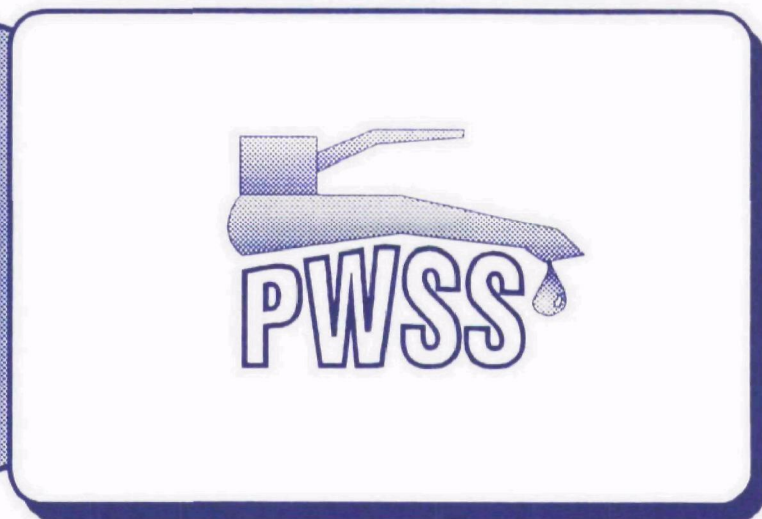
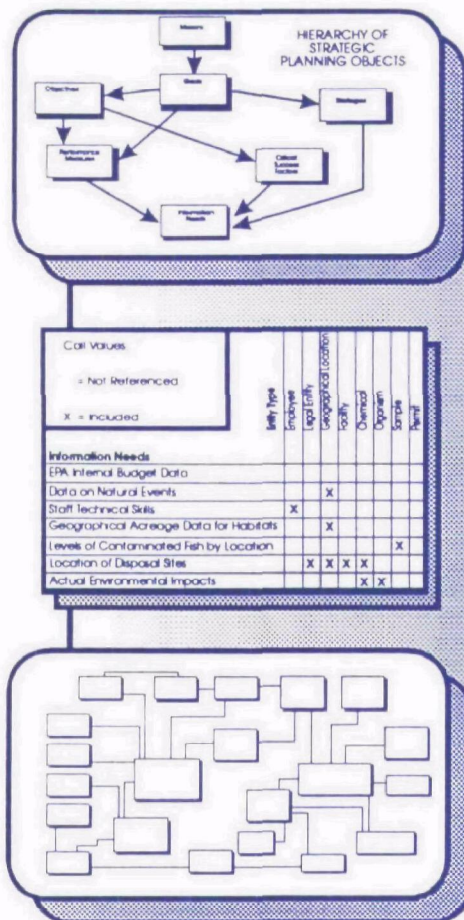




Public Water System Supervision Information Strategy Plan

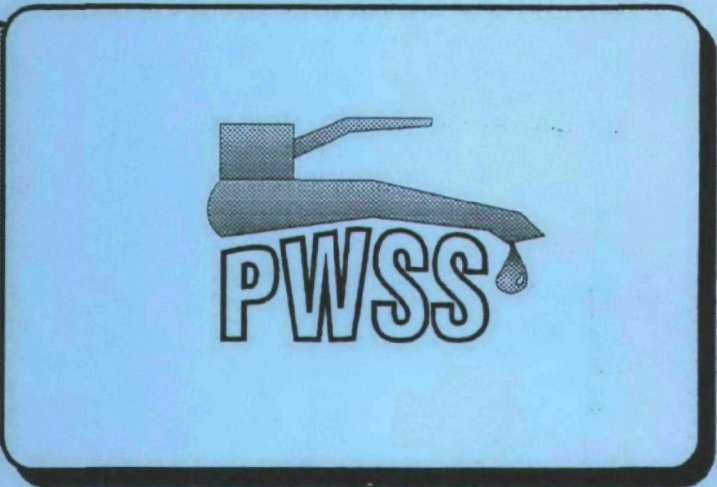
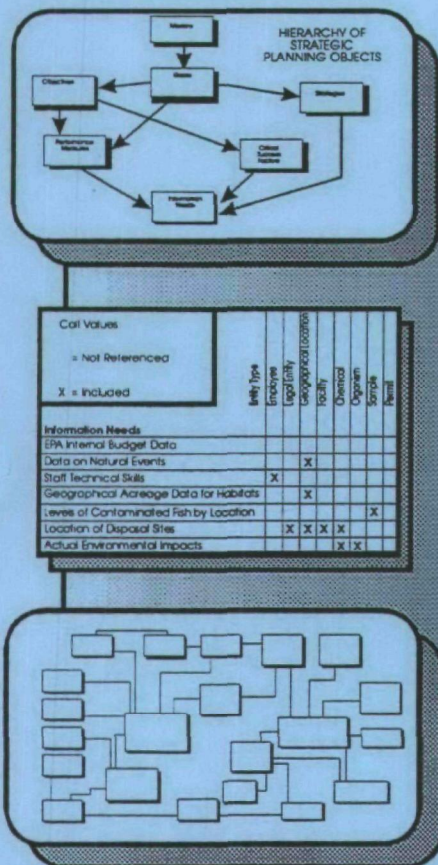


Contract No. 68-W1-0055
Delivery Order No. 012
Document No. SDC-0055-012-TB-2009

December 31, 1992



Public Water System Supervision Information Strategy Plan



Contract No. 68-W1-0055
Delivery Order No. 012
Document No. SDC-0055-012-TB-2009

December 31, 1992

Public Water System Supervision Information Strategy Plan

Contents

Chapter 1 Introduction

Chapter 2 Information Architecture

Chapter 3 Business Systems Architecture

Chapter 4 Technical Architecture

Chapter 5 Analysis of Information Strategies

Appendices

- A Information Engineering Methodology (IEM_{TM}) Overview**
- B Current Technical Environment**
- C JRP Participants List**
- D Strategies Supported by Information Needs**
- E Critical Success Factors Supported by Information Needs**
- F Objectives Supported by Information Needs**
- G Information Needs and Associated Descriptions**
- H Entity Types with Descriptions**
- I Entity-Relationship Diagram**
- J Function Hierarchy Diagram with Descriptions**

K	Function Supports Organizational Unit
L	Concerns with the Current Environment
M	Entity Type Supported by Current Data Store
N	Entity Type Satisfies Information Need
O	Information Need is for Organizational Unit
P	Function Supported by Current Information System
Q	Current Data Store Used by Current Information Systems
R	Organizational Unit Uses Current Information System
S	Business Function by Entity Type Usage
T	Business System by Business Function
U	Data Store by Entity Type
V	Business Area by Natural Data Store
W	Business Area by Entity Type
X	Business Area by Business System
Y	Business Area by Business Function
Z	System to System Category
AA	Business System by User
BB	Technical Architecture Working Group Participants List
CC	Entity Type by User
DD	Communications Feasibility Analysis
EE	Data Store by User

Chapter 1

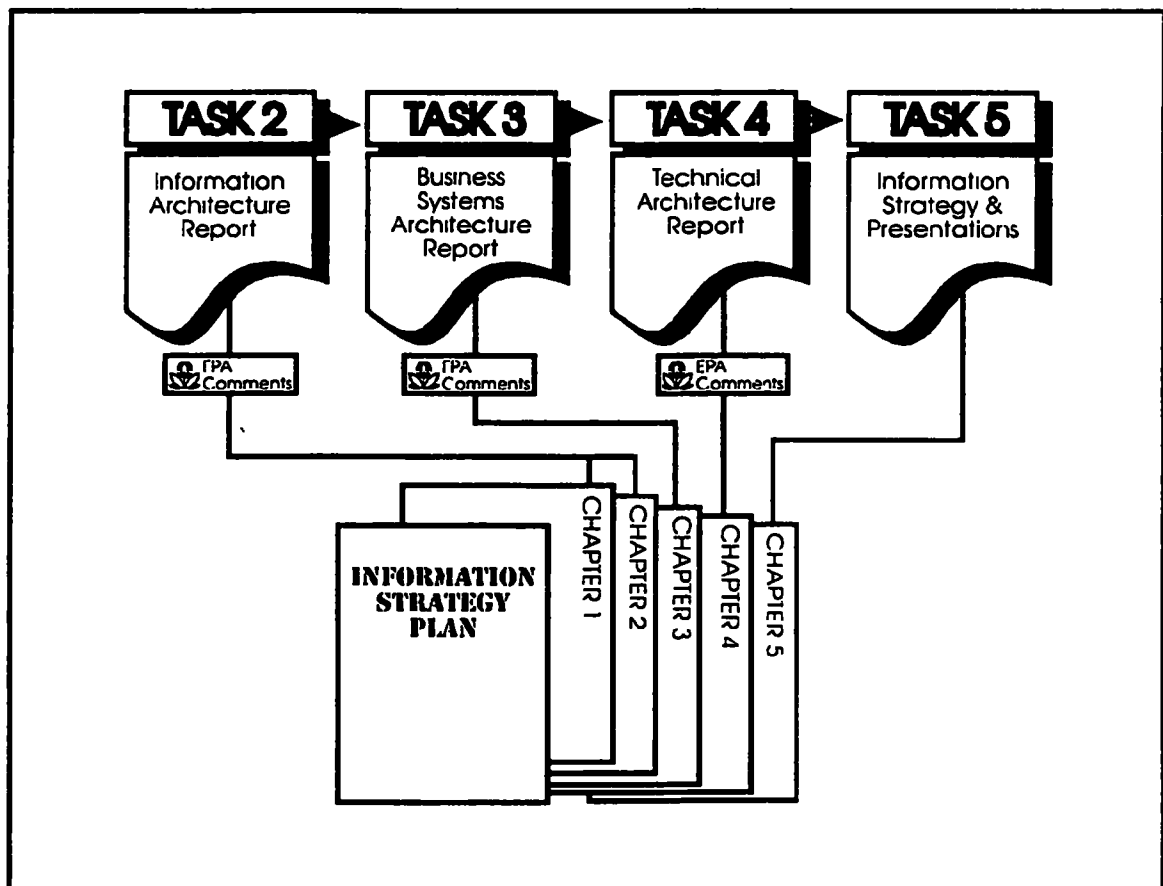
Introduction

Introduction to this Report

The Public Water System Supervision (PWSS) Information Architecture Report, was published in a series of four draft reports. The four reports were:

- Task 2 - Draft Information Architecture Report
- Task 3 - Draft Business Systems Architecture Report
- Task 4 - Draft Technical Architecture Report
- Task 5 - Draft Information Strategy Report

This Report, The Information Strategy Plan Final Report, integrates the four interim reports and incorporates all EPA comments on the three reports listed above. The graphic below depicts the stages of development of the Information Strategy Plan Final Report.



Introduction to the ISP Effort

The United States Environmental Protection Agency (EPA) Office of Ground Water and Drinking Water (OGWDW) is responsible for the implementation of the Public Water System Supervision (PWSS) Program. In an effort to improve the quality and utilization of PWSS data and to assess the information needed to manage program implementation, the OGWDW has established the PWSS Information System Modernization (ISM) Project. The PWSS project goals are:

- Provide blueprints for future PWSS ISM projects;
- Provide a means to tie systems to information needs;
- Improve the quality of data;
- Provide for the collection of essential data required to satisfy PWSS goals and objectives; and
- Provide flexibility in responding to State and EPA needs.

In order to satisfy the project goals, a strategy has been developed to use the Information Engineering Methodology (IEMTM) to guide development of components of the PWSS ISM over the next few years. The first step of the IEMTM is the development of an Information Strategy Plan (ISP). The ISP documents the information strategy and details the architectures for the enterprise. The IEMTM is embodied in a computer aided software engineering (CASE) tool known as the Texas Instruments Information Engineering Facility (IEFTM), which was selected to support the analysis and development of a PWSS Information Strategy Plan.

The Information Strategy Plan Report presents the findings of a high level analysis of the PWSS Program policies and strategies, and the Information Architecture developed for the PWSS Program.

The reader should note that this plan describes the information needs and presents a comprehensive model for State and Federal implementation of activities related to Public Water System Supervision. This comprehensive model provides the framework for development of information systems supporting high priority information needs and functions. However, the specification of a function or information need does not mean that the specific function or need will be implemented within the resulting PWSS information systems. Some functions will continue to be supported by existing State or Federal systems; other functions will continue to be supported by manual systems; and other functions will be selected for implementation by the PWSS Information System Modernization, (ISM) Project.

Scope of the ISP Project

The scope of the PWSS Information Strategy Plan (ISP) is to support the development of information systems to accomplish the mission and goals of the PWSS ISM project. This support focuses on implementing the operational aspects of the program at the Primacy Agency level as well as supporting National level oversight and enforcement of the program. The implementation of the PWSS ISM project places emphasis on responding to information needs and performing functions necessary to achieve success.

The five key products of the PWSS ISP are shown on the right. This report documents the results of the analysis of strategies and policies and presents the Information Architecture. Appendix A provides an overview of the Information Engineering Methodology (IEM™) used to develop the ISP. Appendix B presents an analysis of the current technical environment.

-
- Analysis of Business Strategies and Policies
 - Information Architecture
 - Business Systems Architecture
 - Technical Architecture
 - Analysis of Information Strategies
-

Goal of the ISP Project

The goal of the PWSS ISP project is to provide a framework for systems development and to develop an Information Strategy to satisfy program needs.

ISP Key Products

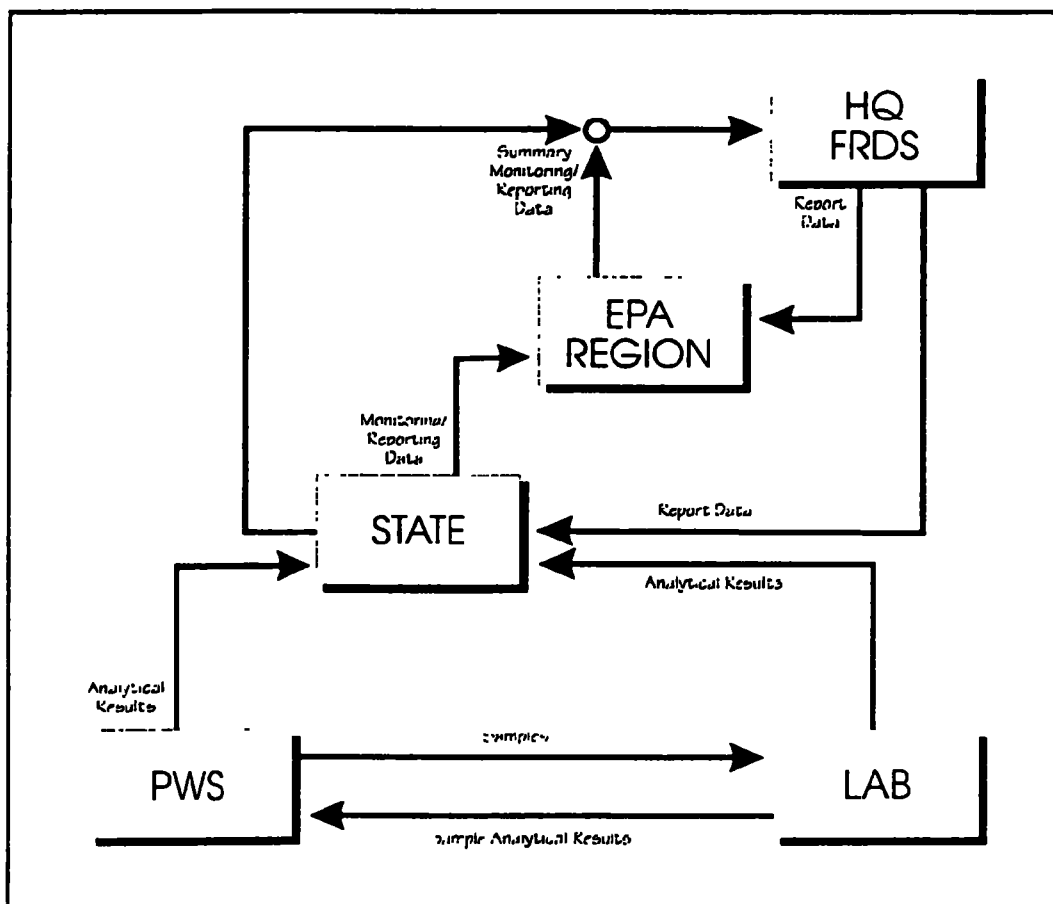
The following strategies support this broad project goal:

- Develop the preliminary information architecture based on analysis of the business strategies and policies,
- Verify and prioritize the information needs required to achieve the business strategy,
- Define the Information Architecture, Business Systems Architecture, and Technical Architecture, and
- Develop an Information Strategy to implement the architectures

Public Water System Supervision (PWSS) Program Background

The EPA Office of Ground Water and Drinking Water (OGWDW) is responsible for the implementation of the PWSS program established under the auspices of the Safe Drinking Water Act (SDWA). Two of OGWDW's major responsibilities under the SDWA are to set National standards for drinking water quality and to ensure that the States that have been delegated primary enforcement responsibility (primacy) are complying with these standards.

Primacy Agencies use a variety of state developed and maintained data systems and periodically report a subset of their inventories and exceptional events to EPA regional offices. The EPA regions are responsible for assuring that all the required primacy agency data are entered into OGWDW's national information system, the Federal Reporting Data System (FRDS). The flow of data into FRDS is graphically depicted below.



Today, the FRDS database and computer system continues to support most of OGWDW's management and oversight requirements. However, increased demands are being placed upon it as a result of the 1986 amendments to the SDWA, and the new regulations (e.g., Surface Water Treatment Rule, Lead and Copper Rule) that have recently been promulgated. The burden placed upon State data management systems has become increasingly onerous as States attempt to incorporate all these new rules into their systems during a time of significant fiscal difficulties.

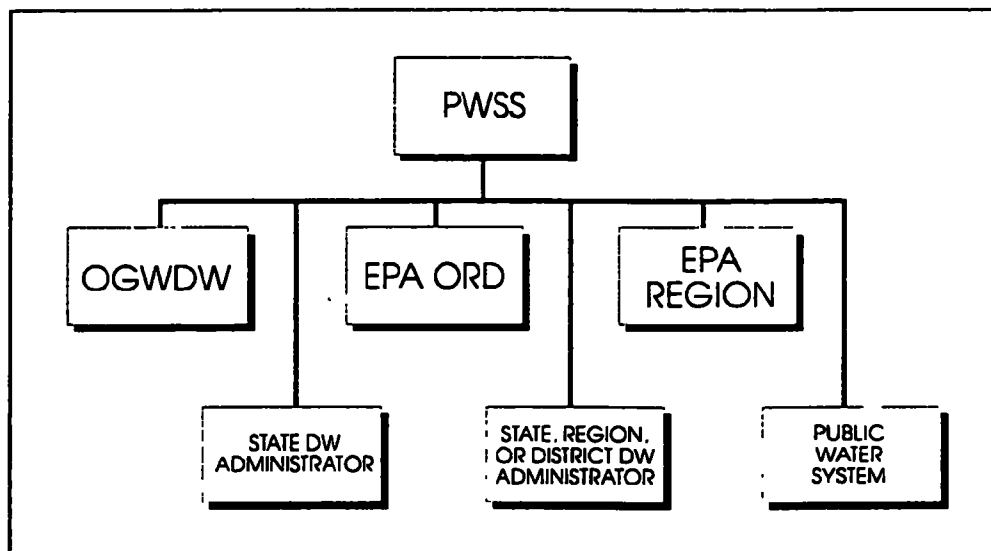
OGWDW recently produced a Mission Needs Analysis (MNA) to re-evaluate the management information requirements for EPA's management of the PWSS program. The results of that effort, coupled with priority changes of OGWDW's senior management, have necessitated a re-evaluation of OGWDW's entire information management philosophy for the PWSS program.

The MNA recommended the design and implementation of a national system. The primary portion, would be operated from EPA's National Computer Center (NCC), but would be flexible enough to accommodate states' varying requirements. This would enable EPA to address some of the most important data quality, timeliness, and completeness problems by working closely with the states. This would also enable EPA regional office access to better use of drinking water information.

Mission and Membership

The mission of the Public Water System Supervision Program is to provide an adequate quantity of safe drinking water. The program is comprised of States, U.S. territories, and Indian tribes. Currently 49 States have primacy; Wyoming and the District of Columbia do not have primacy. US territories and Indian tribes also do not currently have primacy.

The high level PWSS program organizational structure is represented by the following diagram.



ISP Participants

One executive interview and two Joint Requirements Planning (JRP) sessions were conducted during the information gathering process for this ISP. During the course of these sessions, approximately 43 subject matter experts representing 27 organizations have provided input. A listing of individual participants is contained in Appendix C. Organizations that have directly participated in this effort are listed below.

- Alaska Environmental Conservation
- Arizona Department of Environmental Quality
- California DOHG, ODW
- Georgia EPA
- Illinois EPA
- Kansas DHE
- Kentucky NREPC
- Marasco Newton Group, LTD
- Missouri Department of Natural Resources
- North Carolina Public Water Supply
- OGWDW/TSD/Cincinnati
- Oregon Health Division
- Pennsylvania Department of Environmental Resources
- South Carolina DHEC
- Utah Department of Environmental Quality
- Virginia Department of Health
- Washington State Department of Health

- US EPA Headquarters (OGWDW)
- US EPA Region I
- US EPA Region III
- US EPA Region IV
- US EPA Region V
- US EPA Region VI
- US EPA Region VII
- US EPA Region VIII
- US EPA Region IX
- US EPA Region X
- Washington EPA

This page intentionally left blank.

Chapter 2

Information Architecture

Analysis of Strategies and Policies

The first step in laying the foundation for an information architecture is to understand the approach of the Public Water System Supervision (PWSS) Program to meeting its business goals. Analyses of strategies and policies focuses on the identification of the mission, goals, and objectives of the PWSS Program as well as on critical success factors that inhibit or facilitate achieving goals.

Inputs to this analysis included reviews of existing documentation (e.g., Mission Needs Analysis), discussions with subject matter experts, interview results, and two Joint Requirements Planning (JRP) Sessions conducted with middle- and first-line managers within the program. Information from each source was compiled, assessed, and documented using the IEF™ tool.

Organizational Unit

In deploying the strategy, the ISP Project Team considered the following representative organizational units:

- Office of Ground Water Drinking Water (OGWDW)
- EPA Office of Research and Development (EPA ORD)
- EPA Regions
- State Drinking Water Administrators
- State Region or District Drinking Water Administrators
- Public Water System (PWS)

PWSS Program Strategy Statement

The mission, goals, and strategies for the PWSS Program have been developed and refined through the planning process. The mission and goals defined for the program in the Mission Needs Analysis were the basis for the initial strategy statement and served as a departure point for facilitating discussions during executive interviews, consultations with subject matter experts, and the Joint Requirements Planning Sessions. The PWSS strategy statement, which appears on the following page, is the final product of the analysis of



MISSION *

To provide an adequate supply of
safe drinking water

GOALS



Supply: Ensure an adequate quantity of drinking water by the regulated community.



Quality: Reduce/eliminate public health risk by identifying, assessing, and responding to threats to water supplies in a timely manner.



Compliance: Identify, assess, prioritize and appropriately respond to non-compliance in a timely manner



Affordability: Improve affordability by increasing the effectiveness and reducing the cost of applying technology (e.g. treatment, data/sample collection and analysis, and information analysis).



Outreach: Improve the effectiveness of technical assistance, training, and public education.

STRATEGIES

Operational Effectiveness: Promote primacy delegation, compliance determination, water-quality assurance and allocation through: assessment of water systems and threats; technology assistance; consolidation and standardization; and improvement of regulations.

Information Gathering: Collect and analyze the base line data needed to improve primary and support activities of the program (e.g. PWS inventory, supply characterizations, scientific research findings, lab characterizations).

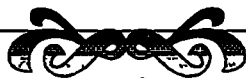
Technology: Discover, assess, develop, and demonstrate new tools and techniques to improve the operation and administration of the program.

Funding: Fight for adequate budget for regulating and regulated communities and develop alternate sources of funding (e.g. usage fees, surcharges, technical grants, demonstration grants).

Marketing: Further the understanding of solutions to drinking water problems by enlisting support from regions, states, PWSs, and the public.

Coordination: Coordinate efforts among agencies and drinking water programs to improve program efficiency.

* Developed by State and EPA Representatives attending PWS JRP.



strategies and policies. The sections following the PWSS strategy statement will discuss the components of the statement in further detail.

Results of the information gathering activities were captured in the IEF™ tool and matrices were developed to document the interaction of the program strategy objects.

PWSS Goals and Objectives

PWSS goals describe the long-term results that must be achieved to accomplish a mission. Each goal has been further refined into shorter term objectives which must be satisfied to achieve the goal. This section presents each goal and the objectives that support it.

Supply: Ensure an adequate quantity of drinking water by the regulated community.

- Characterize source water supply including alternate sources.
- Ensure adequate distribution of water to consumers on demand. Consider consumer demographics.
- Ensure water is properly treated before it is provided to consumers.

Quality: Reduce/eliminate public health risk by identifying, assessing, and responding to threats to water supplies in a timely manner.

- Ensure PWSSs are compliant with other EPA/State environmental regulations (e.g., discharge of treatment waste and air discharges).
- Ensure all supplies are evaluated for potential risk.
- Perform studies and analyses to support development of regulations and standards.
- Eliminate/reduce risks to consumers (immediately) by identifying and assessing all threats and take action to prevent threats (e.g., well head protection and coordination with other program permitting activities).
- Effectively respond to threats in time to protect the public health and to meet public notification requirements.

Compliance: Identify, assess, prioritize and appropriately respond to non-compliance in a timely manner.

- Bring systems into compliance by addressing violations within appropriate timeframes. Addressing violations includes technical assistance and enforcement.
- Develop complete and accurate monitoring plans for all systems.
- Ensure compliance data is timely, reliable, complete, and accurate. Includes lab certification.
- Identify 100% of violations (State and Federal) within prescribed timeframes (PWS and regulators). Note that timeframes will vary (e.g., whether the violation is acute or chronic, reporting to State vs. reporting to Federal, reporting agency (PWS, lab, regulator), etc.).
- Improve accuracy of data relating to the implementation of the PWSS program. Includes reducing duplication of data.
- Encourage/mandate the direct reporting of analytical results by electronic means (EDI) by certified laboratories to State regulators.
- Improve the sharing of data with other programs and agencies, with the public, and within the PWSS program, including providing for reasonable access/authority. Includes establishing protection for data from unauthorized access or modification.
- Maintain a complete and accurate inventory of all PWSs.
- Reduce impact of new regulations on the regulating and regulated community. Provide opportunity for input by States and PWSs earlier in the regulation development process (e.g., review of strawman regulations, considering impacts on other environmental regulations, minimize reporting requirements, regulation development workgroups, assess and consider data management impacts, development of flow diagrams in parallel with regulation development, etc.)
- Take actions to simplify the implementation of the drinking water program and determining if PWSs are compliant. Could include improving user documentation and system interfaces, providing clearinghouse for information relating to drinking water. Also, includes model state regulations, guidance on implementation, regulation/rule interpretation. May also include providing for regional variations or redefining rules.

Affordability: Improve affordability by increasing the effectiveness and reducing the cost of applying technology (e.g., treatment, data/sample collection and analysis, and information analysis).

- Conduct field demonstrations and pilot studies to prove field performance of new technologies and distribute results throughout the community.
- Encourage technology transfer among States, Federal agencies, consulting engineers, manufacturers, laboratories, and utilities.
- Identify and coordinate the use of resources for research and development of new technologies.
- Improve usability/flexibility of automation supporting PWSS program implementation. Includes efforts to standardize/integrate data and procedures.
- Provide States and EPA with improved data management capabilities beginning in FY 1995.
- Promote application of emerging and existing technology including reduction of treatment waste.

Outreach: Improve the effectiveness of technical assistance, training, and public education.

- Facilitate/encourage development of materials at Federal level suitable for adoption by States. Also includes items such as data management standards and lab automation standards.
- Improve communications within the regulating and regulated communities.
- Provide effective emergency notification (warning) concerning contamination and posed risk so that the public can protect themselves.
- Involvement of community and industry groups to further the implementation of goals of the public water supply program. Establishes the value and appreciation of drinking water and support for building/improving State capacity.
- Provide education so that the public will be willing to protect themselves, pay for needed improvements of PWSs, and support regulation of PWSs.
- Provide adequate technical assistance to regulators, regulated communities, and PWS engineering activities to ensure the proper design and operation of PWSs and implementation of NPDWRs and State regulations.

Strategies

A strategy is an approach, planned or in place, to achieve a goal. A strategy states the "how" of the approach being considered/used.

During the JRP sessions 37 strategies were identified. These strategies were analyzed and categorized into the six high level groupings listed in the PWSS Program Strategy Statement. Below is a listing of each high level groupings and the identified strategies for it. The supported goal(s) are shown in parenthesis.

Strategies to improve Operational Effectiveness include:

- Use enforcement as needed to return systems to compliance. (Compliance)
- Establish a data management program to improve the quality of data management relating to PWS supervision, including efficiency, effectiveness, analysis, accuracy, timeliness, and ease of reporting. (Compliance, Quality)
- Implement water allocation and administer water rights as required to control demand. (Supply)
- Establish and maintain the primacy program. (Compliance, Outreach, Supply, Quality)
- Perform trend analysis of violations, analytical results, disease outbreaks, health assessments, and sanitary surveys to assess the effectiveness of the drinking water program. (Compliance, Quality, Supply)
- Promote and provide technical assistance for engineering design for PWSs. Includes working with design engineers, including coordination meetings, and preliminary review of designs. (Affordability, Compliance, Outreach, Supply)
- Promote economies of scale with respect to operation and management of small PWSs, including mergers and annexations. Includes centralized management, composite sampling, centralized billing, master planning, and consolidated operations and maintenance. (Affordability, Compliance)
- Promote the security of PWSs, including source protection, system protection, and distribution protection. Includes physical security. (Quality, Supply)
- Promote uniform standards at the state level. (Compliance, Quality)

- Provide financial and technical assistance for treatment to correct deficiencies and to improve capacity. (Affordability, Outreach, Supply)
- Reduce the burden of program implementation. (Affordability)
- Review the financial viability of PWSs to ensure that they can adequately supply the public. (Affordability, Supply)
- Simplify regulations and develop regulations in response to increase knowledge of risks caused by specific contaminants. (Compliance, Outreach)

Strategies to facilitate Information Gathering include:

- Identify and characterize existing, alternate, and emergency sources. (Supply)
- Collect and analyze data concerning public water systems necessary to manage the drinking water program, including information on unregulated contaminants and analytical results for regulated contaminants below MCLs. (Compliance, Supply)
- Assess PWS facility-related, source, and demand needs on a regional basis and develop regional solutions. (Compliance, Quality, Supply)
- Improve and streamline the process for alternative analysis method review and approval. (Compliance, Outreach)
- Network with other agencies to leverage their knowledge and tools, Includes networking with and obtaining data from land, waste, air, and water resource management agencies at federal, state, and local levels; universities and professional associations; etc. (Outreach)
- Use modeling and cost-benefit analysis to maximize return on investment. (Affordability)
- Promote use of geographical information system technology for characterization of sources, demographics, water system facility management, potential sources of contamination, etc. Note: may require a large front-end investment to achieve return. (Outreach, Supply)
- Obtain information about and track sources (non-point and point) of pollution and assess impacts on drinking water. (Supply)

Strategies to improve Technology include:

- Achieve economies of scale in information system development, continuing to improve existing systems while developing the modernized PWSS program. (Affordability)
- Conduct research and development to determine how to measure water quality and to develop technology to facilitate treatment (including desalinization), simplify analysis and geolocation, and improve compliance assessment. (Affordability, Compliance, Outreach)
- Encourage interaction with universities and research institutions for development of PWS related technologies. (Affordability, Outreach)

Strategies to gain Funding include:

- Develop alternate sources of funding (e.g., usage fees, surcharges, technical grants, demonstration grants). (Affordability, Compliance)
- Fight for an adequate budget for the regulating and regulated communities to ensure safe drinking water. (Affordability, Compliance)

Strategies for Marketing the PWSS Program include:

- Advertise enforcement and technical assistance successes to the public and throughout regulated and regulating communities. (Outreach)
- Advertise the results of applying new and innovative technology and new applications of existing technology throughout the regulated and regulating communities. Includes advertising the availability of resources (products, techniques, etc.). (Outreach)
- Encourage PWSs to maintain, develop, and construct adequate facilities for supply, treatment, distribution and storage of water that will support existing, emergency, and future demand. (Compliance, Outreach, Supply)
- Encourage policies, standards, and building codes which allow use of new technology. (Affordability, Outreach)
- Encourage the establishment of permitting programs for PWSs. (Compliance)

- Promote conservation of water use by the public. Includes promoting reuse of non-potable water, when appropriate. (Outreach)
- Promote membership and participating in professional associations (e.g., AWWA, ASDWA). (Outreach)
- Promote public education about drinking water quality and safety. (Outreach)

Strategies for Coordination of efforts among Agencies include:

- Conduct cross-program coordination with other agencies involved in environmental regulation and land-use planning, promote sharing of information, and assess the impact of land use planning, promote sharing of information, and assess the impact of land use and air, waste, and water pollution on supply. (Compliance, Outreach, Quality)
- Promote prevention of contamination through coordination with community and land-use planning and implementation of source and distribution protection programs. Includes cross-connection control, wellhead protection, watershed protection, backflow prevention. (Compliance, Outreach, Quality, Supply)
- Provide timely communication throughout the regulated and regulating community. Includes communication between PWSs and consumers (compliance status, sources, prevention, comparative risk, conservation, etc.); between the regulating community and consumers (town meetings); between states and local regulators and PWSs (e.g., through newsletters and bulletin boards); and between EPA and states. (Compliance, Outreach)

Critical Success Factors

A critical success factor (CSF) is a situation or event that cause success (a facilitator) or failure (an inhibitor) in reaching a goal or objective. It is often, but not always, outside the control of the manager or organization but is generally something of which the manager needs to be aware.

Eighteen critical success factors have been identified. Each critical success factor is classified as an inhibitor or a facilitator. The following two lists list inhibitors and facilitators respectively. Supported goals are shown in parenthesis.

Inhibitors

- Inadequate quantity or quality of source water. (Quality, Supply)
- High level of complexity of federal and state statutes and regulations relating to drinking water. (Compliance)
- Adverse weather resulting in increased storm runoffs or droughts. (Quality, Supply)
- Turnover of personnel. (Quality, Supply)
- Economic situation/stability.
- Inability or difficulty in acquiring loans, grants, increased fees or other financial assistance.

Facilitators

- High level of third party support for the drinking water program (e.g., consumer education and technical dialogue by professional associations). (Outreach)
- Ready availability of hydrological, toxicity, and risk assessment data within data systems. (Compliance)
- Ready availability and affordability of analytical, prevention, and remediation technology supporting the drinking water program. (Affordability)
- Increases in development of industry and population. (Quality, Supply)
- Increased threats from terrorists or from geologic activity. (Quality, Supply)
- Support by the legislative and executive branches of State and Federal government, evidenced by their understanding and competent support of water quality issues. (Compliance, Outreach)
- Ready availability of mapping data (e.g., river reach files) within automated systems. (Supply)
- Increases in point and non-point source contamination. (Quality)
- Public awareness of issues relating to health impacts of drinking water. (Outreach)

- Public interest in conservation. (Outreach)
- Thorough coordination of research and regulatory development activities among State and Federal agencies. (Affordability)
- Existence of State and local construction standards which favorably consider drinking water issues. (Affordability, Quality, Supply)
- Ready availability of water system engineering data within automated systems. (Compliance, Quality, Supply)

Information Needs

This subsection focuses on the information needs and how they are interrelated to the entities types and organizational units.

Developing Information Needs

An information need is a specific information requirement of a particular person or organizational unit that can be used to make decisions or complete a task. Information needs helps to:

- Evaluate a strategy,
- Detect the occurrence/non-occurrence of critical success factors, and
- Measure progress toward meeting an objective or goal.

The information need is the link to ensuring that system development projects are tied to the specific business requirements. An alphabetical listing of the 76 information needs and their definitions are in Appendix G. Matrices associating information needs with strategies, critical success factors, objectives, and organizational units are found in Appendices D, E, F, and J respectively.

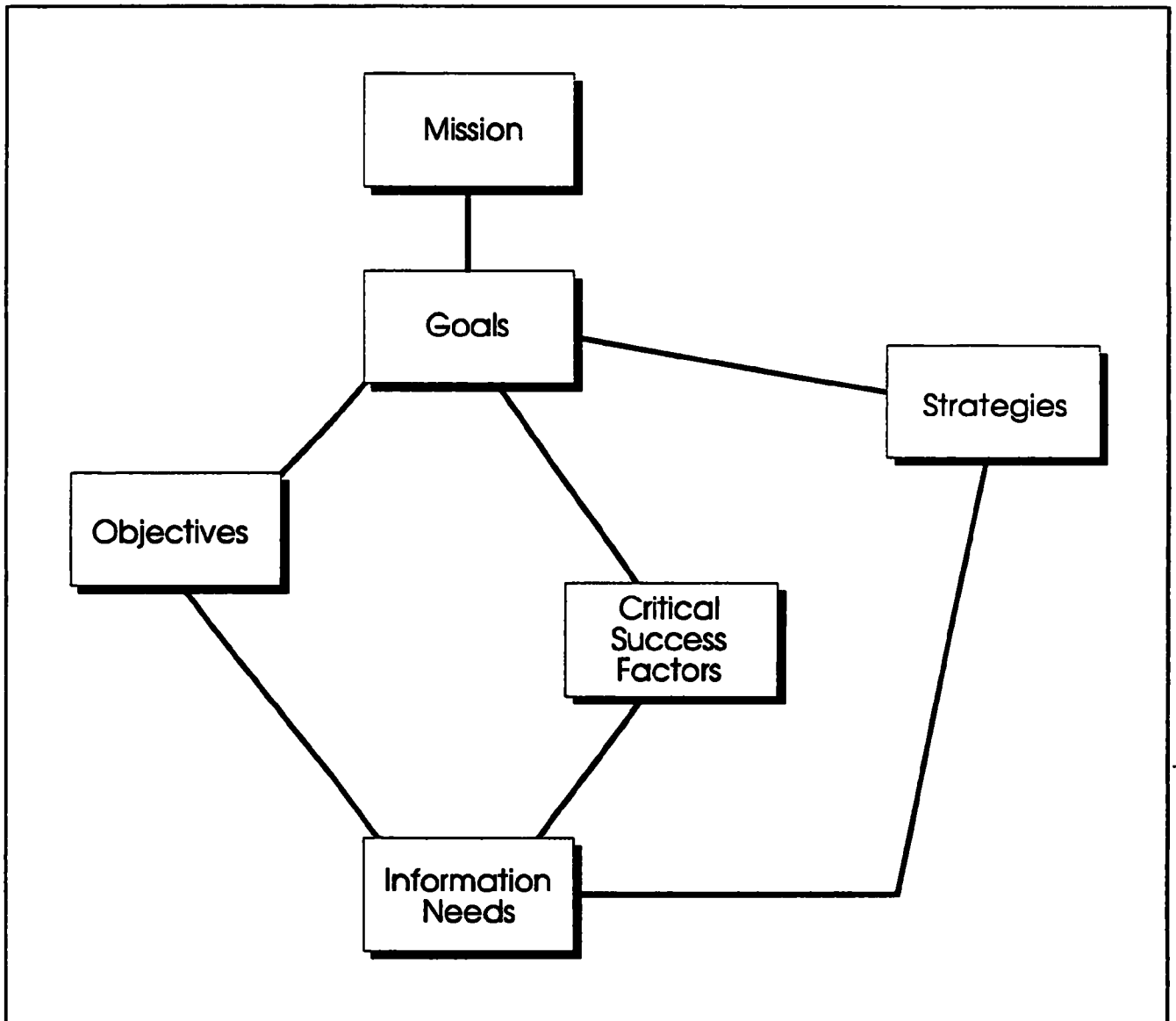
Information needs are determined based on the mission, goals, strategies, objectives, and critical success factors as shown on the next page.

Information Needs by Entity Type

Appendix N identifies the information need with the entity type in which the supporting data is stored. This exercise verifies that all information needs are supported by one or more entity types.

Information Needs by Organizational Unit

Appendix O shows what information needs are required by which organizational unit. This exercise assists in identifying which information need is shared by what organizational unit and ensures that all the information needs are needed by one or more organizational units.



Information Architecture Components

The PWSS information architecture defines the activities performed by the organization and the information needed to perform the activities. The information architecture consists of several components, which are referred to as business objects. These objects are captured in the IEF™ tool as the PWSS model presents these objects in a graphical form to facilitate understanding and support analysis. The major high-level components that make up the preliminary information architecture for PWSS include:

- Entity types,
- Subject areas,
- Relationships,
- Major business functions, and
- Matrices.

The subsequent paragraphs discuss each of these components. Data analysis and activity analysis, done concurrently, are the principal analytical activities that bring the components together to form the information architecture for PWSS.

Entity Types

An entity type is a fundamental thing of relevance to the PWSS Program about which data may be kept. Examples of this data include:

- inventory information,
- violation, and
- enforcement action taken against a PWS.

The PWSS project team identified entity types using two methods. Entity types were developed by analyzing written documentation related to the PWSS Program, and by analyzing the information needs.

Appendix H contains a description for each entity type in the PWSS Program.

Subject Areas

As the entity types were identified, they were categorized into high level subject areas. The resulting subject areas represent a collections of related entity types. Each subject area is named using a plural noun and entity types are named using a singular noun. This naming convention assists the analyst by distinguishing the names of data related objects.

For PWSS, eight subject areas were identified as follows:

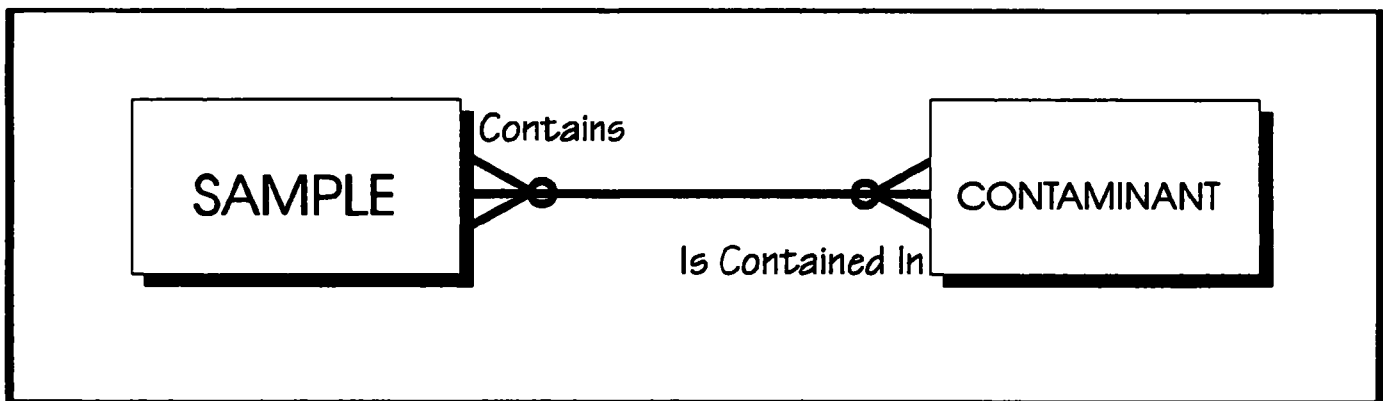
- ***Compliances:*** Information supporting compliance determination. Used to evaluate program implementation, oversight, violations, and actions required to return PWS's to compliance.
- ***Controlling Instruments:*** Information concerning statutes, regulations, policies, guidance, agreements, standards, and schedules for regulatory implementation.
- ***Cross-Media Sources:*** Data gathered by other environmental and natural resources programs required to support implementation of the PWSS program.
- ***Inventories:*** Information concerning the inventory of PWS's, water sources, and populations served by PWS's.
- ***Legal Entities:*** Information describing the legal entities involved with the PWSS program, including Government and Non-Government Agencies and private citizens.
- ***Programs and Plans:*** Environmental Programs and implementing plans impacting the PWSS program.
- ***Samples:*** Information associated with the collection and analysis of water samples taken to evaluate the quality of drinking water or the efficacy of treatment or analysis techniques.
- ***Technologies:*** Information related to the technologies required to treat water, assess water quality, or analyze data relating to the PWSS program implementation.

Relationships

One of the primary analysis tools used during an information engineering systems development process is the Entity Relationship Diagram (ERD). The principal purpose of the ERD is to graphically illustrate the information of interest to an organization and to

identify the relationships among data. These relationships reflect the business rules associated with the PWSS Program.

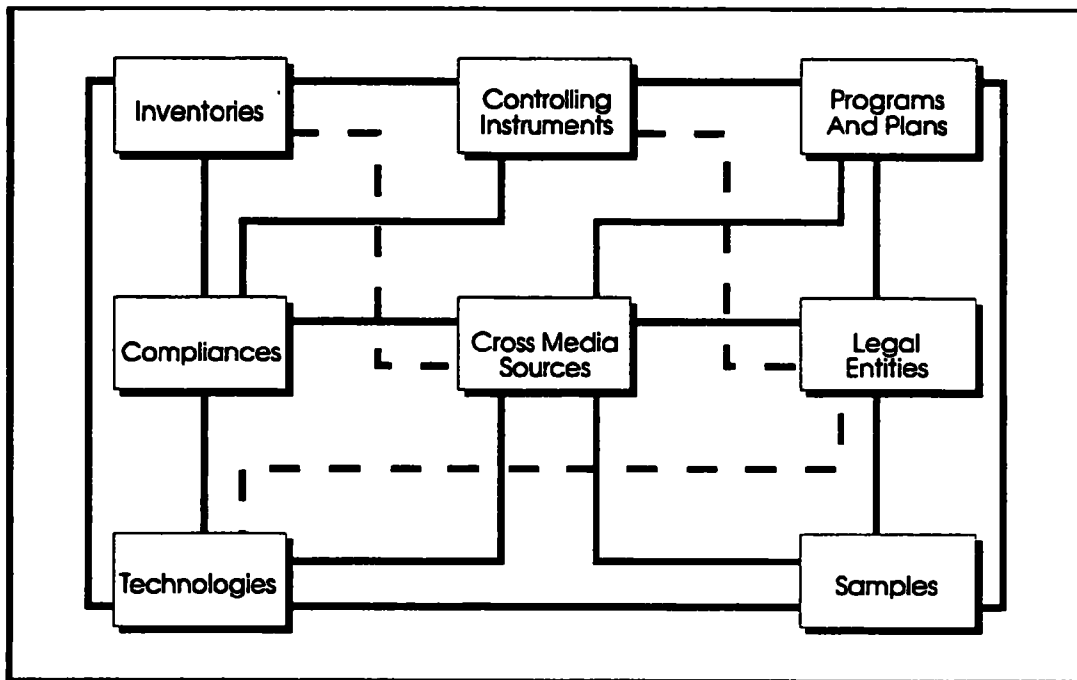
The ERD is made up of three parts: entity types, subject areas, and relationships. Relationships characterize the business reasons for associating different entity types. A relationship is shown by drawing a line between two entity types, and is labeled to express the relationship as shown below:



The relationship in the above diagram is read as follows:

A Contaminant "is contained in zero or more" Samples (reading right to left), and a Sample "contains zero or more" Contaminants (reading left to right).

The following diagram is a high level ERD which is also known as a subject area diagram. Appendix I presents the fully expanded ERD for the PWSS Program.



Major Business Functions

The PWSS functional model provides a high level picture of the activities performed by organizations supervising public water systems. A high level function is a grouping of related business activities, which may be performed at varying levels of an organization or in completely different organizations. Inherent within each function are the coordinating, supervising, managing and reporting activities common to any area within an organization.

The business functions are depicted graphically in an hierarchical decomposition called a Function Hierarchy Diagram (FHD), which breaks principal functions down into more detailed subfunctions. Specifics and details about each function and subfunction are shown in Appendix J.

The following FHD represents the derived high-level breakdown of activities performed within the PWSS Program.

PUBLIC WATER SYSTEM SUPERVISION		
	PROGRAM ADMINISTRATION	000
	WATER RESOURCE PLANNING	000
	RISK AND VULNERABILITY ASSESSMEN	000
	TECHNOLOGY AND METHODS	000
	DATA MANAGEMENT	000
	LAB CAPACITY AND CERTIFICATION	000
	OPERATOR CERTIFICATION	000
	ENGINEERING PLAN REVIEW	000
	FIELD SURVEILLANCE	000
	DISEASE OUTBREAK AND SURVEILLANC	000
	COMPLIANCE DETERMINATION RESOLUT	000
	TECHNICAL ASSISTANCE	000
	ENFORCEMENT	000
	EMERGENCY RESPONSE	000
	TRAINING	000
	OUTREACH	000

The sixteen PWSS high level functions depicted in the previous diagram include:

- ***Program Administration:*** Rule and Regulation Development; Resource Management; Implementation Planning; Primacy Administration; Guidance Provision (seep-Apt); Grant and Loan Administration; and Implementation Support.
- ***Water Resource Planning:*** Supply Forecasting; Demand Forecasting; Geographic Area Analysis; Fund Need Forecasting; Source Protection; Contingency Planning; Allocation; and Conservation Actions.
- ***Risk and Vulnerability Assessment:*** Risk Determination; Vulnerability Analysis; Health Advisory Development; and Cross Connection Control.
- ***Technology and Methods:*** Technology Assessment; Periodic Survey Performance; Applications and Methods Development; and Standard Development.
- ***Data Management:*** State and Federal Interface Guidance; Information Systems Development; Information Systems Maintenance; Request for Information Response; Cross Program Coordination; and Data Analysis and Interpretation.
- ***Lab Capacity and Certification:*** Lab Site Reviews; Lab Personnel Qualification; Lab Capability/Capacity Assessment; Lab Quality Assurance/Quality Control Plan Evaluation; and Lab Certification.
- ***Operator Certification:*** Operator Tracking; Operator Classification; Operator Exam Administration; and Operator Certificate Issuance.
- ***Engineering Plan Review:*** Construction Standards Development; Engineering Plan Evaluation; Engineering Financial Assistance; and Construction Inspection.
- ***Field Surveillance:*** Sanitary Survey Scheduling; Sanitary Survey Performance; Inspection and Site Visits; and Survey and Inspection Follow up.
- ***Disease Outbreak and Surveillance:*** Outbreak Analysis and Recommendation; Epidemiology and Public Health Coordination; and Public Notification.
- ***Compliance Determination and Resolution:*** Inventory; Waiver and Exception Administration; Permit Issuance; Monitoring Plan Development; and Monitoring Performance Assessment.

- **Technical Assistance:** Technical Assistance Needs Assessment; Third Party Coordination; and Technical Support Provision.
- **Enforcement:** Enforcement Policy Development; Enforcement Case Development; and Enforcement Tracking.
- **Emergency Response:** Emergency Plan Implementation; Emergency Response Assistance; and Response Coordination.
- **Training:** Training Needs Identification; Training Development; Training Presentation; and Training Records Maintenance.
- **Outreach:** Outreach Material Development, Networking, Risk Communication; and Public Education.

Mapping of Business Functions and Organizational Units

The business functions identified during functional decomposition are related to organizational units in order to improve the general understanding of the organization's current strategies, to verify the functional decomposition, and to provide a basis for a more in-depth assessment of the organization later on in the analysis.

The business functions are mapped to the appropriate organizational units using the Business Function/Organization matrix which appears in Appendix K of this document.

Business Requirements

Introduction

This section briefly describes the business requirements of the PWSS project and transition from the Information Architecture to the Business Systems Architecture. These two products of the ISP differ in that the Information Architecture defines the activities performed by the organization and the information required to perform them, while the Business Systems Architecture describes probable business systems and data stores required to support the Information Architecture.

Although a more detailed understanding of the actual information requirements is needed to determine the exact contents of each business system, the Business Systems Architecture provides a high-level initial prediction of the application systems to be developed. This

section begins the examination of the Business Systems Architecture, although the actual Business Systems Architecture will be presented in the next chapter. A full list of the issues and concerns affecting the PWSS ISP project is presented as Appendix L.

Current Business Problems

Several major business problems and opportunities for improvement have been identified by the documentation reviews, consultations with subject area experts, executive interviews and Joint Requirements Planning sessions conducted during this phase of the ISP. Business problems and design considerations fall into several categories. These are:

- State apprehensions about national systems and their ability to satisfy State requirements
- Differing goals and objectives between State and National programs
- Constantly changing legislation/rules that put an ever increasing development burden on the States, Labs and Public Water Systems.
- Declining resources (e.g., personnel, funding, etc.)

There are issues and concerns associated with each of these broad categories. In the area of State apprehensions, some of the issues and concerns are:

- Lack of State input and involvement in Federal systems development, and
- Lack of understanding of the purposes for Federally desired information.

Constantly changing rules and regulations and increasing State burdens are reflected in such concerns as:

- Lack of State participation (and opportunities for participation) in the rule and regulation development process,
- The need to provide a stronger correlation between rule development and data management, and
- The need to redesign regulations and reduce the number of violation types.

The problem of differing goals and objectives between State and National programs is shown in issues like:

- The need for a new system that has capabilities beyond compliance and enforcement,
- Ensuring that development plans span other environmental areas (e.g., provide integration amongst all data, such as Superfund, Clean Water Act, and GIS), and
- Understanding the need to reduce the reporting burden on the States, Labs and Public Water Systems.

In an age of declining resources, issues and concerns reflecting the need for a system to provide help in this area are:

- The need to reduce repetitive data entry and paper,
- Better management of system development, maintenance, and enhancement costs,
- Ensuring that State variants to the new system are easy to develop, and
- Providing easier and quicker access to regulations and rules (e.g., Reg-in-a-box, etc.).

Business problems and areas for improvement need to be handled in two ways. Those that can be addressed by changes in the information systems that support the PWSS program can be corrected by systems development. Some issues can only be addressed by changes to EPA policy.

System Difficulties

In addition to business problems and opportunities for improvement in the non-automated areas of the investigation, major difficulties with the current automated systems used to support the PWSS program were also identified. These problems fell into the three major areas below:

- Current systems contained data of marginal quality and lacked timeliness,
- The analytical tools possessed by the current systems were in need of improvement, and
- The current systems were housed on aging and soon-to-be unsupported software.

Data quality and timeliness was the most pressing problem and the need to address this issue is reflected in concerns such as:

- The need to improve reliability by ensuring consistency of process and data,
- Ensuring the improvement of timeliness and accuracy of data collection by incorporating such techniques as Electronic Data Interchange (EDI),
- The need to provide user-friendly interfaces (i.e., Graphical User Interface (GUI)), and
- Providing the capability for decision support information.

The problem of improving the analytical tools and capabilities of the current systems can be seen in these issues and concerns expressed by the interviewees:

- Data analysis must be enhanced by providing new and/or improved analysis tools (e.g., filter rule regression analysis),
- Enhancement of engineering tools for process monitoring and control are needed,
- The system needs to provide meaningful statistical data,
- A means of easily verifying correcting and analyzing data must be supplied, and
- Providing the capability for use of and ready access to inventory data.

The fact that the current systems for PWSS support are contained on aging software and need to be migrated is expressed in concerns such as:

- Any new system must improve response time,
- There is a need to reduce sampling and analysis costs,
- State and National formats must be compatible, and
- The ability to easily modify existing databases to handle additional kinds of information is required.

These concerns and issues helped to document the areas that need improvement for any new PWSS system. The information needs that must be addressed by the new system are shown in the Appendix G.

This page intentionally left blank.

Chapter 3

Business Systems Architecture

Business Systems Architecture

The Business Systems Architecture describes the business systems and data stores required to implement the Information Architecture presented in Chapter 2. Business systems are collections of related functions required to accomplish an aspect of the PWSS program. Data stores are collections of related information required by or produced by the business systems.

Additionally, the Business System Architecture describes the relationships among the business systems and data stores, and groups business systems and data stores into business areas for follow-up analysis.

As a result of the development of the Business Systems Architecture, a ranked list of Business Areas was developed, prioritizing the information systems required to support the requirements of the PWSS Information Systems Modernization effort.

The following describes the five step approach used to develop the Business System Architecture:

- **Interaction Analysis**

The interaction between the data and functions is examined. The analyst determines which functions create, update, delete, or read each entity type. This analysis highlight and explain the dependencies and interactions among each function and entity type.

- **Business Systems Analysis**

Once the dependencies and interactions are understood, the analyst identifies collections of related functions that use the same types of information. These groupings of related functions are called business systems.

- **Data Stores Analysis**

At the same time the business systems are being identified, the analyst is reviewing the data interactions in order to group entity types used by each business system into data stores.

- **Business Systems Architecture Analysis**

The business systems are grouped into business areas and categorized. The data flows and functional dependencies are also diagrammed to ensure that the business systems will support the Information Architecture.

- **Business Area Evaluation**

Once the Business Systems Architecture is completed, the individual business areas are ranked to support development of an implementation strategy.

The results of the analysis will now be presented in more detail following the five steps outlined above.

Interaction Analysis

The primary analytical tool for interaction analysis is a matrix that maps the business functions to the entity types. This matrix is commonly referred to as the "CRUD" Matrix because it designates which functions Create (C), Read (R), Update (U), or Delete (D) each entity type. A copy of the Business Function by Entity Type Usage matrix is included in Appendix S.

Solving the CRUD matrix involves documenting the expected actions that the functions will have on the data. The functions of the organization are listed on the vertical axis of the matrix and are entered in dependency order. For example, the function of Monitoring Plan Development is shown before the function of Water Sampling as Monitoring Plan Development should be completed before Water Sampling is performed. As the analysis of the interaction between the functions and data continues, all data created by specific functions (depicted with a "C" at the intersection of the rows and columns) are grouped together within the matrix. The Cs are arranged along a diagonal path in the matrix. Next, the Us and Rs are arranged to align as closely with the diagonal as possible. This process results in showing the closeness (affinity) of the entity types with their associated functions. Due to the high number of read events, Rs are not displayed in the CRUD matrix shown in Appendix S. Additionally, deletes were excluded from the matrix at this time, as deletes will be identified later during the Business Area Analysis (BAA) phase of PWSS systems development.

Business Systems Analysis

Using knowledge derived from analysis of the CRUD Matrix, the project team conducted Business Systems Analysis for the PWSS program. This analysis developed *natural business systems*, or logical groupings of business functions, that satisfy the business needs identified in the Information Architecture Phase.

Business systems are groupings of one or more of the functions identified in the Information Architecture. The functions are grouped using affinity analysis algorithms and clustering techniques built into the IEF development tool. A total of 29 business systems were identified.

Names for the business systems were selected to represent the functional groups, using terms consistent with the technical vocabulary of PWSS community. For example, the "**Compliance Determination**" Business System is comprised of a group of business functions that perform the following functions: analyze and assess samples; conduct inspections and audit reviews; and perform other monitoring activities to determine whether or not a PWS is complying with the appropriate rules and regulations. Another example is the "**Enforcement**" Business System, which includes functions for developing legal and administrative cases, taking enforcement actions, and tracking enforcement actions.

A Business System by Business Function Matrix, shown in Appendix T, was also prepared. This matrix relates the business systems with the business functions identified in the Information Architecture. This process ensures that all business functions identified in the Information Architecture are accounted for in the Business System Architecture.

Data Stores Analysis

As the business systems were being identified, the data interactions were reviewed in order to group entity types used by each business system into natural data stores (we will use the term data stores to refer to the natural data stores).

Data stores represent collections of data needed to support the business systems that have been identified. The approach for determining data stores is similar to the one employed to determine the natural business systems. The CRUD Matrix was analyzed to determine the affinity among entity types. The analysis first clusters entity types used by each function and then determines which entity types should be grouped within a data store.

A total of 17 data stores were identified. The data stores were named based on the entity types contained within the data store. For instance, the "**Agencies**" natural data store is

composed of two entity types: Government Agency and Non-Government Agency or Company. The data store was named "*Agencies*" since both entity types are agencies. Another example of naming a data store is the "*Financial Assistance*" data store, which consists of three entity types: Budget, Grant, and Guaranteed Loan. The name "*Financial Assistance*" was selected as all of the entity types in this group involve financial assistance functions.

A Data Store by Entity Type matrix was also completed to ensure that all entity types described in the Information Architecture were contained within a data store. A copy of the Data Store by Entity Type Matrix is shown at Appendix U.

Business Systems Architecture Analysis

Once business systems and data stores have been identified, the business systems are grouped into business areas. Business areas result from grouping the related business systems and data stores. A business area can be thought of as a collection of business functions and entity types that defines the scope of a component of the PWSS Program. The sum of all the Business Areas completely defines the scope of the PWSS Program. The business areas are assigned names that best convey the overall meaning of the collection of systems a given area encompasses.

For instance, the "*Compliance*" Business Area deals with the group of Business Systems designed to monitor individual PWS and state program performance, build cases against violators and non-compliers, take enforcement actions, and track enforcement actions. Another example is the "*Inventory*" Business Area, which involves characterizing public water systems, and inventoring natural resources and demographic statistics.

Four matrices were created during the Business System Architecture analysis. The first matrix, Business Area by Natural Data Store, shown in Appendix V maps the Business Areas to the data stores identified in the entity type by business function analysis. The second matrix, Business Area by Entity Type, appears in Appendix W, compares the Business Areas to the entity types identified during the Information Architecture phase analysis of Task 2. The third matrix, Business Area by Business System, shown in Appendix X, contrasts the natural business areas with the natural business systems that were derived from the business function by Entity Type Matrix analysis. The fourth matrix, Business Areas by Business Function, Appendix Y, illustrates how the business functions identified in the Information Architecture map to the business areas identified in the Business System Architecture. The main purpose for conducting this part of the analysis and preparing these matrices are to ensure that all of the functional activities of the business identified in the Information Architecture were transitioned to the Business System Architecture.

Once the business areas are identified, they are categorized as Strategic Systems, Planning Systems, Controlling Systems, or Operational Systems. Note that it is common for a system to be placed in more than one category. The definitions for the categories are shown below.

-
- **Strategic** - focuses on a wide-range of "what-if" analysis and is referred to as the PWSS Executive Information System.
 - **Planning** - deals with a structured framework to conduct "what-if" analysis with a high concentration of statistical analysis.
 - **Controlling** - involves monitoring and managing operational aspects of PWSS with emphasis on routine analysis and reporting.
 - **Operational** - supports high volume, time-critical day-to-day operational features of the PWSS, most of which are pre-defined on-line transactions.
-

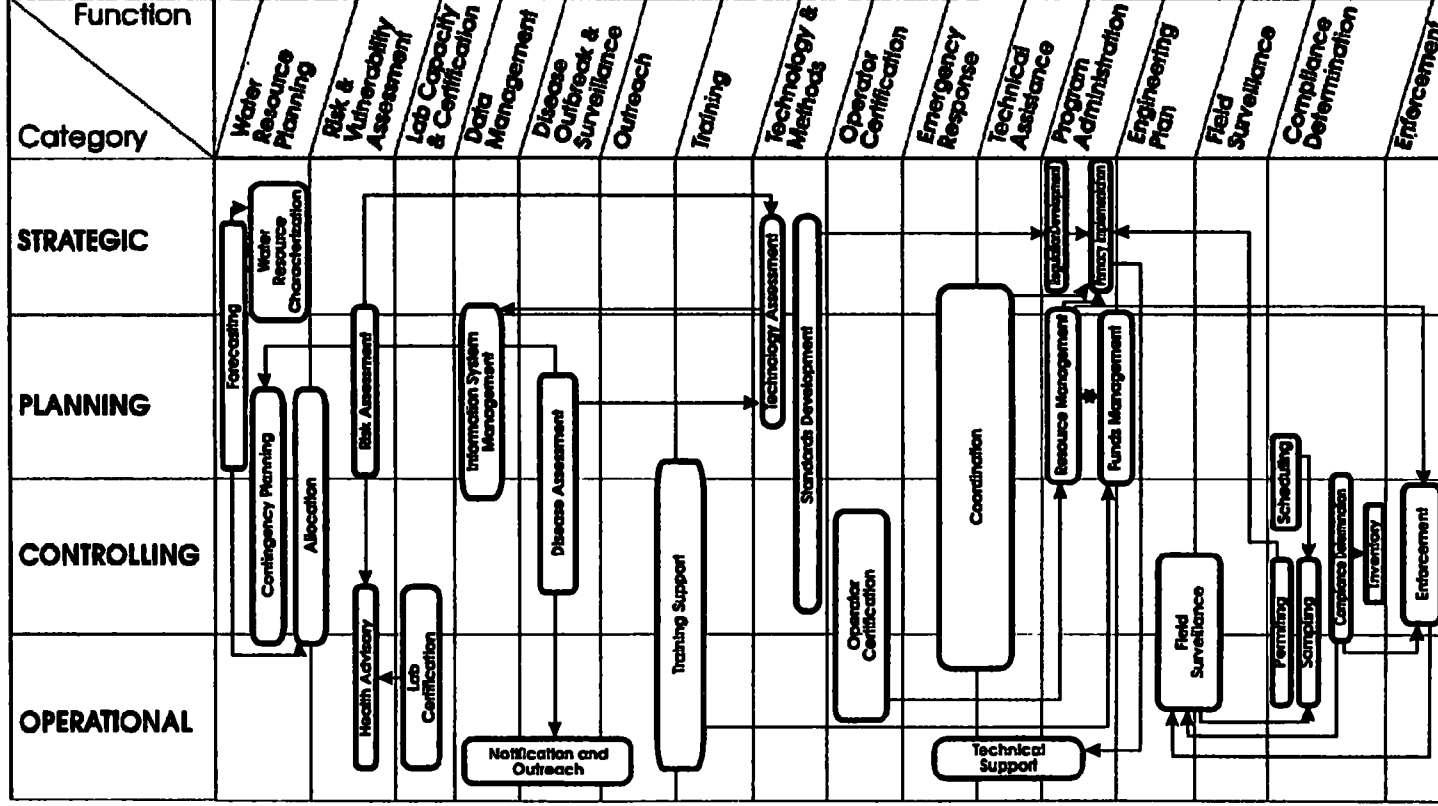
System Categories

After the business areas were categorized, a business system architecture diagram was developed showing the interrelationships of all of the business systems. The PWSS Business System Architecture Diagram, shown on the following page, is a graphical representation of the analysis.

The functions listed across top horizontal axis of the diagram represent the 16 high level functions identified in the Information Systems Architecture. Note that the business systems identified in the Business System Architecture Diagram support one or more of the PWSS program system categories. For instance, the "*Regulations Development*" Business System only supports the Strategic system level. On the other hand, the "*Forecasting*" Business System supports both the Strategic and Planning system levels. Another example involves the "*Coordination*" Business System that spans across all four levels of the system categories. The interaction between the Business Systems is shown graphically by the lines and arrows connecting one system to another.



Business System Architecture Diagram



In support of this analysis, the PWSS project team prepared a System to System Category Matrix as shown in Appendix Z. This matrix shows the interrelations of PWSS system categories to the natural business systems identified in the PWSS Business System Architecture presented in this chapter. The System to System matrix serves as a valuable tool in visualizing which business systems support the various system level requirements.

Another way of depicting the Business System Architecture is shown on the following fold out page. The diagram displays the business systems within each business area and the related data stores. Significant relationships among the business areas are also shown.

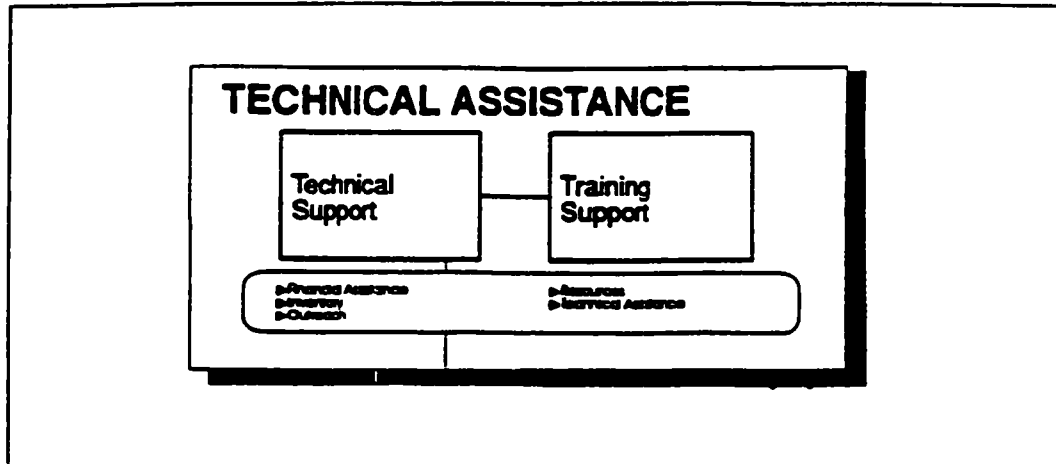
The remainder of this chapter will provide the specific descriptions for each business area and business system, beginning with the Technical Assistance Business Area, located at the upper left-hand corner of the foldout. Descriptions of the data stores will follow the business area discussion.

This page intentionally left blank.

**PAGE NOT
AVAILABLE
DIGITALLY**

This page intentionally left blank.

Technical Assistance



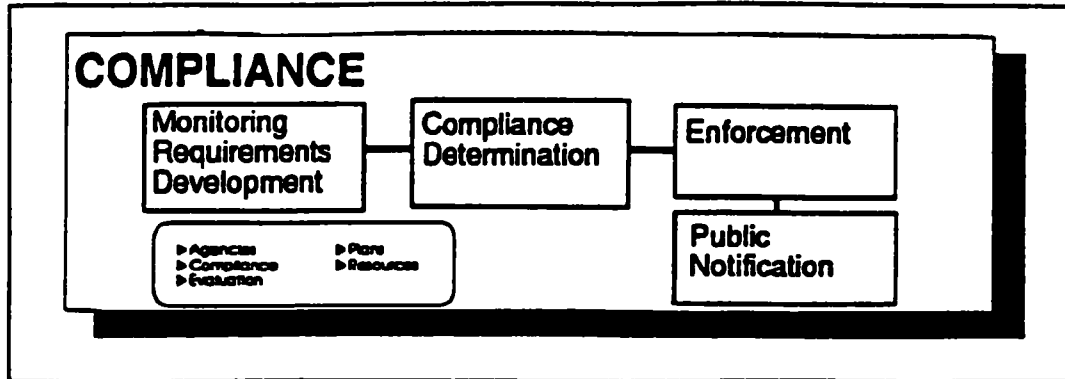
Technical Assistance Business Area

The *Technical Assistance* business area provides assistance to the regulated community and regulators in the form of expertise, technology, and training.

Technical Assistance consists of the following two business systems:

- **Technical Support:** Providing technical advice and services to PWSs and the regulators.
- **Training Support:** Includes functions relating to development and presentation of training related to PWSS implementation.

Compliance



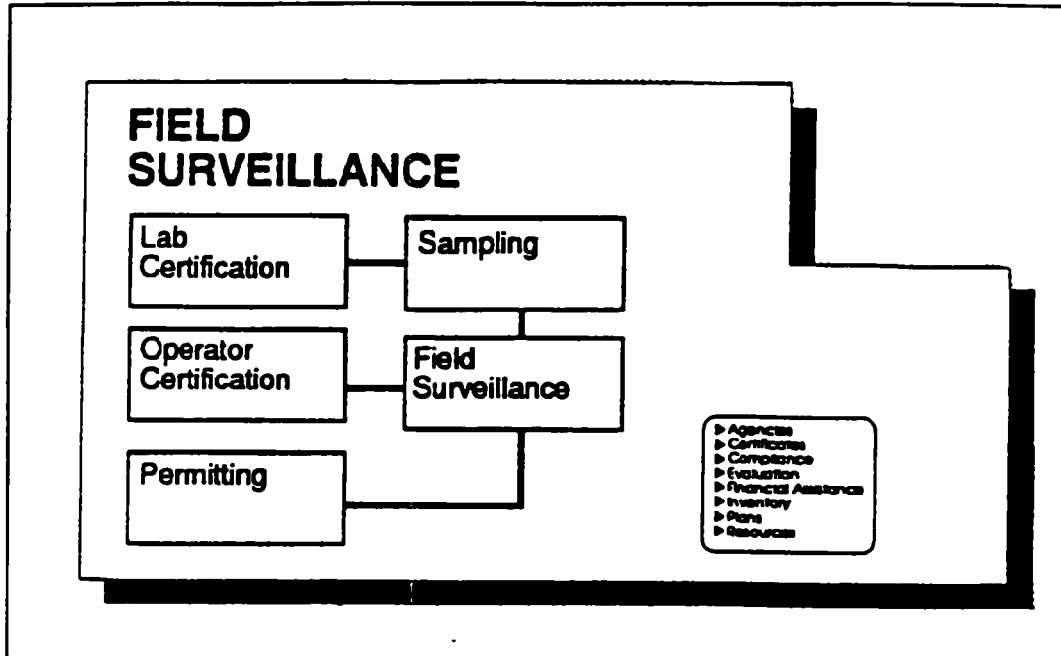
Compliance Business Area

The *Compliance* business area develops monitoring plans, monitors performance, builds cases against violators and noncompliers, takes enforcement actions, and tracks enforcement actions and public notification.

Compliance consists of the following three business systems:

- ***Compliance Determination:*** Analyzing and assessing sampling, inspection, audit review, and other monitoring information to determine whether a violation has occurred.
- ***Enforcement:*** Building cases against violators and noncompliers, taking enforcement actions, and tracking the enforcement actions.
- ***Monitoring Requirements Development:*** Preparing monitoring plans.
- ***Public Notification:*** Development and dissemination of the public of violation and related health effects information.

Field Surveillance



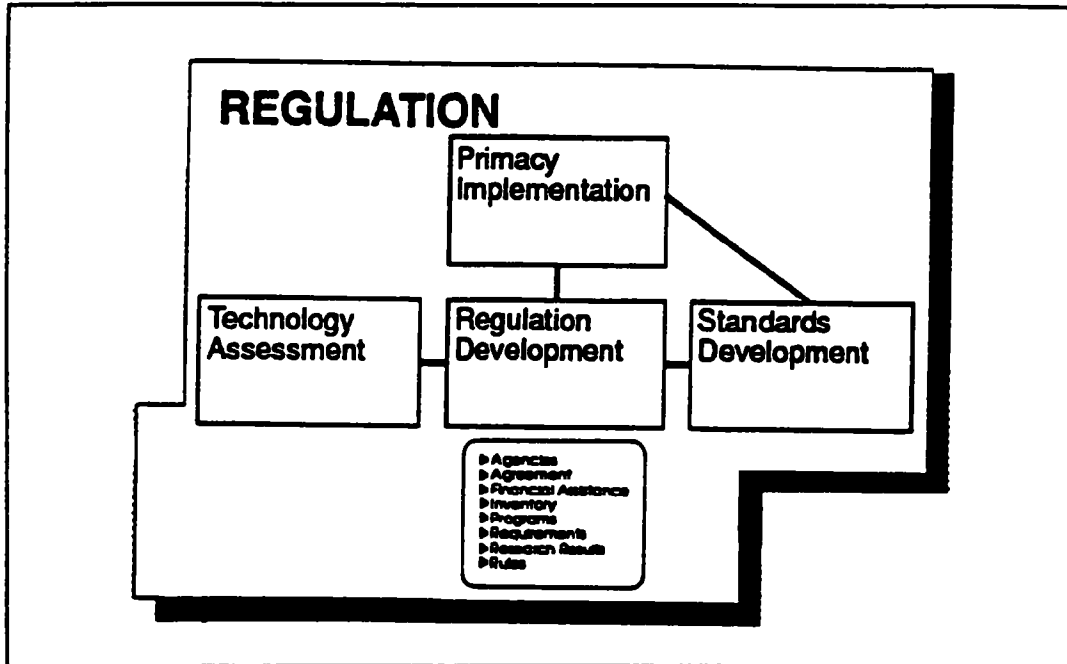
Field Surveillance Business Area

The *Field Surveillance* business area includes certifying labs and personnel. Also, includes conducting surveys and inspections and taking samples.

Field Surveillance consists of the following six business systems:

- **Field Surveillance:** Performing sanitary surveys and site inspections, including construction inspections, and performing follow-up.
- **Lab Certification:** Certifying or licensing labs that do analyses of drinking water compliance samples.
- **Operator Certification:** Certifying operators of water treatment and distribution systems.
- **Permitting:** Issuing permits, exemptions, waivers and variances.
- **Sampling:** Taking water samples to comply with monitoring requirements and comply with water quality standards.

Regulation



Regulation Business Area

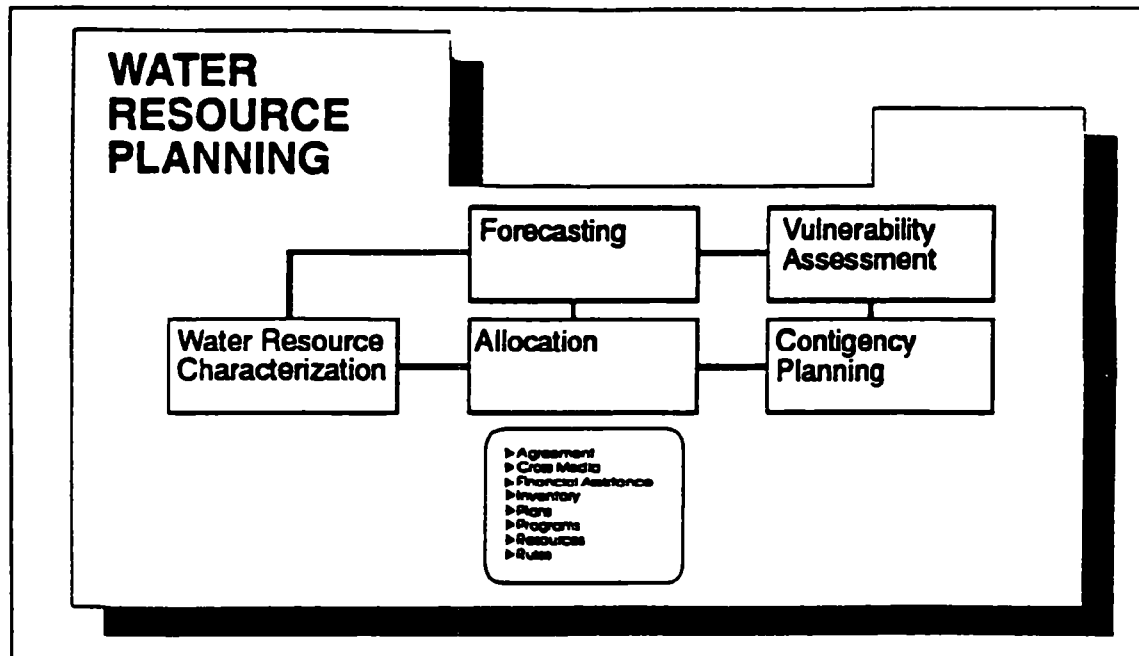
The **Regulation** business area is concerned with scanning scientific and technological research. Using the research in developing regulation, policy, and standards; in planning and delegating primacy; and in assessing regulatory and implementation success.

Regulation consists of the following four business systems:

- **Primacy Implementation:** Interpreting regulation. Also planning, delegating, and assessing the successfulness of regulation implementation.
- **Regulation Development:** Planning, developing, assessing the successfulness of, and recommending changes to regulation.
- **Standards Development:** Developing methods and techniques and setting standards. Includes reviewing third party standards as well as conducting pilot studies and demonstrations and performing field tests and evaluations.
- **Technology Assessment:** Retrieving scientific research and identifying available technologies. Evaluating the information for use in the following activities:

developing regulation, policy, and standards; assessing risk; characterizing water resources; responding to disease outbreak; responding to information requests; and assessing program success.

Water Resource Planning



Water Resource Planning Business Area

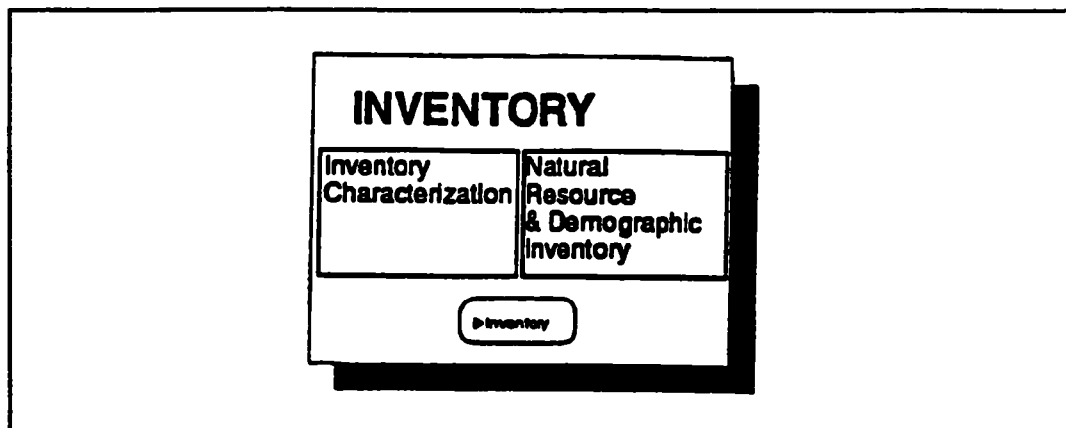
The *Water Resource Planning* business area concentrates on characterizing water resources, providing forecasts, promoting water conservation, and allocation. Includes assessing risks to water sources and human health.

Water Resource Planning consists of the following five business systems:

- **Allocation:** Allocating water resources and taking proactive actions to protect against contamination of water sources and systems and to avoid water shortages.
- **Contingency Planning:** Preparing contingency plans for shortages and emergency situations.

- **Forecasting:** Forecasting drinking-water demand, supply, and financial need for water-system investment.
- **Vulnerability Assessment:** Assessing risks to water resources; such as contamination or drought.
- **Water Resource Characterization:** Characterizing water resources, including water rights, point and non-point sources of contamination.

Inventory



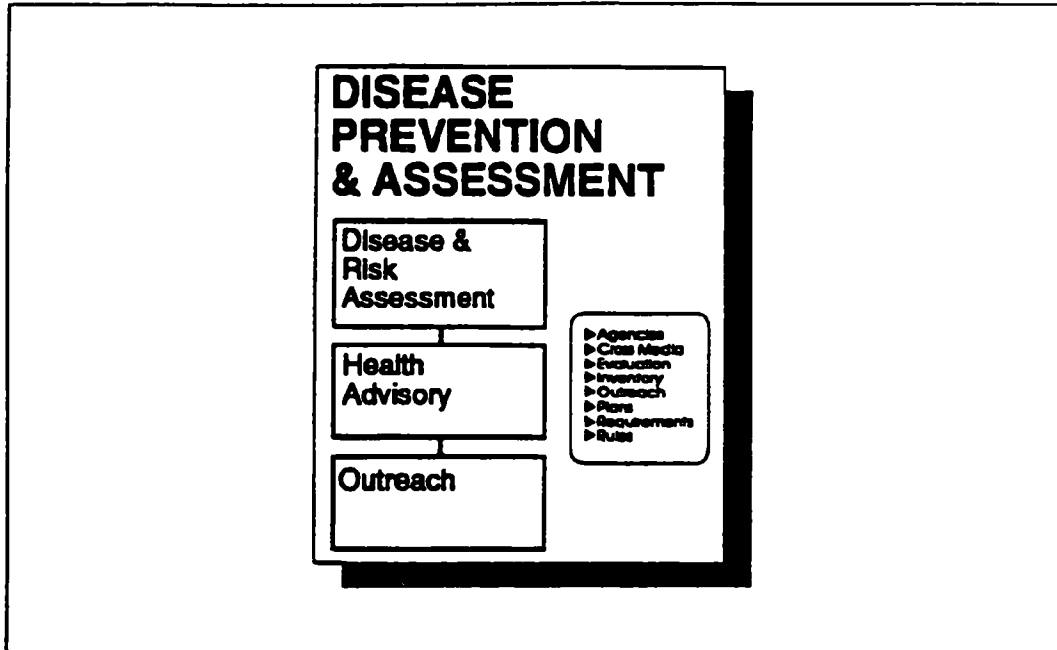
Inventory Business Area

The *Inventory* business area functions include characterizing public water systems, including plants and equipment, human resources, and populations served.

Inventory consists of the following two business systems:

- **PWS Characterization:** Characterizing public water systems, including plants and equipment, human resources, populations served, water resources, responding to disease outbreak, responding to information requests, and assessing program success.
- **Natural Resource and Demographic Inventory:** Inventorying of natural resources, land use, and statistics about people, animals and plant life.

Disease Prevention and Assessment



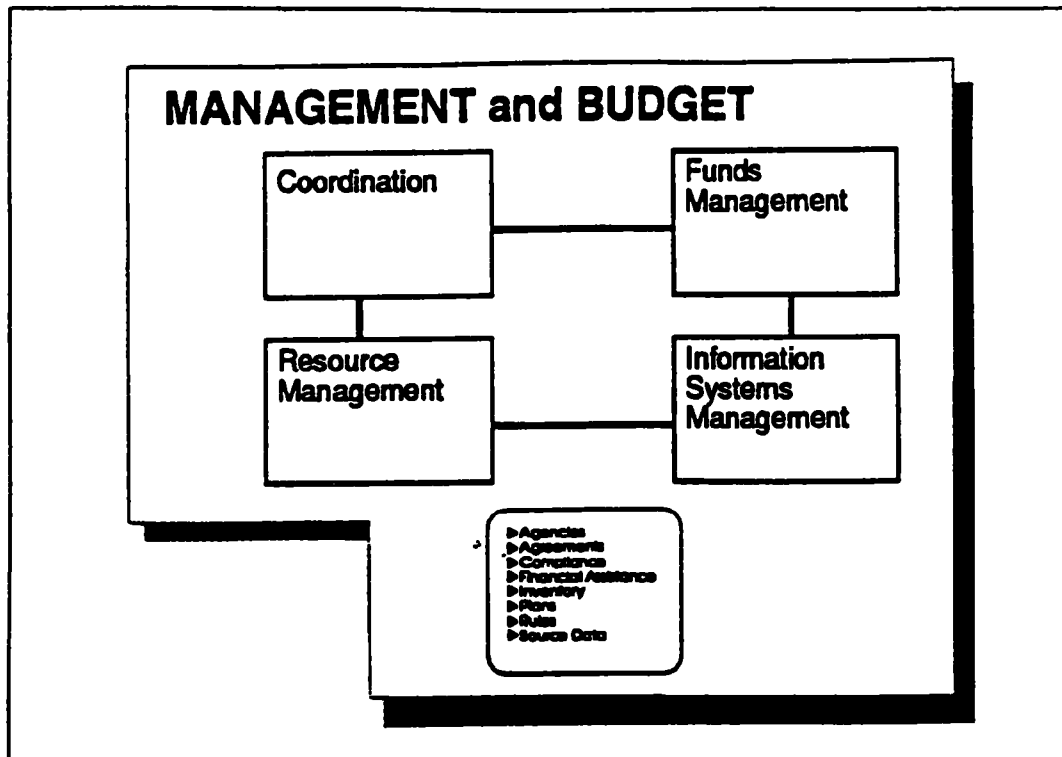
Disease Prevention and Assessment Business Area

The *Disease Prevention and Assessment* business area is concerned with developing disease prevention and outbreak information. Compiling the information to be communicated to the public. Identifying the proper means and alternative modes of communication. Conducting the communication and responding to requests for information.

Disease Prevention and Assessment consists of the following three business systems:

- ***Disease and Risk Assessment:*** Analyzing and assessing disease-related information to determine whether drinking contaminated water caused or can cause illness.
- ***Outreach:*** Developing program and health-related information, identifying the means of communication, and communicating the information in emergency and non-emergency situations. Includes responding to requests for information.
- ***Health Advisory:*** Taking preventive measures to protect the public from health problems.

Management and Budget



Management and Budget Business Area

The Management and Budget business area deals with coordinating activities and information with other organizations, including the provision of information-retrieval capabilities and other information systems development. Includes financial assistance and management of resources.

Management and Budget consists of the following four business systems:

- **Coordination:** Networking and coordinating with other government and nongovernment organizations.
- **Funds Management:** Providing grants and guaranteed loans, such as for construction. Includes monitoring/reviewing compliance with the requirements for the grant/loan. Developing a budget for operations, maintenance, monitoring, personnel and other areas necessary to comply with PWSS program requirements.

- **Information Systems Management:** Developing and maintaining information systems.
- **Resource Management:** Managing plants and equipment, budgets, and people.

The approach used by the PWSS project team arrived at the names for the above business systems. For example, the "**Compliance Determination**" Business System is comprised of a group of business functions that do the following: analyze and evaluate sampling; conduct inspections and audit reviews; and perform other monitoring activities to determine whether a PWS is in violation. From a logical viewpoint, naming this business system "**Compliance Determination**" is representative of the group of functions being carried out in this business system. Another example is the "**Enforcement**" Business System, which includes functions for building cases against violators and non-compliers, taking enforcement actions, and tracking enforcement actions taken. The overall objectives of this group of functions can be expressed as enforcement. All of the business systems that compose the PWSS Business System Architecture were formed using this approach.

Another automated product that helped the PWSS project team identify the natural business systems is the Business System by Business Function Matrix, shown in Appendix T. This matrix relates the natural business systems with the original business functions. This process ensures that all business functions identified in the PWSS Information Architecture are accounted for in the Business System Architecture.

The strategy used by the PWSS project team to identify the above business areas was based on the logical grouping of functions that support the various PWSS program activities in today's operational environment at both EPA Headquarters and the individual States. For instance, the "**Compliance**" Business Area deals with the group of Business Systems designed to monitor individual PWS and state program performance, build cases against violators and non-compliers, take enforcement actions, and track enforcement actions. From a logical standpoint, the "**Compliance**" Business Area captures the essence of the group of functions being carried out in this Business Area. Another example is the "**Inventory**" Business Area, which involves functions such as characterizing public water systems to include plants and equipment, natural and human resources, and populations served. The overall goal of this group of functions can be expressed very logically under an inventory Business Area.

The Business System Architecture also included the identification of the natural data stores to support each of the business areas listed in the preceding section. The primary function of the natural data stores are to create repositories of data for the users in support of each of the natural business areas identified in the Business System Architecture Summary foldout.

To arrive at the natural data stores, the PWSS project team used an approach similar to the one employed to determine the natural business systems. The CRUD Matrix was analyzed to obtain the natural data stores, consisting of groups or clusters of entity types that are manipulated (e.g., Created and Updated) by a specific business function. As a result of the CRUD analysis, the IEF development tool assisted the project team to create groups of entity types that were closely related to each other because of the functions, and ultimately, the business area they support. The 17 natural data stores to support the PWSS Information System Modernization are as follows:

- ***Agencies:*** Includes Government Agency and Non-Government Agency or Company entity types.
- ***Agreement:*** Includes Agreement entity type such as permits, primacy, enforcement.
- ***Certificates:*** Includes Lab Certificate, Operator Certificate, and Permit entity types.
- ***Compliance:*** Includes Deviation, Sample, Sample Analytical Result, Sample Assessment, Violation, and Enforcement Action entity types.
- ***Cross Media:*** Includes Environmental Event, Weather Data, Water Habitat Quality Information, and Water Threat entity types.
- ***Evaluation:*** Includes Review Audit and Evaluation and Complaint entity types.
- ***Financial Assistance:*** Includes Budget, Grant, and Guaranteed Loan entity types.
- ***Inventory:*** Includes Legal Entity, Public Water System, Water System Facility, Treatment Equipment, and Population Group entity types.
- ***Outreach:*** Includes Communications Media, Public Notification, Technical Publication, and Information Request entity types.
- ***Plans:*** Includes Monitoring Plan, Cross Media System, Contingency and Emergency Plans, and Engineering Plan entity types.
- ***Programs:*** Includes Program and Program Plan entity types.
- ***Requirements:*** Includes Legal Mandate, Regulation, Research Need, and Requirement entity types.
- ***Research Results:*** Includes Research Result and Contaminant entity types.

- **Resources:** Includes Analytical Equipment, Field Equipment, Individual, and Laboratory entity types.
- **Rules:** Includes Policy and Guidance and Standard Techniques or Procedures entity types.
- **Source Data:** Includes Drinking Water Source, Hydrological Information, and Hazardous Waste Information entity types.
- **Technical Assistance:** Includes Technical Assistance and Training Event entity types.

Refer to the Business System Architecture Summary foldout shown on page 7 to follow along with the listing of the business areas with their supporting natural data stores. Note that many of the natural data stores support more than one natural business system. This design supports the data sharing concept that is inherent with information engineering.

Technical Assistance business area consists of the following natural data stores:

- **Financial Assistance**
- **Inventory**
- **Outreach**
- **Resources**
- **Technical Assistance**

Field Surveillance business area consists of the following natural data stores:

- **Agencies**
- **Certificates**
- **Compliance**
- **Cross Media**
- **Evaluation**
- **Financial Assistance**
- **Inventory**
- **Plans**
- **Resources**

Compliance business area consists of the following natural data stores:

- **Agencies**
- **Compliance**
- **Evaluation**

- *Inventory*
- *Plans*
- *Resources*

Regulation business area consists of the following natural data stores:

- *Agencies*
- *Agreement*
- *Financial Assistance*
- *Inventory*
- *Programs*
- *Requirements*

- *Research Results*
- *Rules*

Inventory business area consists of the following natural data stores:

- *Inventory:* Data store contains individual PWS, facility and personnel data.
- *Cross Media*

Management and Budget business area consists of the following natural data stores:

- *Agencies*
- *Agreement*
- *Certificates*
- *Compliance*
- *Financial Assistance*
- *Inventory*
- *Plans*
- *Programs*
- *Rules*
- *Source Data*

Disease Prevention and Assessment business area consists of the following natural data stores:

- *Agencies*
- *Compliance*
- *Cross Media*
- *Evaluation*
- *Inventory*
- *Outreach*
- *Plans*
- *Requirements*
- *Rules*

Business Area Evaluation

The primary reason for performing the assessment described in the Business Systems Architecture is the identification of business areas for the PWSS program. In order to designate the relative importance of a business area in fulfilling the users' information needs, the PWSS project team used a two-step method to rank the business areas identified during the Business Area Evaluation process. This method involved:

- Counting the number of information needs that a particular Business Area supports and ranking the business areas accordingly.
- Analyzing the program requirements and priorities, the potential development time, and other issues, and then revising the business area rankings based on these criteria.

The first step in this method is straightforward. The PWSS program information needs, shown in Appendix G and developed for the Information Architecture in Chapter 2, was the basis for ranking the Business Areas. This process resulted in the construction of a ranked list of the eight business area projects for the PWSS program as shown in the Initial Business Area Ranking list that follows.

Rank	Business Area Name	Info Needs Supported
1	COMPLIANCE	69
2	REGULATION	66
3	MANAGEMENT AND BUDGET	61
4	INVENTORY	56
5	WATER RESOURCE PLANNING	51
6	FIELD SURVEILLANCE	48
7	TECHNICAL ASSISTANCE	29
8	DISEASE PREVENTION AND ASSESSMENT	19

Initial Business Area Ranking

The second step used to rank the business areas is a little more complex. The PWSS MNA addressed the oversight requirements primarily from the EPA Headquarter's perspective instead of the State's perspective. For instance, while some States consider issuing PWS permits one of their highest priorities, other states are more concerned with enhancing their enforcement capabilities. Still other issues such as systems development sequence and program impact must be considered. For example, it is reasonable to assume that the "*Regulation*" Business Area should be developed before the "*Compliance*" Business Area. However, in reality at the state level, the sequence may be altered by the lag time between federal and state regulation development, conflicting priorities, and available resources. Another issue to consider is the availability of systems (e.g., Model State Information System or the Drinking Water Information System) to support a particular State. Costs and schedule to complete a particular business are (or part of a business area, in the case of a rapid application development project) also play a role in this ranking process.

This second process considered the importance of the Business Area to the fulfilling the mission of PWSS and its impact; the complexity of Business Area (how hard would it be is

design and implement) and development time required; and the required development ordered (which Business Area must be completely developed before another can begin). This process resulted in the construction of a revised ranked list of the eight business area projects for the PWSS program as shown in the list that follows.

Rank	Business Area Name
1	INVENTORY
2	FIELD SURVEILLANCE
3	COMPLIANCE
4	WATER RESOURCE PLANNING
5	TECHNICAL ASSISTANCE
6	REGULATION
7	DISEASE PREVENTION AND ASSESSMENT
8	MANAGEMENT AND BUDGET

Final Business Area Ranking

The "*Management and Budget*" Business Area appears last because it is felt that current systems address the "near term" requirements of this business area. The revised ranked list of business areas represents the recommended ordering of the development efforts to be adopted for implementation in the PWSS Information Strategy Planning project.

This page intentionally left blank.

Chapter 4

Technical Architecture

Technical Architecture

The Technical Architecture defines the operating environment required to implement the Information and Business Systems Architectures defined in Chapters 2 and 3. The Technical Architecture specifies the computers, telecommunications, supporting utilities, database management systems, and operating systems needed to support the business systems.

The Technical Architecture defines a general framework for the system, describing where components would be located and how the components would interact. The Technical Architecture is refined during follow-on Business Area Analysis (BAA) projects, adding technical detail and specifications, including model numbers and software product names.

Three major products result from completing the Technical Architecture: the "Statement of Technical Requirement," the "Technical Architecture" chart, and the "Statement of Technical Direction." The "Statement of Technical Requirement" specifies needed system throughput, availability, response, and security for each proposed business system. The "Technical Architecture" chart illustrates the basic architectural options proposed for PWSS development. The "Statement of Technical Direction" describes long-term plans and recommended alternative(s) for the PWSS system; it also describes policy implications and proposed changes that could affect the PWSS program. These products are presented later in this chapter.

To develop the Technical Architecture, the PWSS project team used the following four-step approach: business area distribution analysis, performance requirements analysis, technical distribution requirements analysis, and architectural options definition and evaluation.

- **Business Area Distribution Analysis**

Business systems and data stores are used by each user category are identified. PWSS user categories are: EPA Headquarters, EPA Regions, Primacy Agencies, Laboratories (Labs), and Public Water Systems (PWSs). Primacy Agencies consist of State, State Region, or in certain cases, EPA Regions.

- **Performance Requirements Analysis**

The high-level technical performance requirements are identified. These performance requirements are later used to evaluate various Technical Architecture options.

The "Statement of Technical Requirement" is produced during this analysis step.

- **Technical Distribution Requirements Analysis**

The required computer hardware, software, and communications capabilities are determined for each user category.

- **Architectural Options Definition and Evaluation**

The architectural options that form the basis for the Technical Architecture are defined. Evaluation of the options involves using the technical performance requirements identified above to determine the most suitable architecture(s) for each organizational level of the PWSS program.

The "Technical Architecture" chart and "Statement of Technical Direction" are produced during this step.

The above four-step analysis process and the results produced from it are described in the following sections.

Business Area Distribution Analysis

When building the Technical Architecture, it is important to identify the functions and data required by each organization. This process helps determine what information is shared by the organizations and how the information flows between them. For PWSS, business area distribution analysis focused on developing a thorough understanding of the organizations' and users' functional requirements and data requirements. This effort involved three steps:

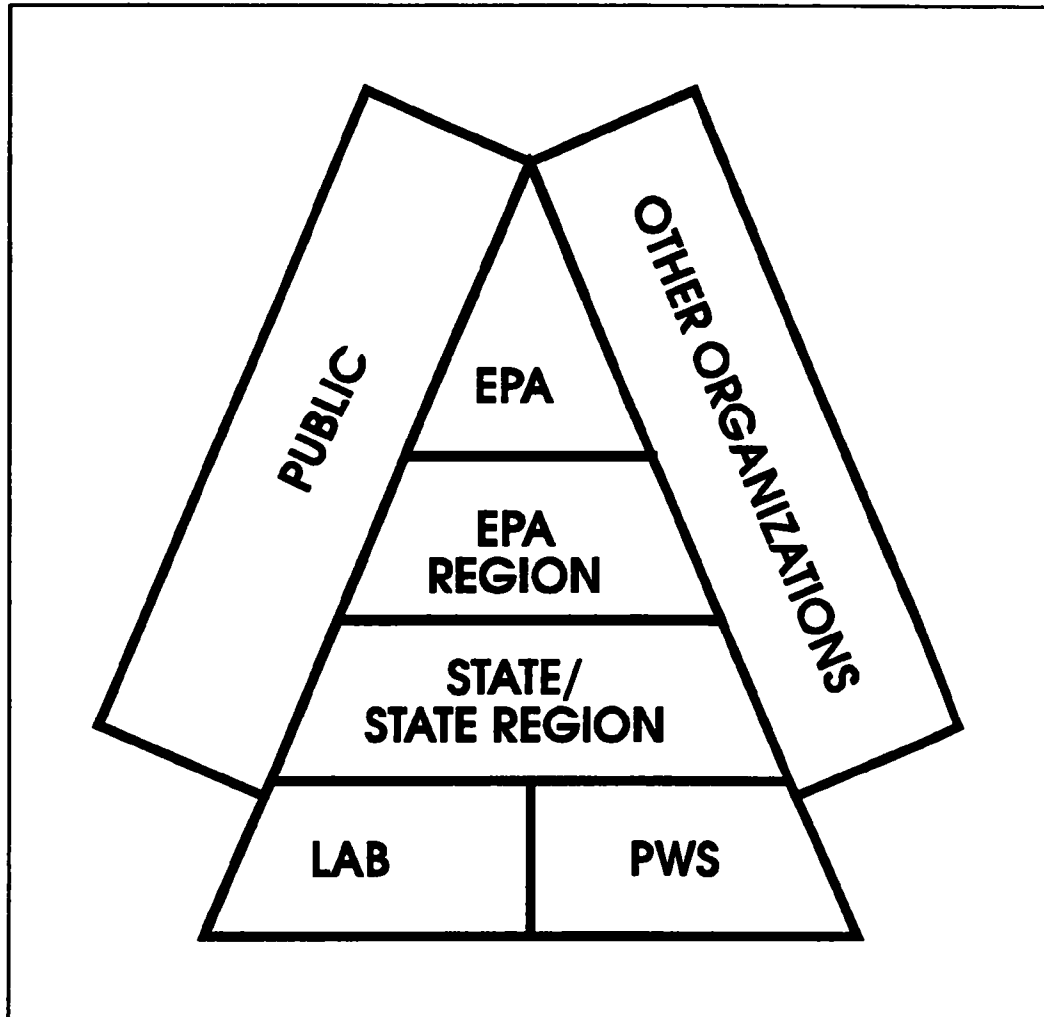
- **Assessment of Organizational Data Sharing**
- **Assessment of Organizational Functions**
- **Data Life-Cycle Assessment**

The results of these three steps are described below.

Assessment of Organizational Data Sharing

PWSS users are located within State and EPA organizations nationwide. In addition, the public and other State and Federal organizations are potential PWSS users. The public includes any person or organization outside the government, from average citizens to citizens' action and interest groups. Other organizations are EPA organizations outside the Drinking Water program and State and Federal organizations and agencies outside the EPA. The following "General Organizational Relationships of PWSS" diagram represents information-sharing relationships within the user community. Organizations shown adjacent to each other typically share information directly.

Assessment of organizational data sharing helps determine the interrelationships of the system from an informational point of view. The interrelationships help determine communication-connection needs and help establish the kinds of communication hardware and software necessary to support the sharing of data.



General Organizational Relationships of PWSS

Assessment of Organizational Functions

Each user category typically performs a set of business activities, represented by a collection of PWSS business systems, that accesses a portion of selected data stores. A business system is considered to be used by a user category if any of the functionality of the particular business system is needed by typical users within the specific user category. For example, Labs can be expected to use at least one of the functions performed by each of the following

December 31, 1992

business systems: Lab Certification, Coordination, Information Systems Management, and Operator Certification.

The "Primary Business System Usage" chart below displays the business systems used by each user category. This information provides insight into the distribution of system functionality and helps determine the expected technical architectural components needed by each user level within the PWSS system hierarchy.

USER	ALLOCATION	CONTINGENCY PLANNING	SCHEDULING	HEALTH ADVISORY	FORECASTING	RISK ASSESSMENT	NOTIFICATION & OUTREACH	RESOURCE MANAGEMENT	SAMPLING	COORDINATION	INFO SYSTEMS MANAGEMENT	OPERATOR CERTIFICATION	STANDARDS DEVELOPMENT	FIELD SURVEILLANCE	TECHNICAL SUPPORT	DISEASE ASSESSMENT	FUNDS MANAGEMENT	ENFORCEMENT	PERMITTING	PRIMACY IMPLEMENTATION	REGULATION DEVELOPMENT	INVENTORY	TECHNOLOGY DETERMINATION	LAB CERTIFICATION	TRAINING SUPPORT	WATER RESOURCE CHARACTERIZATION
PWS	●	●	●	●	●	●	●	●	●																	
LAB									●	●	●															
PRIMACY AGENCY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EPA REGION		●	●	●		●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EPA				●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Primary Business System Usage

Data Life-Cycle Assessment

Business area distribution analysis also included analysis of *entity types* (an *entity type* is a collection of related information [data] required to be kept by the system) from two additional perspectives:

- Data Life Cycle

First, a typical life cycle of operational data was developed showing the functional flow of the data from its origin at a PWS or Lab through its use by various organizations needing it.

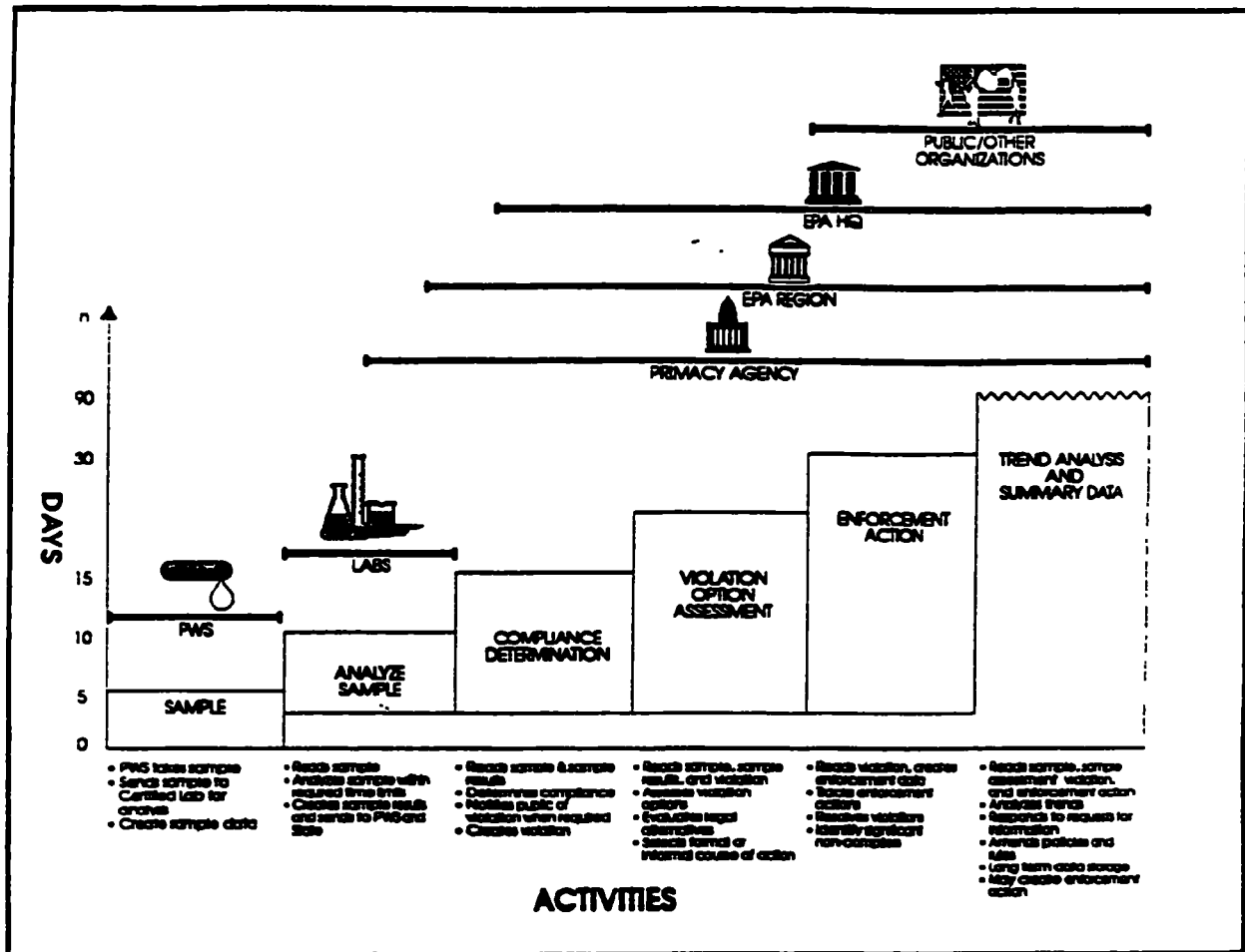
- Data Distribution

Then it was determined which user categories need the information, with respect to age and data owner. A data owner is a governmental user entrusted with custody of the data. Data owners typically have authority to validate and release data to other agencies or the public and to remove data from a system.

Results from the above two analysis perspectives are described below.

Data Life Cycle

The "Typical Entity Life Cycle" diagram, which follows, is a conceptual view of the functional flows affecting the following four PWSS operational entity types: Sample, Sample Result, Violation, and Enforcement Action.



Typical Entity Life Cycle

This "Typical Entity Life Cycle" diagram is an abstract representation of the delegated responsibilities and functions of the typical Primacy Agency. These responsibilities are based on a typical State implementation plan, and are not intended to capture all variations.

The diagram highlights the interaction of selected functions with entity types. The diagram is useful in developing a general model for determining where the data typically should be located and what age of the data would be acceptable for performing particular functions.

Acceptable age of data is a significant design consideration, because an often-stated general requirement for many modern data systems is to provide the most recent data. Since costs associated with real-time (or *almost* real-time) data availability are significantly greater than those associated with a less time-critical database, an understanding of data requirements as being *Strategic*, *Planning*, *Controlling*, or *Operational* allows for realistic design. (Refer to Chapter 3 for definitions of *Strategic*, *Planning*, *Controlling*, and *Operational* requirement levels.)

Operational functions generally need the most recent data to support their efforts. Controlling functions generally need the most recent data, but may tolerate older data. Strategic and Planning functions generally can tolerate older data. All these factors influence design. For example, a realistic design would not require extraordinary or unnecessary investment in communications and processing capabilities to allow instantaneous updates if the effort is to review natural trends over the past five years.

On the "Typical Entity Life Cycle" diagram, the vertical axis "Days" represents time frame for the entity-type life cycle. For example, day 0 is the day a particular sample is taken; it is the day the entity-type SAMPLE is created. The horizontal axis represents activities that occur that use and transform the entity types. (For clarity, entity types are written with all capital letters within the remainder of this explanation.) Shortly after the SAMPLE is taken, the Lab receives the SAMPLE, reads the SAMPLE data, analyzes the SAMPLE, and documents the findings. This process creates SAMPLE RESULTS data. The Lab forwards SAMPLE RESULTS to the PWS and Primacy Agency. The Primacy Agency reads SAMPLE and SAMPLE RESULTS data, determining compliance and creating VIOLATION data, if appropriate. Then the Primacy Agency reads and assesses VIOLATION data, considering ENFORCEMENT ACTIONS. The Enforcement function reads SAMPLE, SAMPLE RESULT, and VIOLATION data, and creates ENFORCEMENT ACTION data. The process outlined above may occur within a few days or (more typically) over thirty days. Generally, the operational functions accessing SAMPLE, SAMPLE RESULT, VIOLATION, and ENFORCEMENT ACTION need the most current data available.

While the above discussion highlights the use of data by Operational functions, the data is still needed for Planning and Strategic functions for such purposes as trend analysis, primacy oversight, and program implementation review. The life cycle of the various entity types (SAMPLE, SAMPLE RESULT, VIOLATION, and ENFORCEMENT ACTION) may range from thirty days to several years. As a result of data life-cycle analyses, it was determined that Strategic and Planning functions accessing SAMPLE, SAMPLE RESULT, VIOLATION, and ENFORCEMENT ACTION information can tolerate data from two to three months old (i.e., historic data); these functions do not require the most recent data for analysis.

Data Distribution

To understand the distribution of information within the PWSS program, it was necessary to assess the *users of* and *sources for* data. This assessment is discussed below.

- Users

The Entity Type by User Category Matrix, included as Appendix AA, displays the data needs of the various PWSS user categories. For each entity type, the PWSS project team first indicated the data owner. Note that a particular entity type may have several data owners. For example, SAMPLE may be owned by a Primacy Agency or the EPA. A Primacy Agency is the custodian for SAMPLEs created in response to its own programs. EPA is custodian for SAMPLEs that the Agency takes directly, outside the auspices of a Primacy Agency.

Once owners were determined, entity-type usage was considered. If an entity type is needed to perform Operational functions by a user category, then the use was coded *operational*. If the entity type is needed to perform only Strategic or Planning functions, then the use was coded *strategic/planning*.

- Sources

Analyzing the operations and information stored at each organization results in the "Organization Information Interface Matrix," which follows. This matrix considers each organization as an information source (shown along the horizontal axis) that supplies other organizations as information users (the vertical axis). The type of information passed from the source organization to the user organization is marked at each matrix intersection with a number. The number 4, for example, at the intersection of EPA (source) and EPA Region (user) indicates that rules, regulations, etc., are passed from the EPA to the EPA Region. Six numbered categories of interfaced data are defined in the table below and are used in the matrix.

Category	Data Description
0	The source organization is not the normal data source for another user organization. Exceptions may occur, but the intent of the matrix is to be a general representation.
1	The organization is a source for the data; i.e., it "owns" the entity type, which can be read by other user organizations. For example, an EPA Region or State would own violation data.
2	Inventory data, such as the numbers and types of laboratory equipment, flow from the source.
3	Analytical results flow from the source to the user. For example, a Lab sends water-analysis reports to a Primacy Agency.
4	Static and directive data (rules, regulations, etc.) flow from the source to the user.
5	The source organization determines violations and generates enforcement data.
6	The source organization is a Primacy Agency and is the source for implementation status.

Categories of Interfaced Data

SOURCE \ USER							
	EPA	EPA REGION	PRIMACY AGENT	PWS	LAB	PUBLIC	OTHER AGENCIES
EPA	-----	4, 5	4, 5	4	4	1, 4, 5	1, 4, 5
EPA REGION	5, 6	-----	1, 4	1, 4, 5	1, 4	1, 4, 5	1, 4, 5
PRIMACY AGENT	3, 5	3, 5, 6	-----	1, 4, 5	1, 4, 5	1, 4, 5	1, 4, 5
PWS	0	0	2, 3	-----	2	0	0
LAB	0	0	3	3	-----	0	0
PUBLIC	0	0	0	0	0	-----	0
OTHER AGENCIES	0	0	0	0	0	-----	-----

0 = NOT NORMAL DATA SOURCE
1 = SOURCE FOR DATA ACCESS
2 = INVENTORY DATA

3 = SAMPLE RESULTS
4 = RULES, REGULATIONS, ETC.
5 = VIOLATION & ENFORCEMENT DATA
6 = PRIMACY (IMPLEMENTATION STATUS)

Organization Information Interface Matrix

The analysis of business area distribution for the PWSS system shows that both the national EPA Drinking Water program and various Primacy Agency drinking water programs need full PWSS functionality. The division of some business areas is more definitional than actual, in that both the national program and the Primacy Agency programs can perform aspects of the same function. (e.g., both the States and the national EPA engage in regulation development, technical assistance, management and budget, etc.) Similarly, the location of data stores to support these business areas is dependent on the definition, since information such as sample data and inventory data may appear in both Primacy Agency and national EPA databases.

Performance Requirements Analysis

The second step in defining the Technical Architecture is assessing performance requirements. A recommended Technical Architecture is determined mainly by how it meets performance requirements in two categories: programmatic performance and technical performance.

- **Programmatic Performance**

For PWSS, programmatic performance includes considerations such as cost, portability, and compatibility with existing State systems.

- **Technical Performance**

Technical performance includes features such as response time, security features, and the ability of the system to meet key PWSS functionality requirements.

Summaries of the analyses performed for the two categories of performance requirements are discussed below in detail. The "Statement of Technical Requirement," which recaps the results from the analyses, follow the summaries.

Programmatic Performance

Considerations identified as important to programmatic performance are listed below. The identified considerations are:

- Acquisition Cost
- Maintenance Cost
- Operational Cost
- Portability and Scalability
- Accessibility to Information
- User Acceptance
- Compatibility

- Ability to Satisfy Requirements
- Conversion Cost
- Political Acceptability.

Following is a description of each consideration:

Acquisition Cost - The initial cost incurred to acquire the system. This includes the costs of purchasing hardware and software components used at each level. The number of components in each organizational level is important because it is a multiplier--the more components, the greater the cost. For example, at the Primacy Agency level the multiplier is low compared with the multiplier for PWSs (65 Primacy Agencies compared with over 200,000 PWSs).

Maintenance Cost - The cost of keeping the system running at a uniform level of operation. This includes the costs of hardware/software upgrades and the costs associated with special operators and computer technicians.

Operational Cost - The day-to-day cost built into the system. This includes the costs of leasing/using communication lines and the costs of purchasing supplies.

Portability and Scalability - A feature of *open systems* (also known as *open systems interconnection* [OSI]) in data communications. The International Standards Organization developed OSI to coordinate standards development at all communications levels. OSI permits a single software product to be used across a wide range of computing platforms.

Accessibility to Information - A view of the Technical Architecture from the perspective of how communications interfaces are implemented needed in order to provide the necessary access to PWSS information while maintaining the necessary security.

User Acceptance - Consideration of how users, especially at the State and local levels, view the PWSS. The Technical Architecture must offer apparent benefits to users.

Compatibility - Consideration of how compatible the PWSS will be with regard to the way States currently do business. If the system is radically different from what users expect or are comfortable with, it may not be accepted.

Ability to Satisfy Requirements - The Technical Architecture must be capable of satisfying all identified functional requirements. There must be nothing inherent in the Technical Architecture that prevents implementing the required functionality. Technical requirements cover features such as response time and security. Since technical performance can vary, this consideration evaluates the degree to which the system meets its performance requirements.

Conversion Cost - The cost of converting the software and hardware of existing systems to conform to the Technical Architecture.

Political Acceptability - Consideration of how acceptable the Technical Architecture is to all user organizations. Influencing this evaluation are personal preferences, existing computer hardware and software, training/familiarity investments, and other qualitative factors.

Members of the PWSS Technical Architecture Working Group, which met October 21-23, 1992, weighted the above considerations on a scale of 1 to 10. (Appendix BB contains a list of Working Group participants.) The composite result of the meeting is shown in the following table.

CONSIDERATION	WEIGHTED AVERAGE
Ability to Satisfy Requirements	8.7
Accessibility to Information	8.1
User Acceptance	7.3
Acquisition Cost	7.2
Maintenance Cost	7.1
Political Acceptability	7.0
Compatibility	6.7
Portability and Scalability	6.2
Operational Cost	5.8
Conversion Costs	5.6

Weighted Considerations In Technical Architecture Evaluation

Technical Performance

Three main areas of technical performance are considered when developing the Technical Architecture:

- **System Response**
- **System Security**
- **Functional Performance**

This information gathered in these areas is used to aid selection of options for data communications, levels of security, etc. This data, combined with the business area distribution developed in the previous task, can be used to determine the kind of technical support that is needed throughout the organization. The three areas of technical performance are discussed below.

System Response

System response can be constrained either by communications capacity or by computational capacity. If communications are limited, then transactions flow slowly between organizations, (i.e., communications capacity limits response). When communications are adequate so that transactions flow quickly. On the other hand, if the computers in each organization cannot respond, then computational capability limits response.

Computational capacity limitations can be easily overcome by ensuring that the computing platforms at each location are adequate for the processing load. This can be done by using modern computing technology, provided the costs of the computers are within acquisition budgets. Communications, on the other hand, is a recurring expense directly related to the time of channel use and the bandwidth (bits per second) of the channel. Since communications costs are recurring, care must be taken that the Technical Architecture is configured so large amounts of data need not be transferred between the source and the user.

An example of communications inefficiency is the use of a remote graphical user interface (GUI). If the GUI program resides remotely, then each time the user accesses the system, bit-mapped graphics are transferred between the host machine (containing the GUI program) and the user. Since access takes place over communications lines, response is slowed and the amount of actual data transferred is small relative to overall channel use. In other words, GUI programs and data should reside with local users. Another example of potential communications inefficiency is in the area of data queries. If a user (such as the public) is

given free-form query capability of an organization's database, response to the query could be an extremely large amount of data. This would effectively lock up the communications channel and require a great deal of time to transfer the information.

The Technical Architecture must also support essential data transfer in a timely manner by limiting the amount of extraneous data flowing through the system. Essential data transfer involves the analytical results taken from water samples and corresponding physical inventory that pass from PWSs and Labs to higher level organizations.

The reporting of sample results for all contaminants is a goal of the PWSS system and is expected to result in maximum communications loading. System feasibility depends on providing adequate communications. Consequently estimating communications loading is useful to ensure that communication requirements are reasonable. Appendix DD, the "Communication Feasibility Analysis," describes an analysis that defines worst-case type bounds on communication requirements. The analysis assumes the worst-case reporting situation is caused by each Lab reporting results for all contaminants in each sample. The analysis considers annual, quarterly, monthly, weekly, and daily sampling, and assumes an efficient coding system (other than straight ASCII) is used to represent contaminant type and sample value. The results of the analysis show that the communications needed to report all contaminant measurements are reasonable and within the scope of dial-up and/or leased-line interconnections. However, success of using dial-up lines is dependent on development of a PWSS Communications Management Plan that distributes the transfer of information over a reporting period.

System Security

The PWSS user community is diverse. It includes both official government users and the public as well as PWSs, Labs, and other drinking-water program participants. In addition, information to be stored within the system would include sensitive information, potentially including data protected by the Privacy Act of 1974, and sensitive enforcement data.

The PWSS system will process sensitive data as defined by OMB Circular A-130, and will require incorporation of security safeguards to preclude unauthorized access, modification, or inadvertent loss of PWSS data.

Also, each user category will be restricted to performing only their prescribed set of functions within specific business systems. For example, a PWS should be able to review their inventory information, but should not be permitted to unilaterally change the inventory records. However, a PWS should be able to submit a proposed change to inventory records for verification and approval by the government data custodian. As a result, the security design must provide for limiting access to prescribed business systems and to specified

functions within each business system. Security would also include controlling access to the capabilities that establish authority (by user category or user identifier) over the ability to create, update, delete, and read each entity type.

Additionally, the system must provide a means to audit use by individual users, including the logging of data activity. Included would be the capability to roll back changes, should unauthorized access occur. Audit trail records of any updates to the database are critical to developing and maintaining data integrity and traceability.

Functional Performance

Analysis of functional performance involves consideration of needed system functionality in light of its potential impact on choosing a Technical Architecture. Of the functional needs discussed during the Technical Architecture Working Group Meeting, the following eleven items directly affect the Technical Architecture:

- Automated Data Flow
- Retrieval
- Update
- Cross-Media Data Access
- Compatibility and Scalability
- Interface
- Flexibility
- Response Time
- Security
- System Maintenance
- Historical Record Keeping

Each of these functional needs is described in more detail below:

Automated Data Flow - The system must be able to maintain schedules by which automated synchronization of selected entity types are performed between Primacy Agency data stores and EPA data stores. Primacy Agencies must be able to define the schedules according to agreements with other organizations (field office, EPA Regional office, etc.). This functionality must be transparent to the user.

Issue:

Should a truly distributed architecture be selected, synchronization would be managed by the database management system (DBMS).

Retrieval - Both batch and online data retrieval must be available locally and remotely (field personnel, Labs, PWSs, etc.) and to the public. Access to the system must be simple and must include the ability to formulate data queries and define and select reports. Responses to retrieval requests must be timely. Retrieval of sensitive/confidential data must be controlled appropriately.

Issues:

- Deciding and controlling who has access.
- Achieving economies of scale between batch and online capabilities.
- Limiting the size of query responses and reports so normal processing is not impacted, or providing sufficient systems and communications capacity to generate them.

Update - Both batch and online updating must be available to locally and remotely. The update process must be straightforward and simple (i.e., responsive [timely and logically complete and intuitive], with easy-to-use add, change, and delete capabilities). The online update process must be immediate. The system must support total data replacement as well as traditional updating (inserting new database records, deleting existing records, and modifying values). Updates to sensitive/confidential data must be controlled appropriately.

Issues:

- Deciding and controlling who has access.
- Whether to update a master file through the use of a batch transaction file.
- Whether to allow online access to edit erroneous data.
- How to realize economies of scale by maintaining both batch and online capabilities
- Maintaining audit trail records of every update to the database.

Cross-Media Data Access - The system must be able to possess the minimum data set necessary to access other information systems (STORET, USGS, PCS, CERCLIS, etc.). Of special interest is compatibility with EPA geographic information systems. Access to

other data systems would include the following minimal capabilities: fundamental data retrieval; foreign data integration with PWSS-specific data; and/or augmentation of PWSS-specific data with foreign systems' data.

Issues:

- Which "hooks" are needed to the other database systems.
- Whether compatibility should include direct import.
- Whether database systems should be integrated.
- Suitability of periodic imports of selected data from other systems.

Compatibility and Scalability - The system must be compatible with personal computer (PC), minicomputer, and mainframe implementations found throughout the PWSS community and must avoid (as much as possible) use of unusual or uncommon equipment. In PC environments, the system must be single-user compatible as well as network compatible.

Issues:

- Providing compatibility with systems in broad use in the community.
- Providing a *de facto* standard that satisfies the majority of users.
- Providing portability within EPA standard technologies.
- Providing scalability.
- Achieving the goal of developing a usable system within ten years.

Interface - For States, field offices, Labs, and PWSs not choosing to use the PWSS system directly, a common system interface (standard/data format) must be established. Automated data entry may also be necessitated. Overall, however, the system should support existing and emerging state-of-the-art technologies for data acquisition (GPS equipment, laboratory information management systems, portable computers, etc.) and interchange (electronic data reporting, electronic data interchange [EDI], etc.).

Flexibility - The system must be adaptable to State-specific requirements, which include the following:

- State-definable data elements (i.e., customization and expandability).
- State-definable code values and descriptions.
- State-definable data-validation criteria (e.g., date, numeric, min/max value, value range, code-table lookup).
- State-definable rule bases for compliance determination, correspondence generation, etc.

Response Time - The system must provide "reasonable" response times to user inquiries, report-production requests, and batch processing. The "reasonableness" of response time will vary depending on the characteristics of the task in question and the other demands being placed on the system at the time.

Security - Retrieval and update of sensitive/confidential data must be controlled appropriately. Access authority must be controllable to the individual user level, and States must be able to define and customize their access authorities.

Issues:

- Whether a master user list should contain the privileges and authorities.
- The number of public access points (the more points of entry, the greater the risk).

System Maintenance - To reduce cost and manpower burdens on users, the system must be centrally maintained and installation of system upgrades should need minimal user intervention.

Historical Record Keeping - The system must support retrieval of operational and historical data. Types of data for which historical records are maintained must be determined by agreement between EPA and the Primacy Agencies.

Issue:

The age of historical data maintained in a readily available media is often established in Federal or State rules. When not established by rule, the age may be determined at State discretion. Data older than established limits must be archived in a manner allowing for retrieval if needed.

In analyzing the performance requirements of each business system has been assessed to determine the kind of technical support needed throughout the PWSS program. Performance requirements for all levels of PWSS have been established for throughput, availability of the system, response times, and the need for security.

These performance requirements will be fully detailed during the Business Area Analysis portion of the systems development life cycle, and are shown for the above mentioned categories on the "Statement of Technical Requirement," which follows.

Certain performance criteria are associated with each of the 29 business systems that comprise the PWSS Business Architecture. These criteria help identify the technological requirements and constraints that define the Technical Architecture. Broad statements about four areas of identified technological requirements--Throughput, Response, Availability, and Security--arise from the performance requirements for business systems.

Throughput

Throughput requirements vary widely across business systems. The largest flow of data will be from PWSs and Labs to Primacy Agencies at the State level. Some States receive hundreds, even thousands, of sample-analytical results per day. The timeliness of submissions is based on the monitoring schedules of the PWSs and the reporting requirements of the Labs. PWSs and Labs must comply with State and Federal policies and have reporting requirements for given contaminants. Other throughput requirements pertain to the transfer of data between nodes of the PWSS communications network. Large volumes of data may move throughout the system, driving the need for automated data-flow procedures.

Response

Response requirements also cover a wide range. Sub-second response times are required for online transaction processing at the Primacy Agency level. Less stringent response is required for query and summary functions at all levels of the PWSS structure. To reduce network traffic and response-time degradation, the application software must be able to identify potentially time-consuming queries and warn users before the queries are executed.

Availability

No requirement exists for 24-hour availability of the PWSS system. It is assumed that the system will be available at all levels for online access and transaction processing during normal working hours with nonworking hours reserved for system maintenance, batch processing, backup and recovery, and upgrading of system hardware and software.

Security

The PWSS system will process sensitive data as defined by OMB Circular A-130, and will require incorporation of security safeguards to preclude unauthorized access, modifications, or inadvertent loss of PWSS data. Determining who has access to the system at each level and across the levels will be established according to policy based on agreements between Primacy Agencies and the national EPA. Public access is assumed to be read only.

Statement of Technical Requirement

Technical Distribution Requirements Analysis

The third step in defining the Technical Architecture is to identify the technical support needed for each predicted business system and data store in terms of required computer hardware and software. That is, this step determines the level of technology required to satisfy the needs of each business area. Analysis is based on the distribution of business areas for various organizations and on the performance requirements for the business systems making up each business area.

This analysis involves assessing integration requirements for each organization, then determining the levels of technology required to satisfy the requirements. Assessing integration requirements consists of judging whether business systems and data stores should be *highly integrated* (implemented at a central facility), *moderately integrated* (implemented using some form of distributed processing), or *stand-alone* (implemented through local processing at a single site or workstation).

The approach used was to evaluate the technical support required at each organizational level. For PWSS, evaluation involved the following four areas of consideration:

- **PWS and Lab**

The technical functionalities needed at the PWS and Lab levels.

- **Primacy Agency**

The technical functionalities at the State, State Regions, and EPA Regions with Primacy.

- **EPA/EPA Region**

The technical functionalities at the national and Regional EPA levels.

- **NCC**

The technical functionalities at EPA's National Computer Center, Research Triangle Park, North Carolina.

Each organizational level is characterized in terms of data operations, storage, applications, hardware, and communications. The results of evaluating the four PWSS areas are explained in the following sections.

PWS and Lab

The large numbers of PWSs and Labs are significant cost multipliers when considering which computer technology should be used. The most effective computing platform meeting all PWS and Lab needs is the PC. A table of technical functionalities for the PWSs and Labs follows.

Primacy Agency (State/State Region)

Primacy Agency centers require computing platforms capable of operating the database management systems needed to meet data organizational and security requirements. These computing platforms can range from capable workstations and minicomputers to mainframes. Technical functionalities for Primacy Agencies are also shown in the following table.

EPA/EPA Region

EPA Regional offices require technical facilities comparable with those of the Primacy Agencies. EPA Headquarters and Regions will use the technical facilities provided by EPA's National Computer Center, Research Triangle Park, North Carolina (NCC). Technical functionalities for EPA Headquarters and EPA Regions are also shown in the following table.

NCC

Currently, the computers at the NCC are mainframes. These computers can accommodate the additional software necessary to support PWSS reporting, so no additional hardware is required. Since NCC is not a separate user within the system, the technical distribution requirements shown for the EPA/EPA Region include the NCC, so NCC is not specified in the table.

Technical Distribution Requirements

	PWS	Lab	Primacy Agency	EPA/ EPA Region
DATA/OPERATIONS				
PWSS functionality:	Limited	Limited	Full (data owner)	Full (data owner)
Data entry/edit capability	✓ (to create initial record)	✓ (to create initial record)	✓	✓
<i>Ad hoc</i> query capability	✓	✓	✓	✓
Submission of change request required	✓	✓		
No direct update capability	✓	✓		
Data uploads to State/State Region	(of Lab reports to State/ State Region) ✓	(of Lab reports to State/State Region and/or PWS) ✓	✓ (to national EPA)	✓ (to national EPA)
Data verification			✓	✓
Data retrieval (analysis)			✓	✓
Data reporting			✓	✓
STORAGE				
Local storage:			Large	Large
Of Lab reports	✓	✓	✓	✓
Of sample records	✓	✓	✓	✓
Of system inventory data	✓		✓	✓
APPLICATIONS				
Range of business systems			Full	Full
Communication software (commercial)	✓	✓	✓	✓
Shell (DOS/Windows™)	possible	✓	✓	✓
Terminal emulation (VT-100, 3270)	✓	✓		
Strategic functions				✓
DBMS			✓	✓

Technical Distribution Requirements		PWS	Lab	Primacy Agency	EPA/ EPA Region
HARDWARE					
Use of existing PCs, or optional purchase of PCs, as required	✓	✓	✓	✓	✓
Local Area Network (LAN) environment:					
Application server			✓	✓	
Data server			✓	✓	
Communication server			✓	✓	
Minicomputer			✓	✓	
Mainframe			✓	✓	
Host-to-public interface					✓
PC-to-host (NCC)					✓
COMMUNICATIONS					
Dial-up or leased circuits to States/State Regions	(or Labs) ✓	(or PWSs) ✓			
Communication interface:					
PWS			✓		
Lab			✓		
State/State Region			✓	✓	
EPA/EPA Region			✓	✓	
Public			✓	✓	
Other organizations, including Federal, States, and local government databases			✓	✓	

Technical Distribution Requirements

Based on the above distribution of technical functionalities required by each PWSS user group, another matrix was developed--the Technical Facility by User Matrix, which follows. This matrix identifies the technical support (i.e., computer hardware and software) required

to satisfy the needs of each business area. The technical facilities shown in this matrix are categorized and described as follows:

Processing Facilities - Includes computers, peripherals, data stores, and support software.

Workstations and Terminals - Includes PCs and systems software (VMS/XA, CICS, IMS/DC, network protocols, etc.).

Communications Facilities - Includes facilities supporting all communications-hardware interfaces to PWSS.

DBMS - Database management system software, which includes data dictionaries.

System Development Facilities - Includes systems-development software such as computer-aided software engineering (CASE) tools, compilers, debuggers, and code generators.

Office Support Software - Includes software to support the office environment (word processing, electronic mail, etc.).

Decision Support Software - Includes software packages such as spreadsheets and statistical software (SASTM, etc.).

External Resources - Includes timesharing services, service bureaus, and facilities management.

Technical Facility	Location (User)	PWS	Lab	State and State Region	EPA and EPA Region	Other Organizations	Public
Processing Facilities			●	●			
Workstations, PCs, and Terminals	●	●	●	●			
Communications Facilities	●	●	●	●	●	●	
DBMS SW			●	●			
System Development Facilities			●	●			
Office Support SW			●	●			
Decision Support SW			●	●			
External Resources			●	●			

Technical Facility by User Matrix

This section identifies the locations (users) where various categories of hardware units and software products are required. From the matrix, we can see that the bulk of the technical distribution will be at the Primacy Agency and national EPA levels. Other users will need access to data, but they have more limited requirements for hardware and software to support their operations.

Architectural Options Definition and Evaluation

The fourth step in defining the Technical Architecture is to identify feasible architectural options and provide the basis for mapping the options into the proposed Technical Architecture. Each candidate Technical Architecture presents particular strengths and weaknesses. Because the PWSS Technical Architecture represents a concept for building a geographically diverse system with differing functional and information-storage requirements at each organizational level, the Technical Architecture is expected to incorporate features from several of the candidates presented here. For PWSS, analysis of architectural options involved three steps:

- References to the technical facilities at each organizational level were used to identify architectural alternatives and combinations that are feasible both technically and financially.
- Then the alternatives and combinations that best satisfy the performance requirements discussed earlier in this chapter were evaluated.
- Finally, the best architectural solution was recommended in the "Statement of Technical Direction."

The above analytical procedures resulted in the development of the three following architectural evaluation assessments:

- **Candidate Architectures**
- **Mapping of Candidate Architectures to the PWSS Technical Architecture**
- **Software Considerations**

The results of each of these assessments are described in the next section, followed by the "Statement of Technical Direction," which was produced from the assessments.

Candidate Architectures

Five candidate architectures have been identified:

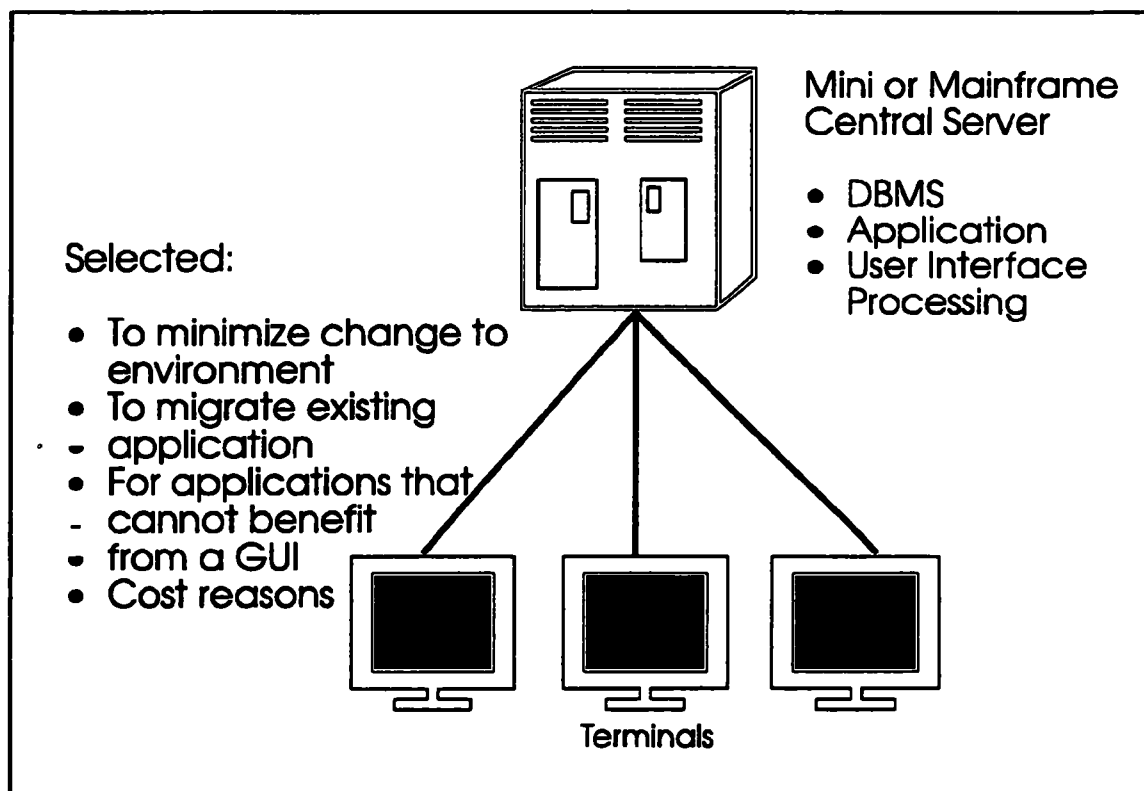
- **Time-sharing**
- **Client/Server**
- **Distributed Database**
- **Cooperative Processing**
- **Store-and-Forward (Two-Tiered)**

These five candidate architectures are discussed on the following pages.

Time-sharing

The traditional time-sharing approach consists of dumb terminals connected to a central mini or mainframe computer that manages all databases, processes all applications, and handles all user interfaces. A recent variation on this model is the development of "screen scrappers," which are software applications that provide graphical interfaces to users and process transactions between PC terminal emulators and a central computer. "Screen scrappers" may provide some data-validation and help facilities; however, they do not store operational data. The application and operational data stores all reside and operate on the central host computer.

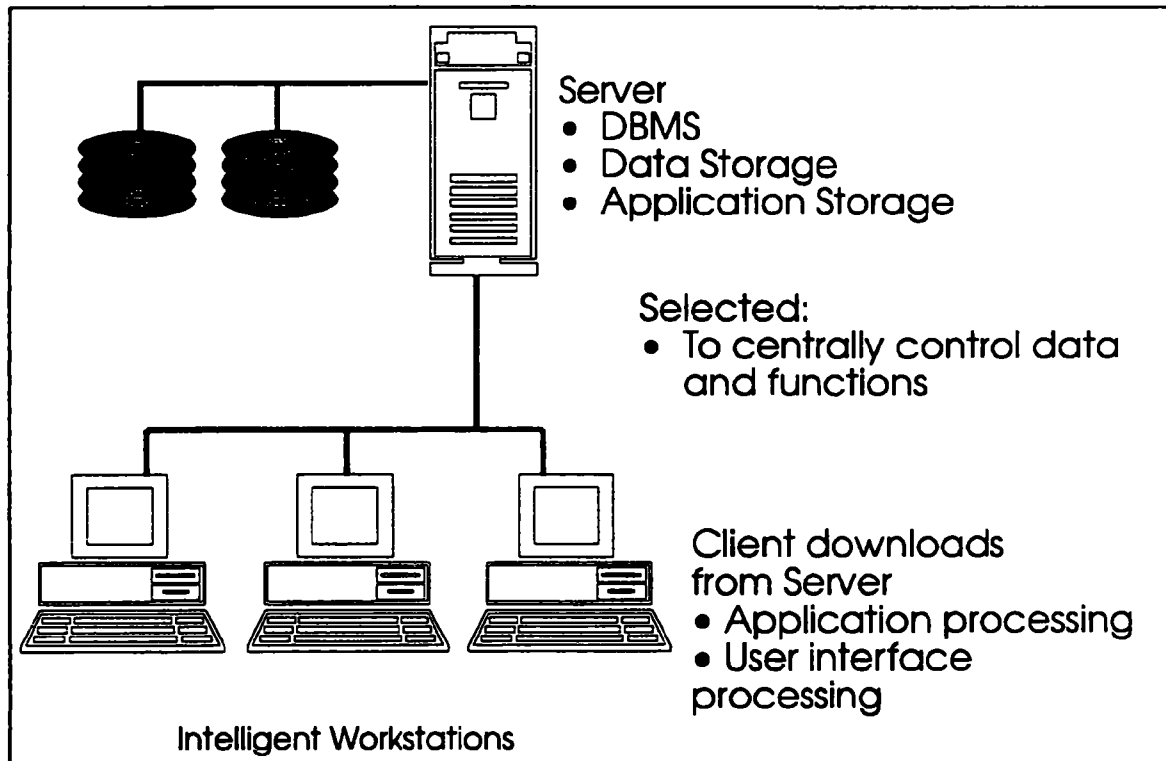
The diagram below depicts the time-sharing architecture.



Client/Server

The client/server approach consists of many *client* workstations or PCs connected to a central *server* or computer. Client/server software manages a tightly coupled relationship between client processes and server processes. Workstations typically handle user interface. Applications may either be retrieved from the server or reside on the client. In either case, the application executes on the workstation, while the server centrally stores the databases and perform database-management services.

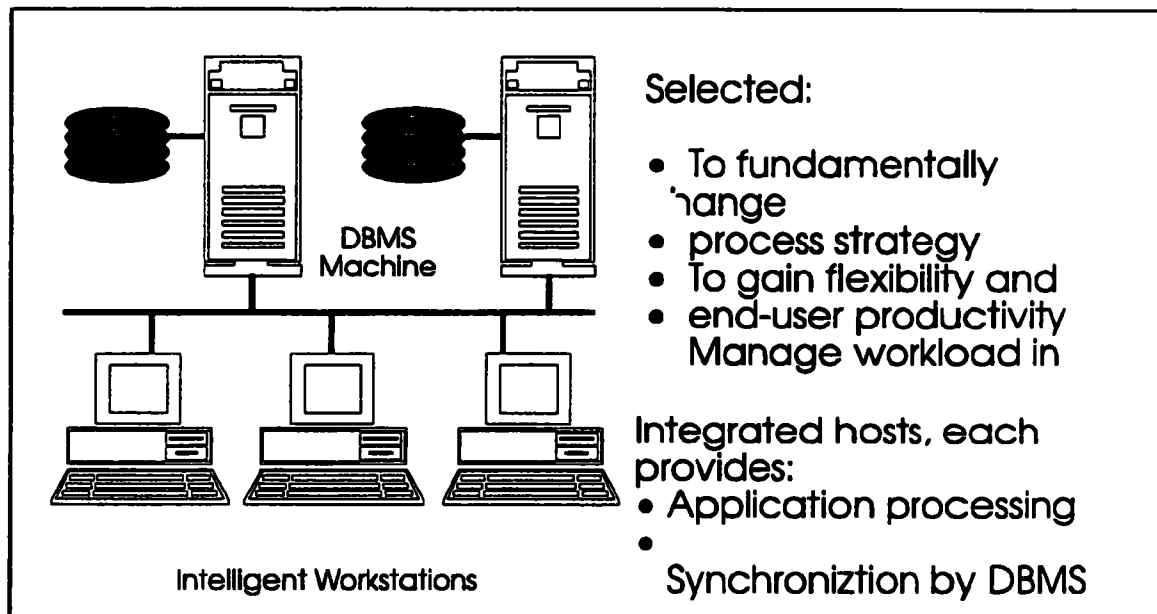
The diagram below depicts the client/server architecture.



Distributed Database

The distributed database approach utilizes one logical DBMS operating across multiple physical computers, generally at separate geographic locations. Distributed database computers may be connected with many intelligent workstations that individually process applications and handle user interface.

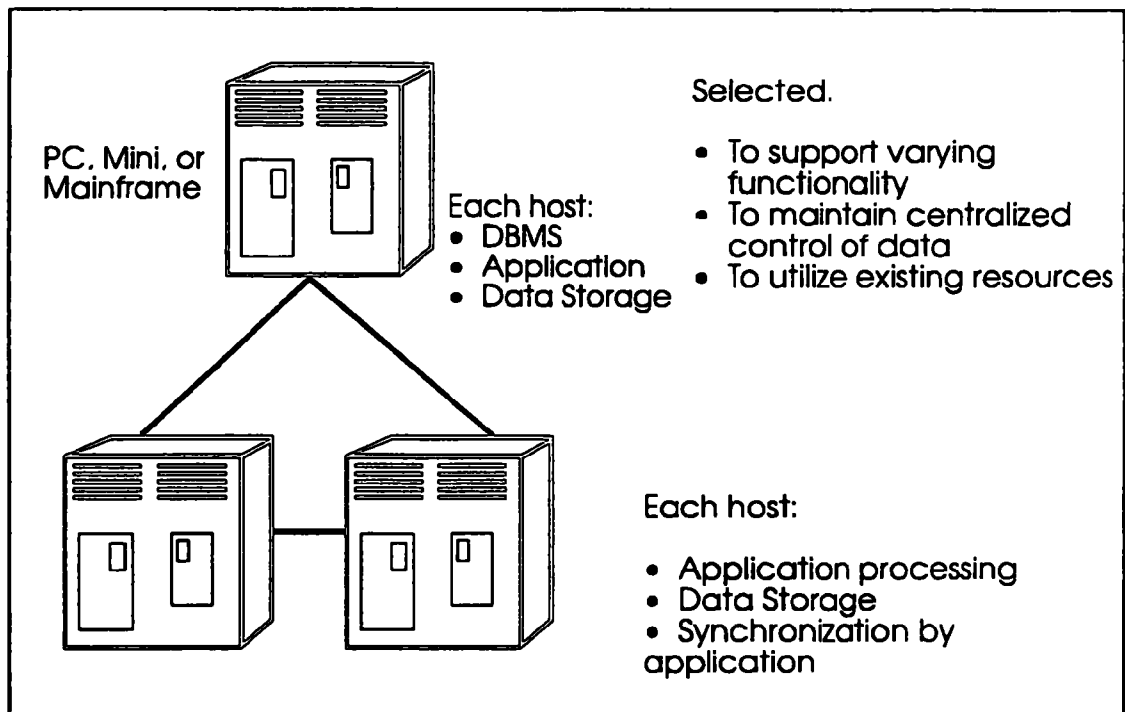
The diagram below depicts the distributed database architecture.



Cooperative Processing

The cooperative processing approach provides for the exchange of data between two or more computer systems performing independently. Each computer provides database-management services to its user community and interacts with other computers to exchange selected information. Generally the processes running on the various computers have knowledge of one another and essentially "co-operate," exchanging information transparently to the user.

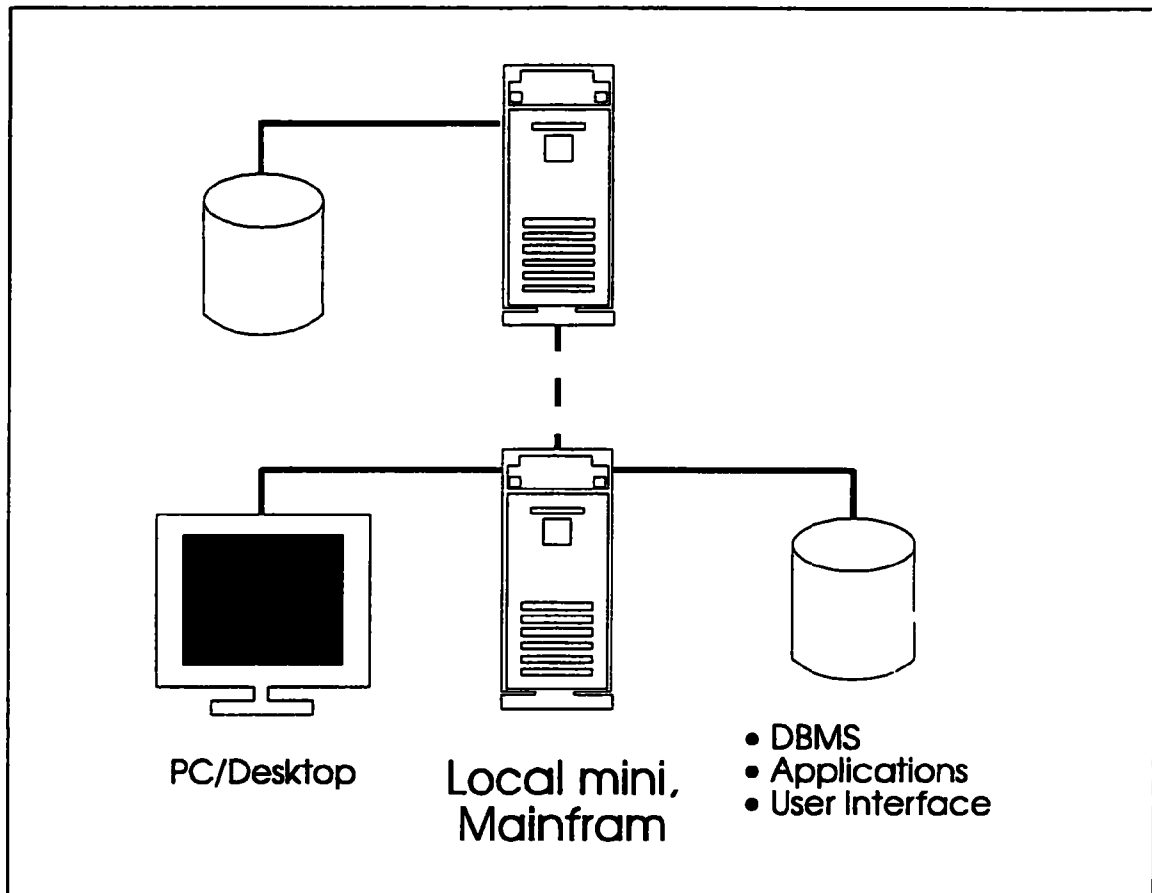
The diagram below depicts the cooperative processing architecture.



Store-and-Forward

Store-and-forward is a two-tiered approach. While computer systems may be physically connected, applications do not directly intercommunicate and do not have "knowledge" of one another. Typically, extracts of databases from a "local" computer are performed, then physically or electronically forwarded to a "remote" computer. The database extract is then imported into the database system residing on the "remote" computer. Batch programs may be written to facilitate extract, store, forward, and import processes.

The diagram below depicts the store-and-forward architecture.



Mapping of Candidate Architectures to the PWSS Technical Architecture

The recommended PWSS Technical Architecture is a composite of architectural candidates applied at each organizational level and between organizations. Analysis for the recommendation addressed four user categories:

- **PWS and Lab**
- **Primacy Agency**
- **EPA Region**
- **EPA Headquarters/NCC**

The analysis descriptions that follow present the architectural candidates considered most likely to be used at the different organizational levels. An illustration of the complete architecture is presented on the fold-out page at the end of this Chapter.

PWS and Lab

At the PWS and Lab levels, architectural options are limited. Neither type of site is a candidate for full PWSS-application implementation, and the actual technical architecture for these sites cannot be mandated by the PWSS program. The architecture for these levels consists of PCs or workstations running low-end (less than full PWSS functionality) application shells and commercial communications software. This architecture would enable the sites to interface with the Primacy Agency level on a time sharing basis to do uploading of required data and change requests and to do read-only querying of information stored at higher levels in the architecture. Communication would be through dial-up access or leased line for sites with appropriate hardware.

More advanced communications options are envisioned for the Labs to support connection of PWSS to Lab data systems using electronic data interchange (EDI). The Lab-PWSS component would receive and format data from the Lab's data system, and would enable the forwarding of data on a periodic basis to the Primacy Agency.

Primacy Agency (State/State Region)

Primacy Agency architectural options are more varied than PWS and Lab options. Some States have complex and fully functional PWSS systems already in place that would only need interface access to the national level PWSS. Other States have virtually no existing systems. Still other States have some hardware and software capability that either would be replaced by the new PWSS applications or would have to interface with them.

States desiring to continue use of existing automated systems could adopt one of the following approaches:

- **Modify existing State software to conform to the data and interface requirements of PWSS.**
- **Implement a PC-based PWSS interface to maintain an interface between the State system and the national PWSS system. Since this interface approach would have the least impact on existing State software, it offers the lower risk.**

For Primacy Agencies having few PWSs, obtaining PWSS functionality would require opting for one of the following architectures:

- **PC(s) connected to the NCC through leased or dial-up line(s) on a timesharing basis. The State database would be established on the NCC computing environment and would interact with the NCC PWSS environment as would any other State. Public access would be through the NCC PWSS public-access *gateway*. (A *gateway* is a software application with network protocols, hand-shake dialogues, and access-processing modules that allow users to seamlessly access databases other than their own.) Lab and PWS access would be manual; i.e., through a PWSS application shell and also by mailing magnetic media or hard copy reports to the Primacy Agency.**
- **PC-based PWSS applications processing cooperatively with the NCC. The PWSS applications and database would reside on the State PC(s), which would interact with the NCC on a cooperative basis. Public access, including access by Labs and PWSs, would be through the State PC(s).**

For States with large number of PWSs, obtaining PWSS functionality would require implementation of a server-based PWSS system architecture. The PWSS system potentially could include applications, communications, and database servers. Terminals connected to

the server would operate in a client/server architecture. The State PWSS system would operate in a cooperative architecture with EPA's system. Connection would be established through the communications server using leased lines. Public access, including PWS and Lab access, would be managed through the communications server. Depending on the size of the database and the number of users, the functions of the database server, application server, and communications server may be performed by a processor ranging from a single PC to minicomputer. Primacy Agencies below the State level would interconnect with this mature system using any of the architectural options outlined above, depending on their work load and data requirements.

EPA Region

Two architectures would be supported for EPA Regions: timesharing by connection with the NCC, and client/server on a Regional LAN. Timesharing would support the majority of Regional functions. Client/server would be most appropriate for an EPA Region with Primacy, or for downloading selected data from the NCC for Regional analysis. Public access is not envisioned at the Regional level.

EPA Headquarters/NCC

EPA Headquarters would be supported using the same approaches developed for the EPA Regions. Public access would be accomplished by dial-in to the NCC.

Software Considerations

The PWSS system is being developed using the Texas Instruments Information Engineering Facility™ (IEF™) computer-aided software engineering (CASE) tool set. The initial application environment will be the NCC mainframe computer using the MVS operating system and DB2 database system. Workstations at EPA, EPA Regions, and States are envisioned to include Microsoft Windows™, OS/2 Presentation Manager™, VAX VMS, and UNIX operating systems. The Current Operating System Comparison exhibit, which follows, summarizes some of the advantages and disadvantages of the principal operating-system candidates.

The DBMS for workstations, minicomputers, and LANs will be varied; however, each must be compliant with Structured Query Language (SQL). (SQL is the standard open-system compliant language for building database queries.) Candidate DBMSs for workstations and minicomputers include DBM™, ORACLE™, INFORMIX™, and SYBASE™.

The selection of supported DBMSs will be discussed further in Chapter 5, which outlines the Information Strategy.

Three options for the technical architecture are presented in the "Statement of Technical Direction," which follows. The phasing of the implementation and the importance of making use of available hardware and software serve to differentiate the options.

Option one, for example, details the initial automation of "have not" States with basic PWSS functionality, moving over time into option two, where States with full or partially automated PWSS programs are brought into the system. The Technical Architecture diagram, which follows, depicts the options defined in the "Statement of Technical Direction."

OPERATING SYSTEM	TECHNICAL FEATURES	ADVANTAGES	DISADVANTAGES
DOS	Standard operating system for PCs. In use since introduction of PC	Widespread use Several suppliers Mature operating system User familiarity Much available low cost applications software	640 Kbyte DOS memory partition PC technology trends (more processing, more memory) not fully utilized with DOS May be nearing end of life-cycle for use in newer powerful PCs
WINDOWS NT	Full 32-bit operating system with graphical (e.g. windows) user interface	Compatible with Windows 3.0 Large compatible third party applications software base Compatible with DOS applications Runs on many different computing platforms (PCs to RISC machines) for wider spectrum of applications Has potential to become new standard PC operating system	Not yet released in commercial version
OS/2	Full 32-bit operating system with graphical (e.g. windows) user interface	Uses full capabilities of modern PCs Low cost Computing platforms running OS/2 are also low cost Can run multiple DOS partitions	Not widely used Lack of low cost third party software packages Single supplier
UNIX/POSIX	UNIX/POSIX has become a "standard" for most modern mid-range to upper range computing systems.	Standardization Portability Wide-use, proven with good software support tools such as X-windows, OSF/MOTIF, and applications.	UNIX-based workstations tend to cost more than PC based systems There are no "good" inexpensive UNIX operating systems for PCs UNIX application software (e.g. wordprocessors, spreadsheets, etc) are limited and more expensive (up to 10 times) than PC-based equivalents

Current Operating System Comparison

This page intentionally left blank.

**PAGE NOT
AVAILABLE
DIGITALLY**

Three PWSS architectural options are presented:

Option One

The basic low-end architecture is a national system residing on a time-sharing mainframe at the NCC; the system would have direct connections with Regional offices nationwide through the EPA *backbone*. Application shells would reside on Regional office computers and be used to examine and report on information obtained from the States. States having their own application systems would retain their structures, but would have communication servers with appropriate PWSS software to facilitate transmission of State data to the national level. Individual PWSSs and Labs would be encouraged to acquire PCs or intelligent workstations and use leased-line or dial-up connections with the State or State Regional offices for electronic data interchange (EDI). The PWSS application shell and communications software would be available to PWSSs and Labs having PC/workstation systems that enable the connection.

Option Two

The high-end solution consists of tailored PWSS application systems functioning at each Primacy Agency; the systems would communicate interactively with PWSSs, Labs, and national level EPA. The architecture would be a combination of client/server and cooperative processing architectures, whereby Primacy Agencies maintain control over their own data while allowing querying and extraction of selected information. The national database would house summary information and such specific sample and sample analytical-results as needed for rule and regulation formulation and trend analysis. Each State level system would be connected to the national network by dedicated lines to facilitate data transfer and speed of access. The central national database would support both national office LANs and Regional office systems.

Option Three

The recommended solution is a marriage of the two previous solutions. While PWSS application systems would be provided to States having limited (or no) automated capability, States having fully functional systems would attach to the PWSS system PWSS interface systems servers over leased-line or dial-up connections. Portions of the PWSS system would gradually be incorporated into these existing systems, the desired end being full replacement of the existing system by PWSS over time. Primacy Agencies having partially automated systems would adopt pieces of PWSS that replace their current modules; they would acquire those PWSS modules that automate manual portions of their systems. This would be done over time based on the availability of PWSS modules. Initially, communications would be provided either through leased lines from Primacy Agencies that require direct connectivity to the EPA communication network or through dial-up connections where leased lines are impractical. Within Primacy Agencies, PWSSs and Labs would be encouraged to establish EDI connections with the State PWSS systems.

Statement of Technical Direction

RECOMMENDATION

While all three architectural alternatives are possible over time, the third option presents the most logical solution for meeting the needs of EPA and the Primacy Agencies. For the first phase of implementation, by concentrating on those Primacy Agencies with little or no automated solutions, the PWSS ISM will make the best use of economies of scale by providing immediate improvement to the quality and quantity of data available. This solution would also provide nationally maintained basic PWSS modules that would be modifiable by Primacy Agencies, reducing the need for the Primacy Agencies to maintain large system-development staffs. The third option provides for a partially distributed database consisting of State-specific data residing at the Primacy Agencies and having a national database for summary and trend data as well as selected State-specific data used in regulation and rule development. The recommended solution provides for:

- Nonautomated Primacy Agencies being brought up first with basic functionality.
- Primacy Agencies maintaining their own data and cooperatively sharing data with EPA.

The national PWSS database housing summary and historical data as well as selected sample and sample analytical results for regulation development and trend analysis.

- PWSS-developed interface systems interconnected to existing full-function Primacy Agency systems to transfer selected data to EPA.
- Flexible communication network options using existing leased-line and dial-up capabilities and supporting nonelectrical transfer of magnetic media where appropriate.

Communications from the State level to EPA using existing EPA network facilities.

- Phased implementation allows all Primacy Agencies to evaluate the new PWSS applications and encouraging State "buy-in."
- Providing the best use of existing hardware and software.

The recommended option provides the necessary flexibility, scalability, cost effectiveness, and ease of implementation not available from the other options. It will have the least impact on the current environment, while providing the greatest level of functionality to all levels of the system.

cont'd

Statement of Technical Direction

Chapter 5

Analysis of Information Strategies

The Information Strategy

The Information Strategy provides the blueprint for implementing the PWSS ISM Project, including a prioritized development plan and implementation schedule. The Information Strategy was developed using the following steps:

- **Principles of the Strategy.** The general principles for developing the strategy are determined to help establish priorities for development.
- **Development Prioritization.** The specific priorities for system implementation are determined, considering the importance of the particular business systems to accomplishing the organization's mission.
- **Technical Capability Projects.** Specific technical projects required to develop essential technologies demanded by the Technical Architecture are determined.
- **Implementation Schedule Options.** The implementation schedule options are developed based on resource constraints. For the PWSS ISM Project, the implementation schedule options were based on three levels of resources.
- **Organizational Concepts.** Organizational concepts that relate to developing the software required to implement the PWSS ISM Project are outlined.
- **Next Steps.** The follow on systems development activities are outlined.

Principles of the Strategy

The Information Strategy for the PWSS ISM Project is based on the following principles:

- Initial development for states with limited automation capabilities
- Interface with mature state systems
- Modular development and phased implementation of system components
- Early development and refinement of a standard user interface.

Each of these principles will now be discussed in detail.

Initial Development for States With Limited Automation Capabilities

Some states have little in the way of automated help for their drinking water programs. The intent of the PWSS ISM Project is to begin by targeting development that will aid these states with limited automation capabilities. Selected states with limited automation capabilities will receive the initial PWSS component releases developed during the Rapid Application Development (RAD) and Business Area Analysis projects. Incremental implementation allows for rapid development and implementation of certain critical portions of the database, while the long-term project continues to be developed in the background.

Interface with Mature State Systems

Some states have already spent considerable resources developing their own systems for basic inventory and water quality data maintenance, electronic data reporting, violation calculation, compliance and enforcement tracking and reporting, and other areas. The PWSS ISM project will develop interfaces, when feasible, to allow the existing systems to interface with the PWSS data structures. Additionally, interfaces with state electronic data interchange (EDI) systems will be explored, with potential capabilities to accept selected data directly through EDI systems, avoiding the re-entry of electronic data.

Modular Development and Phased Implementation of System Components

Modular development and phased implementation of system components will allow early fielding of critical capabilities and provide time to test and refine components throughout the development life cycle. Modules supporting core business functions constitute the baseline system and provide essential means to comply with Federal enforcement and data reporting requirements. Supporting and ancillary system business functions provide the means to support the full range of primacy implementation requirements.

Early Developmental Refinement of a Standard User Interface

All PWSS ISM program business systems will be supported by a standard graphical user interface (GUI). The standard user interface will be developed during the first development project and refined throughout the system development life cycle. The user interface will include pull-down menus, user help, and limited data editing facilities.

Development Prioritization

The PWSS Information Strategy Plan has identified eight business areas that need to be developed. As noted in the Business System Architecture, the prioritized business areas are:

- Inventory
- Field Surveillance
- Compliance
- Water Resource Planning
- Technical Assistance
- Regulation
- Outreach
- Management and Budget

The prioritized development plan was determined by first considering the relative importance of the eight business areas. The business systems within each business area were then analyzed and categorized as follows:

- Core business systems may be thought of as the backbone of the day-to-day operation of the PWSS program. Thus, it is logical that most all of these business systems will be automated in their entirety. Business systems classified as core include:
 - Compliance Determination
 - Enforcement
 - Field Surveillance
 - PWS Characterization
 - Lab Certification
 - Primacy Implementation
 - Public Notification
 - Sampling
 - Monitoring Requirements Development

- **Support business systems serve a supporting role for the core business systems. Although most of the business systems in this category should be automated, many of these business systems could be manual processes. Business systems falling into this category include:**
 - Allocation
 - Coordination
 - Forecasting
 - Funds Management
 - Natural Resources and Demographics
 - Outreach
 - Permitting
 - Technical Support
 - Training Support
 - Vulnerability Assessment
 - Water Resource Characterization

- **Ancillary business systems consists of information of importance to the PWSS program that is obtained from a wide-range of sources. A few of these business systems may be automated in part or entirely. Many of these systems, however, will support the PWSS program using a manual interface. Business systems that make up this category include:**
 - Contingency Planning
 - Disease Prevention and Assessment
 - Health Advisory
 - Information Systems Management
 - Operator Certification
 - Regulation Development
 - Resource Management
 - Standards Development
 - Technology Assessment

The figure on the following page summarizes the business system categorization.

BUSINESS SYSTEM CATEGORY SUMMARY

CATEGORY	BUSINESS SYSTEM	COMPLIANCE DETERMINATION	ENFORCEMENT	FIELD SURVEILLANCE	PWT CHARACTERIZATION	LAS CHARACTERIZATION	PRMCT CERTIFICATION	PUBLIC IMPLEMENTATION	SAFETY NOTIFICATION	MONITORING REQUIREMENTS DEVELOPMENT	ALLOCATION	COORDINATION	FORECASTING	FUND MANAGEMENT	NATURAL RESOURCES & ENVIRONMENT	OUTREACH	PERMITTING	TECHNICAL SUPPORT	TRAINING SUPPORT	VULNERABILITY SUPPORT	WATER RESOURCE CUES/REGISTRATION	CONTINGENCY ASSESSMENT	DISEASE PREVENTION & ASSESSMENT	HEALTH ADVISORY	INFO SYSTEMS PLANNING	OPERATION MANAGEMENT	REGULATION CERTIFICATION	RESOURCE DEVELOPMENT	STANDARDS MANAGEMENT	TECHNOLOGY DEVELOPMENT	TECHNOLOGY ASSESSMENT
CORE		●	●	●	●	●	●	●	●																						
SUPPORT										●	●	●	●	●	●	●	●	●	●	●	●										
ANCILLARY																					●	●	●	●	●	●	●	●	●	●	●

Technical Capability Projects

The development plan must also consider the development of specific technologies required to support the PWSS ISM Project. Within the development plan, these technologies are developed by technical capability projects.

The SDC project team has identified seven technical capabilities that are essential for satisfying the Technical Architecture. Realizing that these capabilities could not all be phased-in at the same time, the SDC project team assigned priorities to these capabilities based on their criticality to the PWSS program. The required technical capabilities include:

Priority	Technical Capability
1	<p>Dial-In State Environment at NCC.</p> <p>States with limited automation capabilities must be provided sufficient data processing and storage facilities early in the development cycle. One option to satisfy this requirement is to develop a technical means to establish state databases on the EPA mainframe computer. This solution provides a fully functional system without making a major investment in computer hardware within the state environment.</p>
2	<p>User Interface</p> <p>The PWSS user interface will consist of a set of standardized elements and interaction techniques. PWSS will rely on a graphical user interface (GUI) that will have the same "look and feel" across all applications to all user groups.</p>
3	<p>Interface System</p> <p>The PWSS program will provide interfaces to external systems, when feasible. This capability will be limited to transferring, formatting, and verifying files for uploading to the National database. Additionally, this technology will interface selected EDI systems to PWSS.</p>

4 Client/Server

The Client/Server architecture will be required to support large state systems. This technical project develops the technology required for client/server operation.

5 Cooperative Database

Cooperative database technology will be required to support interaction between state region, state, and national systems.

6 Public Access Interface

In support of the EPA's Public Access Program, the PWSS program will develop a Public Access Interface to give the general public and other organizations (e.g., Association of State Drinking Water Administrators, USGS, etc.) access to the PWSS system. PWSS information available to these users will be identified in EPA's Online Library System, which can be accessed via a dial-in access commercial telephone circuit. The electronic information services offered by EPA's Public Information Center is also available to the public and other organizations wishing to access PWSS database. PWSS will also be available to universities and other scientific institutions via EPA's Internet. Similar capabilities for public access to state systems will be explored.

7 User-Defined Reports

This technology is required to allow users to create tailored reports and to produce files for import to other software packages (e.g., SAS).

The PWSS ISM Development Plan

This analysis addresses the recommended sequence in which the business areas should be developed, assigns a business area analysis (BAA) Roman numeral to each business area,

identifies two Rapid Application Development (RAD) projects, and correlates how the technical capabilities described above will be phased-in with these development projects.

The chart on the following page displays the general development plan and the phase-in points for the technical capability projects.

Implementation Schedule Options

Three implementation schedule options have been defined based on the system category breakdown presented in the previous section.

Option 1 represents the full implementation of the PWSS Business System Architecture by the end of FY 95. This schedule provides for design and development of each of the business systems that make up the architecture, and includes full automation of the core and support systems as well as bridges to the ancillary systems needed by the design. It will deliver the full functionality of the core and support business systems and will automate the connections needed to enable the exchange of information with the ancillary business systems that have been identified. The full development schedule is presented in the Option 1 foldout at the end of this section.

Option 2 implements the core and support business systems. It does not include the automation of the bridges to the ancillary systems. The definition of the interface links will be completed, but fully-automated electronic connections will not be developed. Data will be able to be shared with these ancillary processes, but online connection and data transfer may not be included in the final product of this option. This option would provide complete PWSS functionality and will interface with the ancillary business systems, but will not provide for the automated interchange of data between PWSS and the other systems outside of the PWSS automation boundary. The development schedule for this option is presented in the Option 2 foldout that follows.

Option 3 only develops the core functionality of PWSS. The support and ancillary business systems would not be included in the automation boundary of PWSS at this time. This does not mean that these systems could not be automated at a later date; only that they will not be automated as part of this option. The development of the core business systems would provide minimum functionality for PWSS. Connections to the support and ancillary systems would be defined and preliminary designs for these interfaces would be created. Actual connections between the PWSS system and these business systems would be accomplished through indirect means such as transfer of electronic media and hard copy. Option 3 represents the lowest cost and the shortest development time frame with completion of the core systems scheduled for the end of December 1994. The Option 3 foldout presents the development schedule for this option, and appears at the end of this section.

TECHNICAL CAPABILITY PROJECTS IMPLEMENTATION PHASE-IN POINTS

TECHNICAL CAPABILITY	BUSINESS AREA DEVELOPMENT PROJECT Inventory Characterization (RAD I)	Inventory (BAA I)	Field Surveillance (BAA II)	Compliance (BAA III)	Water Resource Planning (BAA IV)	Public Notification (RAD II)	Technical Assistance (BAA V)	Regulation (BAA VI)	Outreach (BAA VII)	Management & Budget (BAA VIII)
Dial-In	◐	◐	●	●	●	●	●	●	●	●
User Interface	◐	◐	●	●	●	●	●	●	●	●
Interface System	◐	◐	◐	●	●	●	●	●	●	●
Client/Server	◐	◐	◐	◐	◐	◐	◐	◐	◐	●
Cooperative Database	◐	◐	◐	◐	◐	◐	◐	◐	◐	●
Public Access Interface								◐	◐	●
User-Defined Reports								◐	◐	●

◐ = Technical Capability Partial Implementation Point

● = Technical Capability Full Implementation Point

Note: The fully shaded circles under BAA VIII indicate that all technical capabilities have been implemented

Each of these options will enable PWSS to be implemented in support of both national EPA and state needs. As previously mentioned, the proposed development schedules for each of the options are presented on the following pages. The differences in these options reflect the differing levels of automation required by the three options.

**PAGE NOT
AVAILABLE
DIGITALLY**

This page intentionally left blank.

**PAGE NOT
AVAILABLE
DIGITALLY**

This page intentionally left blank.

**PAGE NOT
AVAILABLE
DIGITALLY**

This page intentionally left blank.

Organizational Concepts

Development Coordination

Implementation of the ISP requires effective management of a shared development environment. The development coordination approach assigns responsibilities and fosters necessary interactions required for successful implementation of Business Area Analysis projects. Additionally, a Development Coordination Approach contributes toward:

- Producing highly integrated business systems.
- Improving the quality of the systems being developed through the establishment and enforcement of development standards.
- Improving productivity by facilitating the sharing of reusable processes and procedures, as well as other design and development objects.

Within the EPA Systems Development Center, development coordination responsibilities are shared between elements of the Development Methodology and Maintenance Group (DMMG) and the development project team.

The interrelationship of development coordination functions is detailed on the SDC Development Coordination Template diagram on the next page. The key functions presented are:

- Data Administration
- Data Base Administration
- Encyclopedia Administration
- Project Model Coordination
- Project Application Architect
- Methodology Guidance
- Training

Three functions (data administration, encyclopedia administration, and methodology guidance) are performed primarily within the SDC's Development Maintenance and Methodology Group (DMMG). Two functions (database administration and training) are performed by both the DMMG and the PWSS project staff. PWSS model coordination and the PWSS application architect functions are performed within the PWSS project. The SDC Development Coordination Template also shows the major relationships between functions. For example, while training may be provided to all functions, within the context of development coordination training is primarily the link between methodology, project model coordination, and the development teams.

SDC-0055-012-TB-2009
December 31, 1992

This page intentionally left blank.

**PAGE NOT
AVAILABLE
DIGITALLY**

This page intentionally left blank.

Appendix A

Information Engineering Methodology (IEM™) Overview

This appendix presents an executive level overview of the Information Engineering Methodology.

Appendix A

Information Engineering Methodology (IEM™) Overview

Software development has traditionally been process driven, focusing on developing computer code to automate processes that manipulate data. That is, each process has one or more associated data sets, and often the data relationships are embedded, to some degree, with the process. If there is a need to change the process or functionality of the system, the resulting data set must also be modified. Consequently, as the system matures and functionality changes, so must the data. This process-driven approach often precipitates significant maintenance costs, and seriously limits efforts to share or to integrate data.

The PWSS Program has chosen to respond to this information management challenge by incorporating Information Engineering (IE) concepts and principles into software system development efforts. IE is data-centered and process driven. Data-centered means that the methodology is centered on the most stable aspect of the business, as the data and their relationships change slowly. For example, the type of information maintained about employees is relatively stable, even though the way employee information is used may vary greatly based on legislation or personnel regulations (i.e., the changes directed by the Privacy Act of 1974 on access to information about employees).

Process-driven means that methodology focuses on developing basic building blocks to implement functions. Data relationships are defined apart from the descriptions of the functions and their resulting processes. These building blocks are called processes and may be used to support several different organizations.

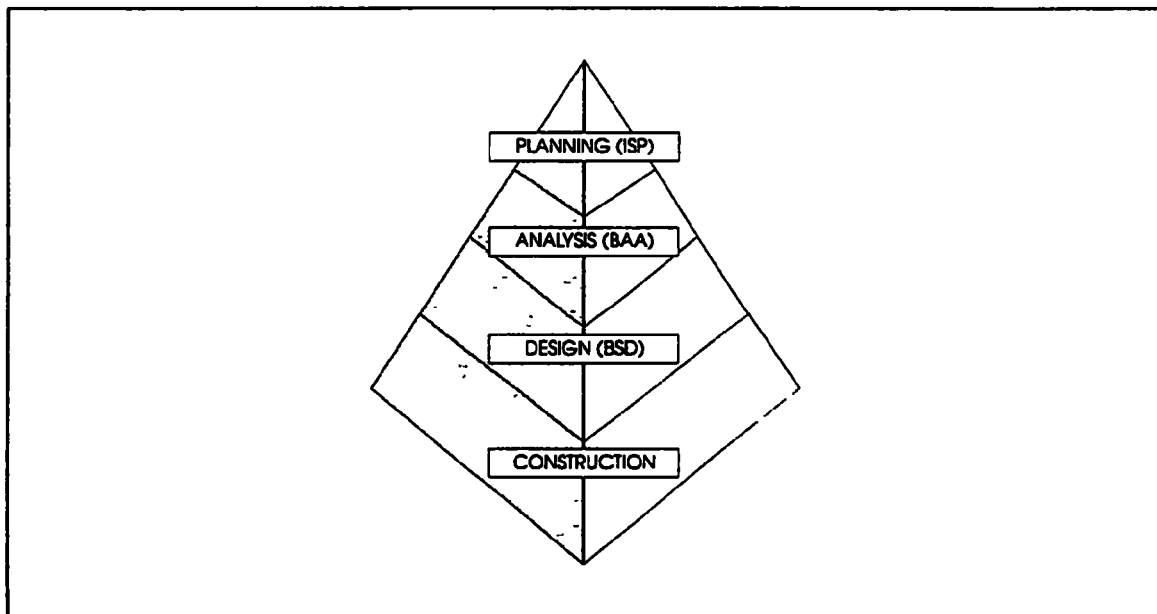
The detailed models of functions and data are linked through association matrices, defining the precise interactions of data and functions. As systems are enhanced or developed, designers consider all interactions (existing and planned) and build towards the envisioned architecture. Should changes occur in the function or data, the developer updates the appropriate model and confirms the interaction. As a result, information systems can be more readily adopted to the changing needs of the enterprise without major redesign or new development of systems.

The Information Engineering Methodology (IEM™) is a formal approach for the development of information systems focused primarily on detailed analysis and modeling of

an organization's business. As shown in the exhibit below, the methodology begins at the strategic level with the Planning Stage and proceeds through the life cycle to the Retirement Stage. Information Strategy Planning is the principle component of the Planning Stage.

The life cycle activities build on the information developed during the ISP by iterative application of software engineering techniques and organization modeling activities. A comprehensive model of the business is developed which includes goals, objectives, strategies, critical success factors, performance measures as well as detailed organizational, functional, and data models for the enterprise.

The remainder of this section provides a summary of the Information Engineering Methodology, followed by a detailed description of the planning activities performed to develop the PWSS ISP.



Planning Stage

Information Strategy Planning (ISP) is concerned with identification and analysis of the mission, goals, objectives, strategies, performance measures, information needs, data, and functions of an organization; the development of a target information environment to satisfy the information needs; and the development of a strategy to achieve the target information environment. This high-level view is extremely important in laying the foundation and in

setting the direction for follow-on system development activities. Three architectures are the core products of the ISP. The core products are the Information Architecture, which defines the activities performed by the organization and the information needed to perform the activities; the Business System Architecture, describing the business systems and data stores required to support the Information Architecture; and the Technical Architecture, describing the hardware and software environment needed to implement the Business System Architecture. Information is gathered using Executive Information Planning (EIP) and Joint Requirements Planning (JRP) facilitated work groups to elicit information needs and to gain a detailed understanding of the business of the enterprise.

Analysis Stage

During the Analysis stage, information engineering activities are primarily focused on gaining a better understanding of the data, the basic business process, and the more detailed interactions of the data and processes. Business Area Analysis (BAA) begins with planning and conducting additional information gathering. The results are analyzed, using IEF™ tools to develop data and process diagrams and to update the project. The outputs from the IEF™ CASE tool, along with visual prototypes, are used to review the analysis results. Involvement by subject area experts during all phases of the analysis ensures that the client's functional area experts at all organizational levels understand the model of their data and business activities. These prototypes are rapidly constructed, with minimal functionality, to represent only the data requirements. The outputs of IEF™ along with the prototype are used to encourage discussion and obtain feedback in facilitated sessions. Once the subset of a functional area has been stabilized, other fundamental entities may be identified for addition to the model. This process will be continued until all data requirements are addressed.

Design Stage

The objective of the Design stage is to determine "how" the set of needs identified and specified in the first two stages will be satisfied in terms of an information system. The products of this stage are designs based on data and process architectures, man-machine interfaces, and system administration procedures.

The design process proceeds in two parallel thrusts: data design and process design. In data design, the logical data model is translated into a physical data structure design that will be used to produce the physical data base tables. The logical data model is analyzed to ensure the integrity of all relationships, cardinalities, and definitions. Open issues that preclude the successful design of the data base are documented. The open issues are resolved in Joint Application Design (JAD) facilitated sessions with the client functional area

experts. The CASE tool is used to generate data structure diagrams showing the resultant data base design.

The procedure design is developed by implementing the elementary processes defined in the BAA within online or batch procedures. The resultant logical model transformed into a representation of the physical data structure. The detailed system design includes dialogue flow diagrams and procedure action diagrams. Screen and report layouts are also developed. Data conversions and bridges to current systems are also designed.

Rapid Application Design (RAD) can be applied during the design stage as an alternative approach for certain types of systems development projects. The RAD approach uses a small team of highly experienced developers to design and implement well-defined projects within a compressed development cycle. The RAD approach features strong reliance on a continuous interaction with the system manager and users throughout the development process. Concepts are prototyped and approved designs are documented and implemented. It is important to document all of the key options considered and the reasons for selecting a particular option. If this process is not followed, the same decision process could be repeated again and again, reducing productivity. At the end of each prototyping any open design issues are formally recorded and tracked to closure.

Development Stage

The preferred approach to development is automated code generation using a fully developed IEF™ project model. Of course, since not all target environments are supported, capabilities for manual coding may be a requirement.

Languages currently supported by IEF™ include COBOL and C. DB2, DBM, Oracle, and RDB are the supported databases. Operating environments include IBM (CIC, IMSDC, and TSO), DEC VAX, UNIX, and OS/2. The code construction is performed on mainframe and personal computer platforms and utilize the CASE tool's procedures, dialogue flows, and screen designs.

Unit and integration test plans are reviewed during the walkthroughs to ensure that the planned testing addresses all requirements, both functional and performance. Following the walkthroughs, the code is unit and integration tested. If required, data bases are constructed to support both the testing and future operations of the system. For some projects, hardware and software may be installed during this phase in order to meet construction and operational requirements.

Implementation Stage

Implementation planning begins back in the analysis and design stages during documentation of current systems and specification of conversion requirements. The implementation plan is developed in collaboration with the client and operators of the target host computer and includes a schedule of 1) the hardware (if any) and software installation, 2) user acceptance testing, and 3) final cut-over from the current system. It defines how any existing electronic data will be transferred to and formatted for the new application and how any non-electronic data will be gathered and input. The Transition Plan ensures quality of the conversion software and the converted data by rigorous testing and evaluation of sample data sets using file comparison tools to verify that outputs of converted processes match original outputs.

The acceptance test procedures are developed in close collaboration with the client and are administered using the test plans developed in the previous stage. Testing tools are used to run scripts and compare actual results with the planned results. All problems identified are recorded and tracked to resolution, including failure mode analysis to isolate process related problems, as well as fixes to developed products.

User training is developed and is provided prior to system cut-over.

System Maintenance Stage

Maintenance is tailored to specific types of maintenance activities. One activity is minor system enhancements to accommodate changes in either the computer or the client's operating environments. The second type of maintenance activity involves analysis and resolution of identified problems. For both types of activities a maintenance request is generated and used to track the activity through its resolution.

Before any maintenance request can be implemented, the proposed change must be processed through the Software Configuration Management procedures and be approved by the Change Control Board. Approved maintenance tasks are scheduled and prioritized.

For implementing software maintenance requests, the same Design and Development processes that was applied to the original or last enhancement to the system is followed. First, the modules requiring updates are identified and the CASE tool products or source code is checked out through the configuration control process. If the source code is not structured, then a re-engineering tool is used, if possible, to structure the source code. If source code or CASE tool products are not available, then a reverse engineering tool can be applied. Manual reverse engineering analysis may also be required.

After CASE tools products or the source code has been acquired, the changes are made following Design and Development stage processes. This includes the creating of test data, if there is no original test data. Next, unit testing is performed, followed by systems integration and regression testing. Upon successful completion of the regression testing, the system is turned over for final independent verification and validation testing.

Problems requiring analysis and resolution are routed for application by Hotline Services if they are available for the system. If it is determined that software changes are required to correct the problems, a software maintenance request is generated and tracked to resolution.

When a system becomes operational, on going user training and consultation via its Hotline service, User Support, and Information Services Support activities are outlined and implemented where feasible.

With this overview setting the context, we now turn to a more detailed presentation of the Planning Stage of the IEM™.

The Planning Stage of Information Engineering

An overview of the ISP phase of information engineering is shown on the following page. Information strategy planning begins with work planning, including development of a detailed project plan and work schedule. Naming conventions for objects entered into the IEF™ toolset are also established). Information gathering focuses on developing the details required to analyze the strategic planning objects, including missions, goals, strategies, objectives, critical success factors, and performance measures. An analysis of the organization's hierarchy is also conducted, including documenting the missions and high-level functions of the major elements of the organization.

The next stage of information strategy planning includes data analysis and function analysis. This stage analyzes the detailed information gathered during the analysis of business strategies and policies, and includes analysis and prioritization of information needs and an assessment of business problems noted during the executive interviews and planning sessions. Preliminary definitions for data and function planning objects are developed as well as preliminary relationships among the entity types. These relationships are represented on a high-level entity relationship diagram.

The core products of the information strategy plan are developed during the interaction analysis stage. These products are the Information Architecture, Business Systems Architecture, and the Technical Architecture. Additionally, the Analysis of

Information Strategies is also developed with recommendations for proceeding from the current environment to the objective environment represented by the three architectures.

Throughout the development of the ISP, client confirmation activities are performed, including preparation of bi-weekly status reports and review meeting at the conclusion of each stage of the process. The review meetings are an essential component of the process and help to ensure scheduling and other issues are identified. A formal management presentation of the results of the information strategy planning is developed and presented to the project sponsors at the conclusion of the effort. The presentation can also serve to provide feedback to the executives and mid-level managers to participated and interacted with the ISP Team throughout the project.

Appendix B

Current Technical Environment

This appendix details the current technical environment.

Appendix B

Current Technical Environment

Technical Environment Assessment

This technical assessment describes the current PWSS technical environment. The Federal Reporting Data System II (FRDS-II) is the primary system supporting PWSS. The OGWDW delegated day-to-day operational responsibility of FRDS-II to the Enforcement and Implementation Division (EIPD). In addition to FRDS-II, a large number of other data base systems collect and store data related to drinking water quality. This technical assessment focuses on a selected number of key Federal and State systems that support various aspects of the PWSS Program. These systems are candidates for data sharing with PWSS.

Key Federal Systems

Many large scale and small scale systems currently support the PWSS Program. The large scale applications operate on a mainframe at EPA's National Computer Center (NCC) at Research Triangle Park, North Carolina. The small scale applications run on a variety of stand-alone microcomputer systems within in the immediate office environment. Appendix Q shows the relationship of these current data stores to the entity types in PWSS.

Large Scale Systems

Large scale systems, operating on an NCC mainframe computer, analyzed during this technical assessment include:

- Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS)
- Environmental Review Tracking System (ERTS)
- Facilities Index System (FINDS)
- Freedom of Information and Control System (FIATS)
- FRDS-II

- Grants Information and Control System (GICS)
- National Water-User Data System (NWUDS)
- Permit Compliance System (PCS)
- Reach File (RF)
- Storage and Retrieval (STORET) of U.S. Waterways - Biological System (BIOS) and Water Quality System (WQS)
- Water Quality Analysis Simulation Program (WASP4)
- Water Body System (WBS).

CERCLIS

The CERCLIS information system version 3.0 will support EPA HQ and regions for the management & oversight of the Superfund program. CERCLIS serves two purposes: to maintain an automated inventory of abandoned, inactive, or uncontrolled hazardous waste sites; and to act as the vehicle for the regions to report to headquarters on the status of major stages of cleanup at sites. CERCLIS V3.0 will be developed with an in-depth look at the long term information needs of state and other federal agencies in effectively managing clean ups. CERCLIS V3.0 may be developed using a data base manager other than System 2000, such as ADABAS. CERCLIS V3.0 will begin with a long-range study of the relationships of CERCLIS to Federal Agencies.

ERTS

ERTS is a management information system used to track all Environmental Impact Statements (EIS), in addition to other actions for EPA. ERTS stores a wide range of environmental data and serves as a cross media system for use throughout the EPA.

FINDS

FINDS is a computerized inventory of facilities regulated or tracked by EPA. All facilities are assigned unique Facility Identification numbers by FINDS that serve as cross-reference numbers to facility information residing in the EPA program system. This function supports cross-media data integration by tracking facility locations across EPA program offices. FINDS is useful in integrating enforcement analysis, hot-spot determination, and risk analysis.

FIATS

FIATS is an administrative system used by EPA's FOI Officer. The system tracks the status of requests for information under the requirements of the Freedom of Information Act. The data from this system is used for the Agency's annual FOIA activity report to Congress. The system also reports types of requestors, program office caseload and performance, and appeal activity. In conjunction with new FOI policies and procedures, the system streamlines request processing and tracks and records the seemingly endless dispositions of a request or the possibilities for responding to a request.

FRDS-II

The primary system supporting the current PWSS program requirements is **FRDS-II**. This system maintains inventory and compliance data (violations and follow-up actions) reported by primacy agents under the PWSS program. Headquarters EPA uses **FRDS-II** to provide quarterly reports to other components of EPA and to satisfy external reporting requirements. Headquarters, Regions, and States also use **FRDS-II** to perform oversight. **FRDS-II** currently supports rolling quarter compliance data for the previous four quarters only and it currently contains compliance information from 1980 to the present and relates follow-up actions to specific violations. PWSS will replace **FRDS-II**.

GICS

GICS is the EPA's management information system for all grant programs. This national system is used by Headquarters, Regions, and States to administer and monitor grants. GICS uses the ADABAS DBMS and the Natural Programming language to support data requirements. Report menus for HQs, Regions, and Programs are available for batch or on-line reporting. On-line data entry systems for the construction and non-construction programs have been customized to provide for updating and tracking of the grant process.

NWUDS

NWUDS stores and retrieves data on site-specific water-use data and aggregate water-use data. States routinely collect information in these areas for inclusion in the system, but the level of detail and coverage varies by state. Most of the information in this system is still valid even though the latest information available was collected in 1985.

PCS

PCS is a computerized management information system for tracking permit, compliance, and enforcement status for the National Pollutant Discharge Elimination System (NPDES) program under the Clean Water Act. PCS contains information on more than 63,000 active water discharge permits issued to facilities throughout the nation. The Office of Water Enforcement and Permits (OWEP) in the EPA is responsible for the operation and maintenance of PCS. EPA Regional Offices and State users of PCS are responsible for the entry and quality of the data in the system. The system components are (1) on-line and batch data entry; (2) batch update; and (3) batch and on-line retrieval packages.

RF

The RF is a hydrographic database of the surface waters of the continental United States. Elements within the database were created for the express purpose of performing hydrologic routing for modeling programs, identifying upstream and downstream elements and providing a method to uniquely identify any particular point associated with surface waters. Any point within any of these databases can be associated with, and identified by a specific location on any surface water element. The RF can be defined as the U.S. Surface Water Hydrographic Identification Database.

STORET

The STORET system assists State and EPA officials in making pollution control decisions by providing a capability to store, retrieve and analyze water quality information. Current emphasis of control decisions are: issuing water quality based NPDES permits; inclusion of toxic pollutants in water quality standards; evaluating water quality impacts of control programs; and assessing levels of toxic pollutants, including dioxin and other bio accumulative pollutants in the aquatic biological data, hydrologic data, stream reach data, ground-water data, and other related information. The system is used by State and EPA analysts to assemble and analyze data to support each of the above types of decisions.

WASP4

WASP4 is a generalized compartment modeling program for simulating water quality in rivers, lakes, and estuaries. Linked with the various kinetic subroutines, WASP4 is used to predict water quality response to waste water management strategies. Version 4.2 is linked to the hydrodynamics program DYNHYD. Water quality kinetic subroutines are provided to simulate conventional pollutants including, nutrients, algae, and toxic pollutants (organic chemicals, sediment) in the water column and benthos. WASP4 runs on a mainframe or a microcomputer.

WBS

WBS contains state-reported information on the water quality status of specific water bodies. States input data including causes, sources, and monitoring basis.

Small Scale System

Small scale systems, operating on a stand-alone microcomputer, that analyzed during this technical assessment include:

- Inventory of Certified Labs
- Reg-In-A-Box
- State Revolving Fund (SRF) Award List.

Inventory of Certified Labs

The Inventory of Certified Labs system contains a list of laboratories certified to do compliance analyses and the chemicals and methods for which they are certified to test in each state.

Reg-In-A-Box

Reg-In-A-Box enables users to quickly find all National Primary Drinking Water Regulations applicable to PWS's that have been promulgated or proposed through July 18, 1991. Promulgated regulations include Surface Water Treatment Rule, Total Coliform Rule, Phases I and II, Fluoride, Lead and Copper, and the pre-1986 amendment rules. Proposed rules include Phase V and Radionuclides. The system includes the full Federal Register text, a brief description, and unreasonable risk to health information for each rule. Reg-In-A-Box features five different ways to access information: by reading the Federal Register, and by PWS characteristic. All of the instructions for using this convenient way of accessing regulations are contained within the application itself.

SRF Award List

The SRF Award List system tracks the amounts and dates of SRF grant awards to States. Information contained in the system includes: the State to which the grant is being made, the grant number, grant amount, date grant awarded, the appropriation from which the grant was provided, and the amount of State match.

Key State Systems

Key state systems analyzed during this technical assessment include:

- Model State Information System (MSIS)
- PA State Water Plan System
- Drinking Water Information System (DWIMS).

MSIS

The MSIS was developed by EPA for the express purpose of assisting the states to manage their drinking water program. MSIS was divided into several modules, each of which supported a specific functional area in the drinking water program. Examples of the modules include: PWS inventory management, violations determination, and enforcement tracking.

Funding the maintenance of MSIS became cost prohibited as a result of the changing drinking water requirements. As a result, EPA decided to discontinue supporting MSIS. Despite this situation, a few states are still using portions of MSIS to support some of their reporting requirements.

PA State Water Plan System

The PA State Water Plan System records and tracks water uses and discharges and maintains an inventory of water storage facilities. Virtually all water users (industrial, mining, public water system, power generation, irrigation, and domestic) are tracked by the system. Information from the system is used to allocate current water usage and to plan for future system needs. The system currently resides on a Burrough's mainframe as flat files, but will be converted to the DEC/Oracle platform in the near future. Applications for the current system were mostly developed in COBOL, but a few applications were written in FORTRAN.

DWIMS

DWIMS was initially developed for States in Region V. In DWIMS, site inspectors use a lap top computer and portable telephone to dial-in and make on-line updates to Public Water System inspection results. The system is menu-driven and supports ad hoc queries and compliance evaluations. DWIMS requires significant tailoring to meet the varying needs of the states. DWIMS is currently used by a limited number of States.

Non-Automated System Interaction

PWSS will interact with the Drinking Water Regulatory Impact Analyses (RIA) system. This is a paper collection of studies performed by the OGWDW in accordance with Executive Order 12291. The order requires that an analysis of benefits and costs be performed for every major rule to be promulgated by the PWSS Program and Underground Injection Control (UIC's) Program. A regulatory impact analysis provides the EPA Administrator

with analyses of the potential costs and benefits of, and alternative approaches, to the regulation of drinking water contaminants and/or injection practices.

PWSS will develop an automated capability to support future drinking water regulatory impact analyses.

Information Needs

This subsection focuses on the information needs and how they are interrelated to the entities types and organizational units.

Information Needs by Entity Type

Appendix N identifies the information needs with the entity type in which the supporting data is stored. This exercise verifies that all information needs are supported by one or more entity type.

Information Needs by Organizational Unit

Appendix O shows what information needs are required by which organizational unit. This exercise assists in identifying which information need is shared by what organizational unit and ensures that all of the information needs are needed by one or more organizational unit.

Current Environment Assessment

This assessment contrasts the relationships of the objects under development in PWSS to those already existing in the PWSS Program environment.

Mapping of Entity Types and Current Data Store

Appendix M maps entity types to current data stores. In the context of this project, data stores equate to the data base of the current system identified in this document. This exercise assists in detecting if there are any entity types that have been overlooked or if there is currently an entity type unsupported in the current information environment.

Business Functions Supported by Current Information Systems

Appendix P identifies the business functions that are supported by which of the current systems. This exercise assists in detecting if there are any business functions that have been overlooked or if there is a business function that is unsupported in the current information environment.

Current Data Stores Used by Current Information Systems

Appendix Q identifies the current data stores that are supported by which of the current systems. This exercise assists in detecting if there are any data stores that are not being used and if any data stores or organizational units have been left out of the preliminary information architecture.

Organizational Units Uses Current Information Systems

Appendix R identifies the organizational units that are supported by which of the current systems. This exercise assists in detecting if there are any current systems that are not being used and if any current systems or organizational units have been left out of the preliminary information architecture.

Appendix C

JRP Participants List

This appendix contains an alphabetical listing of the participants of each JRP session, and also an alphabetical listing of the contractor ISP Project Team members with their roles and responsibilities.

December 31, 1992

San Francisco August 18 - 20, 1992	
Attendee	Organization
Mary Alvey	Oregon Health Division
Tracy Bair	SAIC
Ken Bousfield	Utah ODW
Cliff Bowen	CDOHG, ODW
LouAllyn Byus	Illinois EPA
Stan Calou	US EPA Region VII
Jon Dahl	Arizona Dept of Environmental Quality
Bill Davis	US EPA Region VI
Fran Haertel	US EPA Region VI
Peggy Johnson	Washington State Dept of Health
Ron Johnston	SDC/SAIC Team
Bruce Keith	SAIC
Richard Lampert	US EPA Region IX
Clint Lemmons	US EPA Region VIII
Corine Li	US EPA Region IX
Dennis Martin	SAIC
Doug Martinson	Alaska Environmental Conservation
Jon Merkle	US EPA Region IX
Tom Poleck	US EPA Region V
Bill Robberson	US EPA Region IX
Jeff Sexton	US EPA Headquarters
Jim Walasek	OGWDW/TSD/Cincinnati

San Francisco August 18 - 20, 1992	
Attendee	Organization
Larry Weiner	US EPA Headquarters

Arlington, VA August 25 - 27, 1992	
Attendee	Organization
Tracy Bair	SAIC
Allen Basham	Virginia Dept of Health
Mary Brewster	US EPA Region III
Chrysa Cullather	Marasco Newton
Jon Dahl	Arizona Dept of Environmental Quality
Claudia Darnell	US EPA Region IV
Rob Daubenspeck	SAIC
Doug Davenport	Georgia EPD
Jim Elder	OGWDW
Ray Enyeart	OGWDW
Barry Greenawald	Pennsylvania DER
Jeff Hass	US EPA Region III
Anne Jaffe Murray	OGWDW
Bruce Keith	SAIC
Kathy Lynch	US EPA Region I
A.W. Marks	OGWDW
Dennis Martin	SAIC
Evans Massie	Virginia Dept of Health
John McFadyen	North Carolina Public Water Supply
Doug McKenna	US EPA Region II
Darrell Osterhoudt	Missouri DNR
Darrel Plummer	Kansas DHE

Arlington, VA August 25 - 27, 1992	
Attendee	Organization
Vicki Ray	Kentucky NREPC
Jeff Sexton	OGWDW
Charles Stringfellow	SAIC
Steve Vassey	SCDHEC
Larry Weiner	OGWDW
Sonny Wolfe	SAIC
Larry Worley	US EPA Region X

Arlington, VA August 25 - 27, 1992	
Attendee	Organization
Kenna Study	FL DER
John Grace	Maryland DE
Alan Roberson	AWWA
Van Hoofnagle	FL DER
Ron Decesare	OGWDW
Rey de Castro	ASDWA
Steve Clark	OGWDW
Lynn Curry	SAIC
Linda Kemp	SAIC
Jeff Markham	SAIC
Marilynn Dokos	SAIC

Name	Role/Responsibilities
Tracy Bair	Project Manager - Responsible and accountable for all aspects of the project.
Debbie Bruce	Senior Analyst - Responsible for document control and deliverable coordination
Chrysa Cullather	Systems Analyst - Drinking water program analyst responsible for subject area support and analysis and design guidance.
Lynn Curry	Senior Environmental Scientist - Expert on State drinking water programs responsible for subject area support and expertise.
Jon Dahl	Environmental Scientist - PWSS expert responsible to provide subject area expertise and design guidance
Rob Daubenspeck	Senior Analyst - Responsible for quality assurance and product control Also to provide IE expertise
Marilyn Dokos	Senior Analyst - Responsible for the PWSS Organizational Model and authorship of all the outlines of deliverables through completion of Task 2.
Barry Greenawald	Environmental Scientist - Water expert and State level Water Division Information Systems Chief responsible for subject area analysis and design guidance.
Ron Johnston	Periodic Expert - IEM and IEF expert responsible for methodology and tool usage guidance and facilitation support.
Bruce Keith	Systems Designer - PWSS expert responsible for providing subject area analysis and design guidance.
Linda Kemp	Senior Analyst - Responsible for the Activity Model and Project Librarian
Jeff Markham	Senior Analyst - Responsible for IE technical support and maintaining and using the IEF tool
Dennis Martin	Technical Project Lead - Responsible for the technical accuracy, quality, completeness and timeliness of the project and its deliverables.
Adair Martinez	Data Base and Central Encyclopedia Support Manager - Responsible for coordinating all data base and central encyclopedia support functions.
Evans Massie	Environmental Scientist - Water expert and State level Water Division Chief responsible for subject area expertise and project support
Sonny Wolfe	Senior Systems Engineer - Responsible for the Data Model and Current Systems Technology.

Appendix D

Strategies Supported by Information Needs

This appendix contains a matrix showing strategies associated with information needs. An "x" indicates that a particular strategy is supported by a particular information need.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix E

Critical Success Factors Supported by Information Needs

This appendix contains a matrix showing critical success factors associated with information needs. An "x" indicates that a particular critical success factor is supported by a particular information need.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix F

Objectives Supported by Information Needs

This appendix contains a matrix showing objectives associated with information needs. An "x" indicates that a particular objective is supported by a particular information need.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix G

Information Needs and Associated Descriptions

This appendix contains a list of the information needs and their associated descriptions.

Information Strategy Planning

Information Need

ANALYTICAL RESULTS OF TESTS

Detailed laboratory test results, including sample purpose and results of the analysis. (different retention times may be used for positive and negative results). If sample is not accepted, need reason for not accepting sample.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

ANALYTICAL TECHNIQUE

Approved or proposed analytical techniques for assessing the quality of drinking water, including approving authority, date, and purpose.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

APPLICABLE DATA STANDARDS

Descriptions of data standards relating to drinking water.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

BARRIERS TO USE OF NEW TECH

Information on barriers to State/local use of new technology (e.g., construction standards).

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

BEST AVAILABLE TECHNOLOGY BAT

Information on best available technology for treatment of drinking water.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

BUILDING CODES RELATING TO PWS

Building codes relating to PWS construction, including plumbing and electrical codes.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

CERTIFIED LABS

Information concerning certified labs, including purpose certified for, certification authority, certification period, lab owner/operator, certified technician in charge, PWSs served, capacity, analytical equipment and methods, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

COMMUNICATIONS MEDIA SOURCES

Information on various public communications media suitable for disseminating public information, including public notifications for a PWS.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

COMMUNITY GROUPS

Information on community groups interested in drinking water issues.

Examples include: environmental groups, advisory boards, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

COMPLAINTS

Complaints from consumers and other interested parties concerning drinking water.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

CONSUMER_PRODUCT_EVALUATIONS

Consumer product evaluations, including devices such as POE, POU, filters, bottle water coolers/dispensers, cross-connection device evaluations, including date and purpose of evaluation, evaluating activity, and findings/recommendations.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

CONTAMINANT TREND ANALYSIS

Results of trend analysis of analytical results, including isolating sources of contaminants, assessing efficacy of treatment techniques, assessing remediation actions, etc.

Analysis may be characterized by PWS, geographic area, watershed, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0

Information Strategy Planning

Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

COST_IMPACT_ANALYSIS

Cost impact and cost/benefit analysis of application of technology for various typical PWss, including large and small systems.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

COST_TO_SATISFY_INFORMATION_NEED

Estimates of the costs to satisfy various information needs. Used for cost/benefit analysis.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

CPE_RESULTS

Results of Comprehensive Plant Evaluations.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

CROSS_MEDIA_INTERACTION

Information on impacts of interaction of air, water, and waste programs. (i.e., TRIS, PCS, UST, underground injection, STORET)

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

CURRENT_INFORMATION_SYSTEMS_INV

Information Strategy Planning

Information on the current information systems supporting PWSS activities. Also includes plans for future technical architectures.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

DATA ACCESS REQUIREMENTS

Includes both security concerns as well as provisions for allowing/promoting public access.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

DATA_MGT_NEEDS_AND_REQUIREMENTS

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

DATA_PROCESSING_IMPACT_OF_RULE

The impact of proposed statutes, regulations, and rules on data management.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

DEFICIENCIES_AND_MILESTONES

Descriptions of deficiencies, needs, costs, and projected milestones for correcting deficiencies for each PWS. Includes cost/benefit analysis.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0

Information Strategy Planning

Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

DISTRIBUTION_SYSTEM_CHARACTER

Distribution system characterization, including size of pipe, corrosion and deposition, flushing program, compliance with distribution related rules (e.g., lead and copper).

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

EMERGENCY_CONTACTS

Details on emergency contacts at PWSs and at State/Federal emergency agencies.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

EMERGING_TECHNOLOGY_STATUS

Maintain awareness of new technology which might be appropriate for application to treatment, collection, and information analysis.

Information gathered by review of research needs, vendor product reviews, literature reviews, attendance at conferences and symposiums.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

ENFORCEMENT_ACTIONS

Details on planned or issued enforcement actions, including compliance orders and administrative orders, required actions,

Information Strategy Planning

target completion date, and date corrective actions completed.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

FIELD MONITORING RESULTS

Reporting of monitoring operational information that relates to compliance (i.e., turbidity and disinfectant residual results).

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

HEALTH EFFECTS DATA

Data on the health effects relating to drinking water, including relative dangers of specific contaminants.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

HYDROGEOLOGICAL INFORMATION

Hydrogeological descriptors (e.g., geologic structure, topography, and aquifer and river reach characterizations).

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

IMPACTS OF RULES ON SYSTEMS

Analysis of the impacts of existing or proposed Federal and State statutes, regulations, and rules on PWSS, particularly relating to small systems.

Information Strategy Planning

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

INCIDENCE OF CONTAMINATION

Analysis of information on incidence of
contaminants in drinking water, their
potential effects on public health, and
efficacy of treatment or other controls.
(PDMSA)

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

INTERCONNECTIVITY

Interconnectivity (buy and sell) of PWSSs.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

LAB AUTOMATION CAPABILITIES

Includes knowledge of lab automation software
and knowledge of where software could be
applied/used.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

MEANS FOR ASSESSING COMPLEXITY

Information to assist in assessing the
complexity of rules and regulations.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.

Information Strategy Planning

Information may be categorized as: summary.

MONITORING_SCHEDULE_BY_CONTAMINA

Monitoring schedule by contaminant and site (e.g., sample site plan for TCR). Schedule applies to State and Federal requirements.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

NEEDED_ANALYTICAL_TOOLS

Statements of need for new analytical tools to support PWSS implementation.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

NEW_INFO_SYS_TECHNOLOGY

Status of emerging information system technology. Includes EDI technology to improve transfer of data from point of collection.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

OPERATOR_CERTIFICATION_STATUS

Status of certification of operators, including level of operations/treatment techniques certified for, PWS assigned to, designation as operator in charge (responsible operator), etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

PERMITS ISSUED

Information on permits issued for operation or construction of PWS, including issuing authority, permitted treatment, population served, etc.

Also includes information on other environmental permits issued which may impact on drinking water quality.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

POPULATIONS SERVED

Descriptions on populations served, include number of people, ages, education level, language spoken, average income, political unit (county, district, etc.), servicing PWS, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PRESS RELEASES RELATING TO PWS

Press release information, including date and releasing activity, author/point of contact, distribution, and synopsis.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PUBLIC HEALTH TRENDS

Trend analysis of public health with respect to drinking water.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

PUBLIC NOTICES ISSUED

Information on Public Notices issued,
including date, period, and content of
notice; community affected; and servicing
PWS.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PWS DEMONSTRATIONS STATUS

Information on on-going or planned
demonstrations, including purpose, sponsor,
demonstration dates, and outcomes/findings.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PWS ENGINEERING PLAN INFORMATIO

Information to support review of construction
permits or other permits related to PWSs.
Includes proposed, planned, or ongoing
construction.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PWS FACILITY INVENTORY

Information on PWSs, including location,
treatment, population served, ownership,
addresses, responsible operator in charge,
etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

PWS_OPERATIONAL_INFORMATION

Operational information from PWS relating to compliance, including water served, population served, and treatments being used. (reported in annual or monthly water supply reports which not used by all states)

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PWS_OWNERSHIP_INFORMATION

PWS ownership information, including financial viability.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PWS_RELATED_GRANTS_AND_LOANS

Information on grants and loans supporting improvements to PWSSs, PWSS, and research on PWS related technologies.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

PWS_WITH_SPECIFIC_PROBLEMS

Information on PWSs with specific problems which might be remedied by a demonstration or pilot project.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

QA_STATISTICS_FOR_SAMPLING

Statistics on QA programs for certified labs

Information Strategy Planning

and field sampling by PWS operators,
including QA Plans and QA results.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

REGULATORS

Regulator descriptive information, including
political/geographic area regulated, name,
points of contact, type of activities
regulated, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

REQUESTS FOR TECHNICAL ASSISTANCE

Information on requests for technical
assistance from PWSs or regulators, including
date, requestor name, address, point of
contact, subject, synopsis of requested
assistance, synopsis of actions taken to
respond, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

RESEARCH NEEDS

Research needs identified with possible
application to drinking water.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

RESEARCH RESULTS

Results of PWS related research, including
pilot studies and demonstrations.

Information Strategy Planning

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

RISK ASSESSMENTS

Assessments of health risk related to drinking water.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

SAMPLE LOCATIONS

Locations where samples are to be taken
(plant, entry point, tap)

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

SAMPLE SITING PLAN

Sample siting plan information (e.g., TCR siting plan), including schedule.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

SANITARY SURVEY RESULTS

Results of sanitary surveys for each PWS, including date, sanitarian, and findings/recommendations.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

SPILLS AND EVENTS IMPACTING PWS

Details concerning environmental spills and natural phenomenon with actual or potential impact on drinking water sources, including date and location of event, emergency agencies, and description of threat and remediation activities.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

STATE AND NATIONAL REGULATIONS

Descriptions of requirements of State and Federal statutes, regulations and rules, and how they are applied to various types of PWSSs.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

STATUS OF FUNDING

Status of budgets (planned and actual) and expenses relating to implementation of the PWSS program.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

SURFACE WATER INTAKES

Surface water intake information, including source identifier, location (latitude and longitude), depth, seasonal use, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

Information Strategy Planning

TECHNICAL ASSISTANCE PROVIDED

Technical assistance requested and provided,
including date, purpose, action taken,
schedule of future assistance, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

TECHNICAL LITERATURE

Technical literature and outreach information
relating to treatment or analysis of drinking
water, including date published,
author/publishing activity, subject,
applicability, availability, and synopsis.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

THREATS BY NATURAL PHENOMENON

Information on threats to public water
supplies due to natural phenomenon such as
earthquakes, floods, and severe storms.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

THREATS OF TERRORIST ACTIVITY

Information on threat of terrorist activities
posing danger to public water supplies.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

TRADE ASSOCIATIONS

Information Strategy Planning

Information on trade associations and their literature, including purpose, address, leadership, training provided, and membership statistics.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

TRADE CONFERENCES

Information on trade conferences, including schedule, topics, sponsoring association(s), attendees, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

TRAINING EVENTS

Information on planned or completed training events (including 3d party), including purpose, intended cost, presenting activity, point of contact, attendees, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

TREATMENT TECHNIQUE

Approved or proposed treatment techniques for treating water for use as drinking water, including approving authority, date, purpose, chemicals used, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

UNDERSTANDABILITY OF COMPLIANCE

Information on the state of regulators' and

Information Strategy Planning

regulated community's understanding of
compliance requirements.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

VARIANCES AND EXCEPTIONS

Status of variances and exceptions, as well
as waivers, exceptions, exclusions, etc., for
a PWS, including date granted and provisions.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

VIOLATION INFORMATION

Information on violations, including PWS and
community served, regulatory provisions that
were violated, date on which violation
identified, date on which SNC status
determined, SNC expiration date, etc.).
Includes monitoring and reporting violations.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

WELL DESCRIPTORS

Well descriptors, including location
(latitude and longitude), depth, aquifer
identifier, seasonal availability, elevation,
casing material, screen size, age, etc.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

WELL HEAD PROGRAM IMPLEMENTATION

Information on well head protection for each

Information Strategy Planning

well.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

ZONING AND LAND USE ACTIVITY

Information on zoning activity, to include land use. Used to forecast demand as well as impact of development on water supply and quality.

Priority (0 - 9): 0
Satisfaction Rating (0 - 3): 0
Requirement Weight: 0
Importance Factor (1 - 5): 1
Information should be updated continually.
Information may be categorized as: summary.

-End of Report-

Appendix H

Entity Types with Descriptions

This appendix contains an alphabetical listing of entity types and their associated descriptions.

Entity Definition

Entity: AGREEMENT

Description: Documents formal and informal understandings
(oral and written) between two or more
parties.

Examples: primacy agreements, bilateral
compliance agreements, grant agreements,
memorandums of understanding between
agencies, delegation agreements with county
health departments, dedicated well site
documents, contractual agreements.

Example descriptors: type and date of
agreement, purpose of agreement, agreement
number, date signed, and redress information.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS A RESULT OF many VIOLATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ADMINISTERS many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS A RESULT OF many ENFORCEMENT ACTION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS SIGNED BY many LEGAL ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE BASIS FOR many GRANT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: ANALYTICAL_EQUIPMENT

Description: Identifies and describes capabilities of laboratory equipment, field equipment, and information systems processing equipment used to measure or assess water quality. Equipment may report results.

Examples: spectrometers, ADPE, analytical software, and sampling devices.

Example descriptors: name of equipment, precision and detection limit, calibration schedule, cost, type of output.

Relationships: detects CONTAMINANT, manufactured (or sold) by NON GOVERNMENT AGENCY, located at/owned by LEGAL ENTITY, funded by BUDGET

Subject area: TECHNOLOGIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) USES many STANDARD_TECHNIQUE_OR_PROCEDURE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_IMPROVED_BY many RESEARCH_RESULT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_USED_BY many WATER_SYSTEM_FACILITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_USED_BY many LABORATORY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DESCRIBED_IN many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS TRAINED_BY many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: BUDGET

Description: Information on planning and execution of funds for the PWSS. Budgets may be planned (outyears) or actual (current year and carryover), and may be amended. National-level budgets normally include the current operating year and forecasts for the outyears.

Budgets may also account for/plan use of fees cost recovery, or fines.

Examples: national budgets for Federal programs, State budgets for State programs, certified laboratory budgets/fees, research and development budgets, and PWS budgets.

Example descriptors: appropriation, accounting year, budget amount, budget purpose, budget status, and budget line item, actual expense information.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) FUNDS many GRANT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always FUNDS many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_ESTABLISHED_FOR one LEGAL_ENTITY
cannot transfer.

Sometimes (0%) IS_USED_BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SUPPORTS_IMPLEMENTING many CONTINGENCY_AND_EMERGENCY_PLANS

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SUPPORTS many MONITORING_PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SUPPORTS_IMPLEMENTING one ENGINEERING_PLAN

cannot transfer.

Entity Definition

Entity: COMMUNICATIONS_MEDIA

Description: Information on communications media and
community groups serving PWS consumers.

Examples: newspapers, television, radio,
billboards, newsletters, billing inserts,
etc.

Example descriptors: point of contact, name,
subject area, frequency.

Subject area: LEGAL_ENTITIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) DISTRIBUTES one TECHNICAL_PUBLICATION
cannot transfer.

Sometimes (0%) IS OWNED BY many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SERVES many POPULATION_GROUP
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: COMPLAINT

Description: Written/oral communications received
concerning drinking water or water systems.

Examples: complaints about taste, color,
odor, pressure, illness, fees, operation,
etc.

Example descriptors: date, prognosis,
corrective action(s), location of problem,
nature of problem, duration, etc.

Subject area: COMPLIANCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) LODGED_BY many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_RESPONDED_TO many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONCERNS many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONCERNS many LABORATORY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONCERNS many GOVERNMENT_AGENCY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS_IN many VIOLATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS_IN many REVIEW_AUDIT_AND_EVALUATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: CONTAMINANT

Description: Any physical, chemical, biological, or radiological substance, parasitic/pathogenic organism, or matter in water that is of interest.

Contaminants may result in a health risk to the consumer or may be aesthetically objectionable.

Maximum contaminant level goals and maximum contaminant levels (MCLs) are established for regulated contaminants identified by Federal and State Primary Drinking Water Regulations.

Other contaminants are identified in Federal and State Secondary Drinking Water Regulations.

Examples of regulated contaminants include: inorganics (e.g., arsenic, barium, and cadmium), organics (e.g., endrin, lindane, methoxychlor, and trihalothanes), (3) microbials (e.g., coliform bacteria), and (4) radionuclides (e.g., gross alpha and gross beta).

Examples of regulated contaminant groupings include inorganics, synthetic organic contaminants, and volatile organic contaminants.

Example descriptors include: name, description, health effects, sources, etc..

Subject area: SAMPLES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) MCL IS IDENTIFIED BY many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS MONITORED BY many MONITORING PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS MEASURED BY many LABORATORY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS MEASURED BY many SAMPLE ANALYTICAL RESULT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Sometimes (0%) HAS ACTION LEVEL SPECIFIED BY many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RELEASED BY many ENVIRONMENTAL EVENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ARE FORECAST BASED UPON many WEATHER DATA

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: CONTINGENCY_AND_EMERGENCY_PLANS

Description: Descriptions of foreseen actions, responsibilities, and coordination procedures for contingency or emergency situations.

Examples: plans for loss of capability at a water facility, loss of source, natural disasters, etc.

Example descriptors: date, purpose, summary of actions to be taken.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS PREPARED BY many LEGAL ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS APPROVED BY many GOVERNMENT AGENCY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESPONDS TO many WATER THREAT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ARE PREPARED FOLLOWING many POLICY_AND_GUIDANCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRE SUPPORT FROM many BUDGET
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESPOND TO many ENVIRONMENTAL EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONSIDER many WEATHER DATA
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: CROSS_MEDIA_SYSTEM

Description: Descriptions of cross media information systems.

Examples: PCS, STORET, FINDS, RCRA, CERCLIS, GICS, USGS's National Water Data Exchange (NAWDEX), Weather Data Bases, etc.

Example descriptors: name, description, platform, access information

Subject area: CROSS_MEDIA_SOURCES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) PROVIDES many WEATHER_DATA

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES many WATER_HABITAT_QUALITY_INFO

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES many HAZARDOUS_WASTE_INFORMATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_OWNED_BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_DESCRIBED_IN many TECHNICAL_PUBLICATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES many HYDROLOGICAL_INFORMATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES many ENVIRONMENTAL_EVENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_USED_BY many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: DEVIATION

Description: Provisions for an EPA or primacy State official to grant a public water system a deviation from one or more requirements.

Deviations may be granted if, for some compelling reason, a public water system is unable or not required to comply with one or more mandated requirements (e.g., maximum contaminant level, treatment technique, or technology requirement). Deviations must not result in unreasonable health risks to the consumers. Deviations are granted for a prescribed period of time. A public hearing or public notice may be required.

Examples: variances and exemptions (SDWA), waivers, and exceptions.

Example descriptors: type, date issued, purpose, schedule, conditions, and duration.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) MITIGATES many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_EXAMINED_BY many REVIEW_AUDIT_AND_EVALUATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS_GRANTED_BY many GOVERNMENT_AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always APPLIES_TO many PUBLIC_WATER_SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: DRINKING_WATER_SOURCE

Description: Information characterizing a source from which a public water system obtains water.

Examples: ground water sources (e.g., aquifers), surface water (e.g. rivers, streams, lakes, and reservoirs), and water purchased from other systems. Also may include bottled water and interstate carrier conveyances.

Example descriptors: type, quantity, location (latitude and longitude), depth, elevation, reach or aquifer identifier, and quality.

Subject area: INVENTORIES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS USED BY many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS JEOPARDIZED BY many WATER_THREAT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ANOTHER many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EVALUATED BY many SAMPLE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DESCRIBED BY many HYDROLOGICAL_INFORMATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS IMPACTED BY many HAZARDOUS_WASTE_INFORMATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DESCRIBED BY many WATER_HABITAT_QUALITY_INFO
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ANALYZED BY many WEATHER_DATA
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: ENFORCEMENT_ACTION

Description: Documents actions taken against a PWS,
laboratory, or operator.

Includes requirements that must be met in
order to rectify a failure to perform under
the PWSS Program.

Enforcement actions are informal and formal.
They may be issued by the Primacy State (or
its representative) or the EPA.

Examples: administrative and civil/criminal
legal actions, warning notices, citations,
orders to follow water treatment procedures,
orders to follow sampling requirements,
orders to resolve violations, moratoriums on
connections, temporary injunctions,
restraining orders, penalties, and orders to
comply with reporting requirements.

Example descriptors: type of enforcement
action, directed actions, and milestone
date(s).

Subject area: COMPLIANCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always RESULTS FROM many VIOLATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DIRECTED AGAINST many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ISSUED BY one GOVERNMENT_AGENCY

cannot transfer.

Sometimes (0%) RESULTS IN many AGREEMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPLIES TO many PUBLIC_WATER_SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS BASED ON many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS IN many PUBLIC_NOTIFICATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: ENGINEERING_PLAN

Description: Describes engineering work to be completed
for a PWS or water system facility.

Examples: installation of new treatment
system, construction of new well, etc.

Example descriptors: schedule,
responsibilities, inspection requirements,
etc.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) SPECIFIES many BUDGET

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PREPARED_BY many PUBLIC_WATER_SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONSTRUCTS_OR_MODIFIES many WATER_SYSTEM_FACILITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_APPROVED_BY many GOVERNMENT_AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PREPARED_PER many STANDARD_TECHNIQUE_OR_PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES_INSTALLATION_OR_MOD_OF many TREATMENT_EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_SUPPORTED_BY many GRANT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_SUPPORTED_BY many GUARANTEED_LOAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES many PERMIT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES many TECHNICAL_ASSISTANCE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PREPARED_PER many POLICY_AND_GUIDANCE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONSIDER many HAZARDOUS_WASTE_INFORMATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

This page intentionally left blank.

Entity Definition

Entity: ENVIRONMENTAL_EVENT

Description: Describes non-weather-related occurrences which may affect drinking water quality/quantity.

Examples include: earthquakes, volcano eruptions, mudslides, toxic spills, land subsidence, etc.

Example descriptors include: type, date(s), population affected, geographical area affected, potential impacts on drinking water, etc.

Subject area: CROSS_MEDIA_SOURCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS PROVIDED BY many CROSS MEDIA SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RESPONDED TO BY many CONTINGENCY_AND_EMERGENCY_PLANS
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RESPONDED TO BY many GOVERNMENT_AGENCY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RELEASES many CONTAMINANT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPACTS many POPULATION_GROUP
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EVALUATED BY many REVIEW_AUDIT_AND_EVALUATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RESPONDED TO BY many TECHNICAL_ASSISTANCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS IN many VIOLATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CAUSES many WATER_THREAT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: FIELD_EQUIPMENT

Description: Equipment used to perform field operations.

Examples: test kits, instrumentation,
GPS aids, mobile labs, etc.

Example descriptors: name, capability,
type, cost, precision and detection limit,
calibration schedule, inventory number, etc.

Relationships: owned by GOVERNMENT AGENCY,
measures CONTAMINANT, owned by PWS, owned by
LABORATORY

Subject area: TECHNOLOGIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS DESCRIBED IN many TECHNICAL_PUBLICATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS TRAINED BY many TRAINING_EVENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: GOVERNMENT_AGENCY

Description: A government agency, including the staff, organizational structure, and operating mission.

Examples: Federal agencies, State agencies, State Legislature, Federal Court, local governments, and Indian tribes or other governments (e.g., foreign).

Example descriptors: name, type, purpose, address, points of contact, and staff.

Subject area: LEGAL_ENTITIES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IS_A many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many LAB_CERTIFICATE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many ENFORCEMENT_ACTION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EMPLOYS many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) BACKS many GUARANTEED_LOAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EXECUTES many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many PERMIT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many VIOLATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many REGULATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES one LEGAL_MANDATE

cannot transfer.

Sometimes (0%) PERFORMS many REVIEW_AUDIT_AND_EVALUATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many POLICY_AND_GUIDANCE

Entity Definition

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPROVES many CONTINGENCY_AND_EMERGENCY_PLANS
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ESTABLISHES many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS AUTHORIZED BY many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) GRANTS many DEVIATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPROVES one ENGINEERING_PLAN
cannot transfer.

Sometimes (0%) DEVELOPS many PROGRAM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPROVES many PROGRAM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE SUBJECT OF many COMPLAINT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) COORDINATES RESPONSE TO many ENVIRONMENTAL_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: GRANT

Description: Information relating to an application for and award of grants, grant agreements and work plans, plan implementation status, and funds need. Also included are the criteria for grant eligibility.

Examples: technology demonstration grants, public water system construction grants, special program grants (e.g., school water cooler program, drinking water related training, and education grants), Community Development Block Grant (CDBG), technical assistance grants, and primacy grants to States having primary enforcement responsibility.

Recipients of grants include primacy States, public water systems, private citizens, and technology vendors.

Example descriptors: grant amount, grant purpose, award date, eligibility criteria.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IS FUNDED_BY many BUDGET

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PROVIDED FOR BY many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PROVIDED TO many LEGAL ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SUPPORTS many ENGINEERING PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PROVIDED BASED_ON many PROGRAM PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS BASED_ON one AGREEMENT

cannot transfer.

Entity Definition

Entity: GUARANTEED_LOAN

Description: An arrangement between Federal/State agencies and a qualified financial institution (e.g., Federal Reserve backed bank) to guarantee a loan for construction of water supply facilities. Includes applications for loans and loan approval criteria.

Examples: loans for the construction of new or improved PWS facilities.

Example descriptors: loan amount, loan terms, loan purpose, loan status.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IS BACKED_BY many GOVERNMENT_AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES FUNDS_FOR many PUBLIC_WATER_SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ESTABLISHED_BY many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SUPPORTS many ENGINEERING_PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS ISSUED_TO many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always ARE ISSUED_BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: HAZARDOUS_WASTE_INFORMATION

Description: Describes hazardous waste sites, spills, sources that may affect drinking water supply.

Examples include: nuclear waste disposal sites, chemical plants, refuse sites, etc.

Example descriptors include: name, type, owner, potential threat to drinking water, regulatory agency, location, etc.

Subject area: CROSS_MEDIA_SOURCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS PROVIDED BY many CROSS_MEDIA_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CAUSES many WATER_THREAT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPACT many DRINKING_WATER_SOURCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CONSIDERED BY many ENGINEERING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CONSIDERED BY many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: HYDROLOGICAL_INFORMATION

Description: Describes hydrological water sources.

Examples include: water basins, water bodies, flood plains, underground water sources, water tables, surface water, etc.

Example descriptors include: name, location, quantity, pollutants, water quality assessment, threat evaluation, etc.

Subject area: CROSS_MEDIA_SOURCES

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:

Sometimes (0%) IS PROVIDED BY many CROSS_MEDIA_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES many DRINKING_WATER_SOURCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: INDIVIDUAL

Description: A person involved in the implementation of
the PWSS.

Example descriptors: name, address,
identifying number, skill, and
responsibility.

Subject area: LEGAL_ENTITIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IS_A one LEGAL_ENTITY
cannot transfer.

Sometimes (0%) HOLDS many LAB_CERTIFICATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RESPONSIBLE_OPERATOR_FOR many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EMPLOYED_BY many GOVERNMENT_AGENCY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EMPLOYED_BY many NON_GOVERNMENT_AGENCY_OR_COMPANY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CERTIFIED_TECHNICIAN_FOR many LABORATORY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) TAKES many SAMPLE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ATTENDS many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PRESENTS many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DEVELOPS many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PREPARES one SAMPLE_ANALYTICAL_RESULT
cannot transfer.

Entity Definition

Entity: INFORMATION_REQUEST

Description: Describes a request for information regarding the PWS program. Requests include information on health risks, rules and policies, public water systems, consumers, treatment techniques, and contaminant levels.

Examples: inquiries by government officials/agencies, private firms, private citizen requests, FOIA requests, and other requests.

Example descriptors: form of request, request date, required and actual response dates, if response complied with legal requirements, nature of request, form of response cost.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS RESPONDED TO BY many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS FULFILLED UNDER many PROGRAM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS SUBMITTED BY many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS SUBMITTED UNDER many LEGAL_MANDATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: LABORATORY

Description: Documents information on laboratories that
 are certified or applied for certification by
 EPA or States to conduct drinking water
 sample analysis.

Examples: Environmental organic
 laboratory and microbiological laboratory.

Example descriptors: lab identification,
 location and address, area served, capacity,
 point of contact, type of reporting
 (capability, method, and means), fee
 information, other services provided.

Subject area: SAMPLES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) ANALYZES many SAMPLE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CERTIFIED BY many LAB CERTIFICATE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS OWNED BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) HAS AS CERTIFIED TECHNICIAN many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) USES many ANALYTICAL EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CERTIFIED FOR ANALYZING FOR many CONTAMINANT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CERTIFIED FOR many STANDARD TECHNIQUE_OR_PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PREPARES many SAMPLE ANALYTICAL RESULT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE SUBJECT OF many COMPLAINT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: LAB_CERTIFICATE

Description: Includes applications for certification,
tracking information, including renewal
dates and fees.

Examples: laboratory certifications, lab
technician certification.

Example descriptors: purpose of certificate,
date of issue, period of validity,
competency test results, applicant
qualifications (including education and
training), fees paid.

Subject area: CONTROLLING_INSTRUMENTS

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:

Always BASED_ON one REQUIREMENT
cannot transfer.

Sometimes (0%) CERTIFIES one LABORATORY
cannot transfer.

Always IS_ISSUED_BY one GOVERNMENT_AGENCY
cannot transfer.

Sometimes (0%) CERTIFIES one INDIVIDUAL
cannot transfer.

Entity Definition

Entity: LEGAL_ENTITY

Description: A person, corporation, government agency,
private commission, etc.

Example descriptors: name, address(es), and
telephone number(s)

Subject area: LEGAL_ENTITIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) TAKES many SAMPLE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESPONDS_TO many INFORMATION_REQUEST

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) OWNS many PUBLIC_WATER_SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_A many GOVERNMENT_AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS many NON_GOVERNMENT_AGENCY_OR_COMPANY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_ISSUED many PERMIT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) OWNS many LABORATORY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_THE_SUBJECT_OF many ENFORCEMENT_ACTION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always ESTABLISHES many BUDGET

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PREPARES many CONTINGENCY_AND_EMERGENCY_PLANS

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) USES many BUDGET

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPROVES many TRAINING_EVENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PRESENTS many TRAINING_EVENT

Entity Definition

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PREPARES many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DISTRIBUTES many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RECEIVES many GRANT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many PUBLIC_NOTIFICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SIGNS many AGREEMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES many TECHNICAL_ASSISTANCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PROVIDED many TECHNICAL_ASSISTANCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ARE ISSUED many GUARANTEED_LOAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ISSUES many GUARANTEED_LOAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SUBMITS one INFORMATION_REQUEST
cannot transfer.

Sometimes (0%) OWNS many CROSS_MEDIA_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) OWNS many COMMUNICATIONS_MEDIA
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RECEIVES many SAMPLE_ANALYTICAL_RESULT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PERFORMS many SAMPLE_ASSESSMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) LODGES one COMPLAINT
cannot transfer.

Sometimes (0%) RESPONDS_TO many COMPLAINT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ORIGINATES many RESEARCH_NEED
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: LEGAL_MANDATE

Description: A law passed by the U.S. Congress/State
 Legislature or an order signed by the
 President of the United States/State
 Governor.

Examples: the Safe Drinking Water
 Act and the Clean Water Act.

Example descriptors: title, dates,
 legislature/congress, rules and requirements,
 costs to implement, and milestones.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) ESTABLISHES many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_IMPLEMENTED_BY many REGULATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPLEMENTS_ANOTHER many LEGAL_MANDATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPLEMENTS many LEGAL_MANDATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS_ISSUED_BY one GOVERNMENT_AGENCY
cannot transfer.

Sometimes (0%) APPLIES_TO many INFORMATION_REQUEST
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: MONITORING_PLAN

Description: Documents the specific approach and schedule that a PWS will use to satisfy monitoring requirements.

Examples: Standardized Monitoring Framework.

Example descriptors: approval information, required sampling frequency, required sampling locations, deviation provisions

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS THE BASIS FOR many VIOLATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS BASED ON many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES SAMPLING USING many STANDARD_TECHNIQUE_OR_PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PRESCRIBES TRANSPORTING_BY many STANDARD_TECHNIQUE_OR
PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PRESCRIBES ANALYSIS_BY many STANDARD_TECHNIQUE_OR_PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPLIES TO many PUBLIC WATER SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES SAMPLING_FOR many CONTAMINANT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS IMPLEMENTED_BY many BUDGET

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PRESCRIBES TAKING many SAMPLE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: NON_GOVERNMENT_AGENCY_OR_COMPANY

Description: A non-government agency, company, or corporation (e.g., a private water company).

Examples include: professional association, private water company, or laboratory.

Example descriptors: name, address, location, function.

Subject area: LEGAL_ENTITIES

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:

Always IS_A many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EMPLOYS many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: OPERATOR_CERTIFICATE

Description: Includes applications for certification,
tracking information, including renewal dates
and fees.

Examples: PWS operator certifications,
sample-taker certifications, back-flow tester
certifications, and certifications issued by
other agencies (e.g., plumber licenses,
electrician licenses, well-driller licenses,
etc.).

Example descriptors: purpose of certificate,
date is issue, period of validity, competency
test results, applicant qualifications
(including education and training), and fees
paid.

Subject area: CONTROLLING_INSTRUMENTS

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:
Always BASED_ON one REQUIREMENT
cannot transfer.

Entity Definition

Entity: PERMIT

Description: Permit is issued by a government agency to a PWS for a specified purpose and period. Includes applications for permits, tracking information, fees, including renewal dates.

Examples: operating permit and construction permit.

Example descriptors: application date, date issued, period (end date), fee, activity (e.g., treatment) permitted, conditions, milestones, descriptions of limits/term of permit.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always BASED_ON many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_ISSUED_TO one LEGAL_ENTITY
cannot transfer.

Sometimes (0%) APPLIES_TO many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS_ISSUED_BY one GOVERNMENT_AGENCY
cannot transfer.

Sometimes (0%) IS_REQUIRED_TO_IMPLEMENT many ENGINEERING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: POLICY_AND_GUIDANCE

Description: A set of instructions used to establish
policy or guide implementation of
Federal/State regulations.

Examples: the Primacy Guidance Manual Phase
II Implementation Guide for the Lead and
Copper Rule, also the Federal Reporting Data
System (FRDS) Reporting.

Example descriptors: title, date,
applicability, policies, and milestones.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) HELPS_TO_IMPLEMENT many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS_ISSUED_BY many GOVERNMENT_AGENCY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) HELPS_IN_PREPARATION_OF many CONTINGENCY_AND_EMERGENCY_PLANS
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) GUIDES_PREPARING many ENGINEERING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: POPULATION_GROUP

Description: Characterization of a group of persons who consume drinking water provided by a public water system as described and regulated by Federal and State Drinking Water Regulations.

Examples: trailer parks, rest stops, institutions, Indian tribes, subdivisions, camp sites, cities, and districts.

Example Descriptors: political area, type of population (wholesale, retail, transient, non-transient, etc.) age, average income, other demographic and geographical characteristics of the consumer groups, residence type, size of community, location of community, distance community is from the PWS, education level, primary language.

Subject area: INVENTORIES

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:

Sometimes (0%) IS SERVED BY many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RECEIVES many PUBLIC_NOTIFICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS SERVED_BY one COMMUNICATIONS_MEDIA
cannot transfer.

Sometimes (0%) IS IMPACTED_BY many ENVIRONMENTAL_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS AFFECTED_BY many WEATHER_DATA
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: PROGRAM

Description: Documents information on a component of an environmental program. Includes Federal and State programs and special programs (e.g., Pesticide Survey)

Examples: laboratory certification program, reclamation and recharge program, ground water permitting program, water treatment device certification program, interstate carrier program, bottled water program, wellhead protection program, primacy program, and grant and loan programs.

Example descriptors: program type, program purpose, and milestones (beginning and ending date).

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS IMPLEMENTED BY many PROGRAM_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DESCRIBED BY many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EXECUTED BY many GOVERNMENT_AGENCY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) FUNDED BY many BUDGET
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EXAMINED BY many REVIEW_AUDIT_AND_EVALUATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES FOR many GUARANTEED_LOAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES many PUBLIC_NOTIFICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) REQUIRES many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES FOR many TECHNICAL_ASSISTANCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESPONDS TO many INFORMATION_REQUEST
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

Entity Definition

cannot transfer.

Sometimes (0%) PROVIDES_FOR one GRANT

cannot transfer.

Sometimes (0%) IS_DEVELOPED_BY one GOVERNMENT_AGENCY

cannot transfer.

Sometimes (0%) IS_APPROVED_BY many GOVERNMENT_AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) USES many CROSS_MEDIA_SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) IS_DEVELOPED_BASED_UPON many RESEARCH_NEED

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Entity Definition

Entity: PROGRAM_PLAN

Description: Documents methods and assigns responsibilities for implementing part of or the entire program or programs mandated in the Safe Drinking Water Act/State statute and other regulatory instruments developed to support the PWSS Program.

Examples: Outreach Plan, Regulatory Program Plan, Work Plan, Lead & Copper Plan, etc.

Example descriptors: type, time, dates, milestones, objectives, and performance measurements.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IMPLEMENTS many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES_A_BASIS_FOR many GRANT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: PUBLIC_NOTIFICATION

Description: A notice that informs the public of possible health risks, violations or operational advisories (e.g, flushing). Public notifications are made by public water systems (but may be also made by government agencies). Notifications may be written or verbal.

Requirements for notification include monitoring and reporting violations, MCL violations, treatment technique violations, variance/exemption non-compliance, failure to comply with specified testing procedures, or that a variance/exemption has been allowed.

An insufficient notification made by a PWS may require that a government agency issue a follow-up notification, which corrects the deficiency.

Examples: news releases, personal letters, boil water advisories, door-to-door notification, postings, radio/TV announcements and in-person notices.

Example descriptors: date of release, description of health risk, reporting period, duration of risk, risk mitigation actions.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS A RESULT OF many VIOLATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS MADE TO many POPULATION GROUP
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PROVIDED FOR BY many PROGRAM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS ISSUED BY many LEGAL ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS A RESULT OF many ENFORCEMENT ACTION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

This page intentionally left blank.

Entity Definition

Entity: PUBLIC_WATER_SYSTEM

Description: Information concerning public water systems (PWS). A PWS has at least 15 service connections or regularly serves at least 25 individuals.

State and local definitions/classifications may be more stringent than the SDWA definition.

Examples: municipal water treatment systems, rest stops, and camp sites.

Example descriptors: numbers of service connections, plant capacity, addresses, operations and maintenance data, distribution system information, etc.

Subject area: INVENTORIES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always USES many DRINKING_WATER_SOURCE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS OWNED BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SERVES_AS_A SELLING many DRINKING_WATER_SOURCE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS JEOPARDIZED BY many WATER_THREAT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) SERVES many POPULATION_GROUP

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CONSISTS_OF many WATER_SYSTEM_FACILITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) HAS many PERMIT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) HAS_A RESPONSIBLE many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS FUNDED BY many GUARANTEED_LOAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS EXAMINED BY many REVIEW_AUDIT_AND_EVALUATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

Entity Definition

cannot transfer.

Sometimes (0%) IS THE SUBJECT OF many ENFORCEMENT ACTION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) IS REQUIRED TO FOLLOW many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) IS GRANTED many DEVIATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) IS GOVERNED BY many MONITORING PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) PREPARES many ENGINEERING PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) IS THE SUBJECT OF many COMPLAINT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) CONSIDERS many HAZARDOUS WASTE INFORMATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Entity Definition

Entity: REGULATION

Description: A directive and enforceable document, issued by a State or Federal agency, that implements a Federal or State law.

Examples: National Primary Drinking Water Regulations and National Secondary Drinking Regulations.

Example descriptors: issue date, effective date(s), citation, level, name, number, and milestones.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) ESTABLISHES many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPLEMENTS ANOTHER many REGULATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPLEMENTS many REGULATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IMPLEMENTS many LEGAL_MANDATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RELATED TO ANOTHER many REGULATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RELATED TO many REGULATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS ISSUED BY one GOVERNMENT_AGENCY
cannot transfer.

Entity Definition

Entity: REQUIREMENT

Description: Identifies State and Federal PWSS Program requirements resulting from statutes, agreements, policies, regulations, permits, certifications, and guidance.

Examples: type contaminants being tracked, maximum contaminant levels, type of samples, sampling techniques, treatment techniques, and frequency of sampling.

Example descriptors: type, frequency, and milestones.

Subject area: CONTROLLING_INSTRUMENTS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS ESTABLISHED_BY many REGULATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ESTABLISHED_BY many LEGAL_MANDATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DESCRIBED_BY many POLICY_AND_GUIDANCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ADMINISTERED_BY many AGREEMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ESTABLISHED_CRITERIA_FOR many LAB_CERTIFICATE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CITED_BY many VIOLATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES_FOR_ISSUING many PERMIT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS MITIGATED_BY many DEVIATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) GUIDES many REVIEW_AUDIT_AND_EVALUATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IDENTIFIES_MCL_FOR many CONTAMINANT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE BASIS_FOR many ENFORCEMENT_ACTION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Sometimes (0%) APPLIES TO many PUBLIC WATER SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS ESTABLISHED BY many GOVERNMENT AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE BASIS FOR many MONITORING PLAN

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) AUTHORIZES one GOVERNMENT AGENCY

cannot transfer.

Sometimes (0%) SPECIFIES ACTION LEVELS FOR many CONTAMINANT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ESTABLISHES many OPERATOR CERTIFICATE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: RESEARCH_NEED

Description: Documents the needs for new and innovative requirements to support the PWSS Program.

Examples include: new treatment techniques and new sampling methods.

Example descriptors: type, sponsoring organization (s), research organization (s), and milestones.

Subject area: TECHNOLOGIES

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:

Sometimes (0%) IS DESCRIBED IN many TECHNICAL PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ORIGINATED BY many LEGAL ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS FOLLOWED BY many PROGRAM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CREATED BY many REVIEW AUDIT AND EVALUATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CREATED BY many SAMPLE ASSESSMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: RESEARCH_RESULT

Description: Documents information obtained from research and development projects, pilot studies, and demonstrations.

Examples: Drinking water surveys and studies, health effects studies, and information on emerging technology.

Example descriptors: type study, date, and findings.

Relationships: published by LEGAL ENTITY

Subject area: TECHNOLOGIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) ARE BASIS FOR DEVELOPING many TREATMENT_EQUIPMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EXAMINES many STANDARD_TECHNIQUE_OR_PROCEDURE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPLIES TO many ANALYTICAL_EQUIPMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DESCRIBED IN many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: REVIEW_AUDIT_AND_EVALUATION

Description: Results of an examination process of a regulated entity or regulating community activity. Review findings could result in a formal audit or the scheduling of additional on-site follow-up visits to support or correct the situation.

Examples: Comprehensive Plant Evaluations (CPE), reviews of exemptions and variances to determine their validity, reviews of PWS compliance with sampling requirements as established by regulations, audits of proper accounting practices, audits of the maintenance of sampling records, on-site visits to conduct a PWS sanitary survey, on-site inspections of new PWSSs, and reviews of state drinking water programs. Reviews may be formal (i.e., mandated by regulatory instruments) or informal.

Example descriptors: date(s) of review, type of review, finding(s), recommended actions, and status of actions.

Subject area: COMPLIANCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) DETECTS many VIOLATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS GUIDED BY many REQUIREMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EXAMINES many DEVIATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS PERFORMED BY many GOVERNMENT AGENCY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EXAMINES many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EXAMINES many PUBLIC WATER SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS FROM many COMPLAINT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) EVALUATES IMPACT OF many ENVIRONMENTAL_EVENT

Entity Definition

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULT_IN many RESEARCH_NEED

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: SAMPLE

Description: Physical description of a water specimen taken for the purpose of analyzing water quality. Samples may be taken from either raw (untreated) or treated water sources. Samples are typically taken at representative points within the distribution system or at entry points to the distribution system, but may be taken at the consumer's tap, or at the water source (Surface Water Treatment Rule [SWTR]).

Some samples may be combined (in a laboratory) to form a composite sample. Samples may be rejected (e.g., due to improper handling or time lapse).

Examples: raw water sample and treated water sample.

Example descriptors: volume, date and time collected, purpose, date reported, sample type (e.g., routine, special, repeat), preservative/preservation techniques, chain of custody.

Subject area: SAMPLES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IS TAKEN_BY one LEGAL_ENTITY
cannot transfer.

Sometimes (0%) IS ANALYZED_BY one LABORATORY
cannot transfer.

Sometimes (0%) IS TAKEN_AT many DRINKING_WATER_SOURCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS TAKEN_BY one INDIVIDUAL
cannot transfer.

Sometimes (0%) IS TAKEN_AT many WATER_SYSTEM_FACILITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS TAKEN_ACCORDING_TO many MONITORING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS TAKEN_ACCORDING_TO many STANDARD_TECHNIQUE_OR_PROCEDURE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS_IN many SAMPLE_ANALYTICAL_RESULT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Sometimes (0%) IS A COMPOSITE OF many SAMPLE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS A COMPOSITE many SAMPLE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) CHARACTERIZES one WATER_HABITAT_QUALITY_INFO

cannot transfer.

Entity Definition

Entity: SAMPLE_ANALYTICAL_RESULT

Description: Results of the analysis of samples by laboratories and field equipment.

Typically identifies contaminants and the level of contamination. A sample that exceeds maximum contaminant levels may result in an MCL violation and a sample that exceeds the method detection limit may result in a detection.

The sample analytical result may be rejected and/or invalidated -- the reason for the rejection will be noted.

Example descriptors: results (measurements), date analysis completed, date results reported.

Subject area: SAMPLES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) MEASURES many CONTAMINANT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS PREPARED BY one LABORATORY
cannot transfer.

Always IS BASED ON many SAMPLE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS REPORTED TO many LEGAL ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS PREPARED BY many INDIVIDUAL
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS BASED ON many STANDARD TECHNIQUE_OR_PROCEDURE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ARE USED TO PERFORM many SAMPLE_ASSESSMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: SAMPLE_ASSESSMENT

Description: Assessment of analytical results to determine action to be taken.

Examples: compliance determination findings, determinations of changes to monitoring schedules, 90th percentile results compared with action levels, etc.

Example descriptors: findings of the assessment, date, required/recommended actions, schedules

Subject area: SAMPLES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Always IS_BASED_ON one SAMPLE_ANALYTICAL_RESULT
cannot transfer.

Always IS_PERFORMED_BY one LEGAL_ENTITY
cannot transfer.

Sometimes (0%) RESULT_IN many RESEARCH_NEED
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: STANDARD_TECHNIQUE_OR_PROCEDURE

Description: Identifies standards to follow in a scientific method or procedure, data flow procedure, data formats, or operational procedure.

Examples: analytical method, treatment technique, preservation technique, and sampling procedure.

Example descriptors: title, effective date, purpose, method detection limit, and approving authority, BAT status, certifications, etc.

Relationships: approved by LEGAL ENTITY,
developed by LEGAL ENTITY

Subject area: TECHNOLOGIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS_USED_BY many ANALYTICAL_EQUIPMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_EXAMINED_BY many RESEARCH_RESULT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_APPLIED_BY many WATER_SYSTEM_FACILITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_USED_FOR_SAMPLING_BY many MONITORING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_CITED_FOR_TRANSPORTING_BY many MONITORING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_CITED_FOR_ANALYSIS_BY many MONITORING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) ARE_USED_IN_PREPARING many ENGINEERING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_DESCRIBED_BY many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_TRAINED_BY many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PRESCRIBED_FOR_TAKING many SAMPLE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

Entity Definition

cannot transfer.

Sometimes (0%) IS CERTIFIED FOR USE BY many LABORATORY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Sometimes (0%) IS USED TO DETERMINE many SAMPLE ANALYTICAL_RESULT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Entity Definition

Entity: TECHNICAL_ASSISTANCE

Description: Describes technical services provided to/or requested by a PWS, laboratory or regulating activity.

Examples: Routine and emergency technical assistance.

Example descriptors: cost(s), method, date(s), reason, and technical staff.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS_PROVIDED_FOR_UNDER many PROGRAM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PROVIDED_BY many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PROVIDED_TO many LEGAL_ENTITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PROVIDED_TO_SUPPORT many ENGINEERING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESPONDS_TO many ENVIRONMENTAL_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: TECHNICAL_PUBLICATION

Description: Describes the inventory of outreach products about the State or Nation's drinking water, or related topic.

Examples: information guides, health advisories, pamphlets, newsletters, public news releases, videos, and audio cassettes used for consumer education and/or technical assistance/water system outreach.

Example descriptors: type, title, medium, targeted community, publication date, synopsis, version, and cost.

Subject area: TECHNOLOGIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) DESCRIBES many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PREPARED BY many LEGAL ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DISTRIBUTED BY many LEGAL ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DISTRIBUTED BY many COMMUNICATIONS_MEDIA

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES many STANDARD TECHNIQUE OR PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES USE OF many TREATMENT EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES USE OF many FIELD EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES USE OF many ANALYTICAL EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES many RESEARCH RESULT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES many RESEARCH NEED

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE BASIS FOR many TRAINING EVENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

Entity Definition

cannot transfer.

Sometimes (0%) DESCRIBES many CROSS MEDIA SYSTEM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1

cannot transfer.

Entity Definition

Entity: TRAINING_EVENT

Description: Describes training associated with requirements of the PWSS program, including operator and laboratory certification training.

Examples: classroom lecture, self-study guide, automated tutorial, and video for certification, regulatory implementation, sanitary engineers, data management.

Example descriptors: descriptions, staff requirements, durations, locations, and schedules, CEUs, level of certification supported, costs, prerequisites.

Subject area: PROGRAMS_AND_PLANS

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) SUPPORTS many PROGRAM

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS APPROVED_BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PRESENTED_BY many LEGAL_ENTITY

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS ATTENDED_BY many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS PRESENTED_BY many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS DEVELOPED_BY many INDIVIDUAL

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES_TRAINING_FOR many STANDARD_TECHNIQUE_OR_PROCEDURE

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS BASED_ON many TECHNICAL_PUBLICATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES_TRAINING_FOR many ANALYTICAL_EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) PROVIDES_TRAINING_FOR many FIELD_EQUIPMENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Model : OGWDW PWSS ISP MODEL V01.01D
Subset: (complete model)

Dec. 21, 1992 18:13
page 60

Entity Definition

Sometimes (0%) PROVIDES_TRAINING_FOR many TREATMENT_EQUIPMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: TREATMENT_EQUIPMENT

Description: Capabilities of equipment used to
alter/improve water quality.

Examples: Filters, sedimentation basins, and
chlorinators.

Example descriptors: type and purpose, date
installed and manufactured date, capacity,
usage period (e.g., seasonal), backup or
on-line, chemicals needed for the process,
maintenance and inspection schedule.

Relationships: uses STANDARD TECHNIQUE OR
PROCEDURE, manufactured by LEGAL ENTITY

Subject area: TECHNOLOGIES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS_USED_AT many WATER_SYSTEM_FACILITY
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_DEVELOPED_BASED_ON many RESEARCH_RESULT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_INSTALLED_OR_MODIFIED_PER many ENGINEERING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_DESCRIBED_BY many TECHNICAL_PUBLICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_TRAINED_BY many TRAINING_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: VIOLATION

Description: Documents a breach of a requirement. Violations are detected by assessment of sample results or reviews (including on site visits). Violations may lead to legal actions or compliance orders. Violations are publicized, when required, by public notification. Violations may be remedied by compliance/enforcement remedies, such as improved filtration techniques or changes in procedures.

Examples: MCL violations, failure to replace lead service lines, monitoring and reporting violations, treatment technique violations, and procedural violations.

Example descriptors: type, date, description, severity, and recommended corrective action(s) to include milestones.

Subject area: COMPLIANCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS DETECTED BY many REVIEW_AUDIT_AND_EVALUATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS IN many AGREEMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS IN many ENFORCEMENT_ACTION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always CITES many REQUIREMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS IN many PUBLIC_NOTIFICATION
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS BASED ON FAILING TO FOLLOW many MONITORING_PLAN
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Always IS ISSUED BY one GOVERNMENT_AGENCY
cannot transfer.

Always IS THE RESULT OF many COMPLAINT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS THE RESULT OF many ENVIRONMENTAL_EVENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Model : OGWDW PWSS ISP MODEL V01.01D
Subset: (complete model)

Dec. 21, 1992 18:13
page 63

Entity Definition

This page intentionally left blank.

Entity Definition

Entity: WATER_HABITAT_QUALITY_INFO

Description: Provides viability information relating to the suitability of water systems as habitats for nature.

Examples include: marshlands, lakes, bays, rivers, estuaries, etc.

Example descriptors include: pollutants, name, type, geographical location, water quality assessment, biological population, etc.

Subject area: CROSS_MEDIA_SOURCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS PROVIDED BY many CROSS_MEDIA_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS CHARACTERIZED BY many SAMPLE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) DESCRIBES many DRINKING_WATER_SOURCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: WATER_SYSTEM_FACILITY

Description: Describes the public water system's resources to collect, store, treat, and distribute water to its consumers.

Examples: treatment facility, pumping station, storage tank, wellhead, water intake, entry points, pipeline systems, etc.

Example descriptors: type facility, storage capacity, pumping capacity, and location.

EPA's "Facility Identification Data Standard Implementation Plan" codes may be used in the future to identify these facilities.

Subject area: INVENTORIES

Properties:	Min Occ:	0	Avg Occ:	0
	Max Occ:	0	Growth Rate:	0% per year

Relationships:

Sometimes (0%) USES many TREATMENT_EQUIPMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_PART_OF many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) USES many ANALYTICAL_EQUIPMENT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) APPLIES many STANDARD_TECHNIQUE_OR_PROCEDURE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_BUILT_OR_MOD_ACCORDING_TO one ENGINEERING_PLAN
cannot transfer.

Sometimes (0%) PROVIDES many SAMPLE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: WATER_THREAT

Description: Documents phenomena and events that adversely affect drinking water.

Examples: threats from nature (e.g., bacteria, viruses, other microorganisms), naturally occurring materials such as arsenic, cadmium, chromium, and nitrates; threats from society (e.g., spills, chemicals both legally and illegally discharged from industrial and other processes, tampering, runoff from city streets, parking lots, and rooftops, leakage of chemicals and wastes from underground storage tanks; runoff of agricultural pesticides and fertilizers, leachate from landfills and waste dumps, injection of waste fluids into underground wells, improper use and disposal of household wastes, such as used oil, cleaning products, and lawn and garden chemicals, faulty septic tanks and sewage systems; and threats from treatment and distribution (e.g., formation of disinfection by-products (for example, trihalomethanes), corrosion by-products, and other contaminants resulting from water treatment and distribution).

Includes risk assessment methods, vulnerability analysis, and rate of return on investment information.

Example descriptors: threat type, threat site, expected effects on water quality, threat probability, health risks, mitigation options, and mitigation costs, regulating program.

Subject area: INVENTORIES

Properties: Min Occ: 0 Avg Occ: 0
 Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) JEOPARDIZES many DRINKING_WATER_SOURCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) JEOPARDIZES many PUBLIC_WATER_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS RESPONDED TO BY many CONTINGENCY_AND_EMERGENCY_PLANS
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Sometimes (0%) IS_CAUSED_BY many HAZARDOUS_WASTE_INFORMATION

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) RESULTS_FROM many ENVIRONMENTAL_EVENT

Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Entity Definition

Entity: WEATHER_DATA

Description: Describes meteorological phenomenae.

Examples include: hurricanes, tornadoes,
floods, thunderstorms, climatological data,
etc.

Example descriptors include: type, date(s),
threat evaluation, impacts, population
affected, etc.

Subject area: CROSS_MEDIA_SOURCES

Properties: Min Occ: 0 Avg Occ: 0
Max Occ: 0 Growth Rate: 0% per year

Relationships:

Sometimes (0%) IS_PROVIDED_BY many CROSS_MEDIA_SYSTEM
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) HELP_ANALYZE many DRINKING_WATER_SOURCE
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) IS_CONSIDERED_BY many CONTINGENCY_AND_EMERGENCY_PLANS
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) FORECASTS many CONTAMINANT
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

Sometimes (0%) AFFECTS many POPULATION_GROUP
Cardinality Min: 1 (est) Max: 1 (est) Avg: 1
cannot transfer.

-End of Report-

Appendix I

Entity Relationship Diagram

This appendix contains a diagram depicting the relationships of entity types with other entity types, as well as, entity types within subject areas.

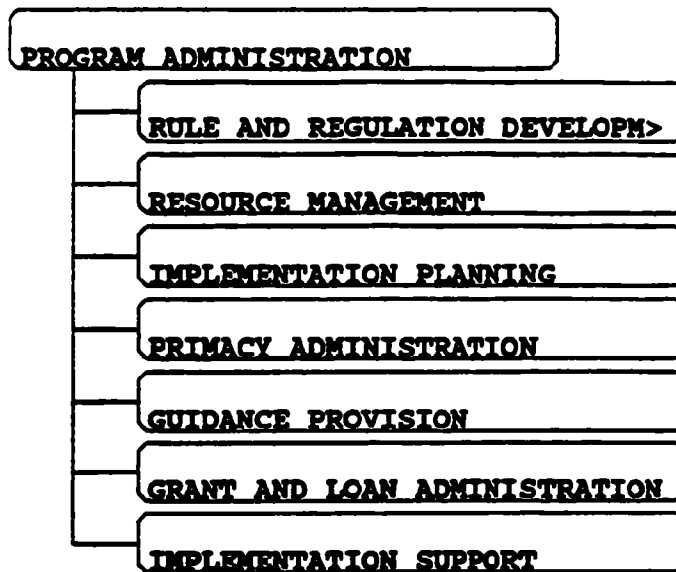
**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix J

Function Hierarchy Diagram with Descriptions

This appendix contains a diagram of the top level functions and separate diagrams of the next level functions for each sibling of the top level. The sibling diagrams will be accompanied by the definitions of each function within the diagram.

PUBLIC WATER SYSTEM SUPERVISION		
	PROGRAM ADMINISTRATION	000
	WATER RESOURCE PLANNING	000
	RISK AND VULNERABILITY ASSESSMEN	000
	TECHNOLOGY AND METHODS	000
	DATA MANAGEMENT	000
	LAB CAPACITY AND CERTIFICATION	000
	OPERATOR CERTIFICATION	000
	ENGINEERING PLAN REVIEW	000
	FIELD SURVEILLANCE	000
	DISEASE OUTBREAK AND SURVEILLANC	000
	COMPLIANCE DETERMINATION RESOLUT	000
	TECHNICAL ASSISTANCE	000
	ENFORCEMENT	000
	EMERGENCY RESPONSE	000
	TRAINING	000
	OUTREACH	000



RULE_AND_REGULATION_DEVELOPMENT

Developing rules and regulations, including inputting to higher level policies (i.e., State input to Federal rule development), and inputting to other program rule/regulation development processes.

RESOURCE_MANAGEMENT

Managing resources (equipment, budgets and people) for PWS supervision, justifying resource needs, and defending resources. Includes steps taken by States to sustain primacy, obtain sufficient resources to fulfill primacy responsibilities, etc.

IMPLEMENTATION_PLANNING

Preparing and reviewing implementation plans. Examples include:

PRIMACY_ADMINISTRATION

Developing and reviewing primacy packages; requesting, granting and revoking primacy; and developing and reviewing requests to revise primacy agreements.

GUIDANCE_PROVISION

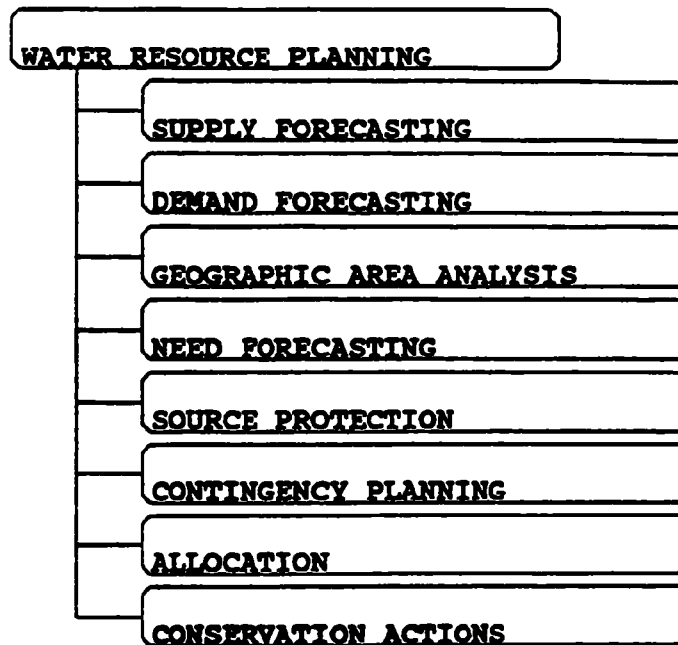
Providing information on current and new programs (e.g., well head protection, vulnerability assessment), interpreting regulations, providing reporting guidance, providing guidance on systems interface, and providing information on steps necessary to retain/obtain primacy.

GRANT_AND_LOAN_ADMINISTRATION

Preparing and reviewing grant requests, developing and implementing guidance for work plans, preparing and reviewing work plans, funding work plans, and reporting and reviewing progress on work plans. Also including guaranteed loan administration at the State level.

IMPLEMENTATION_SUPPORT

Providing support in implementing PWS programs. Examples include: Intergovernmental Personnel Act (IPA) program support, ad hoc personnel assignments such as paralegal support, etc.



SUPPLY_FORECASTING

Includes analyzing source capacity and availability to determine future supply.
Includes long and short range and State-wide forecasts.

DEMAND_FORECASTING

Conducting studies of demographics and industrial/residential/agricultural development to characterize future/existing demand.

GEOGRAPHIC_AREA_ANALYSIS

Performing analyses of geographic areas to support water resource allocation.
Includes demand, water rights, vulnerability assessment, non-point and point sources, etc.

NEED_FORECASTING

Forecasting the needs for funds to support provision of adequate water supplies.
Includes projecting growth and analyzing other demographic information, projecting plant/treatment capacity, engineering evaluations, etc.

SOURCE_PROTECTION

Protecting sources (and potential sources) from contamination. Includes evaluation of zoning, land use restrictions, building permits for large residential and industrial facilities, as well as source evaluation and protection including well head protection, watershed protection, etc.

CONTINGENCY_PLANNING

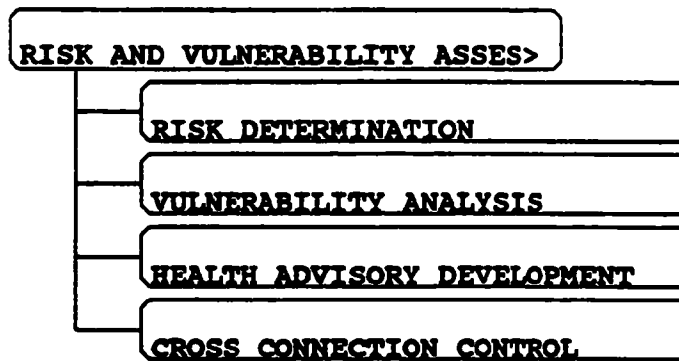
Planning to respond to shortages and emergencies (e.g., emergency responses, regional shortages, seasonal variations, planning alternate sources for supply, etc.).
Includes preparation and review of plans, providing guidance, and performing coordination.

ALLOCATION

Activities relating to allocating water resources, including water rights, reviewing and approving allocation permit applications, etc.

CONSERVATION_ACTIONS

Activities relating to the implementation of water conservation.



RISK_DETERMINATION

Establishing the risk and potential risk to the public of using drinking water from specific systems.

VULNERABILITY_ANALYSIS

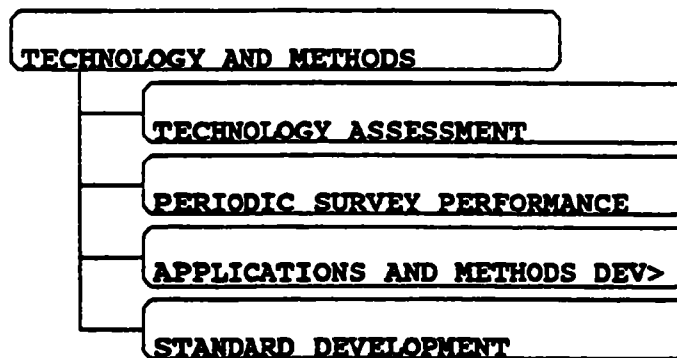
Analyzing occurrence data, geological and hydrological information, and other information concerning sources of contamination to assess trends and determine vulnerabilities. Includes considering occurrences and trends in other environmental and land use programs (e.g., underground storage, coordination with wellhead protection program, agricultural chemical use, underground injection, etc.).

HEALTH_ADVISORY_DEVELOPMENT

Establishing State advisory levels, action levels, health based guidance levels, and health advisories. Issuing advisories is detailed within Outreach.

CROSS_CONNECTION_CONTROL

Establishing and maintaining programs for cross-connection control and backflow prevention. Includes site visits and inspections.



TECHNOLOGY_ASSESSMENT

Assessing technology (existing,new or emerging) for application to treatment, analytical techniques, or data collection and processing activities.

PERIODIC_SURVEY_PERFORMANCE

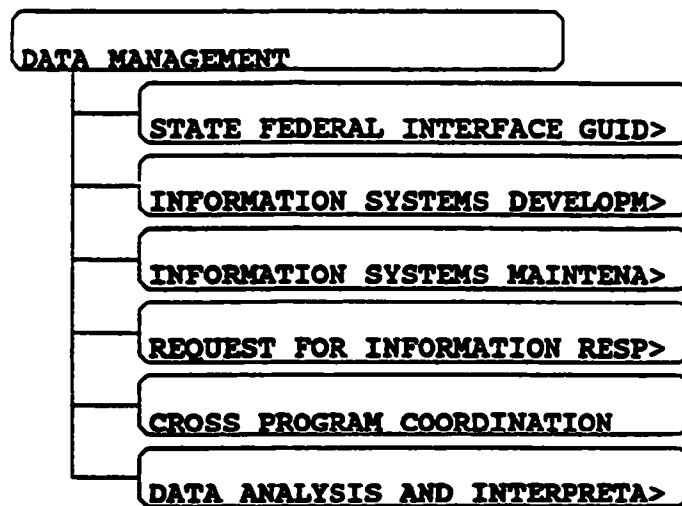
Conduct surveys to support ongoing research (e.g., National Pesticide Survey, NIRS, unregulated contaminants, and special studies).

APPLICATIONS_AND_METHODS_DEVELOP

Activities relating to development of applications, methods and techniques. Includes pilot studies, demonstrations, performance evaluations, and field tests of methods and systems.

STANDARD_DEVELOPMENT

Performing analysis and research to develop standards, including reviewing and approving third party standards (analytical and treatment), out-of-state lab certification, additives and tank coatings, POU device evaluations, and studies of health effects; and performing cost/benefit analysis.



STATE_FEDERAL_INTERFACE_GUIDANCE

Developing and providing guidance for system interfaces among Federal, State, local and industry association systems as well as regulated community.

INFORMATION_SYSTEMS_DEVELOPMENT

Activities related to developing information systems.

INFORMATION_SYSTEMS_MAINTENANCE

Maintaining and enhancing information systems, user support, maintaining information system inventories and controlling information systems equipment. Includes protecting information systems from loss, unauthorized access or modification.

REQUEST_FOR_INFORMATION_RESPONSE

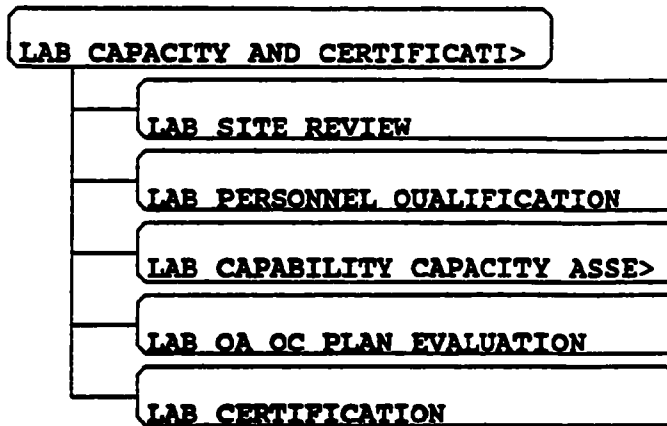
Responding to requests for information, including FOIA, congressional/legislative inquiries, requests from AWWA and ASDWA, requests by lending institutions, etc. Includes analysis of information.

CROSS_PROGRAM_COORDINATION

Coordinating with other programs, such as public health, water rights, CWA, RCRA, Superfund, and CAA.

DATA_ANALYSIS_AND_INTERPRETATION

Performing analysis, verification and interpretation of data relating to implementation of the PWSS program. Includes trend analysis.



LAB_SITE_REVIEW

Visiting labs to evaluate methods, reporting procedures, chain of custody procedures, etc.

LAB_PERSONNEL_QUALIFICATION

Evaluating the qualifications of lab personnel. May also include certification of laboratory technicians. This function is performed by various agencies in the States, and there are reciprocity agreements among various States.

LAB_CAPABILITY_CAPACITY_ASSESS

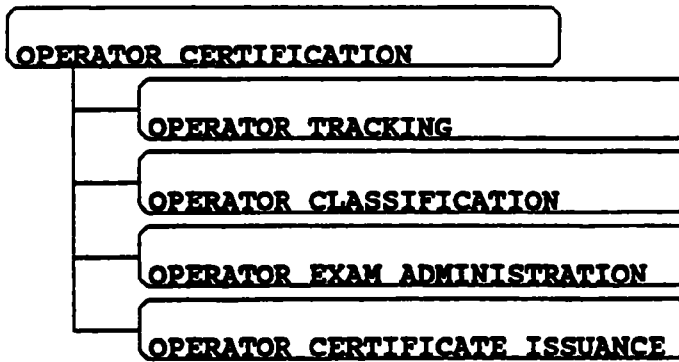
Assessing the capability of labs to perform analysis. Evaluating audit samples, reviewing analysis results, and making assessment of capability and capacity using lab certification standards. Includes assessing State-wide capacity, by method and contaminant. May include work load allocation for some State-operated labs.

LAB_QA_QC_PLAN_EVALUATION

Evaluating laboratory quality assurance (QA) and quality control (QC) plans to determine compliance with standards. May include data audits conducted by States and EPA Regions.

LAB_CERTIFICATION

Issuing or revoking certificates of certification (or licenses), reviewing compliance with terms of certification, renewing/revoking certification, assessing and collecting fees. Certification is by method and contaminant group. May include activities to certify certifying officers.



OPERATOR_TRACKING

Tracking operator applicants, operator certification levels, CEUs, and designation of operator in charge and tracking fees.

OPERATOR_CLASSIFICATION

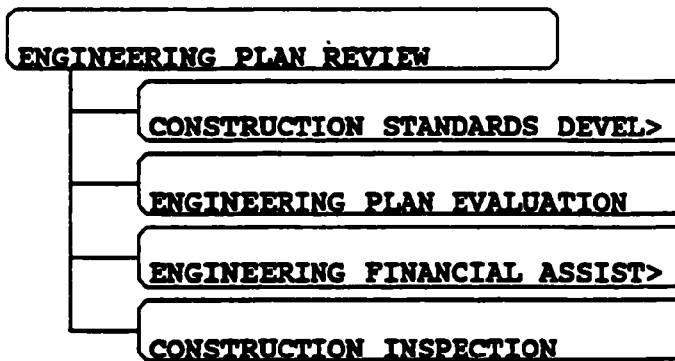
Determining the class of a specific PWS to determine operator classification level requirements. Reviewing staff qualifications of PWSs to ensure that properly certified staff are assigned. May also include determining if each shift at a PWS has properly certified staff (by class).

OPERATOR_EXAM_ADMINISTRATION

Writing, validating and administering operator certification exams and collecting fees. May be performed by other State agencies or third party agencies.

OPERATOR_CERTIFICATE_ISSUANCE

Preparing and issuing operator certificates. Certificates/licenses are issued for the operation of the PWS. Includes revoking and renewing certificates and collecting fees.



CONSTRUCTION_STANDARDS_DEVELOPME

Developing standards (codes) for PWS construction. Includes design policies and standards, construction permit requirements, etc.

ENGINEERING_PLAN_EVALUATION

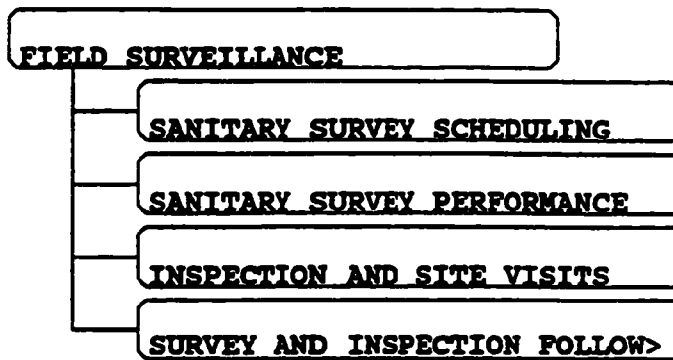
Evaluating, commenting, and approving/rejecting proposed engineering plans (permit applications) and reports relating to PWS construction. Also includes audit of delegated evaluation (e.g., delegation of plan review to State regions, or delegation of plan review to major utilities).

ENGINEERING_FINANCIAL_ASSISTANCE

Developing and reviewing requests for financial assistance to implement engineering plans and construction, performing feasibility studies, prepare system designs, and providing/tracking funds.

CONSTRUCTION_INSPECTION

Performing on site visits to review PWS construction projects and to verify construction according to approved plans. Permits to operate are issued based on results of these inspections.



SANITARY_SURVEY_SCHEDULING

Scheduling sanitary surveys.

SANITARY_SURVEY_PERFORMANCE

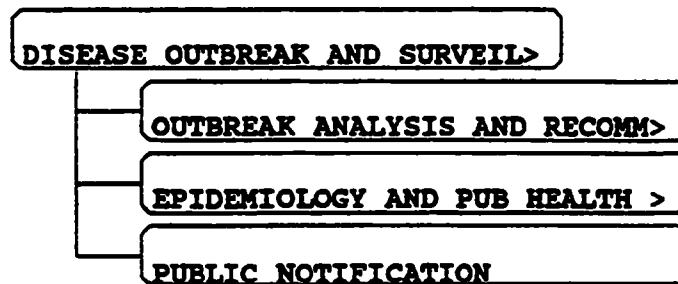
Performing sanitary surveys, including providing technical assistance, enforcement and permit review. Includes Comprehensive Performance Evaluation (CPE).

INSPECTION_AND_SITE_VISITS

Performing site visits and other inspections, O&M inspections, enforcement case support, complaint investigations, special projects, etc.

SURVEY_AND_INSPECTION_FOLLOWUP

Verifying completion of corrective actions recommended/directed as a result of sanitary surveys and other inspections. Includes tracking responses to third party visits.



OUTBREAK_ANALYSIS_AND_RECOMMENDA

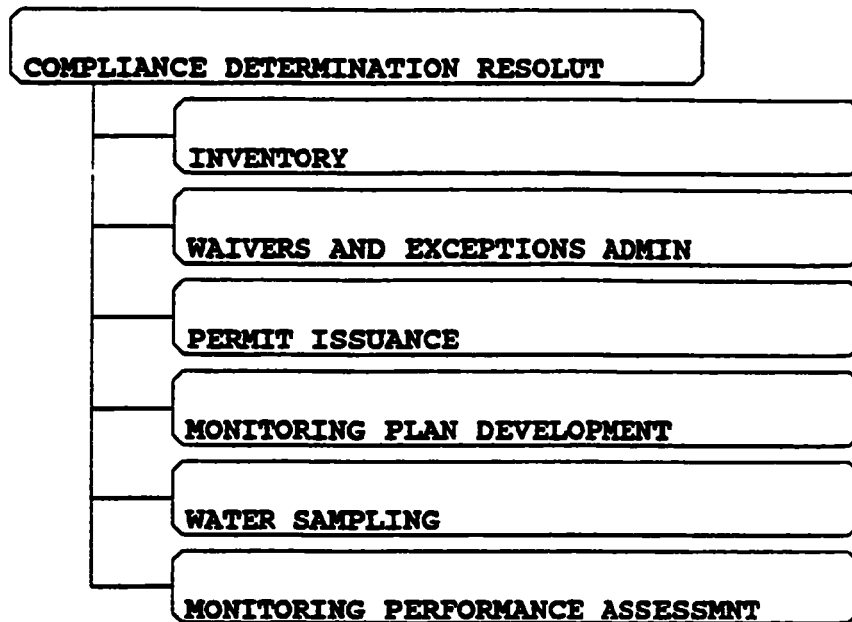
Analyzing the disease outbreak to determine actions which should be taken to preclude reoccurrence.

EPIDEMIOLOGY_AND_PUB_HEALTH_COOR

Collecting data and performing analyses and epidemiological investigations in response to incidents and possible outbreaks of disease and other public health issues. Includes studying numbers of occurrences to determine outbreaks, the source of the outbreak (confirming or ruling out role of water). Also includes coordination with the Center for Disease Control (CDC) and State Health Departments.

PUBLIC_NOTIFICATION

Notifying the public of precautionary measures required to protect themselves (cause, effect, and treatment/preventative measure).



INVENTORY

Identifying and maintaining the inventory of PWSs, including all characteristics and facilities. Also includes complying with legal requirements relating to maintaining inventory.

WAIVERS_AND_EXCEPTIONS_ADMIN

Considering needs to grant deviations to regulations or statutes, including waivers, exceptions, variances, etc, and granting and revoking waivers/exceptions/variances. Includes tracking and reviewing applications as well as compliance with terms of waiver.

PERMIT_ISSUANCE

Analyzing permit applications and provide comment/approval. Reviewing qualifications of applicant, including financial viability, assessing and collecting fees, and tracking. Includes issuing construction permits.

MONITORING_PLAN_DEVELOPMENT

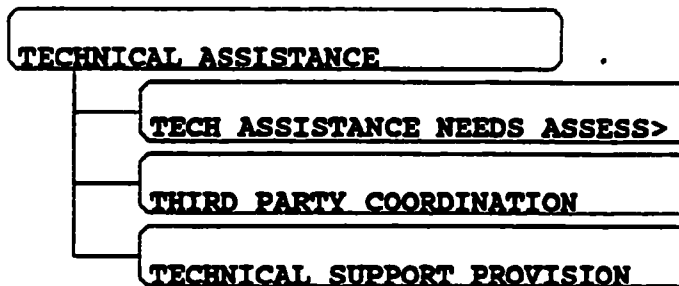
Developing monitoring plans and schedules, tracking compliance with schedules. Includes site plan development and review.

WATER_SAMPLING

Taking water samples. Consists of planning, scheduling, taking and shipping samples.

MONITORING_PERFORMANCE_ASSESSMENT

Receiving and reviewing monitoring results and comparing with monitoring plans, MCL's, Monitoring/Reporting, treatment techniques. Reviewing public notification and PWS operational reports and O&M plans.



TECH_ASSISTANCE_NEEDS_ASSESSMENT

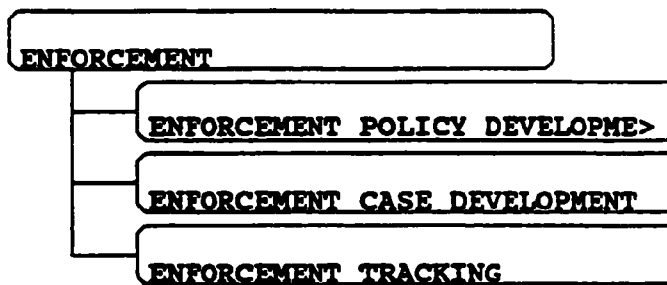
Assessing problems with the PWSs or regulating activities in order to determine the need for technical assistance.

THIRD_PARTY_COORDINATION

Arranging and coordinating to reduce overlap, and participating in seminars and conferences.

TECHNICAL_SUPPORT_PROVISION

Providing technical support. Includes providing funds, bulletin boards, hotline, site visits, reporting experiences and trouble shooting. Also includes providing support to State Utility Commissions for rate hearings.



ENFORCEMENT_POLICY_DEVELOPMENT

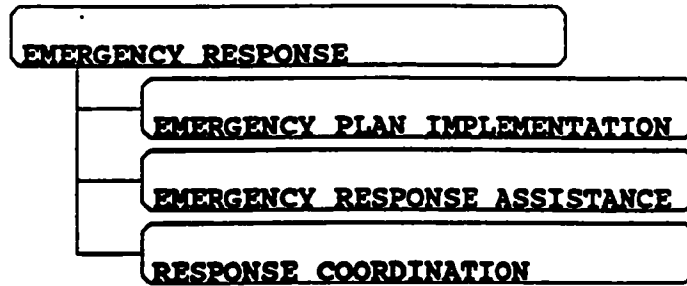
Developing enforcement policies, including review of State authority, developing of State/EPA enforcement agreements, delegations to counties/State regions, targeting and working with other agencies, determining SNC level, setting priorities for enforcement.

ENFORCEMENT_CASE_DEVELOPMENT

Developing and preparing cases for enforcement actions against laboratories or PWSs. Includes determining whether or not to pursue enforcement, type of enforcement action to take, coordinating with State/Federal agencies, referrals, and preparing for administrative and criminal/civil actions.

ENFORCEMENT_TRACKING

Tracking activities relating to enforcement. Includes tracking compliance order implementation, penalties, coordination with Attorney General/Federal prosecutor/State prosecutors, linking enforcement to violations, reporting progress/status relating to enforcement actions, etc. Includes formal and informal enforcement actions.



EMERGENCY_PLAN_IMPLEMENTATION

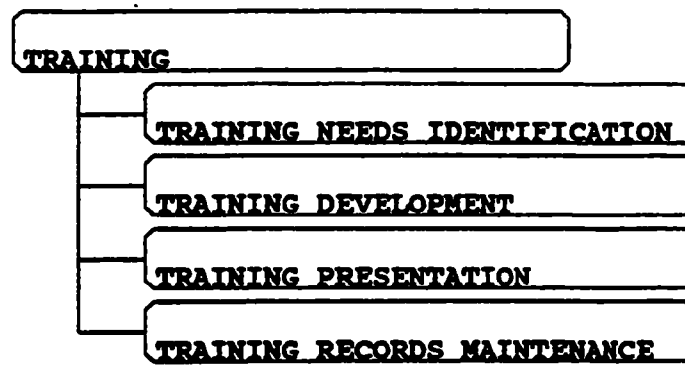
Reviewing/rehearsing emergency plans to determine actions required, coordinating with State/Federal emergency planning agencies, and providing input to State/Federal emergency planning. Includes both local water system response (e.g., what to do if the pump fails), as well as responding to broader area-wide emergencies.

EMERGENCY_RESPONSE_ASSISTANCE

Providing technical and financial assistance to PWSs so that they can effectively respond to an emergency situation.

RESPONSE_COORDINATION

Coordinating with other State/Federal agencies to respond to emergencies and analyzing results of remedial actions.



TRAINING_NEEDS_IDENTIFICATION

Reviewing survey results, violations, rules, regulations, technology, requests for technical assistance, and needs of water systems to determine training needs. Includes determining the type of training required for specific operator class and size of PWS operation. Includes conducting operator job/skill task analysis to determine training needs. May be performed by other State agencies.

TRAINING_DEVELOPMENT

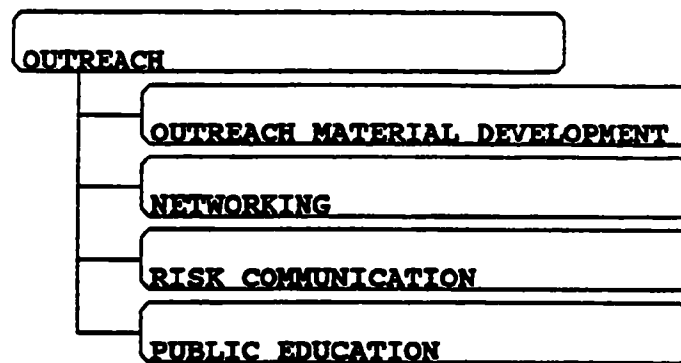
Developing the training materials for presentation of training and arranging and scheduling of training events. Includes developing training videos, handouts, lending libraries, reference materials, including procedures to perform training.

TRAINING_PRESENTATION

Presenting training, including in-house and third party and training opportunities, for the improvement of knowledge of technologies, rules, and management skills. Includes training for PWSs, operators, technical providers, (e.g., rural water association), labs, design engineers, and the regulating community.

TRAINING_RECORDS_MAINTENANCE

Evaluating, recording and maintaining the results of training.



OUTREACH_MATERIAL_DEVELOPMENT

Developing and distributing reference materials and products to support the outreach program. Includes software products, reference materials, establishing a bulletin board, etc.

NETWORKING

Conducting interagency coordination, participating in professional and industry associations and advisory committees, and developing press and legislative contacts to support the outreach program.

RISK_COMMUNICATION

Providing information to the public and water industry (engineers, labs, etc.) concerning risks relating to drinking water. Examples include preparing and distributing public notification, boiled water orders, newsletters, MCLs, health-based guidance levels and their significance.

PUBLIC_EDUCATION

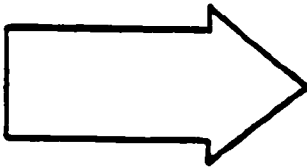
Educating the public concerning the drinking water program. Includes communicating standard drinking water treatment technologies; responding to public inquiries; and providing information on regulatory programs, enforcement, health effects, public notice purpose. Uses a variety of media (e.g., hotline numbers, newspapers, television, etc.).

This page intentionally left blank.

Function Dependency Diagrams

The following top level functional dependency diagram shows the sequence in which the sixteen functions are chained together in the information architecture.

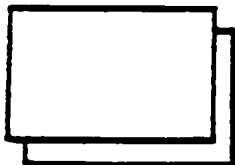
The following top level functional dependency diagram shows the sequence in which the sixteen functions are chained together in the information architecture. The following symbols are used in the diagram:



A large arrow represents one of three things: an event; the availability of information from outside the business; or the passing of a specific point in time, which triggers the execution of a process.



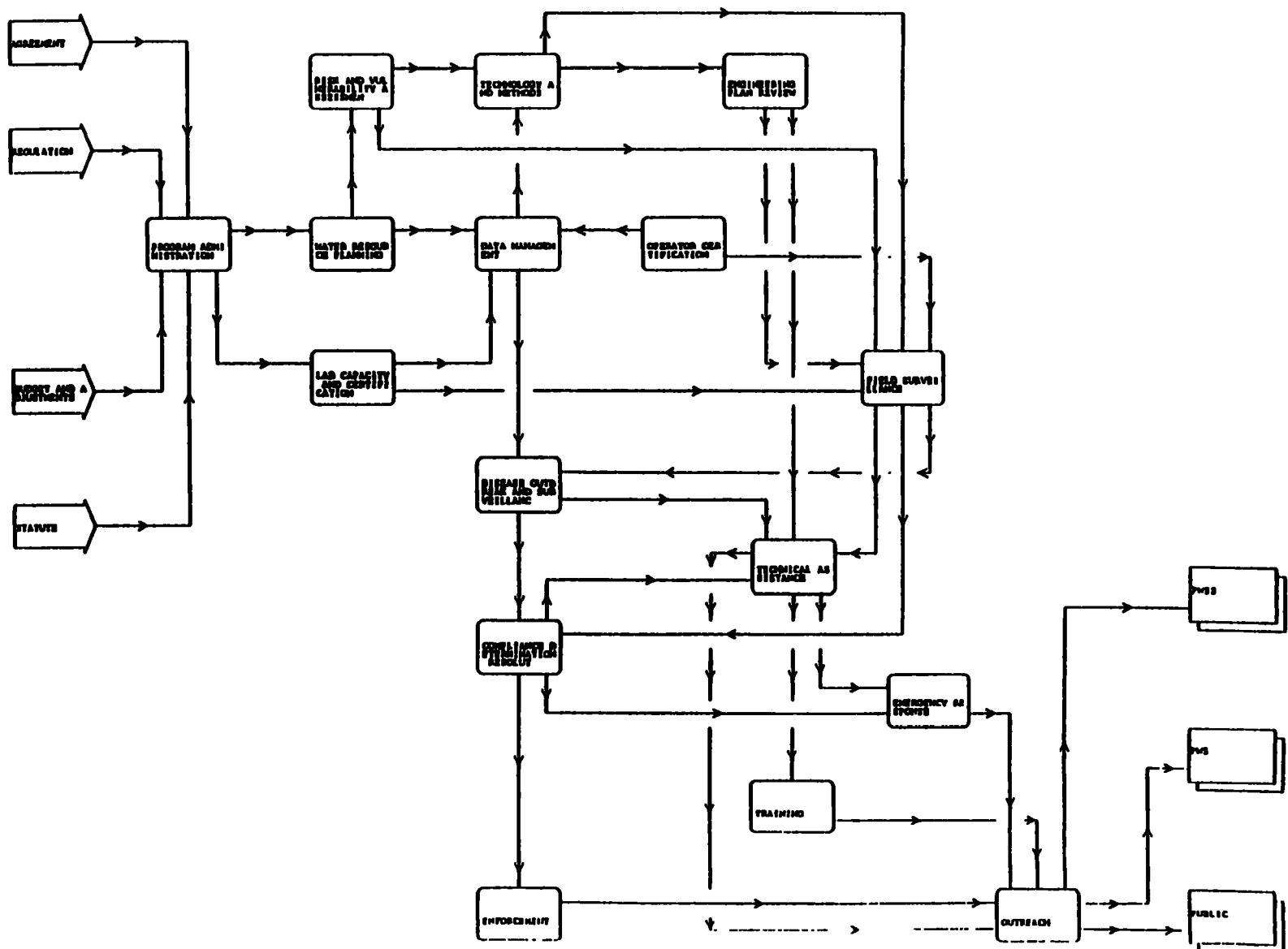
A box with rounded corners represents a business function.



A two-tiered box represents an external object, which is either the source of information used by a process or the destination of information produced by the process.



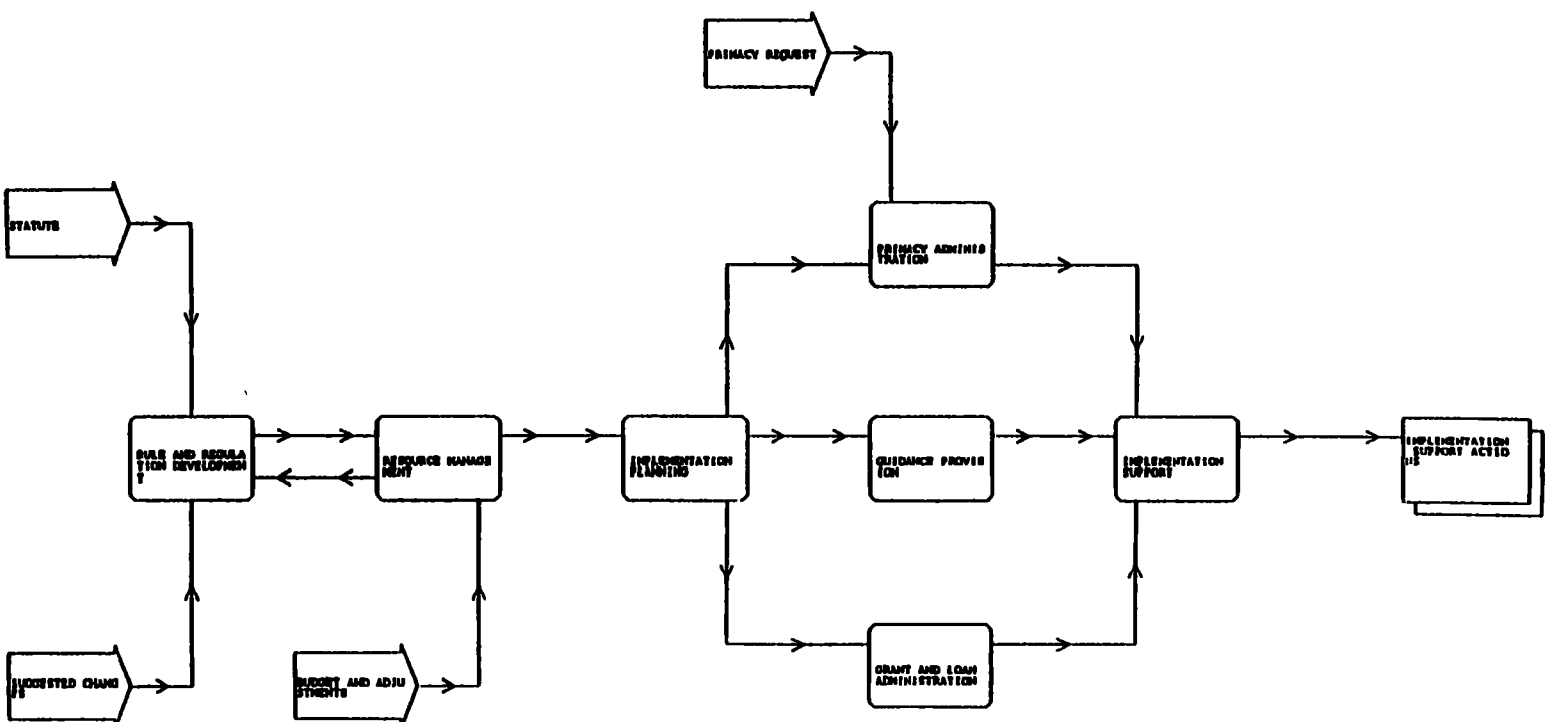
A line with arrows represents either a dependency or an information flow. It shows either flow of control or the movement of information.



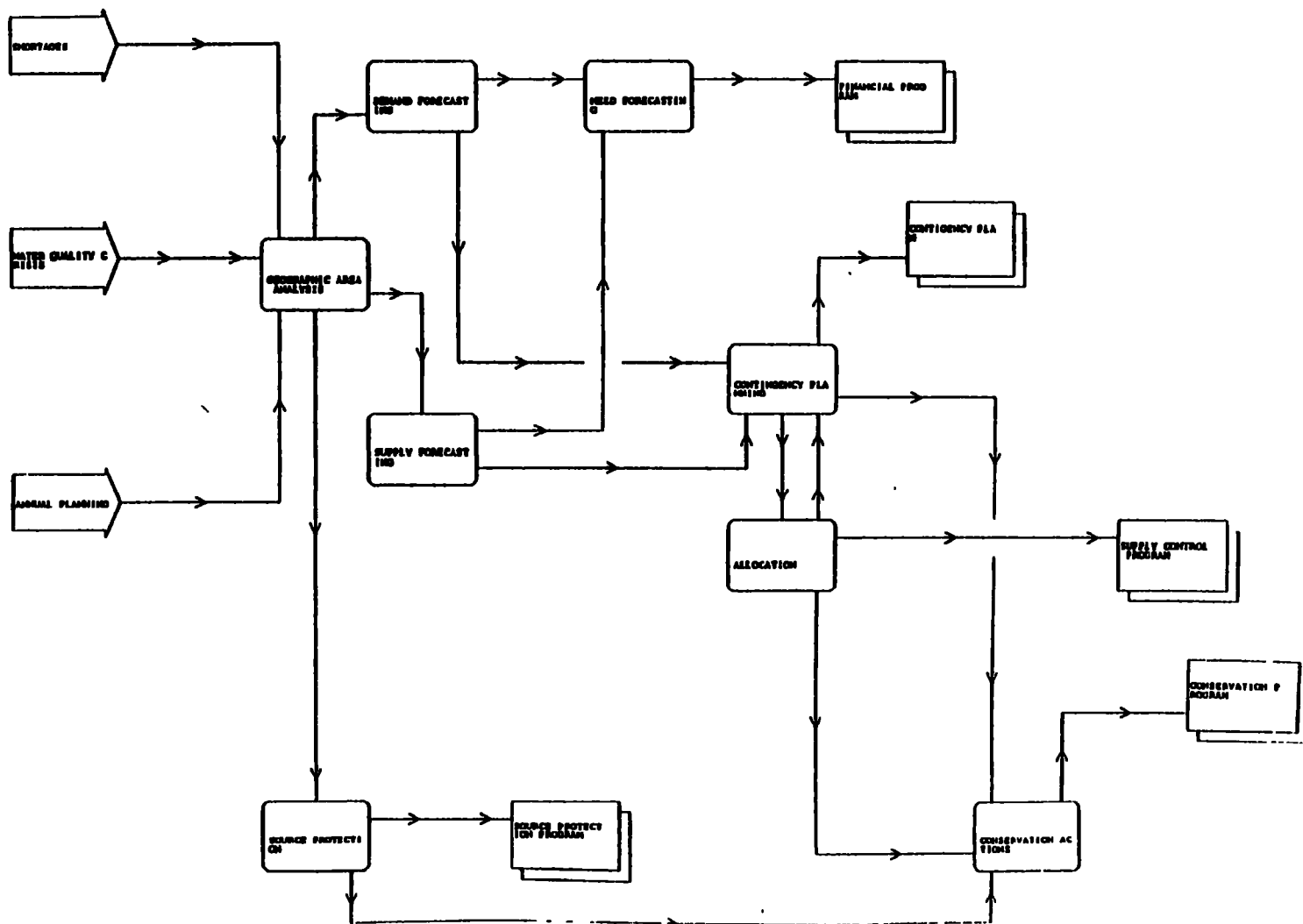
The following pages reflect each of the sixteen lower level functions in the order in which they are shown in the functional hierarchy diagram on page N-3.

PROGRAM ADMINISTRATION

J - 39

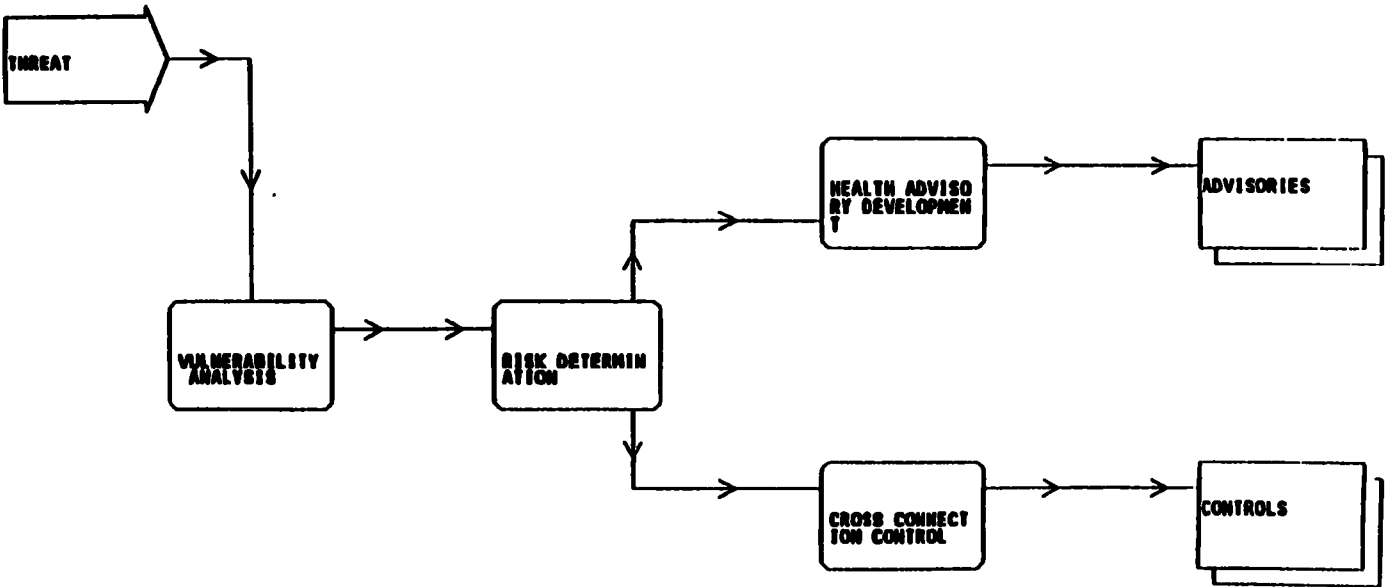


J - 40

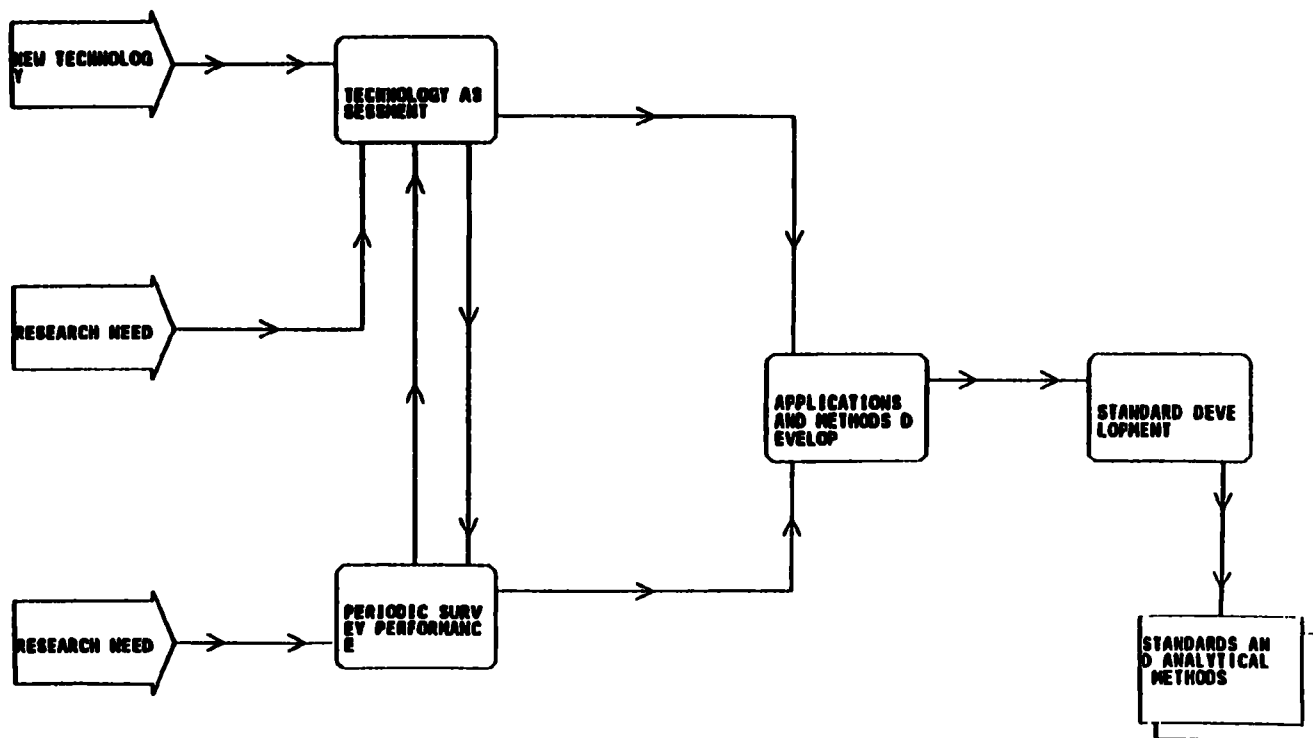


RISK AND VULNERABILITY ASSESSMEN

J - 41

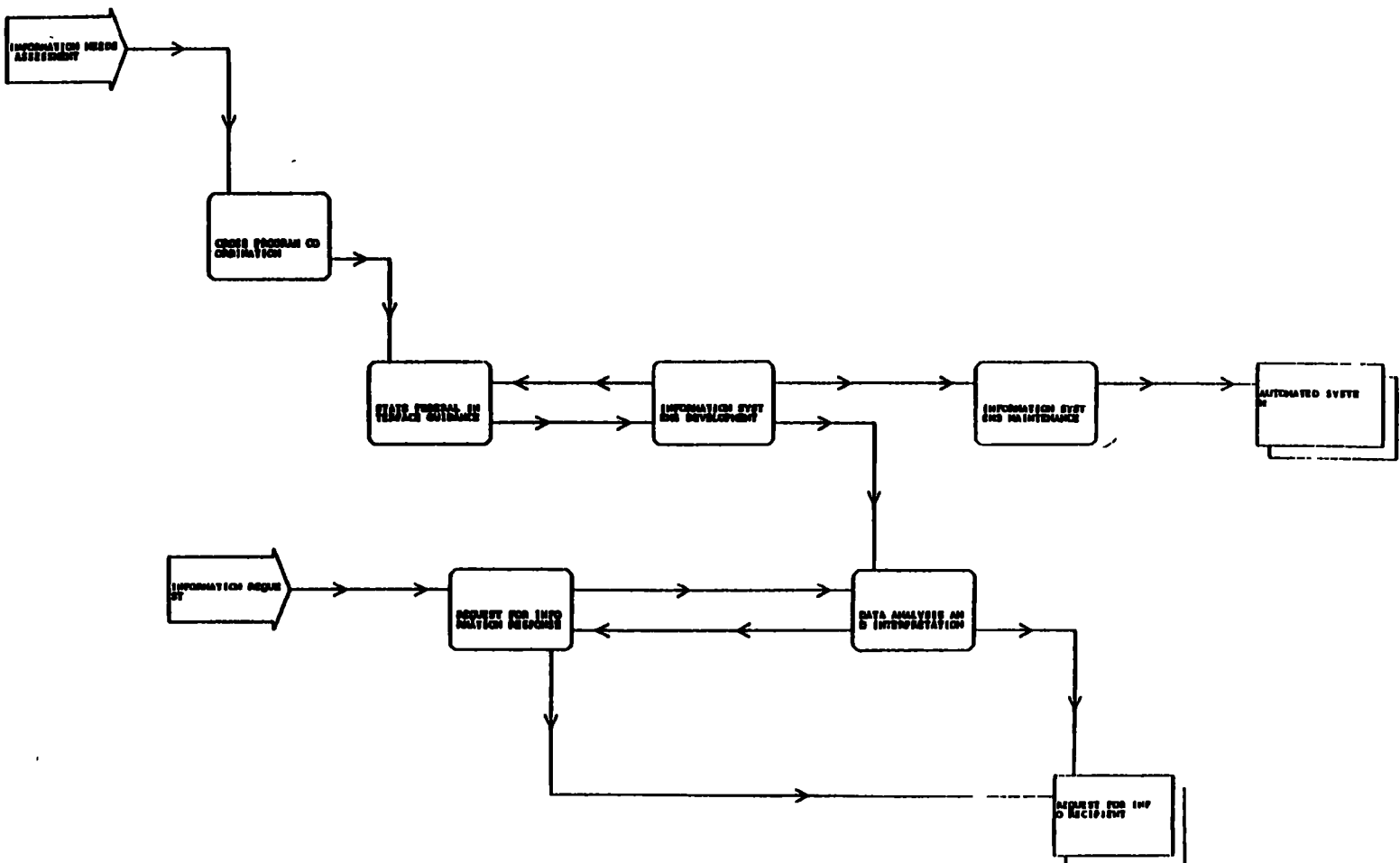


TECHNOLOGY AND METHODS



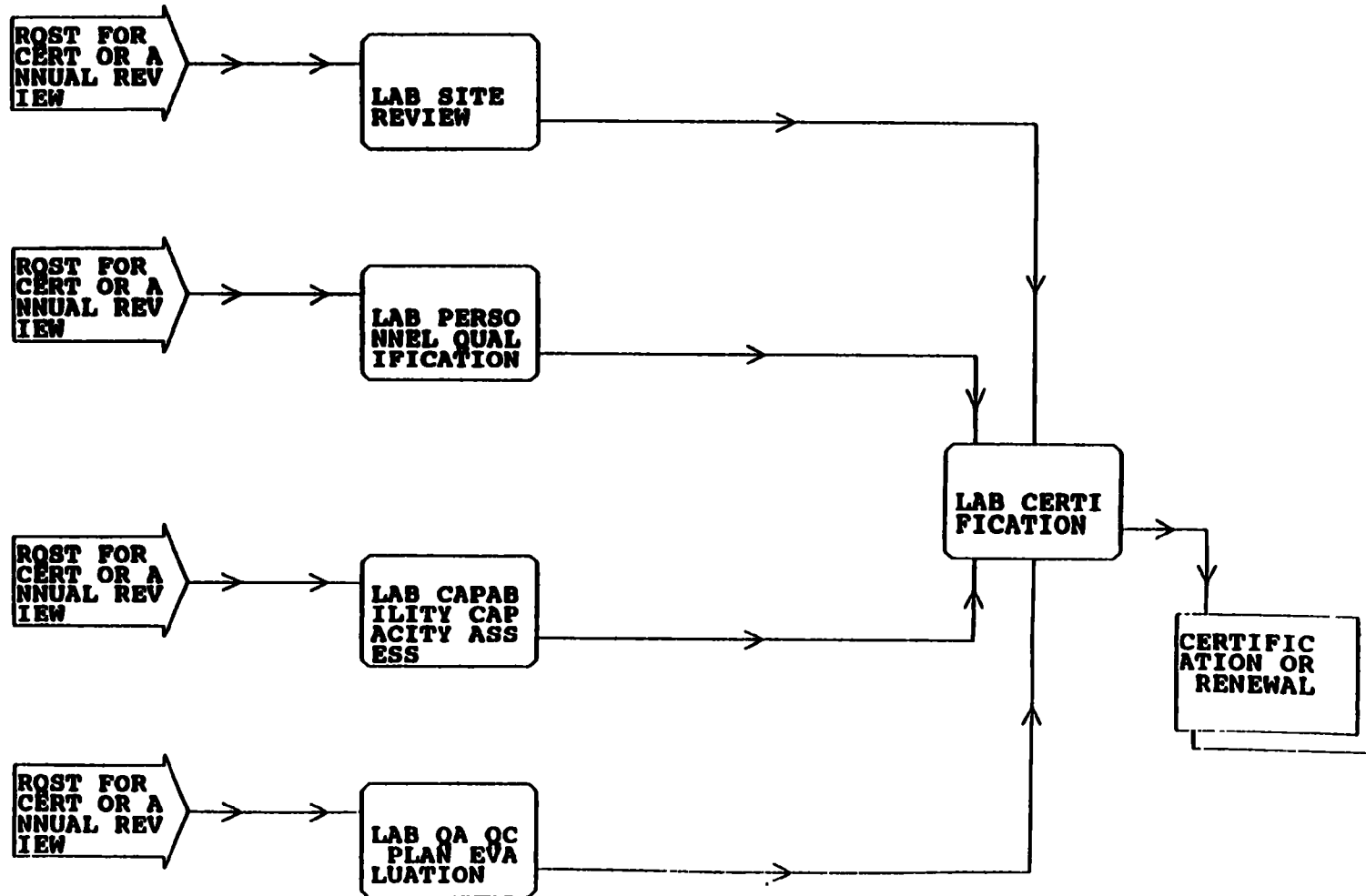
J - 42

DATA MANAGEMENT



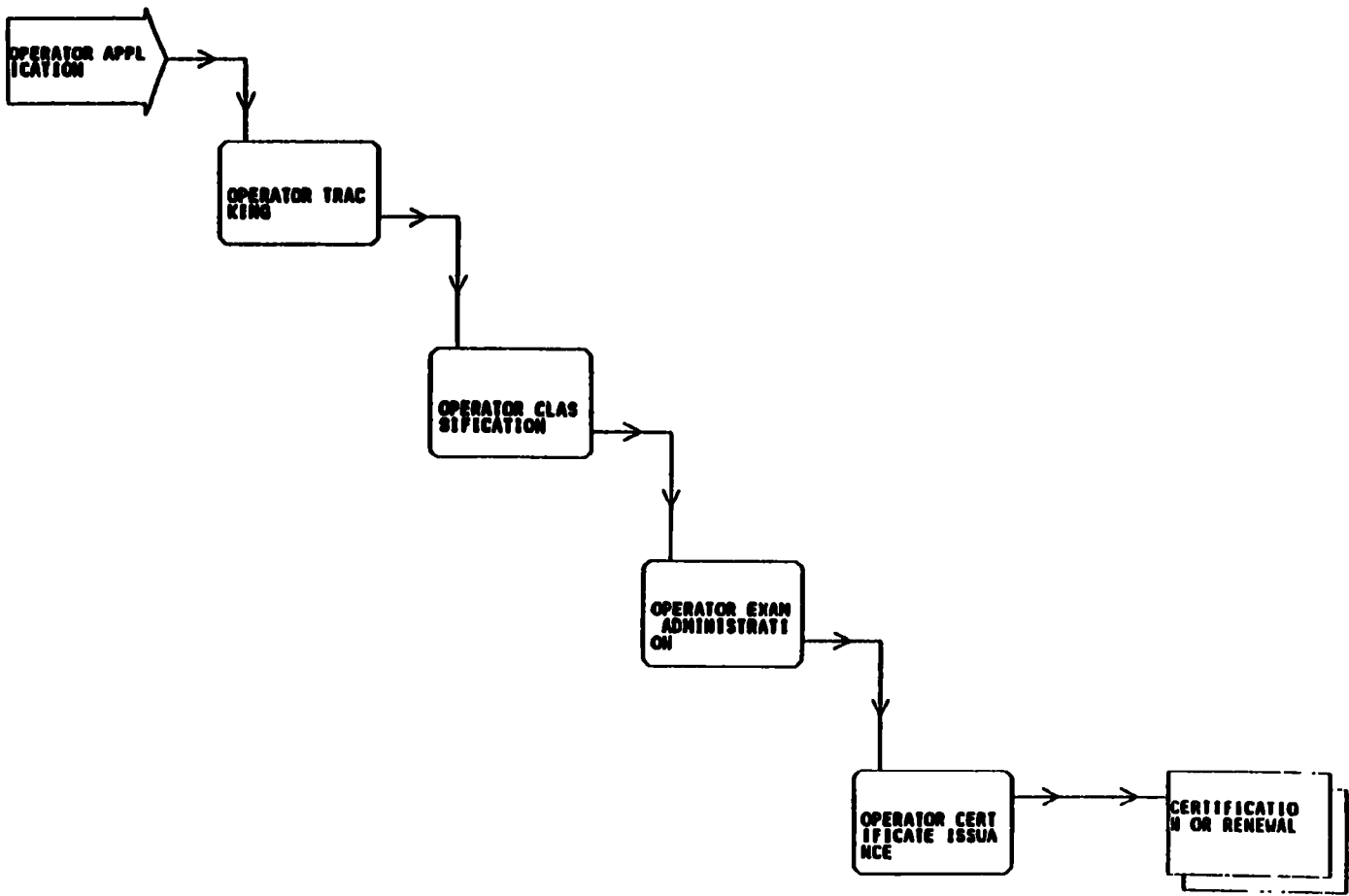
J - 43

LAB CAPACITY AND CERTIFICAT>

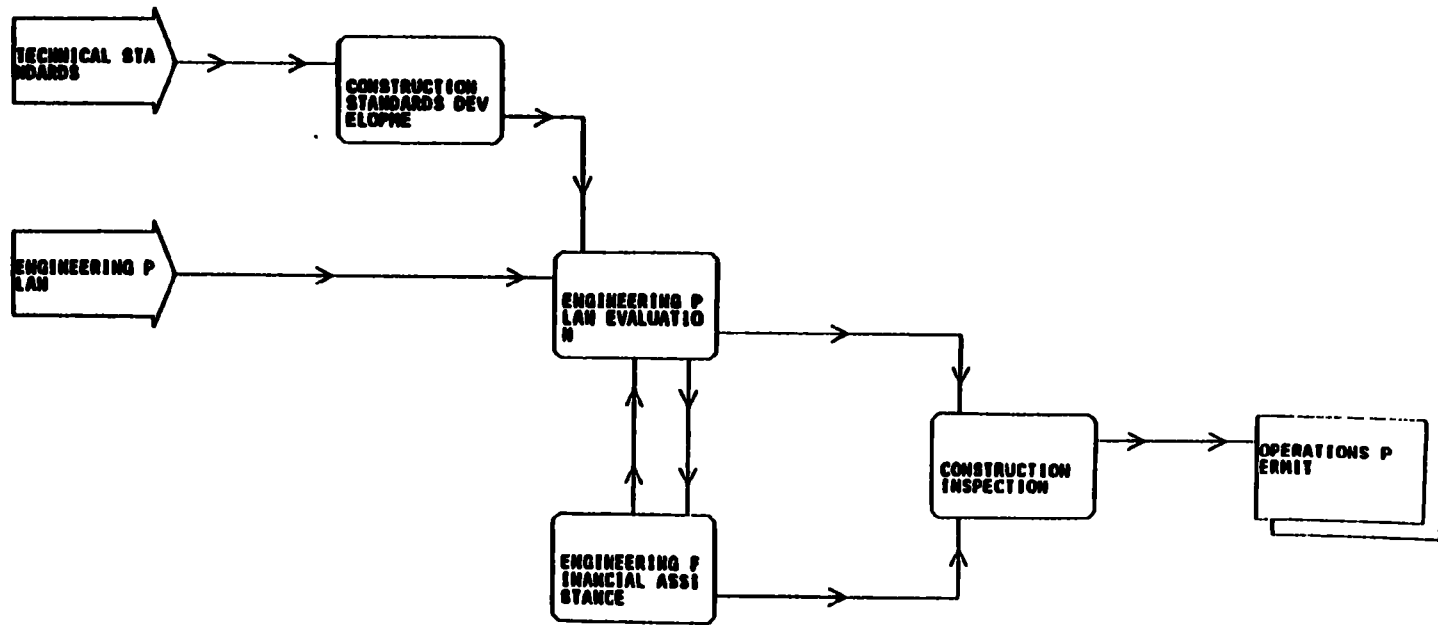


J - 44

OPERATOR CERTIFICATION

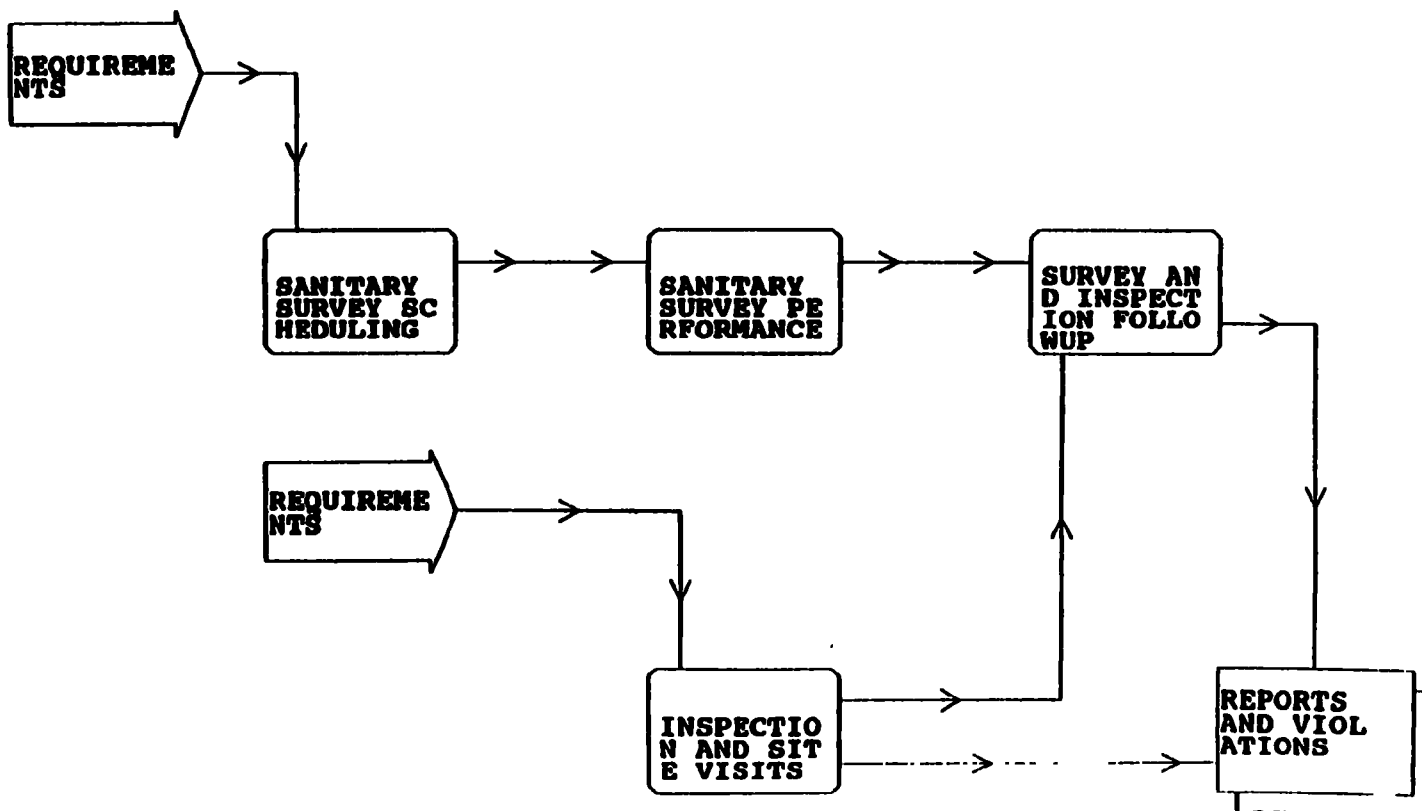


ENGINEERING PLAN REVIEW



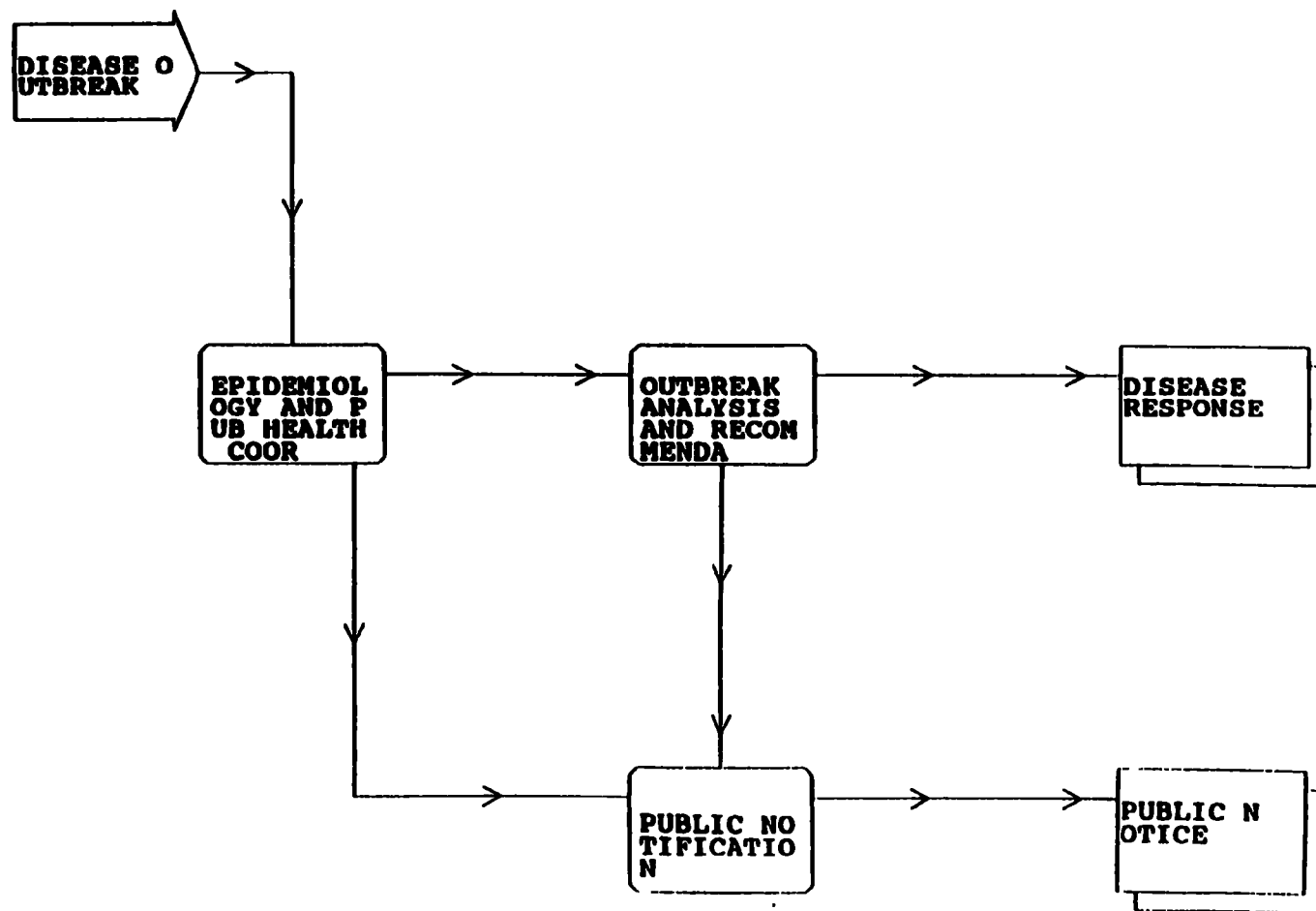
J - 46

FIELD SURVEILLANCE

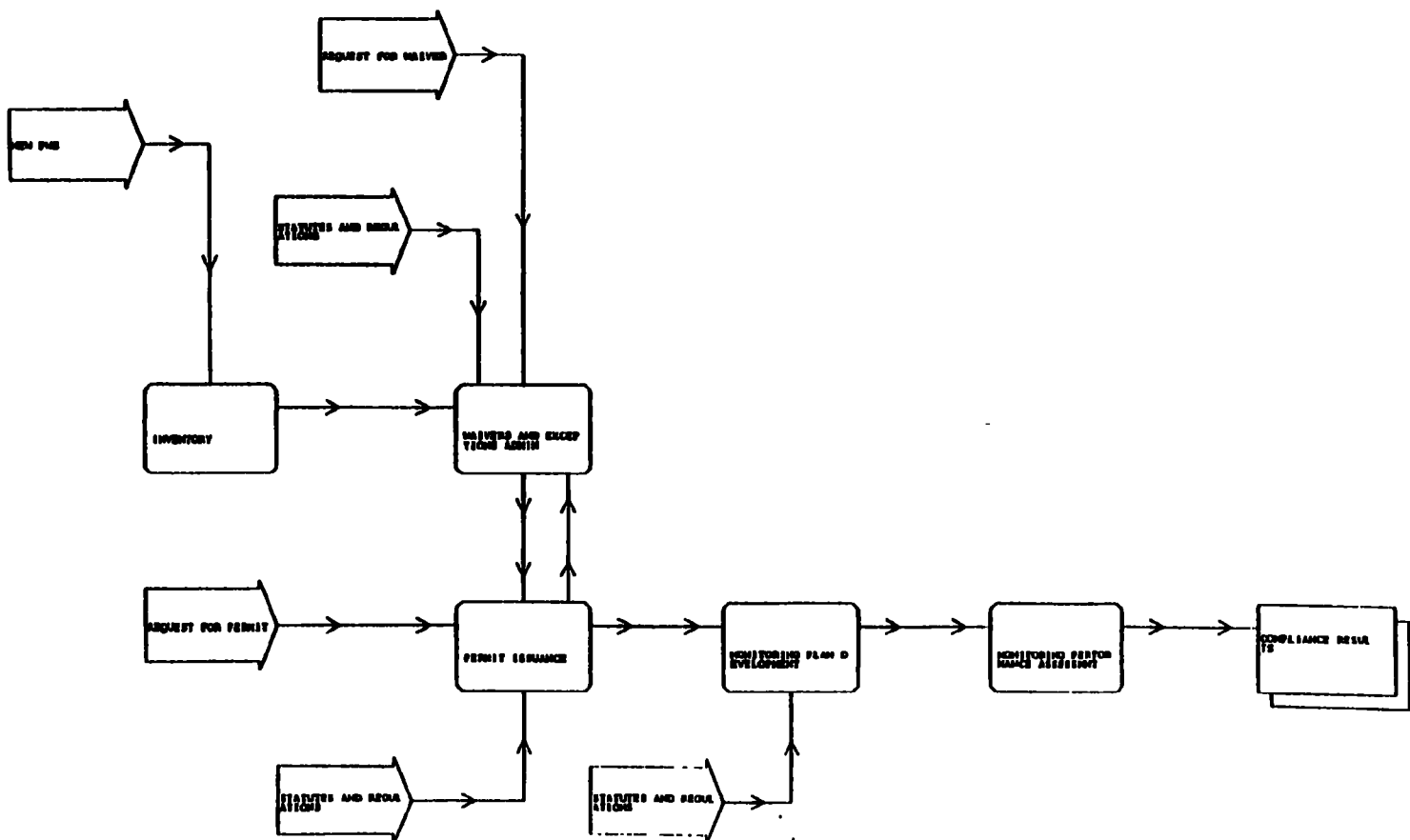


J - 47

DISEASE OUTBREAK AND SURVEIL

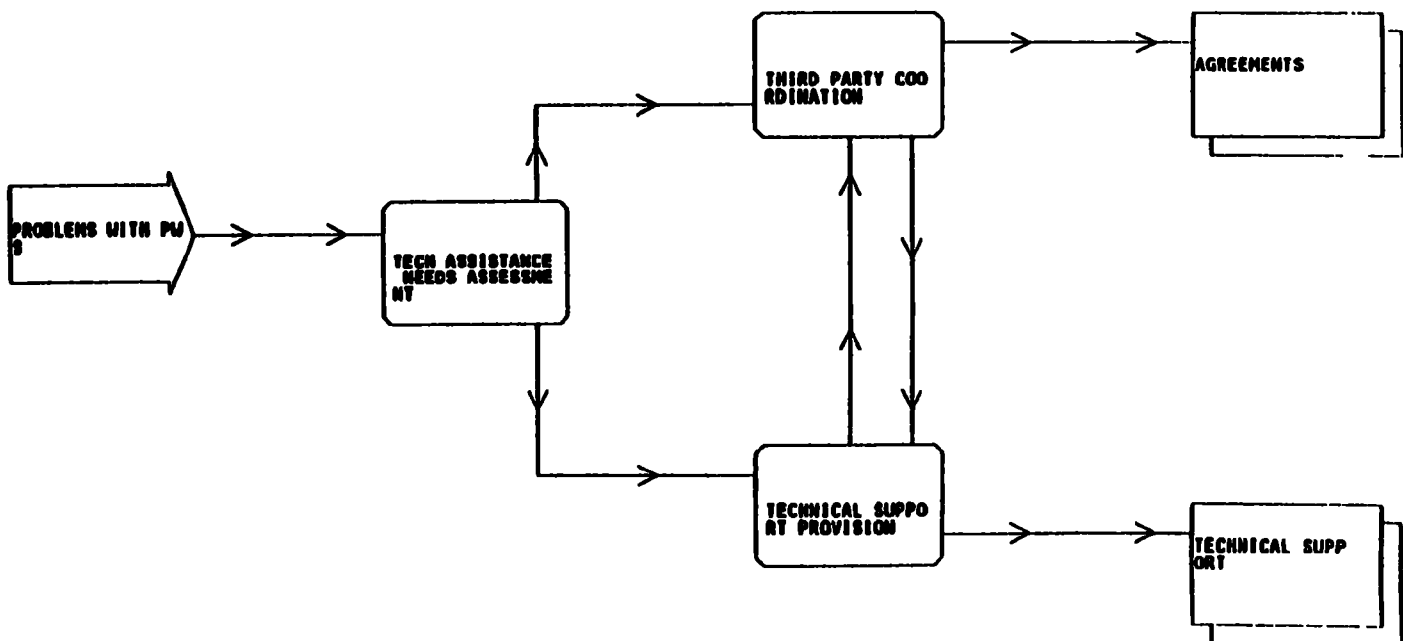


J - 48

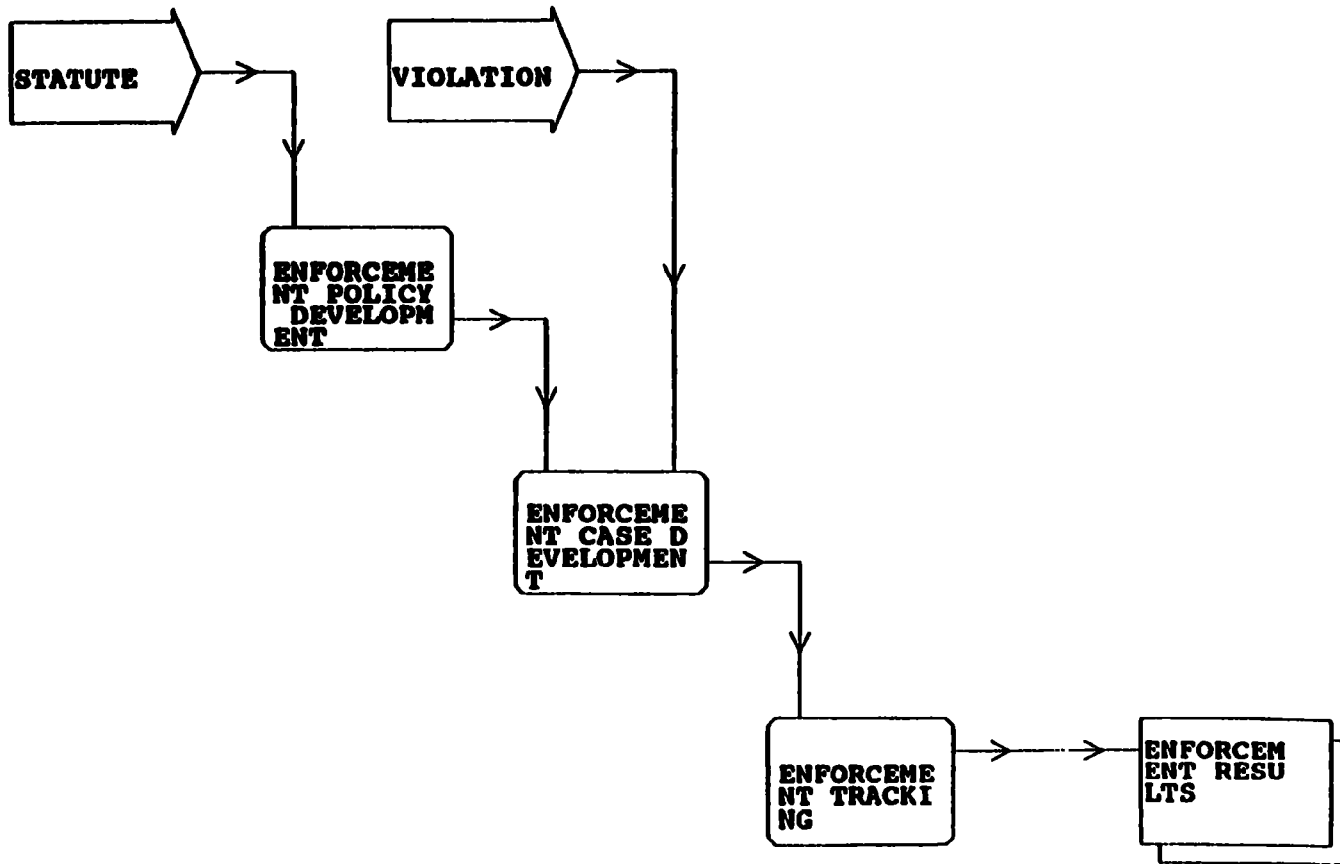


TECHNICAL ASSISTANCE

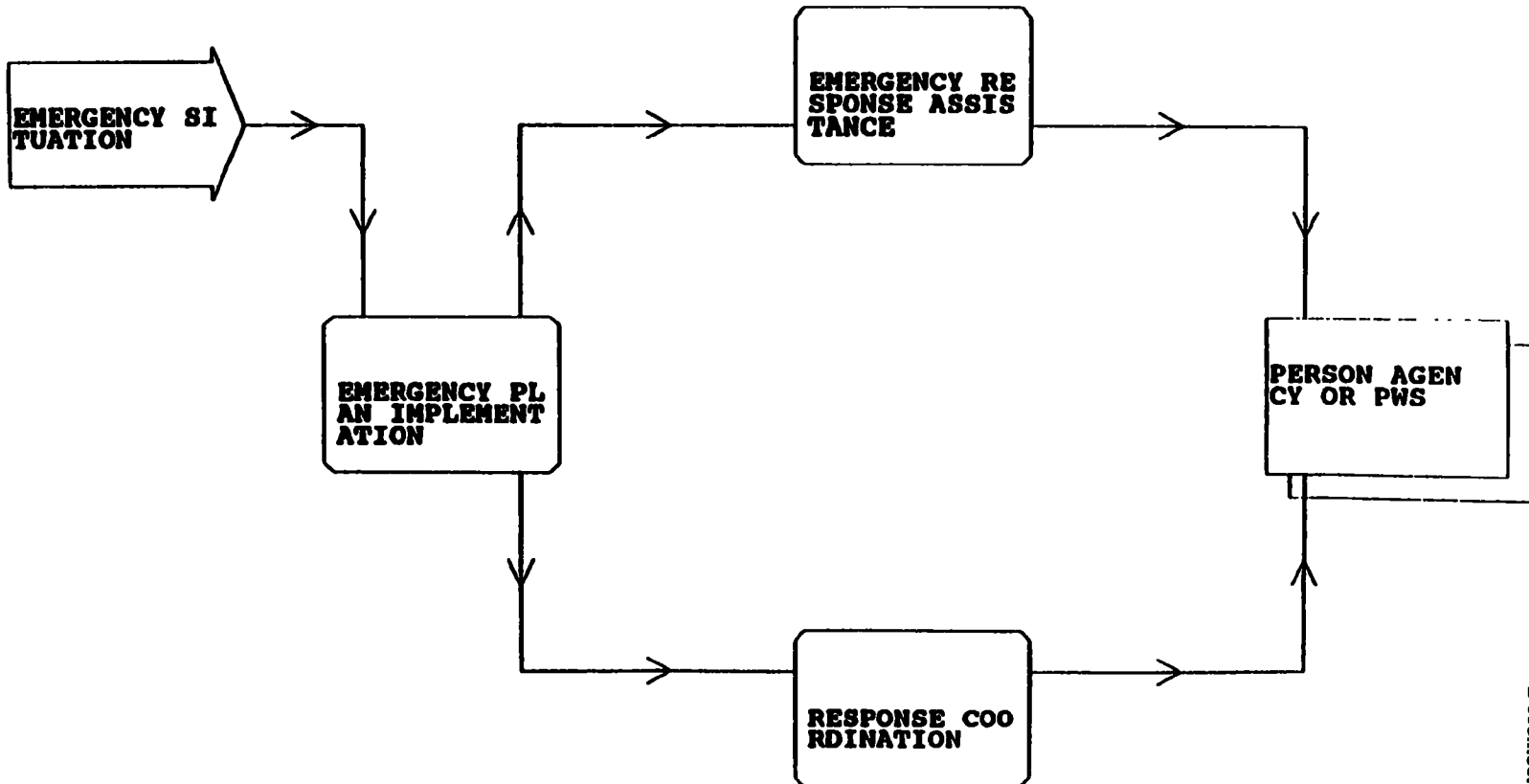
J - 50



ENFORCEMENT



EMERGENCY RESPONSE

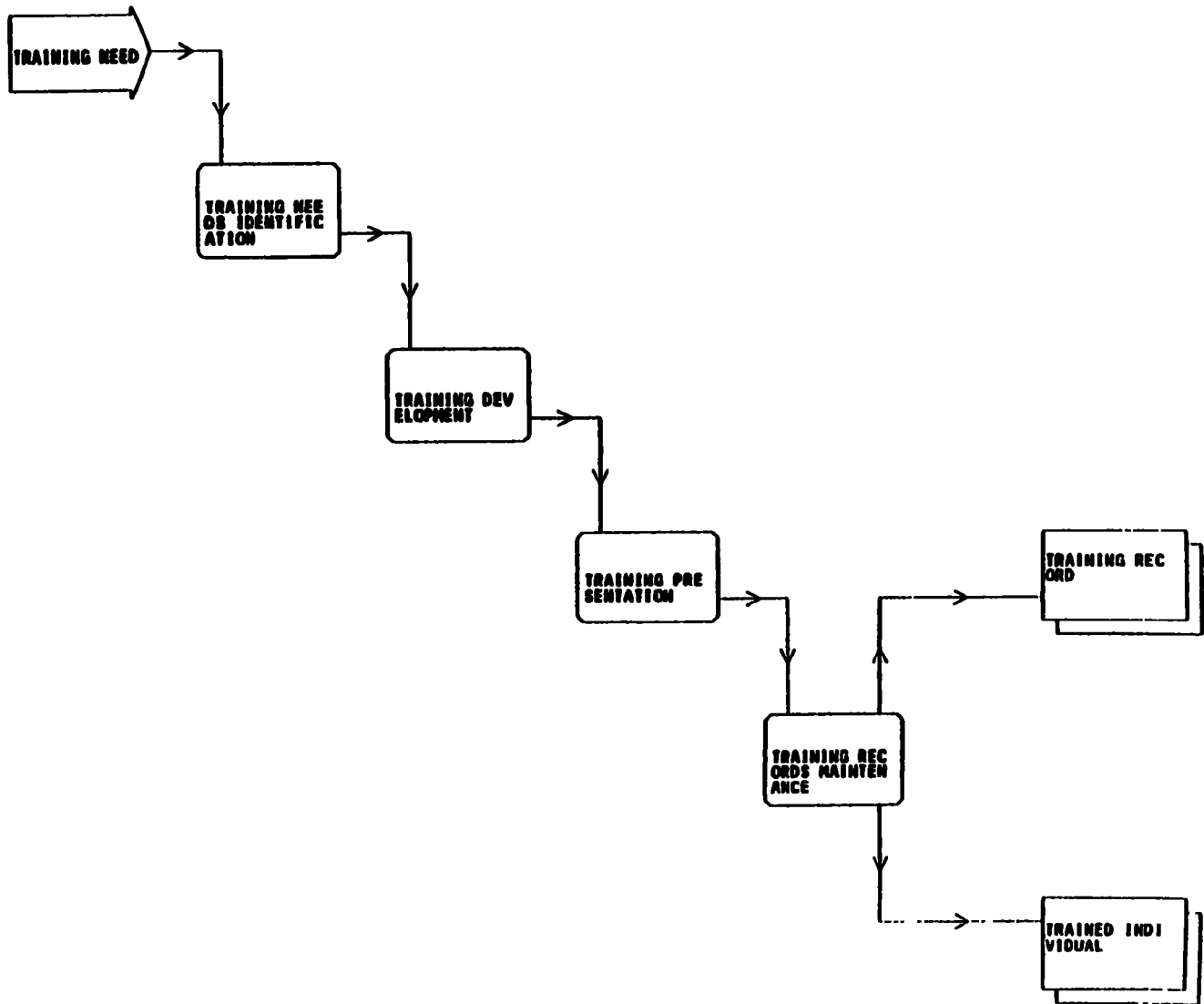


J - 52

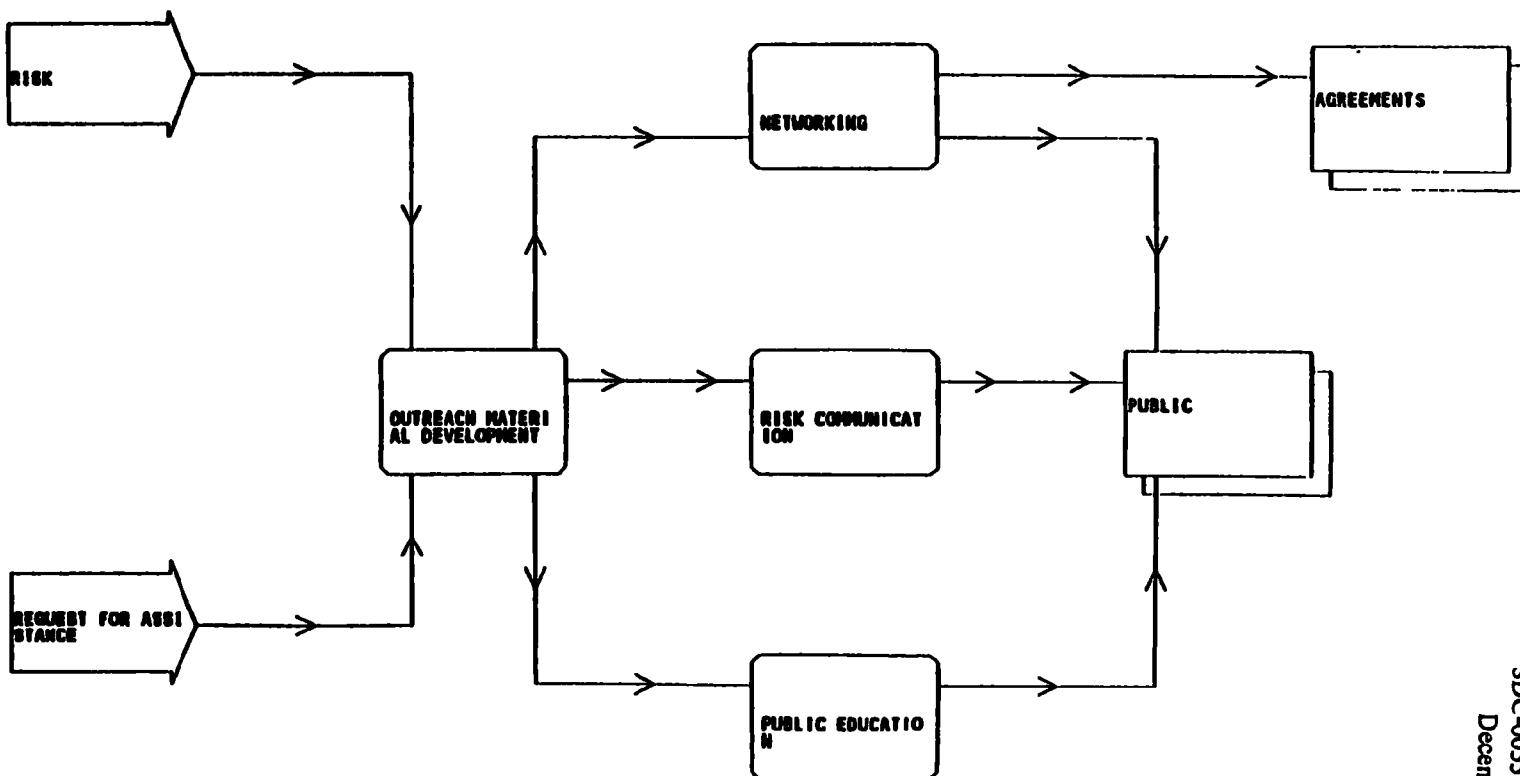
SDC-0055-012-TB-2009
December 31, 1992

TRAINING

J - 53



OUTREACH



J - 54

Appendix K

Function Supports Organizational Unit

This appendix contains a matrix showing functions associated with organizational units. An "x" indicates that a particular function is supported by a particular organizational unit.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix L

Concerns with the Current Environment

This appendix contains a consolidated list of concerns with the current environment which were gathered during the interviews and JRP sessions.

Appendix L

Concerns with the Current Environment

Operational Considerations

Timeliness - data must be current to support operational decisions
need for timely feedback to field with reasons for non-compliance

Responsiveness, in terms of:

Getting information from the system

Accuracy of information

Better response time - need to respond to queries in a timely way

Data quality must be improved

edit process - data validation

should not be intrusive

present rules may be too tight (e.g., lab must be certified to accept data)

maybe different levels of validity instead of binary decision

The system must be user-friendly in terms of:

Ease to input data

Ease of producing reports

Ease of use by infrequent users (menu driven)

User help

Training of users must be straightforward, including:

Simplicity

Intuitive interface

The system must be flexible and tailorable to State needs.

Need to reduce repetitive data entry and reduce paper

Need easy method to input analysis results into the system

Cross Fiscal Years

Operational Considerations (continued)

Need access to regulations/rules, such as:

- "Reg in a Box" - including States
- Compliance strategies, guidance
- All reference materials

Need to capture deficiencies and remedial costs, including:

- capitalization needs
- engineering observations
- milestones - 5 year plan

Costs to develop/maintain/enhance current systems must be brought under control

Need to capture contamination incidents which might impact supply, including:
linking pollution prevention with health vulnerability assessments

Ensure parallel development at the State level with that at the Federal level

Ensure State input and involvement

State and Federal compatibility

Sense that a State system can be developed that can provide both State and Federal data

Address State diversity problems

Integrated data base - cut down on duplication

Broaden the system beyond compliance and enforcement

Indicates new issues added during the Arlington JRP session

Use of data

Use of information to support decision making (make my job easier)

Sampling data must be tied to specific samples

PWSS data must be integrated with other data, including

- Clean Water Act data

- Superfund data

- Non-point source pollutant data

New systems must provide for public access, while protecting information from:

- Tampering

- Unauthorized access (i.e., raw data)

Data must be useful for the States and utilities

Indicates new issues added during the Arlington JRP session

Data and Data Integration Requirements

Location information, including latitude and longitude, is essential

Compatibility with GIS systems (ARCINFO) must be achieved, including information such as:

- maps
- hydrological
- risk assessment of supply
- cartography
- analysis of supply
- presentation

The timeliness and accuracy of data collection must be improved (electronic reporting of data by labs)

improved data collection to help us write better regulations (economic, population, quality, etc.)

Need for inventory data to be used/accessible

Improve types of data in the system...add quality and quantity, etc.

Consistency of process and data to boost reliability

Indicates new issues added during the Arlington JRP session

Data Analysis

A simplified means for determining compliance is essential

New systems must provide easy means to manipulate data, including:

- Correcting errors
- Updating data
- Revising data

The system must provide clear ways to remove SNC's once they are compliant

Engineering tools are required for PWSs, including:

- Process control/monitoring
- Tracking contaminants by distribution zone

The system must provide meaningful statistics to support enforcement.
analysis of violations to develop program responses
same SNC algorithm as National

Costs of sampling and analysis must be reduced.

PWSs must be notified promptly of problems (automatic generation of notices?)

The system must support public notification.

Lack of analysis tools (filter rule - regression analysis)

System needs to determine MCL violations - not rely on labs/manual procedures

~~Indicates new issues added during the Arlington JRP session~~

Other Considerations

States and Regions must know EPA's expectations for the new system and must have assurance that EPA will follow through and field/support the new system.

The system must satisfy end-user's needs.

The system should be designed to promote compliance and use - the current system tends to penalize States that fully satisfy reporting requirements.

States must be motivated to use the system by its functionality and benefits.

There must be a stronger correlation between rule development and data management.

The participation by States in the rule development process must be improved.

The reporting burden on States must be reduced.

The system must serve the people (vs. people serving the system).

The National needs for historical data should not dictate the means for satisfying real-time needs at the operational (State) levels.

Users must understand the purpose for desired information.

Need to redesign regulations and reduce the number of types of violations. (Simplify)

Need to be able to develop variants to system easily

Can we walk away with a good system vision and future?

A plan for development that will transcend other environmental areas.

Improved State involvement ... know our voice counts

Sharing of development and implementation information

Indicates new issues added during the Arlington JRP session

Other Considerations (continued)

Do not repeat history (MSIS, etc.) get level of commitment

Identify system requirements

Assurance that the missing link is being sought

Build trust in this new development

Indicates new issues added during the Arlington JRP session

This page intentionally left blank.

Indicates new issues added during the Arlington JRP session

Appendix M

Entity Type Supported by Current Data Store

This appendix contains a matrix showing entity types associated with current data store. An "x" indicates that a particular entity type is supported by a particular current data store.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix N

Entity Type Satisfies Information Need

This appendix contains a matrix showing entity types associated with information needs. An "x" indicates that a particular entity type satisfies a particular information need.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix O

Information Need is for Organizational Unit

This appendix contains a matrix showing information needs associated with organizational units. An "x" indicates that a particular information need is for a particular organizational unit.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix P

Function Supported by Current Information System

This appendix contains a matrix showing functions associated with current information systems. An "x" indicates that a particular function is partially or fully supported by a particular current information system.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix Q

Current Data Store Used by Current Information System

This appendix contains a matrix showing current data stores used by current information systems. A "C" indicates that a particular current data store is used by a particular organizational unit.

Subset:ALL

Time: 09:13

Cell Values:	Current Data Store																				
		CERCLIS DB	CL DB	DWIMS DB	ERTS DB	FIATS DB	FINDS DB	FRDS II DB	GICS DB	MSIS DB	NMDS DB	PA STATE WATER PLAN SYSTEM DB	PCS DB	REG IN A BOX DB	RF DB	RIA DB	SRF AL DB	STORET BIOS DB	STORET WQS DB	WASP4 DB	WBS DB
= Not referenced																					
C = Create																					
D = Delete																					
U = Update																					
R = Read only																					
Current Info System																					
CERCLIS	C																				
CL		C																			
DWIMS			C																		
ERTS				C																	
FIATS					C																
FINDS						C															
FRDS II							C														
GICS								C													
MSIS									C												
NMDS										C											
PA STATE WATER PLAN SYSTEM											C										
PCS												C									
REG IN A BOX													C								
RF														C							
RIA															C						
SRF AL																C					
STORET BIOS																	C				
STORET WQS																		C			
WASP4																			C		
WBS																				C	

Appendix R

Organizational Unit Uses Current Information System

This appendix contains a matrix showing organizational units associated with current information systems. An "x" indicates that a particular organizational unit uses a particular current information system.

Cell Values:			Organizational Unit	EPA ORD	EPA REGION	ORDOW	OTHER EPA ORGANIZATIONS	PUBLIC WATER SYSTEM	PWSS	STATE OR ADMINISTRATOR	STATE REGION OR DISTRICT OR ADMT
= Not referenced											
X = Include											
1	2	3									
4	5	6									
7	8	9									
Current Info System											
CERCLIS					X	X			X		X
CL									X		
DWIMS									X		
ERTS			X	X	X		X	X	X	X	X
FIATS				X	X		X	X			
FINDS				X	X			X			X
FRDS II				X	X		X	X			X
GICS				X	X			X			X
MSIS				X	X			X			X
NWUDS			X					X			
PA STATE WATER PLAN SYSTEM								X			X
PCS								X			
REG IN A BOX								X			
RF			X		X			X	X	X	X
RIA					X			X			
SRF AL				X	X			X			
STORET BIOS			X	X	X		X	X			X
STORET WQS			X	X	X		X	X			X
WASP4			X		X			X			
WBS			X	X	X			X			X

Appendix S

Business Function by Entity Type Usage

This appendix contains a matrix showing business functions with respect to entity type usage. The cells of the Business Function by Entity Type Usage (or CRUD) matrix contain one of the following "involvement indicators":

C = Create
R = Read
U = Update
D = Delete

A specific letter within a cell indicates that an entity type is either created, read, updated, or deleted within a particular business function. The different involvement indicators do not carry equal significance with regard to analysis. In order of importance, creates (Cs) supersede deletes (Ds), which supersede updates (Us), which in turn supersede reads (Rs). To focus attention on the most significant relationships, Rs have been hidden on this copy of the matrix. Deletes are also excluded, because they will be identified during the Business Area Analysis (BAA) development stage of the PWSS project.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix T

Business System by Business Function

This appendix contains a matrix showing business systems associated with business functions. An "x" indicates that a particular business system is supported by a particular business function.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix U

Data Store by Entity Type

This appendix contains a matrix showing natural data stores associated with entity types. An "x" indicates that a particular data store is supported by a particular entity type.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix V

Business Area by Natural Data Store

This appendix contains a matrix showing business areas associated with natural data stores. An "x" indicates that a particular business area is supported by a particular data store.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix W

Business Area by Entity Type

This appendix contains a matrix showing business areas associated with entity types. An "x" indicates that a particular business area is supported by a particular entity type.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix X

Business Area by Business System

This appendix contains a matrix showing business areas associated with business systems. An "x" indicates that a particular business area is supported by a particular business system.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix Y

Business Area by Business Function

This appendix contains a matrix showing business areas associated with business functions. An "x" indicates that a particular business area is supported by a particular business function.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix Z

System to System Category

This appendix contains a matrix showing business systems associated with system categories. System categories include:

Strategic
Planning
Controlling
Operational

An "x" indicates that a particular business system falls into one or more of the system categories listed above.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix AA

Business Area by Business System

This appendix contains a matrix showing business systems associated with users. A "1" is used to indicate operational functions and a "2" is used to indicate strategic functions.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix BB

Technical Architecture Working Group

This appendix lists the attendees to the Oct 21-23, 1992 Technical Architecture Group.

December 31, 1992

Technical Architecture Working Group Participants List October 21 - 23, 1992	
Attendee	Organization
Tracy Bair	SAIC
Al Basham	VA Dept of Health
Lynn Curry	SAIC
Jon Dahl	SAIC
Claudia Darnell	US EPA Region IV/DWS
Randall Davis	US EPA Region IV
Rey de Castro	ASDWA
Terry Fields	AZ Dept of Environmental Quality
Barry Greenawald	PA Dept of Environmental Resources
Van Hoofnagle	FL Dept of Environmental Resources
Bruce Keith	SAIC
Bob King	US EPA Headquarters
Richard Lampert	US EPA Region IX
Lee Manning	US EPA
Dennis Martin	SAIC
Doug Martinson	AK ADEC
Evans Massie	VA Dept of Health
Randy Moody	NC Dept of Health and Natural Resources
Abe Seigel	US EPA Headquarters
Jeff Sexton	US EPA Headquarters
Richard Smith	SAIC
Steve Vassey	SC Dept of Health & Environmental Control
Larry Weiner	US EPA Headquarters
Sonny Wolfe	SAIC
Don Worley	US EPA, NDPD
Larry Worley	US EPA Region X

Appendix CC

Entity Type by User

This appendix contains a matrix showing entity type associated with users. A "1", "2", or "3" indicates a particular entity type is supported by a particular user.

**PAGE NOT
AVAILABLE
DIGITALLY**

Appendix DD

Communications Feasibility Analysis

This appendix contains a detailed analysis of the communications requirements to support data transmission needs of the user groups within the PWSS Information System Technical Architecture.

APPENDIX DD

COMMUNICATIONS FEASIBILITY ANALYSIS

The Public Water System Supervision (PWSS) Technical Architecture is dependent on communication links between information sources, such as public water systems (PWSs) and laboratories (Labs), and information centers, such as State, State Region, EPA Region and the National Computer Center (NCC). The central question for the PWSS Technical Architecture is whether the goal of reporting contaminant measurements for all samples taken will result in the need for excessive communications bandwidth. The analysis presented in this appendix provides an estimate of the communications requirements needed so that the feasibility of the PWSS Technical Architecture, from a communications point of view, can be determined. The analysis considers the potential worst-case reporting requirement, namely that of reporting the results for each contaminant, each sample, and each test. The analysis is based on certain assumptions, including the total number of PWSs reporting, the frequency of the laboratory (Lab) reports, and the size of the Lab reports. The conclusions from this analysis are: the communications needed to make the PWSS Information System realizable are not a fundamental constraint; and timely reporting of all contaminant measurements is feasible using a reasonable dial-up and/or leased-line communications scheme.

The following steps are used to estimate the communications load:

- ▶ Find the total number of reporting units (on both a State and national basis). These are the PWSs from which samples are taken.
- ▶ Determine the frequency (quarterly, monthly, weekly, etc.) of the samples.
- ▶ Estimate the size of each contaminant report.
- ▶ Determine the time to transmit the total number of reports within a State at various line speeds (2.4Kbps, 4.8Kbps, and 9.6Kbps).
- ▶ Find the utilization of one communications line into the data center (at State level) by averaging the time to transmit the report data over the reporting period.

The first step to determine the number of Lab reporting units on a State basis uses information provided in the "Briefing on The Public Water System Supervision Compliance and Enforcement Program," dated July 1991. This appendix gives the number of PWSs in the Federal inventory and the population served.

The data of interest are:

- ▶ Number of PWSs = 200,990
- ▶ Population Served by PWSs = 242,048,000

Using these numbers, the following generalization can be made: The number of people per PWS is approximately 1,204.

Using the above number and the population of each State, and assuming a normal distribution of PWSs for estimating purposes, an approximate model of the number of reports sent from PWSs and Labs in each State can be determined. Table DD-1 shows an estimate for the baseline number of Lab reports sent to a State (State Region or EPA Region) data center from PWSs and Labs. The number of PWSs shown in Table DD-1 is a baseline estimate and is meant to be an average representation, not a detailed accurate count. Table DD-1 shows three columns labelled QUARTERLY, MONTHLY, and WEEKLY. These columns mean the following:

- ▶ QUARTERLY means the frequency of sampling and reporting is done on a quarterly basis. The number shown in the column represents the number of Lab reports sent per month based on quarterly sampling.
- ▶ MONTHLY means the frequency of sampling and reporting is done on a monthly basis. The number shown in the column represents the number of Lab reports sent per month based on monthly sampling.
- ▶ WEEKLY means the frequency of sampling and reporting is done on a weekly basis. The number shown in the column represents the number of Lab reports sent per month based on weekly sampling.

Some contaminant samples must be taken at least quarterly from each PWS (i.e., organic chemicals and radionuclide chemicals). The use of quarterly, monthly, and weekly sampling in this analysis is meant to define a potential reporting range with weekly sampling representing the worst case (maximum number of Lab reports per fixed interval).

Using Pennsylvania (PA) as an example in Table DD-1, the row indicates that if all the PWSs in that State sampled once per quarter, the number of reports per month would be 3,289. If sampling was done on a monthly basis the number of reports per month would be 9,868 and if sampling was done on a weekly basis, the number of reports per month would be 39,472. These numbers are meant to bound the aggregate reporting load.

Table DD-2 uses the number of Lab reports estimated to be sent on a quarterly, monthly, and weekly basis to compute the

communications load for line speeds of 2.4Kbps, 4.8Kbps and 9.6Kbps. Table DD-2 is based on the following *assumptions*:

- ▶ Each PWS report contains information on 158 contaminants (83 at present, 25 additional over next three years). This number is taken from "The Mission Needs Analysis for Information Systems Support for EPA's Public Water System Supervision (PWSS) Program," January 9, 1992.
- ▶ Each contaminant measurement will be identified with a binary representation in a fixed format report to maximize the information sent for a given number of bits.

In such a scheme, each contaminant and its measurement test value can be represented by an average of 4 bytes.

- ▶ The total number of bytes for a full contaminant Lab report is approximately 636 bytes. Assuming an approximate 80% overhead for error correction, etc., a contaminant report size of 1000 bytes is assumed.
- ▶ Each byte transmitted requires 10 bits due to start and stop bits per byte transmitted for asynchronous communications.

Based on the above, Table DD-2 shows the time (in hours) to transmit all the contaminant Lab reports from all PWSs in a State to a State data center for different line speeds. Using Arizona (AZ), for example, the Lab reports from all the PWSs will take 3.52 hours at 2.4Kbps, 1.76 hours at 4.8Kbps, and 0.88 hours at 9.6Kbps. California (CA), for example, requires 28.61 hours to transmit Lab reports from all PWSs to a State data center.

The time to transmit all Lab reports can be spread over the reporting interval to determine the utilization of one communications line into the State data center. Using Arizona (AZ), for example, we see that a single line utilization based on quarterly reporting is 0.73% for a 2.4 Kbps line, 0.37% for a 4.8 Kbps line, and 0.18% for a 9.6Kbps line. A single line utilization based on samples taken each month for all PWSs in Arizona would be 2.20% for a 2.4Kbps line, 1.10% for a 4.8Kbps line, and 0.55% for a 9.6Kbps line.

The values shown for a single line utilization can be used to estimate the number of dial-up lines and/or leased lines needed at a State data center. Using California as an example, and assuming samples are taken weekly and reported at 2.4Kbps, shows that a single line is utilized 71.52% of the time. If ten 2.4Kbps lines were employed at the State data center the utilization per line would be 7.1%.

The utilization figures in Table DD-2 are based on a standard 8 hour per workday (as opposed to multiple shift operation). The available time per quarter is 480 hours, per month is 160 hours, and per week is 40 hours.

The utilization numbers shown in Table DD-2 are sufficiently low to provide a high confidence that communications should not be a problem in the PWSS Information System, if care is taken to optimize data transmission (i.e. use data compression, no transmittal of graphics, etc.). The utilization numbers also assume report transmissions are spread over the reporting period. Clearly, if all units attempted to report at once, there would be communication line congestion. This assumption means a PWSS Communications Management Plan is an integral part of system development. This plan must insure that transmissions are uniformly distributed over the available reporting interval.

Assuming a single Federal data center (i.e., the NCC) receives Lab reports from 200,990 PWSs, the following utilizations can be expected for samples reported quarterly, monthly, and weekly:

December 31, 1992

<u>One line:</u>	<u>Quarterly</u>	<u>Monthly</u>	<u>Weekly</u>
2.4Kbps	48.5%	145.4%	581.6%
4.8Kbps	24.2%	72.7%	290.8%
9.6Kbps	12.1%	36.3%	145.4%

<u>Five lines:</u>	<u>Quarterly</u>	<u>Monthly</u>	<u>Weekly</u>
2.4Kbps	9.7%	29.1%	116.3%
4.8Kbps	4.8%	14.5%	58.2%
9.6Kbps	2.4%	7.3%	29.1%

<u>Ten lines :</u>	<u>Quarterly</u>	<u>Monthly</u>	<u>Weekly</u>
2.4Kbps	4.8%	14.5%	58.2%
4.8Kbps	2.4%	7.3%	29.1%
9.6Kbps	1.2%	3.6%	14.5%

The results of the analysis presented in this appendix are not intended to be an exact estimate of communications requirements, but are presented here to provide an overall order of magnitude estimate of communications needs. The order of magnitude estimate is useful in determining if the concept of the PWSS Information System is feasible and not constrained by unreasonable communications requirements.

TABLE DD-1

ESTIMATES OF NUMBER OF LAB REPORTS/MONTH FOR FULL CONTAMINANT REPORTING

STATE	POPULATION (MILLIONS)	BASELINE NUMBER OF COMMUNITY WATER SYSTEMS	NUMBER OF CONTAMINANT REPORTS PER MONTH AS FUNCTION OF SAMPLING FREQUENCY AT COMMUNITY WATER SYSTEMS		
			QUARTERLY	MONTHLY	WEEKLY
AL	4.04	3355	1118	3355	13422
AK	0.55	457	152	457	1827
AZ	3.665	3044	1015	3044	12176
AR	2.35	1952	651	1952	7807
CA	29.76	24718	8239	24718	98870
CO	3.294	2736	912	2736	10944
CT	3.287	2730	910	2730	10920
DE	0.666	553	184	553	2213
FL	12.94	10748	3583	10748	42990
GA	6.478	5380	1793	5380	21522
HI	1.108	920	307	920	3681
ID	1.006	836	279	836	3342
IL	11.43	9493	3164	9493	37973
IN	5.544	4605	1535	4605	18419
IA	2.776	2306	769	2306	9223
KS	2.477	2057	686	2057	8229
KY	3.685	3061	1020	3061	12243
LA	4.219	3504	1168	3504	14017
ME	1.227	1019	340	1019	4076
MD	4.781	3971	1324	3971	15884
MA	6.016	4997	1666	4997	19987
MI	9.3	7724	2575	7724	30897
MN	4.375	3634	1211	3634	14535
MO	5.117	4250	1417	4250	17000
MS	2.573	2137	712	2137	8548
MT	0.8	664	221	664	2658
NE	1.578	1311	437	1311	5243
NV	1.2	997	332	997	3987
NH	1.1	914	305	914	3654
NJ	7.73	6420	2140	6420	25681
NM	1.51	1254	418	1254	5017
NY	17.99	14942	4981	14942	59767
NC	6.628	5505	1835	5505	22020
ND	0.638	530	177	530	2120
OH	10.847	9009	3003	9009	36037
OK	3.145	2612	871	2612	10449

TABLE DD-1 (continued)

STATE	POPULATION (MILLIONS)	BASELINE NUMBER OF COMMUNITY WATER SYSTEMS	NUMBER OF CONTAMINANT REPORTS PER MONTH AS FUNCTION OF SAMPLING FREQUENCY AT COMMUNITY WATER SYSTEMS		
			QUARTERLY	MONTHLY	WEEKLY
OR	2.842	2360	787	2360	9442
PA	11.881	9868	3289	9868	39472
RI	1.003	833	278	833	3332
SC	3.486	2895	965	2895	11581
SD	0.696	578	193	578	2312
TN	4.877	4051	1350	4051	16203
TX	16.986	14108	4703	14108	56432
UT	1.722	1430	477	1430	5721
VA	6.187	5139	1713	5139	20555
WA	4.866	4042	1347	4042	16166
WV	1.793	1489	496	1489	5957
WI	4.891	4062	1354	4062	16249
WY	0.453	376	125	376	1505

TABLE DD-2

COMMUNICATIONS UTILIZATION FOR FULL CONTAMINANT REPORTING

STATE	LINE SPEED	TRANSFER TIME IN HOURS	UTILIZATION OF COMMUNICATIONS CAPACITY FOR ONE LINE AT STATE CENTRAL DATA LOCATION FOR REPORTING ALL CONTAMINANTS AT VARIED REPORTING INTERVALS		
			QUARTERLY (480 hours)	MONTHLY (160 hours)	WEEKLY (40 hours)
AL	2.4Kbps	3.88	0.81%	2.43%	9.71%
	4.8Kbps	1.94	0.40%	1.21%	4.85%
	9.6 Kbps	0.97	0.20%	0.61%	2.43%
AK	2.4Kbps	0.53	0.11%	0.33%	1.32%
	4.8Kbps	0.26	0.06%	0.17%	0.66%
	9.6 Kbps	0.13	0.03%	0.08%	0.33%
AZ	2.4Kbps	3.52	0.73%	2.20%	8.81%
	4.8Kbps	1.76	0.37%	1.10%	4.40%
	9.6 Kbps	0.88	0.18%	0.55%	2.20%
AR	2.4Kbps	2.26	0.47%	1.41%	5.65%
	4.8Kbps	1.13	0.24%	0.71%	2.82%
	9.6 Kbps	0.56	0.12%	0.35%	1.41%
CA	2.4Kbps	28.61	5.96%	17.88%	71.52%
	4.8Kbps	14.30	2.98%	8.94%	35.76%
	9.6 Kbps	7.15	1.49%	4.47%	17.88%
CO	2.4Kbps	3.17	0.66%	1.98%	7.92%
	4.8Kbps	1.58	0.33%	0.99%	3.96%
	9.6 Kbps	0.79	0.16%	0.49%	1.98%
CT	2.4Kbps	3.16	0.66%	1.97%	7.90%
	4.8Kbps	1.58	0.33%	0.99%	3.95%
	9.6 Kbps	0.79	0.16%	0.49%	1.97%
DE	2.4Kbps	0.64	0.13%	0.40%	1.60%
	4.8Kbps	0.32	0.07%	0.20%	0.80%
	9.6 Kbps	0.16	0.03%	0.10%	0.40%
FL	2.4Kbps	12.44	2.59%	7.77%	31.10%
	4.8Kbps	6.22	1.30%	3.89%	15.55%
	9.6 Kbps	3.11	0.65%	1.94%	7.77%

Table DD-2 (continued)

STATE	LINE SPEED	TRANSFER TIME IN HOURS	UTILIZATION OF COMMUNICATIONS CAPACITY FOR ONE LINE AT STATE CENTRAL DATA LOCATION FOR REPORTING ALL CONTAMINANTS AT VARIED REPORTING INTERVALS		
			QUARTERLY (480 hours)	MONTHLY (160 hours)	WEEKLY (40 hours)
GA	2.4Kbps	6.23	1.30%	3.89%	15.57%
	4.8Kbps	3.11	0.65%	1.95%	7.78%
	9.6 Kbps	1.56	0.32%	0.97%	3.89%
HI	2.4Kbps	1.07	0.22%	0.67%	2.66%
	4.8Kbps	0.53	0.11%	0.33%	1.33%
	9.6 Kbps	0.27	0.06%	0.17%	0.67%
ID	2.4Kbps	0.96	0.20%	0.60%	2.40%
	4.8Kbps	0.48	0.10%	0.30%	1.20%
	9.6 Kbps	0.24	0.05%	0.15%	0.60%
IL	2.4Kbps	10.99	2.29%	6.87%	27.47%
	4.8Kbps	5.49	1.14%	3.43%	13.73%
	9.6 Kbps	2.75	0.57%	1.72%	6.87%
IN	2.4Kbps	5.33	1.11%	3.33%	13.32%
	4.8Kbps	2.66	0.56%	1.67%	6.66%
	9.6 Kbps	1.33	0.28%	0.83%	3.33%
IA	2.4Kbps	2.67	0.56%	1.67%	6.67%
	4.8Kbps	1.33	0.28%	0.83%	3.34%
	9.6 Kbps	0.67	0.14%	0.42%	1.67%
KS	2.4Kbps	2.38	0.50%	1.49%	5.95%
	4.8Kbps	1.19	0.25%	0.74%	2.98%
	9.6 Kbps	0.60	0.12%	0.37%	1.49%
KY	2.4Kbps	3.54	0.74%	2.21%	8.86%
	4.8Kbps	1.77	0.37%	1.11%	4.43%
	9.6 Kbps	0.89	0.18%	0.55%	2.21%
LA	2.4Kbps	4.06	0.84%	2.53%	10.14%
	4.8Kbps	2.03	0.42%	1.27%	5.07%
	9.6 Kbps	1.01	0.21%	0.63%	2.53%
ME	2.4Kbps	1.18	0.25%	0.74%	2.95%
	4.8Kbps	0.59	0.12%	0.37%	1.47%
	9.6 Kbps	0.29	0.06%	0.18%	0.74%

TABLE DD-2 (continued)

STATE	LINE SPEED	TRANSFER TIME IN HOURS	UTILIZATION OF COMMUNICATIONS CAPACITY FOR ONE LINE AT STATE CENTRAL DATA LOCATION FOR REPORTING ALL CONTAMINANTS AT VARIED REPORTING INTERVALS		
			QUARTERLY (480 hours)	MONTHLY (160 hours)	WEEKLY (40 hours)
MD	2.4Kbps	4.60	0.96%	2.87%	11.49%
	4.8Kbps	2.30	0.48%	1.44%	5.74%
	9.6 Kbps	1.15	0.24%	0.72%	2.87%
MA	2.4Kbps	5.78	1.20%	3.61%	14.46%
	4.8Kbps	2.89	0.60%	1.81%	7.23%
	9.6 Kbps	1.45	0.30%	0.90%	3.61%
MI	2.4Kbps	8.94	1.86%	5.59%	22.35%
	4.8Kbps	4.47	0.93%	2.79%	11.18%
	9.6 Kbps	2.24	0.47%	1.40%	5.59%
MN	2.4Kbps	4.21	0.88%	2.63%	10.51%
	4.8Kbps	2.10	0.44%	1.31%	5.26%
	9.6 Kbps	1.05	0.22%	0.66%	2.63%
MO	2.4Kbps	4.92	1.02%	3.07%	12.30%
	4.8Kbps	2.46	0.51%	1.54%	6.15%
	9.6 Kbps	1.23	0.26%	0.77%	3.07%
MS	2.4Kbps	2.47	0.52%	1.55%	6.18%
	4.8Kbps	1.24	0.26%	0.77%	3.09%
	9.6 Kbps	0.62	0.13%	0.39%	1.55%
MT	2.4Kbps	0.77	0.16%	0.48%	1.92%
	4.8Kbps	0.38	0.08%	0.24%	0.96%
	9.6 Kbps	0.19	0.04%	0.12%	0.48%
NE	2.4Kbps	1.52	0.32%	0.95%	3.79%
	4.8Kbps	0.76	0.16%	0.47%	1.90%
	9.6 Kbps	0.38	0.08%	0.24%	0.95%
NV	2.4Kbps	1.15	0.24%	0.72%	2.88%
	4.8Kbps	0.58	0.12%	0.36%	1.44%
	9.6 Kbps	0.29	0.06%	0.18%	0.72%
NH	2.4Kbps	1.06	0.22%	0.66%	2.64%
	4.8Kbps	0.53	0.11%	0.33%	1.32%
	9.6 Kbps	0.26	0.06%	0.17%	0.66%

TABLE DD-2 (continued)

STATE	LINE SPEED	TRANSFER TIME IN HOURS	UTILIZATION OF COMMUNICATIONS CAPACITY FOR ONE LINE AT STATE CENTRAL DATA LOCATION FOR REPORTING ALL CONTAMINANTS AT VARIOUS REPORTING INTERVALS		
			QUARTERLY (480 hours)	MONTHLY (160 hours)	WEEKLY (40 hours)
NJ	2.4Kbps	7.43	1.55%	4.64%	18.58%
	4.8Kbps	3.72	0.77%	2.32%	9.29%
	9.6 Kbps	1.86	0.39%	1.16%	4.64%
NM	2.4Kbps	1.45	0.30%	0.91%	3.63%
	4.8Kbps	0.73	0.15%	0.45%	1.81%
	9.6 Kbps	0.36	0.08%	0.23%	0.91%
NY	2.4Kbps	17.29	3.60%	10.81%	43.23%
	4.8Kbps	8.65	1.80%	5.40%	21.62%
	9.6 Kbps	4.32	0.90%	2.70%	10.81%
NC	2.4Kbps	6.37	1.33%	3.98%	15.93%
	4.8Kbps	3.19	0.66%	1.99%	7.96%
	9.6 Kbps	1.59	0.33%	1.00%	3.98%
ND	2.4Kbps	0.61	0.13%	0.38%	1.53%
	4.8Kbps	0.31	0.06%	0.19%	0.77%
	9.6 Kbps	0.15	0.03%	0.10%	0.38%
OH	2.4Kbps	10.43	2.17%	6.52%	26.07%
	4.8Kbps	5.21	1.09%	3.26%	13.03%
	9.6 Kbps	2.61	0.54%	1.63%	6.52%
OK	2.4Kbps	3.02	0.63%	1.89%	7.56%
	4.8Kbps	1.51	0.31%	0.94%	3.78%
	9.6 Kbps	0.76	0.16%	0.47%	1.89%
OR	2.4Kbps	2.73	0.57%	1.71%	6.83%
	4.8Kbps	1.37	0.28%	0.85%	3.42%
	9.6 Kbps	0.68	0.14%	0.43%	1.71%
PA	2.4Kbps	11.42	2.38%	7.14%	28.55%
	4.8Kbps	5.71	1.19%	3.57%	14.28%
	9.6 Kbps	2.86	0.59%	1.78%	7.14%
RI	2.4Kbps	0.96	0.20%	0.60%	2.40%
	4.8Kbps	0.48	0.10%	0.30%	1.20%
	9.6 Kbps	0.24	0.05%	0.15%	0.60%

TABLE DD-2 (continued)

STATE	LINE SPEED	TRANSFER TIME IN HOURS	UTILIZATION OF COMMUNICATIONS CAPACITY FOR ONE LINE AT STATE CENTRAL DATA LOCATION FOR REPORTING ALL CONTAMINANTS AT VARIED REPORTING INTERVALS		
			QUARTERLY (480 hours)	MONTHLY (160 hours)	WEEKLY (40 hours)
SC	2.4Kbps	3.35	0.70%	2.09%	8.38%
	4.8Kbps	1.68	0.35%	1.05%	4.19%
	9.6 Kbps	0.84	0.17%	0.52%	2.09%
SD	2.4Kbps	0.67	0.14%	0.42%	1.67%
	4.8Kbps	0.33	0.07%	0.21%	0.84%
	9.6 Kbps	0.17	0.03%	0.10%	0.42%
TN	2.4Kbps	4.69	0.98%	2.93%	11.72%
	4.8Kbps	2.34	0.49%	1.47%	5.86%
	9.6 Kbps	1.17	0.24%	0.73%	2.93%
TX	2.4Kbps	16.33	3.40%	10.21%	40.82%
	4.8Kbps	8.16	1.70%	5.10%	20.41%
	9.6 Kbps	4.08	0.85%	2.55%	10.21%
UT	2.4Kbps	1.66	0.34%	1.03%	4.14%
	4.8Kbps	0.83	0.17%	0.52%	2.07%
	9.6 Kbps	0.41	0.09%	0.26%	1.03%
VA	2.4Kbps	5.95	1.24%	3.72%	14.87%
	4.8Kbps	2.97	0.62%	1.86%	7.43%
	9.6 Kbps	1.49	0.31%	0.93%	3.72%
WA	2.4Kbps	4.68	0.97%	2.92%	11.69%
	4.8Kbps	2.34	0.49%	1.46%	5.85%
	9.6 Kbps	1.17	0.24%	0.73%	2.92%
WV	2.4Kbps	1.72	0.36%	1.08%	4.31%
	4.8Kbps	0.86	0.18%	0.54%	2.15%
	9.6 Kbps	0.43	0.09%	0.27%	1.08%
WI	2.4Kbps	4.70	0.98%	2.94%	11.75%
	4.8Kbps	2.35	0.49%	1.47%	5.88%
	9.6 Kbps	1.18	0.24%	0.73%	2.94%
WY	2.4Kbps	0.44	0.09%	0.27%	1.09%
	4.8Kbps	0.22	0.05%	0.14%	0.54%
	9.6 Kbps	0.11	0.02%	0.07%	0.27%

Appendix EE

Data Store by User

This appendix contains a matrix showing data stores that support the user groups. A "1" indicates that a particular data store is utilized Realtime, "2" shows Historical usage of a Data Store, "3" represents Ownership, while a blank indicates no involvement

**PAGE NOT
AVAILABLE
DIGITALLY**