G	Elevation Units	5	Units for measuring elevation (FT, M, etc.). *Must be present if the elevation is present.	Y*
8 H	Elevation Method	10	The method identifying how the elevation was determined (e.g., survey, estimate, contours).	
9 I	Protective Casing Height	10N	Distance of highest point of well protective casing (outer casing) below RP. (Value is negative if above RP.)	
10 J	Well Casing Height	10N	Distance of highest point of well casing (inner casing) below RP. (Value is negative if above RP.)	
11 K	Total Depth	10	Distance from RP to bottom of well. *Required for monitoring wells.	Y*
12 L	Depth Units	5	Units for measurement of vertical distance (FT, M). *Required if depth or heights are reported.	Y*
13 M	Screen Top	10N	Distance from RP to screen top. *Required for screened monitoring wells.	Y*
14 N	Screen Bottom	10N	Distance from RP to screen bottom. *Required for screened monitoring wells.	Y*
15 O	Screen Material	20	Material of which screen is constructed (stainless steel, PVC, etc.) *Required for screened monitoring wells.	Y*
16 P	Diameter Units	5	Units for diameter measurements (IN, CM, FT, etc.).	Y
17 Q	Screen Diameter	10N	Inside diameter of screen. *Required for screened monitoring wells. (Use units from Diameter Units field.)	Y*
18 R	Screen Opening Size	10N	Screen slot size or opening size. (Use units from Diameter Units field.)	Y
19 S	Well Casing Material	20	The inner well casing/riser material (stainless steel, PVC, etc.). *Required for monitoring wells.	Y*
20 T	Well Casing Diameter	10N	Inside diameter of the inner well casing/riser. (Use units from Diameter Units field.)	Y
21 U	Protective Casing Material	20	Material of which the protective (outer) casing is constructed (stainless steel, PVC, etc.).	

Table B-2. Well Construction Table (continued)

Field #/ Column	Field Name	Maximum Width/ Type	Definition/Comments	Required
22 V	Protective Casing Diameter	10N	Inside diameter of protective casing.	
23 W	Borehole Diameter	10N	Diameter of well boring. (Use units from Diameter Units field.)	
24 X	Completion Date	10	Date of completion of the well (MM/DD/YYYY).	Y
25 Y	Date Abandoned	10	Date that well was plugged and abandoned (MM/DD/YYYY). *Required if well is plugged.	Y*
26 Z	Aquifer Zone	20	Name used to describe aquifer intercepted by screened interval. *Required for monitoring wells.	Y*
27 AA	Comments	254	Any desired comments.	

## Sample Table

This format is used to transfer information from sample analyses. It is meant to capture as much information as possible; however, it is recognized that not all fields may be relevant or available. Therefore, only a limited number of the fields are required. It is recognized that files in this format may be significantly empty. The format specification has been broken into subsections relating to the basic types of information.

The file should not contain laboratory quality control (QC) samples (e.g., method blanks, surrogates). It may contain field QC data such as field duplicates, results from split samples, trip blanks, and equipment rinsates.

Field names marked with an asterisk are coded fields. Codes for these fields should be chosen from the attached codes table. Codes may be added with the approval of the RVAAP Data Manager.

Table B-3. Sample Table

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
Links to Station Coordinate File				
1 A	Project Name	50	Identifies sampling effort associated with the data.	Y
2 B	Station	50	The station name should be unique within a project, although it may be shared between projects.	Y
3 C	Sample Group	50	A name used to group samples into related subsets. For example: 'LL-x Random Grid Samples', 'Waste Characterization Samples', 'Bldg. x Exposure Characterization'.	
Field Sample Information				
4 D	Client Sample ID	22	The client's sample identification number. This sample ID should follow the USACE Nashville District conventions (attached).	Y
5 E	Alternate Sample ID	15	A shorter sample ID used if needed to facilitate field recording and processing by laboratory information management systems.	
6 F	Date Collected	10	The date the sample was collected. Should be reported as MM/DD/YYYY. If reported as MM/DD/YY, the year will be interpreted as 20YY.	
7 G	Time Collected	5	The time the sample was collected in HH:MM format.	
8 H	Field Sample Type*	10	The sample type: regular, field duplicate, trip blank, split, source blank, etc.	Y
9 I	Sampling Method*	20	The sampling method: grab, grab composite, flow composite, etc.	
10 J	Starting Depth	8N	The beginning depth (smaller number) for the sampling interval. For soil samples, this is the depth below ground surface. For groundwater samples, this may be used to indicate the top of the screened interval.	
11 K	Ending Depth	8N	The ending depth (larger number) for the sampling interval. For soil samples, this is the depth below ground surface. For groundwater samples, this may be used to indicate the bottom of the screened interval.	

Table B-3. Sample Table (continued)

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
12 L	Depth Units*	5	The measurement units for the sampling interval. *Must be present if depth interval is specified.	Y*
13 M	Media*	15	The medium from which the sample was collected (e.g., soil, groundwater).	Y
14 N	Sampling Device*	20	The sampling device used to collect the sample (e.g., auger, bailer, bucket, split spoon).	
15 O	Comment	50	Short comment about the sample.	
Laboratory Method				
16 P	Laboratory	50	The laboratory performing the analysis.	
17 Q	Matrix*	10	Code for the analytical matrix. Valid values are solid, water, biota, air.	
18 R	Analysis Type*	20	Code or description for the type of analysis (organic, inorganic, rad, pesticide, TCLP).	
19 S	Method*	21	Analysis method identification reported as the method number from the statement of work (e.g., SW846-6010).	
20 T	SDG Number	15	The sample delivery group number assigned by the laboratory.	
21 U	Lab Sample ID	15	The laboratory sample ID.	
22 V	Date Received	10	The date the sample was received by the laboratory. Format as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.	
23 W	Date Extracted	10	The date the sample was extracted or prepared by the laboratory. Format as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.	
24 X	Date Analyzed	10	The date the sample was analyzed by the laboratory. Format as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.	
25 Y	Percent Solids	8N	The percent solids for the sample. Represented as a percentage (25% = 25, not 0.25).	
26 Z	Sample Weight or Volume	8N	The sample weight for solid samples or volume for liquid samples.	
27 AA	Weight Units	5	The units associated with the sample weight. *Must be present if weight or volume is present.	Y*
28 AB	Reported Basis*	5	A flag indicating basis of reported concentration: "DRY"=concentration corrected to dry weight; "WET"=concentration reported on an "as received" reporting basis.	
29 AC	Analysis Level	4	EPA-specified analysis level (e.g. 'LOW', 'MED').	
Analytical Results				
30 AD	Result Type*	5	Flag to indicate if a result is a regular sample (REG) or a secondary or QC result.	Y
31 AE	CAS Number	15	The CAS number for the analyte. Leave blank if unknown or uncertain.	
32 AF	Chemical	50	The chemical or analyte name.	Y

Table B-3. Sample Table (continued)

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
33 AG	Result	15N	Reportable numeric result for the analyte.	Y
34 AH	Units	15	Units for the result.	Y
35 AI	MDL	15N	Method detection limit for chemicals or minimum detectable activity for radionuclides reported in the same units as the result.	
36 AJ	SQL	15	Sample quantitation limit reported in the same units as the result.	
37 AK	Counting Error	15N	The 2 sigma counting error for radionuclide analyses reported in the same units as the result. *Required for when radionuclide results are reported.	Y*
38 AL	Dilution	8N	The overall dilution of the sample aliquot as a factor of the initial sample size. A value of 1 should correspond to nominal conditions for the method. Values less than 1 correspond to concentrations. Blank will be interpreted as 1.	
39 AM	Lab Qualifier	6	The laboratory qualifier originally assigned to the result by laboratory. *Blank is a valid value; hence, the data should contain laboratory qualifiers, but the field may correctly be blank.	Y*
40 AN	Data Qualifier	6	The qualifier assigned based on data validation. This qualifier should be one of the following: J, UJ, U, R, =. The "=" indicates that the sample was detected at the concentration reported.	
41 AO	Validated	1	Flag indicating if the data were validated ("Y/N"). Blank means "N."	
42 AP	Val Code	20	List of codes identifying why data qualifiers were applied. Separate documentation should contain definitions of codes.	
43 AQ	Filtered/Unfiltered	1	*F = Sample filtered in the field or at the laboratory. U or blank means sample was not filtered.	Y*
44 AR	TCLP	1	*T=TCLP (Toxicity Characteristic Leaching Procedure) or extractable/reactivity analysis. Blank means sample is not a TCLP/reactivity analysis. Used to differentiate between analyses that may have been performed with the same method.	Y*
45 AS	TIC Retention Time	10	Any value present indicates the analyte is a TIC (tentatively identified compound). *Value may be numeral or character.	Y*

Table B-4. Field Measurement Table

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
1 A	Project Name	50	Identifies sampling effort associated with the data.	Y
2 B	Station	50	The station name should be unique within a project, although it may be shared between projects. If the spa_serial is available, it will be used to determine the appropriate spatial table record instead of the station name.	Y
3 C	Client Sample ID	22	*If the measurement is associated with sample collection, this should refer to the related sample ID.	Y*
4 D	Alternate Sample ID	15	A shorter sample ID used if needed to facilitate field recording and processing by field information management systems.	
5 E	Date Collected	10	Date the measurement was collected and formatted as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.	Y
6 F	Time Collected	5	The time the measurement was made in HH:MM format.	
7 G	Measurement Name	50	The measurement that was performed (e.g., turbidity, conductivity, depth to water).	Y
8 H	CAS Number	15	CAS number is the measurement of a chemical concentration.	
9 I	Result	15N	The numeric value for the measurement.	Y
10 J	Units	15	The units for the measurement.	Y
11 K	Detection Limit	15N	Detection limit reported in the same units as the result.	
12 L	Result Qualifier	6	Indicates qualifications on the result such as less than detection limit or off-scale. *Blank is a valid entry indicating no qualification.	Y*
13 M	Validation Qualifier	6	Indicates qualification of result based on QC review.	
14 N	Method	21	The method number or instrument name used for making the measurement.	
15 O	Comment	50	Comment on measurement.	

Table B-5. Codes Table

Code	Description
<b>Field Sample Type</b>	
REG	Regular
FB	Field Blank
FD	Field Duplicate
ER	Equipment Rinsate
TB	Trip Blank
AB	Ambient Blank
BB	Bottle Blank
PE	Performance Evaluation
SP	Split Sample
SB	Source Water Blank
WW	Waste Water
<b>Sampling Method</b>	
GC	Grab Composite
GR	Grab
SC	Spatial Composite
TC	Temporal Composite
FC	Flow Composite
WP	Wipe
<b>Depth Units</b>	
FT	feet
M	meters
IN	inches
CM	centimeters
<b>Media</b>	
GW	groundwater
GF	filtered groundwater
SS	surface soil
SO	subsurface soil
SW	surface water
SD	sediment
PR	free product
SP	seep/spring
QC	QC sample defined by sample type
SR	storm water
VG	vegetation
<b>Sampling Device</b>	
CN	Air canister
AP	Pump, air lift
B	Bailer
AC	Auger, continuous flight



Table B-5. Codes Table (continued)

Code	Description
PC	Pump, centrifugal
DP	Dipper
AO	Auger, hollow stem
AH	Auger, hand
KS	Kemmerer Sampler
PI	Pump, piston
PP	Pump, peristaltic
PL	Pump, suction lift
PS	Pump, submersible
SS	Split spoon
W	Swab or Wipe
NA	Not Applicable
SV	Shovel
TR	Trowel
SC	Scoop
CS	Clam shell
blank	Unknown
GP	Geoprobe
BP	Pump, bladder
HP	Hydropunch
BO	Bottle
<b>Matrix</b>	
WATER	Water
SOIL	Solid
GAS	Gas
BIOTA	biological tissue
<b>Analysis Type</b>	
ANALK	Alkalinity
ANION	Common Anions
BACTER	Bacteria
EPTOX	EP TOX Leachate
FIELD	Field Measurements
FLDGC	Field GC
FLDEX	Field explosives
GEOTEC	Geotechnical
INORG	Metals
MISC	Miscellaneous
ORDIOX	Dioxins/Dibenzofurans
OREXP	Explosives
ORHERB	Herbicides
ORPETH	Petroleum Hydrocarbons including diesel, oil, grease, gasoline
ORPPB	Pesticides and/or PCBs
ORSVO	Semi-Volatile Organics

Table B-5. Codes Table (continued)

<b>Code</b>	<b>Description</b>
ORTOC	Total Organic Carbon (TOC)
ORVOA	Volatile Organics
RAD	Radiological
TCLPHB	TCLP Herbicides
TCLPIN	TCLP Metals
TCLPPP	TCLP Pesticides and/or PCBs
TCLPR	TCLP Reactivity, Corrosivity
TCLPSV	TCLP Semi-Volatiles
TCLPVO	TCLP Volatiles
2320B	Bicarbonate, Carbonate
2340B	Hardness
9215-C	Standard Plate Count Standard Method 9215-C
ASTM	% Moisture
ASTM D1429	ASTM D1429
ASTM D2216	Ash Content
ASTM D240-76	BTU Content
ASTM D240-87	BTU
ASTM D2974	ASTM D2974
ASTM D422	Hydrometer Analysis/Mechanical Grain Size Analys
ASTM D-425	ASTM D-425
ASTM D-508	ASTM D-508
ASTMD2460-70	Radium-226
ASTMD2974-87	ASTMD2974-87
CLP 200.7	Metals by ICP, CLP Method 200.7
CLP 204.2	Antimony by Graphite Furnace, CLP Method 204.2
CLP 206.2	Arsenic by Graphite Furnace, CLP Method 206.2
CLP 210.2	Beryllium by Graphite Furnace, CLP Method 210.2
CLP 213.2	Cadmium by Graphite Furnace, CLP Method 213.2
CLP 218.2	Chromium by Graphite Furnace, CLP Method 218.2
CLP 239.2	Lead by Graphite Furnace, CLP Method 239.2
CLP 245.1	Mercury
CLP 245.2	Mercury in Water by Automated Cold Vapor, CLP Method 245.2
CLP 245.5	Mercury in Soil by Manual Cold Vapor, CLP Method 245.5
CLP 270.2	Selenium by Graphite Furnace, CLP Method 270.2
CLP 272.2	Silver by Graphite Furnace, CLP Method 272.2
CLP 279.2	Thallium by Graphite Furnace, CLP Method 272.2
CLP 335.2	Cyanide by one of the CLP Methods
CLPHG	Mercury by CLP Method
CLP-ILM3.0	EPA CLP Inorganic Method, Version 3.0
CLPMET	Metals by CLP Method
CLPPCB	Pesticides/PCBs by CLP Method
CLPSOW	Unknown CLP Method
CLPSVO	Semi-Volatiles by CLP Method
CLPVOA	Volatiles by CLP Method
DOEE-Pu-06	DOEE-Pu-06

Table B-5. Codes Table (continued)

Code	Description
EML AM-01	Americium-241
EPA 120.1	Conductivity
EPA 150.1	pH
EPA 160.1	Total Dissolved Solids
EPA 160.1	Total Suspended Solids (TSS)
EPA 160.2	Total Suspended Solids
EPA 1664	TPH
EPA 200.7	Metals by ICP, Method 200.7
EPA 204.2	Antimony by Graphite Furnace, Method 204.2
EPA 206.2	Arsenic by Graphite Furnace, Method 206.2
EPA 239.2	Lead by Graphite Furnace, Method 239.2
EPA 245.1	Mercury
EPA 245.5	Mercury in Soil by Manual Cold Vapor, Method 245.5
EPA 270.2	Selenium by Graphite Furnace, Method 270.2
EPA 279.2	Thallium by Graphite Furnace, Method 272.2
EPA 300.0	Anions by ion chromatography
EPA 310.1	Alkalinity by Titrimetric (ph 4.5), CAWW Method 310.1
EPA 310.2	Alkalinity
EPA 325.1	Chloride by Colorimetric Automated Ferricyanide AA I, CAWW Method 325.1
EPA 325.2	Chloride by Colorimetric Automated Ferricyanide AA II, CAWW Method 325.2
EPA 325.3	Chloride by Titrimetric Mercuric Nitrate , CAWW Method 325.3
EPA 335.2	Cyanide
EPA 335.3	Cyanide, total
EPA 340.2	Fluoride by Potentiometric SIE, CAWW Method 340.2
EPA 350.1	Ammonia
EPA 350.2	Ammonia
EPA 350.3	Ammonia
EPA 351.2	Total Nitrogen
EPA 351.3	Nitrogen, CAWW Method
EPA 352.3	Nitrate-Nitrite
EPA 353.1	Nitrate/Nitrite
EPA 353.2	Nitrate-Nitrite by Colorimetric Manual Cadmium Reduction, CAWW Method 353.2
EPA 354.1	Nitrite by Spectrophometric, CAWW 354.1
EPA 365.1	EPA 365.1
EPA 365.2	Total Phosphorous
EPA 365.3	Total Phosphorous
EPA 365.4	Total Phosphorous
EPA 375.2	Sulfate by Colorimetric Automated Methyl Thymol Blue AA II, CAWW Method 375.2
EPA 375.4	Sulfate by Turbidimetric, CAWW Method 375.4
EPA 376.2	Sulfide
EPA 405.1	Biochemical Oxygen Demand

Table B-5. Codes Table (continued)

Code	Description
EPA 405.1	Biological Oxygen Demand (BOD)
EPA 410.4	Chemical Oxygen Demand (COD)
EPA 413.1	OIL & GREASE
EPA 415.1	Total Organic Carbon by Combustion or Oxidation, CAWW Method 415.1
EPA 415.2	Total Organic Carbon by UV Prokmotion and Persulfate Oxidation, CAWW Method 415.2
EPA 418.1	Total Recoverable Petroleum Hydrocarbons, CAWW Method 418.1
EPA 420	Phenols, Total
EPA 420.2	Phenols, Total
EPA 900	Gross Alpha and Gross Beta Radioactiviey, Method 900
EPA 901.0	Radioactive Cesium, Method 901
EPA 901.1	EPA 901.1
EPA 903	Alpha-Emitting Radium Isotopes, Method 903
EPA 903.1	EPA 903.1
EPA 904.0	EPA 904.0
EPA 905	Radioactive Strontium, Method 905
EPA 905.1	EPA 905.1
EPA 906.0	Tritium, Method 906
EPA 906.1	Tritium, Method 906
EPA 907.0	EPA 907.0
EPA 9070	OIL & GREASE
EPA 9071	OIL & GREASE
EPA 908.0	Uranium by Radiochemical, Method 908
ESM430	ESM430
E-TC-01	Technetium-99
FLD GC	Field GC
HASL 300	Unknown HASL 300 Method
MADEP	MADEP VPH & MADEP EPH
NAS 1960	Thorium Isotopes / Strontium-90
NAS 1962	Uranium Isotopes
NAS 1965	Plutonium Isotopes
NDI 1986	NDI 1986
NDI1986	Gamma Spectrometry
ORPPB	ORPPB
SM18TH 254	Ash Content
SM4500 D	Carbon Dioxide
SW846 1311	TCLP (VOC, SVOC, Pest, Herb, Metals)
SW846 3810	Methane, ethane, ethene
SW846 6010	Metals
SW846 6020	Metals for ICP-MS
SW846 7070	Mercury
SW846 7131	Cadmium
SW846 7196	Hexavalent chromium
SW846 7470	Mercury in water by SW846 7470

Table B-5. Codes Table (continued)

Code	Description
SW846 7471	Mercury in soil by SW846 7471
SW846 7740	Selenium
SW846 7841	Thallium by SW846 7841
SW846 8010	Halogenated Volatile Organics, SW846 Method 8010
SW846 8015 M	Diesel/Gasoline Range Organics SW846 8015 Mod
SW846 801M	Diesel/Gasoline Range Organics SW846 8015 Mod
SW846 8020	Volatile Organics SW846 Method 8020
SW846 8021	Volatile Organics by Purge & Trap GC/PID, SW846 Method 8021
SW846 8030	Acrolein, Acrylonitrile, Acetonitrile
SW846 8080	Organochlorine Pesticides/PCBs, SW846 Method 8080
SW846 8081	Pesticides/PCBs
SW846 8082	Pesticides/PCBs
SW846 8100M	Diesel/Gasoline Range Organics SW846 8100 Mod
SW846 8120	Chlorinated Hydrocarbons, SW846 Method 8120
SW846 8151	Herbicides by SW846 8151
SW846 8240	Volatiles by GC/MS, SW846 Method 8240
SW846 8260	Volatiles
SW846 8260A	SW846 8260A
SW846 8270	Semi-Volatiles by GC/MS Capillary Column, SW846 Method 8270
SW846 8270B	Semi-Volatiles by GC/MS Capillary Column, SW846 Method 8270B
SW846 8280	Polychlorinated Dibenzo-p-Dioxins/Dibenzofurans, SW846 Method 8280
SW846 8290	SW846 8290
SW846 8330	Explosives
SW846 8460	SW846 8460
SW846 9010	Cyanide by SW846 9010
SW846 9012	Cyanide by SW846 9012
SW846 9013	Cyanide by SW846 9013
SW846 9020	TOX, Method 9020
SW846 9036	Sulfate by Colorimetric Automated Methyl Thymol Blue AA II, SW846 Method 9036
SW846 9045	pH
SW846 9056	Anions (Cl, F, NO <sub>3</sub> , NO <sub>2</sub> , SO <sub>4</sub> , PO <sub>4</sub> ) SW846 Method 9036
SW846 9060	Total Organic Carbon (TOC)
SW846 9060 M	Total Organic Carbon (TOC), Method SW846 9060 Modified
SW846 9065	Phenols
SW846 9073	Total Petroleum Hydrocarbons, Method 9073
SW846 9081	SW846 9081
SW846 9250	Chloride by Colorimetric Automated Ferricyanide AA I, SW846 Method 9250
TDMS	TDMS
UNKNOWN	Unknown method

Table B-5. Codes Table (continued)

Code	Description
<b>Reported Basis</b>	
DRY	result value corrected to dry weight of sample
WET	result value reported on sample weight as received
<b>Result Type</b>	
REG	regular sample result
REA	reanalysis
REO	result before reanalysis
REDILO	dilution
FLD	field analysis
MS	matrix spike
MSD	matrix spike duplicate
SUR	surrogate result
LCS	laboratory control sample
BLK	laboratory blank

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