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Agency Automated Document Storage and Retrieval Requirements Analysis

Draft Requirements Analysis

Prepared for

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL DATA PROCESSING DIVISION

INFORMATION TECHNOLOGY ARCHITECTURAL SUPPORT
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SECTION 1 - INTRODUCTION

1.1 PURPOSE

The purpose of the Agency Automated Document Storage and Retrieval Requirements Analysis is to identify the automated document storage and retrieval requirements of the EPA user community. This analysis supports the current EPA effort to develop a consistent, Agency-wide approach to records management. In order to accomplish this goal, this study provides a Mission Needs Analysis and a Requirements Analysis that summarizes functional requirements identified. In addition, this document identifies and describes available technological options, compares the functional requirements to these technological options, and summarizes the ability of each technology to meet the identified Agency requirements.

1.2 ASSUMPTIONS

The users to be interviewed were identified by EPA's Information Management and Services Division (ISMD) of the Office of Information Resources Management (OIRM). Users were selected because they have known requirements for automated document storage and retrieval. It is assumed that they are knowledgeable about the requirements of the user community to which they belong.

Prior to committing Agency resources for procurement of automated storage and retrieval systems, it is assumed that each program office will provide further justification as required by the Federal Information Resources Management Regulation (FIRMR) in Section 201-30.007, including a detailed system design with a cost-benefit analysis and a detailed implementation analysis for their applications. It is assumed that these documents will address such issues as the legal admissibility of documents stored on automated media, the expected life of the selected storage medium, and the disposition of original documents once an automated system is implemented. The methodology required to perform these tasks is described in detail in the FIRMR in Section 201-30.007.

1.3 REFERENCES

A list of documents and points of contact used for the preparation of this document are presented in Appendices A and B.

SECTION 2 - METHODOLOGY

In order to determine the Agency's overall automated storage and retrieval requirements, a methodology was used that included the following actions:

- Conducted meetings with Office of Information Resources Management (OIRM) personnel to identify users to be interviewed. OIRM personnel also provided an overview of Agency records management issues.

- Reviewed existing and in-progress documentation, including requirements analyses from a number of program offices. These documents are referenced in Appendix A.

- Performed Mission Needs Analysis, as described in both the EPA System Design and Development Guidance document and the FIRMR.

- Developed an Interview Introduction Package and Interview Questionnaire.

- Performed telephone interviews with EPA regional personnel, the Financial Management Division, and the National Enforcement Investigations Center to identify their automated storage and retrieval requirements. All personnel interviewed are listed in Appendix B.

- Conducted interviews with a number of Headquarters program office personnel to identify Agency automated storage and retrieval requirements. These program offices included the Office of Toxic Substances, the Office of Pesticide Programs, the Headquarters Accounting Operations Branch, the Office of General Counsel, the Procurement and Contracts Management Division, the Contract Laboratory Program, and the Headquarters Operations and Client Services Division. The Headquarters personnel interviewed from these program offices are listed in Appendix B.

- Reviewed technical publications, which are listed in Appendix A.

- Performed and documented functional requirements analysis.

- Performed analysis of available technological options.

- Performed a comparison of the documented functional requirements and the available technological options.

In implementing this methodology, use was made of readily available information to assist in identifying its automated storage and retrieval requirements. This methodology focuses on the Agency as a whole, rather than detailing the requirements of each individual program office.

SECTION 3 - MISSION NEEDS STATEMENT

3.1 INTRODUCTION

This document follows the Systems Design and Development Guidance (OIRM87-02) which conforms to the FIRMR and which was developed by the EPA's Office of Information Resources Management (OIRM). This guidance to life cycle management suggests that the first step of any system design and development effort is a Mission Needs Statement, which is developed by analyzing the current environment, interviewing EPA personnel to determine their information and processing needs, and developing an initial system concept. The Mission Needs Statement contained in this document should provide the Agency with enough information to justify further effort in acquiring and developing automated storage and retrieval systems. The Mission Needs Statement is also the prerequisite for the next phase of the system life cycle, as defined by OIRM, the Preliminary Design and Options Analysis.

This document presents the Mission Needs Statement for the Agency as a whole, in relation to its automated storage and retrieval needs for records management. Because of the broad scope of this effort, this document summarizes the critical needs of a number of EPA offices and program areas, rather than addressing each program and office in depth. In addition, the broad scope of the effort to develop a Mission Needs Statement precludes the development of an initial system concept for each program office, which would typically be provided. Finally, the offices and program areas selected for interviews were identified by OIRM as those having records management problems. As such, they provide a representative although not a comprehensive view of the Agency's records management problems and issues.

In order to complete the Mission Needs Statement, 18 people in eight regional offices and 30 people in nine Headquarters offices and program areas were interviewed. This Mission Needs Statement incorporates the results of these interviews, as well as additional information obtained from program office documentation and OIRM personnel.

The remaining sections of this Mission Needs Statement provide the following information:

- A summary of the overall Agency mission;
- A brief definition of the records management problem;
- A description of key functions and program offices;
- A summary of the records management issues by program office; and

- A summary of the findings of the mission needs analysis.

3.2 AGENCY MISSION

EPA was established in 1970 by Congress to protect human health and to preserve our nation's waterways, land areas, and atmosphere. This mission was further expanded by a number of laws, such as the Clean Water Act, the Toxic Substances Control Act, and the Superfund Act. To accomplish its mission, the Agency sets standards; issues regulations; monitors and enforces compliance; and conducts, analyzes, and publishes environmental research. An organizational chart of the Agency is presented in Exhibit 3-1.

3.3 THE PROBLEM

Within the Agency, there are a number of programs and offices whose direct function is to support the Agency's mission. In order to manage and administer these specific programs, documents and records relevant to the program are received, stored, and generated.

The Agency has become aware of the increasing volume of paper it deals with in many regulated areas. Several factors have contributed to a records management problem: the expansion of existing EPA program requirements, which require data and document submissions from the regulated community; the introduction of new legislation and program requirements, such as the Freedom of Information Act or the Emergency Planning and Community-Right-to-Know Act; and the lack of guidance and standards for automated storage and retrieval.

Currently, many documents are stored in warehouses, file cabinets, or locked rooms. Both the quantities of the documents involved and the effective management of these documents have resulted in concern with and commitment to effective records management solutions. In particular, the Agency is investigating methods of electronic record keeping, or automated storage and retrieval.

Since document processing supports the Agency's mission, an analysis of the Agency's requirements for automated document storage and retrieval has been performed. A number of programs and offices which routinely process vast quantities of documents and records have been identified by OIRM as candidates for automated document storage and retrieval. These programs and offices are described below.

U.S. ENVIRONMENTAL PROTECTION AGENCY

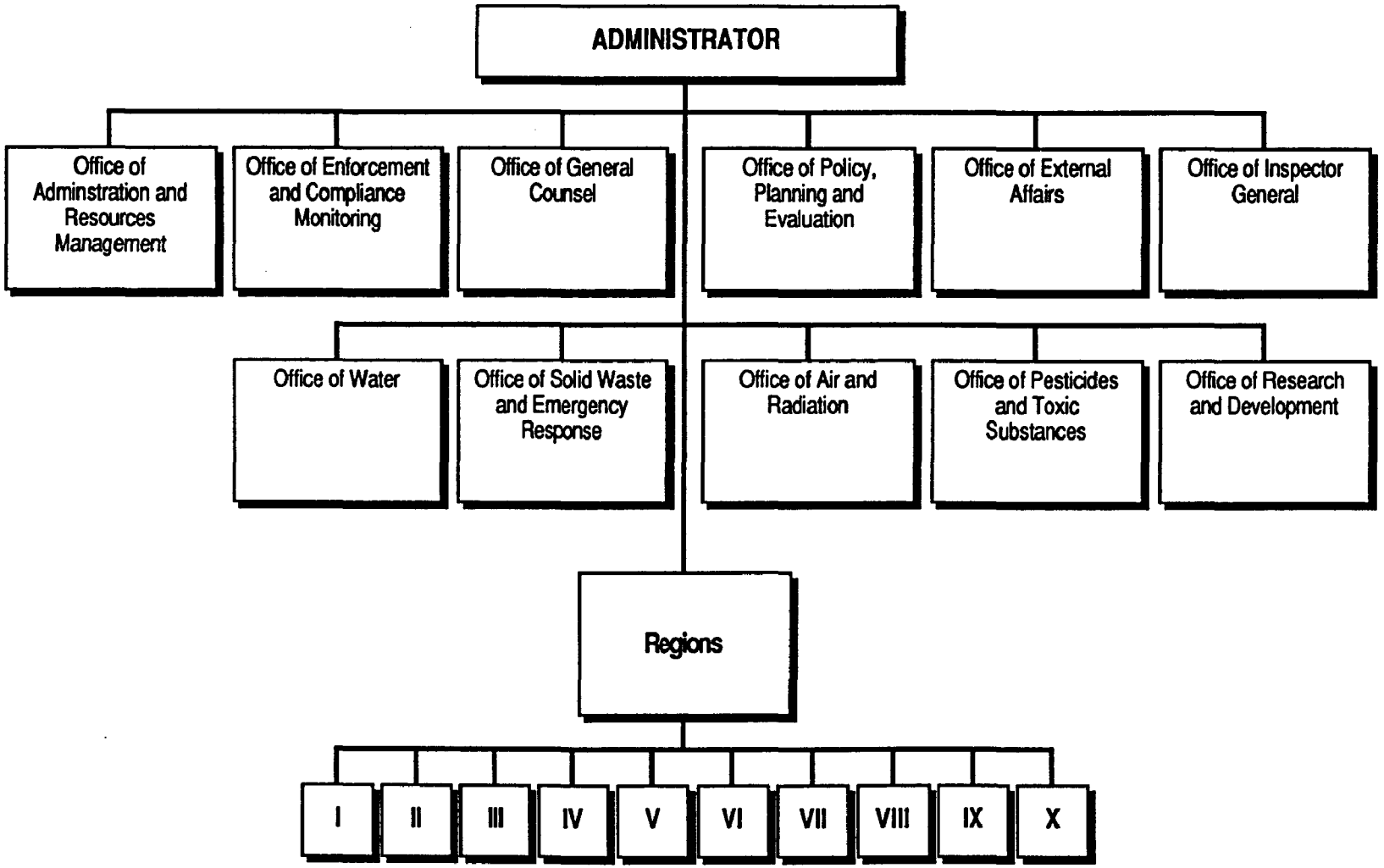


Exhibit 3-1

3.4 KEY FUNCTIONS/USERS AND THEIR MISSIONS

The Agency, as a whole, processes documents for a variety of purposes. Some of these documents contain confidential information while other documents must be made available to the public. Others are submissions required by law from the public sector, while some may be used as legal evidence.

The programs and offices that process huge volumes of paperwork and have been identified as candidates for automated document storage and retrieval are:

- Office of Solid Waste and Emergency Response, which administers Superfund;
- Office of Toxic Substances;
- Office of Pesticide Programs;
- Procurement and Contracts Management Division of the Office of Administration and Resources Management, Office of Administration;
- Headquarters Accounting Operations Branch of the Office of Administration and Resources Management, Office of the Comptroller;
- Headquarters Operations and Client Services Division of the Office of Administration and Resources Management, Office of Human Resources Management;
- Financial Management Division of the Office of Administration and Resources Management Research Triangle Park, NC., and
- Office of General Counsel.

These programs and offices do not represent all programs and offices of the EPA, however they were selected by OIRM for this study because they are a representative sample of the records management problems and issues of the Agency. The mission and key functions of these programs and offices are discussed in further detail below.

3.4.1 Superfund

Superfund was created by the Congress with the passage of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The Act gave the Federal

Government authority to respond to emergencies involving uncontrolled releases of hazardous substances and to develop solutions for the nation's most serious hazardous waste problems.

A "Superfund" was established to pay for these activities. The $1.6 billion Hazardous Response Trust Fund was financed primarily by a tax on crude oil and selected chemicals. The passage of the Superfund Amendments and Reauthorization Act (SARA) of 1986 increased the Hazardous Response Trust Fund to $8.5 billion and incorporated many new management policies and procedures, requiring significant amounts of documentation. Much of this documentation is required for the legal actions taken by the EPA against responsible parties.

The Superfund program is administered by the Office of Solid Waste and Emergency Response (OSWER). OSWER is directed by an Assistant Administrator and is divided into a number of offices and divisions. Exhibit 3-2 displays a complete organizational chart of OSWER.

Several areas of the Superfund program have been identified as having automated storage and retrieval requirements. These are described below.

3.4.1.1 Superfund Site Files

Under the Superfund program, a site file must be maintained for each Superfund hazardous waste site or spill location, documenting activities at the site. These site files contain site-specific information on cleanup operations, legal documents, financial documents, public relations documents, technical documents, and photographs and maps to support a variety of Superfund activities.

In keeping track of Superfund cleanup activities, the ten EPA regions must process thousands of various documents, some of which must be available to the public and many of which must be available to use in court should enforcement action be taken. The regions are responsible for the preservation and maintenance of these documents, which are received from the sites.

Superfund site files are maintained in a variety of locations. The site files are eventually archived at an off-site location. The Superfund site files are integral to the successful implementation of the Superfund program.

3.4.1.2 Contract Laboratory Program

The Contract Laboratory Program (CLP) provides state-of-the-art chemical analytical services on a high volume basis to support the Superfund program. The CLP provides legally defensible analytical results to support Agency enforcement actions or other requirements of the user community.

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE (OSWER)

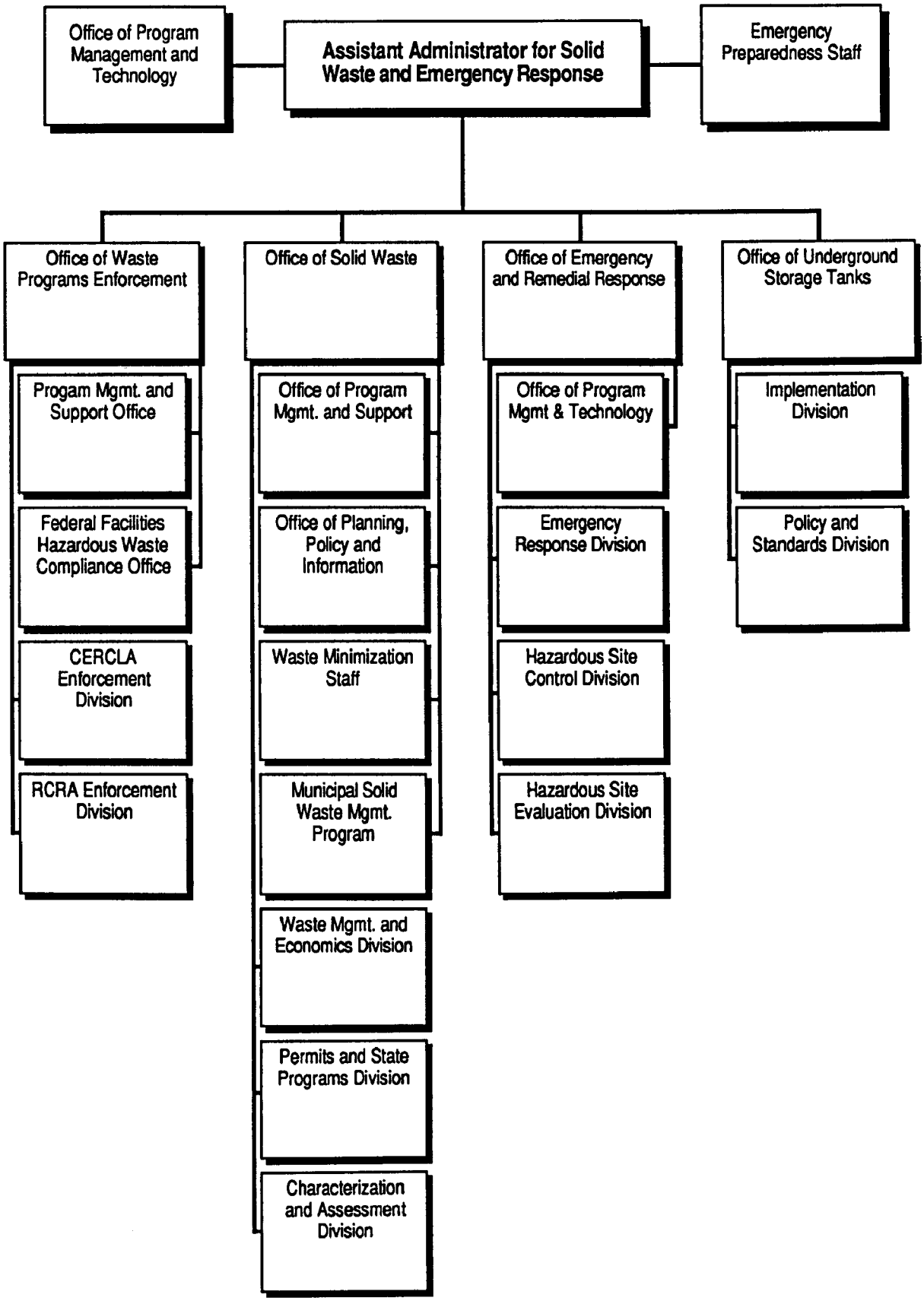


Exhibit 3-2

The Sample Management Office (SMO) provides managerial, operational, and administrative support to the CLP. SMO provides technical and administrative controls over the processes and events of sampling and analysis programs. The primary objective of SMO is to facilitate optimal use of program analytical resources by ensuring data quality, completeness, and timeliness.

The CLP supplies analytical services in direct response to requests from the EPA regions, the primary users of the program. Recently, states and other Agency programs have also become part of the CLP user community.

The documents received by SMO support Superfund compliance, enforcement, analytical, and cost activities. SMO is responsible for the preservation and storage of millions of Superfund documents. These documents are stored in boxes at an off-site location near the SMO offices. Without the existence of these Superfund documents, many Superfund activities could not be accomplished.

3.4.2 Office of Pesticides and Toxic Substances

The Office of Pesticides and Toxic Substances (OPTS) is responsible for administering and monitoring compliance with pesticide and toxic substances statutes. Within OPTS, responsibilities are divided between three offices. The Office of Toxic Substances (OTS) is responsible for administering the Toxic Substances Control Act (TSCA). The Office of Pesticide Programs (OPP) is responsible for administering the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The Office of Compliance Monitoring (OCM) is responsible for monitoring compliance with FIFRA and TSCA. Exhibit 3-3 displays a complete organizational chart of OPTS.

In order to accomplish its mission of administering TSCA, OTS developed the TSCA Premanufacturing Notification Program. In addition, OTS administers the Toxic Chemical Release Inventory, required under SARA Title III. Additional OPTS programs were identified for automated document storage and retrieval. In order to administer FIFRA, OPP developed several programs. These include pesticide product registration, product reregistration, and pesticide product labels. These OTS and OPP programs are described below.

3.4.2.1 TSCA Premanufacturing Notification

A variety of reporting requirements promulgated under Section 5 of the TSCA result in tens of thousands of annual industry submissions to OTS. A major part of the OTS mission is to receive, process, and disseminate information to Agency personnel and the public. OTS functions include the following:

OFFICE OF PESTICIDES AND TOXIC SUBSTANCES (OPTS)

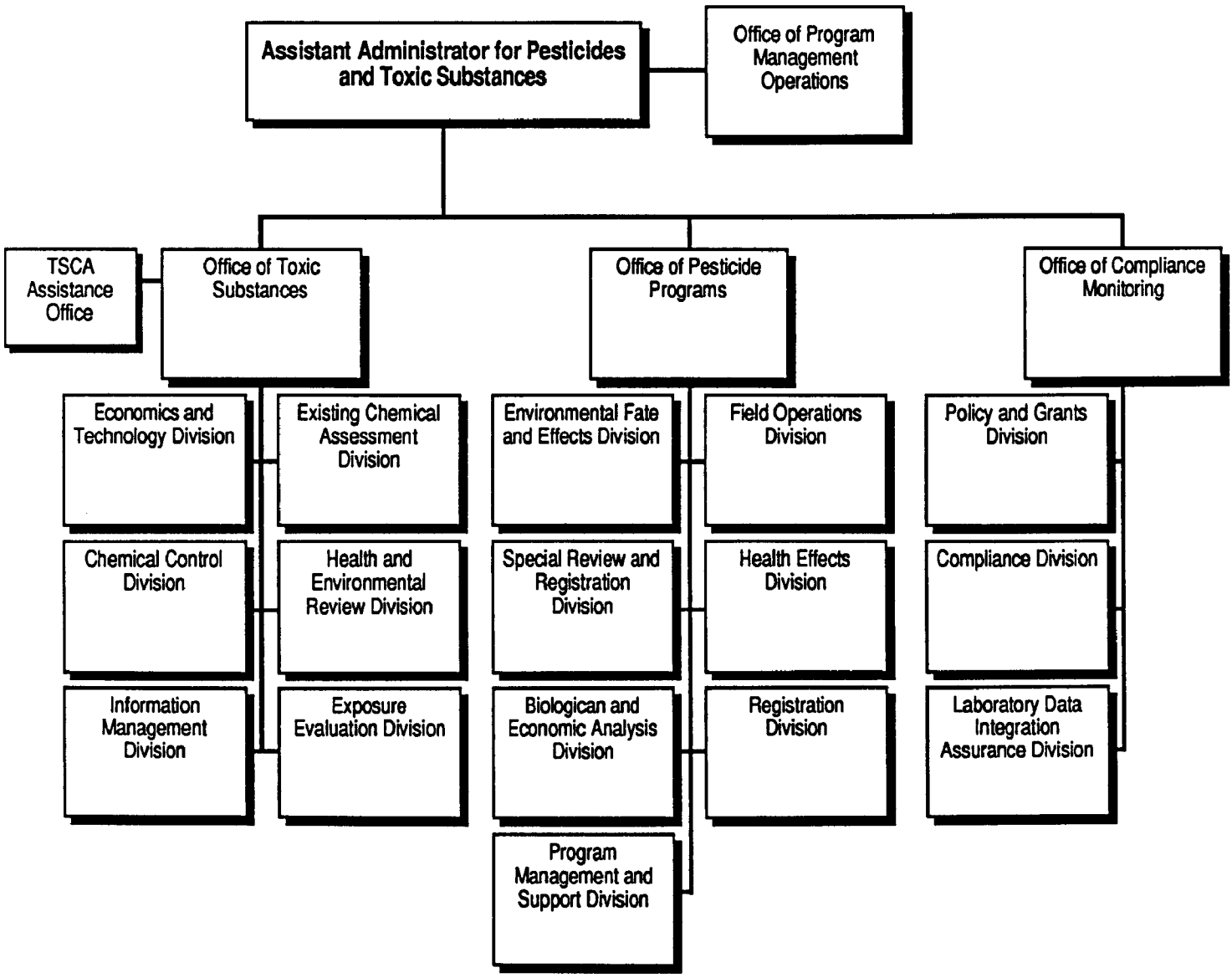


Exhibit 3-3

- Extensive, formal, and statutory deadline-driven review of new chemical substances under TSCA Section 5, which requires producers of new chemical substances to provide information and test data to the EPA prior to manufacturing the new chemical. This program is known as Premanufacturing Notification and involves Confidential Business Information (CBI), which must be protected.

- Response to information requests from EPA, other federal agencies, and the public.

The majority of the industry submissions received by the OTS are claimed as CBI by their submitters. OTS review of industry submissions results in the generation of further thousands of confidential TSCA documents.

Premanufacturing Notifications are reviewed immediately upon receipt and are frequently used to support possible regulatory action, years after receipt. In addition, EPA is required to perform an annual audit of all TSCA CBI hard copy documents in its possession.

3.4.2.2 SARA Title III Toxic Chemical Release Inventory

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) establishes requirements for industry and Federal, state, and local governments regarding emergency planning and "community right-to-know" reporting on hazardous chemicals.

OTS administers Title III's toxic chemical release reporting program. OTS developed an inventory of toxic chemicals, based on information provided by facilities which manufacture, process, or use specific hazardous substances. To accomplish this, OTS maintains industry submissions and related documents, which must be made available to the public.

Title III has four major sections: emergency planning, emergency notification, community right-to-know reporting requirements, and toxic chemical release reporting.

3.4.2.3 Pesticide Product Registration

Pesticide products that must be registered include crop and agriculture pesticides, disinfectants, and insecticides. OPP bases registration decisions upon the determination whether pesticide products cause unreasonable adverse effects to man or the environment. In order to make these regulatory decisions, registrants must perform chemical studies and submit test data and results to OPP for review. This process involves millions of pages of pesticide product documentation. The Registration Standards Program was developed to efficiently identify needed data, obtain those data from pesticide registrants, review the data, and develop regulatory conclusions regarding the

continued registrability of the chemical.

3.4.2.4 Pesticide Product Reregistration

FIFRA88 is an amendment whose purpose is to speed up progress of the product registration program, obtain missing data necessary for pesticide product review, and reduce unnecessary reporting and review. FIFRA88 requires OPP to publish lists of pesticide active ingredients subject to reregistration. Registrants intending to seek reregistration are required to provide OPP with a standard response form, identify data gaps, and agree to fill these data gaps. The responses from the registrants are legal documents which commit the company to specific actions and, therefore, must be stored.

Those registrants seeking reregistration must then submit further documentation to OPP for review. This additional documentation includes new data studies and summaries of existing data studies. If additional data gaps still remain, further data will be requested. Based on the information OPP receives, it will review all data and reregister the product or take other action.

3.4.2.5 Pesticide Product Labels

Every registered product is reviewed by OPP. Each registered product accepted in regulatory review for the past 15 years has an administrative file or product registration jacket, which contains all official documents related to the product. The jacket contains the following types of information:

- Current and prior versions of the product label;
- Proposed and approved use sites;
- Pests the product is used against;
- Approved methods of application;
- Approved percentages of active ingredients;
- Amendment requests;
- Correspondence between registrant and EPA; and
- chemical formulation.

The product labels are stored in the product registration jacket and are integral to the pesticide regulatory program, since they contain all information officially submitted by the registrant about the product, not just the actual label from the product. The results of all regulatory decision-making are contained in the jackets.

3.4.3 Procurement and Contracts Management Division

The Procurement and Contracts Management Division (PCMD) of the Office of Administration and Resources Management, Office of Administration is responsible for developing Agency-wide procurement policies and regulations, and for administering the Contracts Program which includes pre-award activities, negotiation, contract award, post-award administration, and termination settlement. The Division also:

- Provides technical guidance to all field contracting operations, conducts contracts management technical reviews, and performs internal evaluations.
- Provides cost and price analysis services to Headquarters and field contracting operations.
- Coordinates action on contract proposals with the Grants Administration Division.
- Represents the Agency on contracts management matters with other Federal agencies and industry.
- Responds to numerous Freedom of Information Act (FOIA) requests for information.

In addition to the Headquarters contract office, there are offices located in each of the ten EPA regions, in Cincinnati, and in Research Triangle Park, N.C. All PCMD offices perform activities in three crucial areas: cost recovery, FOIA requests, and contract award and administration.

The volume of contract records has grown significantly over the past four years. This growth has occurred primarily due to: (1) a significant increase in the use of contractors to conduct the Agency's business and (2) the Superfund Program use of contractors to assist in conducting investigations and cleanup of hazardous waste sites. The Superfund contract records are voluminous and must be retained for a much longer period of time than other contract records.

PCMD is administered by the Office of Administration and Resources Management (OARM). OARM is directed by an Assistant Administrator and is divided into a number of offices and divisions. Exhibit 3-4 displays a complete organizational chart of OARM.

3.4.4 Financial Operations

The Agency has 14 Financial Management Offices (FMOs), also called Servicing Financial Offices. There are:

- One office in each of the ten EPA regions. Each regional FMO processes its travel vouchers, commercial invoices, and grants.

- One office in Research Triangle Park (RTP), where the financial processing for all Agency contracts is performed. The documents involved are invoices as well as sections of the actual contracts. In addition, this office processes all travel vouchers and commercial invoices for personnel located in RTP.

- One office in Cincinnati, where all of the Agency's Inter-Agency Agreements (IAGs) are processed. In addition, this office processes all travel vouchers and commercial invoices for Cincinnati personnel.

- One office in Las Vegas, where the financial processing of all of the Headquarters grants is performed. In addition, this office processes all travel vouchers and commercial invoices for personnel located in Las Vegas.

- One Headquarters office, where regional and Headquarters payroll processing is performed by the Headquarters Accounting Operations Branch. In addition, this office processes all travel vouchers and commercial invoices for Headquarters personnel.

There is little exchange of financial data between the regional FMOs. However, the regional FMOs receive data from the RTP, Las Vegas, Cincinati, and Headquarters FMOs. The RTP, Las Vegas, Cincinati, and Headquarters FMOs share information among themselves.

Documents processed by the Financial Management Offices include payroll time cards, travel vouchers, commercial invoices, and timesheets.

Financial operations are part of the Office of the Comptroller. The Financial Management Division is administered by the Office of Administration and Resources Management (OARM). Exhibit 3-4 displays a complete organizational chart of OARM.

OFFICE OF ADMINISTRATION AND RESOURCES MANAGEMENT (OARM)

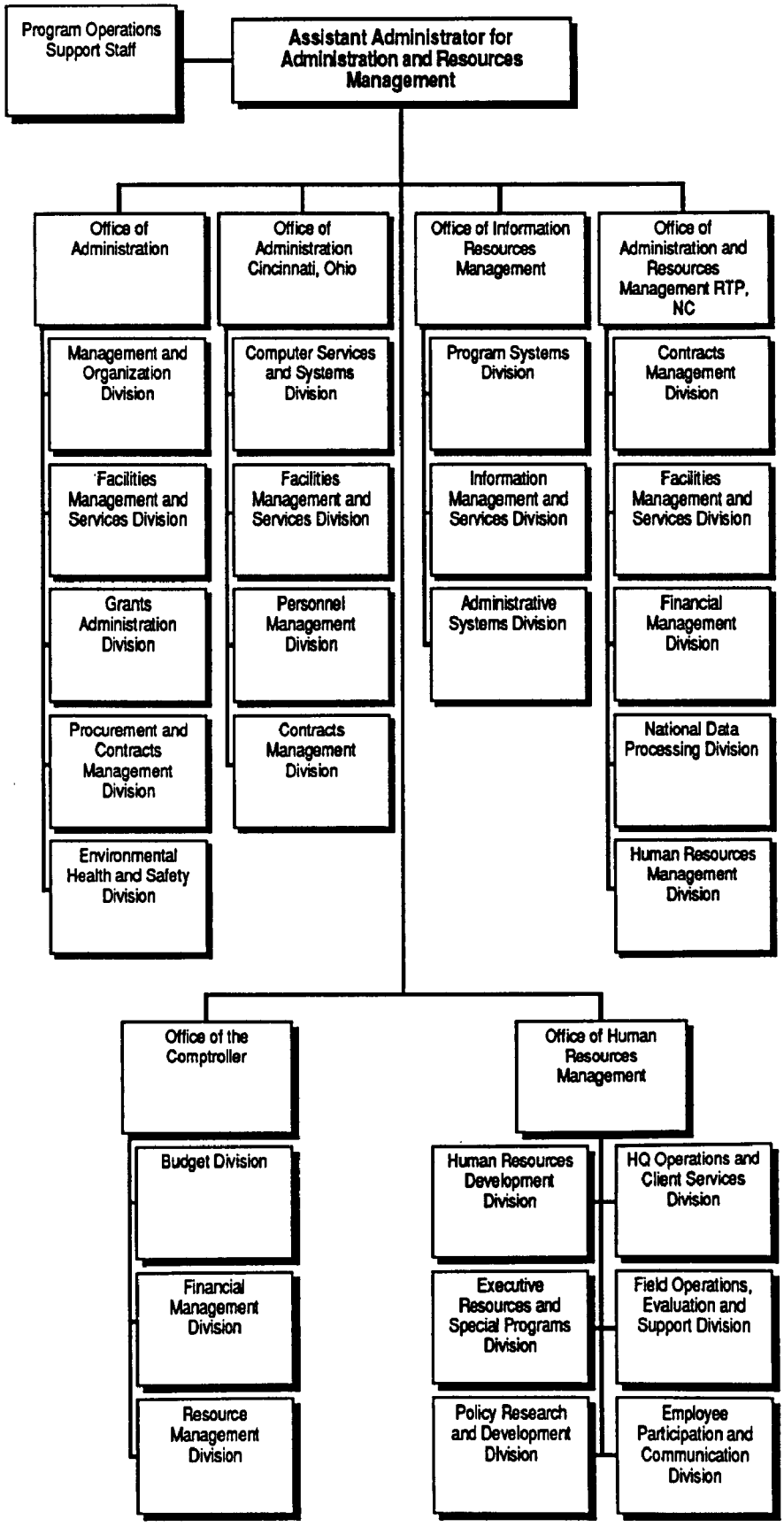


Exhibit 3-4

3.4.5 Office of General Counsel

The Office of General Counsel (OGC) is responsible for performing all regulatory review and legal advisory functions for the Agency. OGC does not initiate litigation, however it represents the Agency in administrative proceedings.

In addition, OGC performs regulatory review to ensure that each proposed regulation meets the intent of the law and to minimize the potential liabilities to the Agency as a result of the regulation. In addition, OGC administers the process of external regulatory review.

OGC processes and maintains large volumes of litigation-related documents at Headquarters. In addition, all documents generated as a result of regulatory review are maintained.

OGC is divided into six divisions. In addition, there are ten Regional Administrators and ten Regional Counsels, as well as a Deputy General Counsel. Exhibit 3-5 displays a complete organizational chart of OGC.

3.4.6 Personnel Operations

The Agency has 14 Personnel offices. There are:

- A Personnel Branch in each of the ten EPA regions;
- A Personnel Management Division in Research Triangle Park (RTP);
- A Personnel Management Division in Cincinnati;
- A Personnel Management Division in Las Vegas; and
- The Headquarters Operations and Client Services Division.

There is little on-going exchange of personnel data between the offices. All locations perform their own processing.

Personnel operations processes all documents related to position openings, job classification, and changes in employee status.

OFFICE OF GENERAL COUNSEL (OGC)

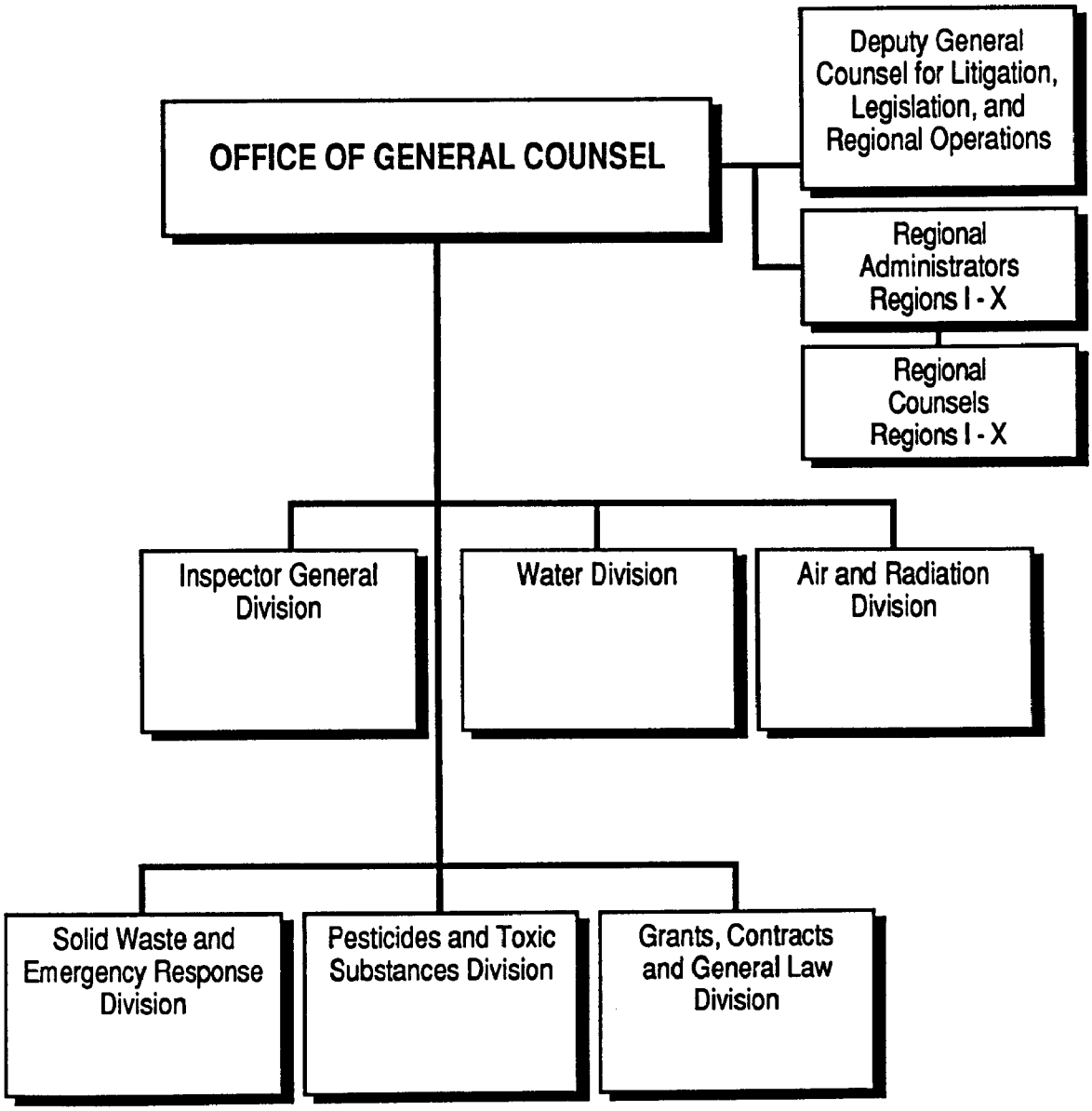


Exhibit 3-5

The Headquarters Operations and Client Services Division is part of the Office of Human Resources Management and is administered by the Office of Administration and Resources Management (OARM). Exhibit 3-4 displays a complete organizational chart of OARM.

3.4.7 National Enforcement Investigations Center

The National Enforcement Investigations Center (NEIC) is responsible for performing TSCA 4, 5, 8, and 12 inspections for all regions except Regions II, III, and V. These inspections involve investigating and auditing paperwork submitted to the EPA by toxic substance manufacturers, as well as auditing the reporting and manufacturing procedures used throughout the manufacturing process. Among its other responsibilities, NEIC performs technical investigations, evidence audits, data audits, and good laboratory practices inspections. Documentation of these activities are maintained by NEIC on-site and at an off-site location.

NEIC is part of the Office of Enforcement and Compliance Monitoring (OECM). OECM is directed by an Assistant Administrator and is divided into a number of offices and divisions. Exhibit 3-6 displays a complete organizational chart of OECM.

3.5 RECORDS MANAGEMENT ISSUES

Each of the Agency offices and applications described above have records management problems. In determining their requirements for an automated document storage and retrieval system, the records management problems of each office were identified.

The following records management issues have been identified for each program office or application:

Superfund Site Files

- Large volumes of documents;
- Inadequate storage space;
- Unstructured file organization;
- Duplication of documents;
- Slow document retrieval;
- Lost, misplaced, or misfiled records;
- Documents retained indefinitely;
- Difficulty in processing confidential data;
- Records not updated on schedule; and
- Difficulty in after hours access.

OFFICE OF ENFORCEMENT AND COMPLIANCE MONITORING (OECM)

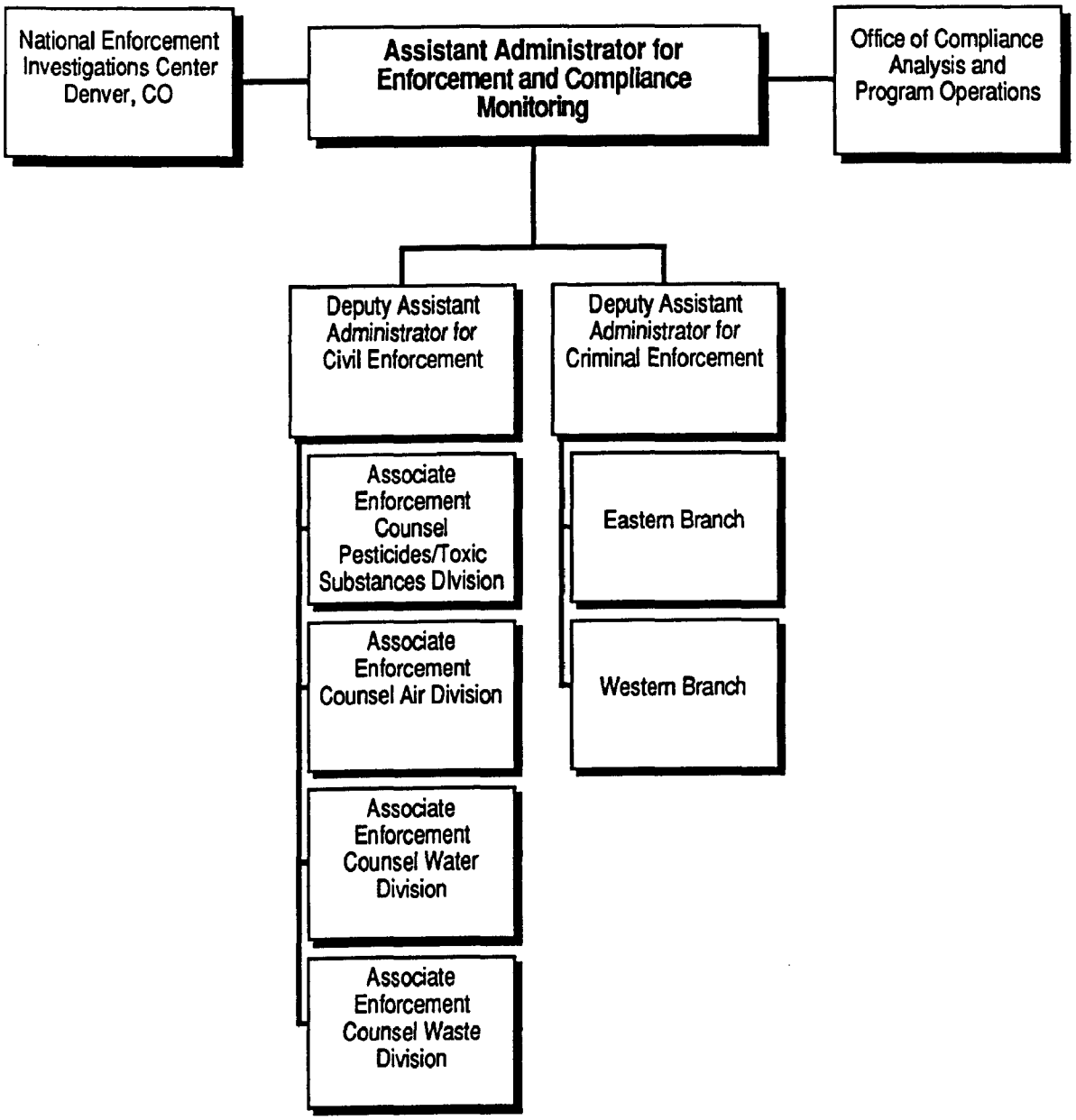


Exhibit 3-6

Contract Lab Program

- Large volumes of documents;
- Inadequate storage space;
- Duplication of documents;
- Slow document retrieval;
- Lost, misplaced, or misfiled records;
- Documents retained indefinitely; and
- Large volumes of data exchanged.

Office of Toxic Substances

- Large volumes of documents;
- Confidential business information;
- Inadequate storage space;
- Slow document retrieval;
- Slow, labor intensive document preparation;
- Documents retained indefinitely;
- Large backlog of documents to be processed;
- Difficulty in tracking documents; and
- Current processing and storage are expensive.

Office of Pesticide Programs

- Large volumes of paper;
- Difficulty in locating documents;
- Missing documents;
- Unstructured information in variable format;
- Duplicate documents;
- Difficulty in maintaining high quality, readable image;
- Significant investment in existing systems; and
- Limited budget for automated storage and retrieval system.

Procurement and Contracts Management Division

- Large volumes of paper;
- No backup;
- Inadequate storage space;

- Confidential business information;
- Documents retained for extended periods of time; and
- Misplaced or lost documents.

Financial Operations

- Timecard processing is outdated;
- Large volumes of paper;
- No backup;
- Confidential information;
- Inadequate storage space; and
- Exchange information between FMOs.

Office of General Counsel

- Large volumes of documents;
- Inadequate document retrieval;
- Duplicate copies of documents;
- Enforcement-confidential information;
- Difficulty tracking documents;
- Inadequate storage space;
- Limited records management procedures;
- Difficulty processing nonstandard documents; and
- Limited budget for automated storage and retrieval system.

Personnel Operations

- Large volumes of paper ("paper factory");
- Inadequate storage space;
- No backups;
- Confidential information; and
- Current storage and retrieval is not automated.

National Enforcement Investigations Center

- Large volumes of paper;
- Inadequate on-site storage;
- Documents retained indefinitely;
- Enforcement confidential information;

- Chain of custody must be maintained;
- Labor intensive; and
- Exchange information with regions.

3.6 MISSION NEEDS SUMMARY

The Agency processes, stores, and organizes vast quantities of legal and official documents that support the successful implementation of the Agency's mission. The responsibilities of the Agency are increasing and the number of Agency documents is growing in support of additional legislative, regulatory, and administrative functions.

Much of the record-keeping of the program offices described in this document is in the form of paper. Much of the document processing is, at best, only partially automated.

As the number of documents increases, maintaining the documents becomes increasingly less effective. Documents are more readily lost, backlogged, or difficult to retrieve. Space for the storage of documents is increasingly scarce and expensive. Other significant issues include document security and integrity, lack of backup for some documents, and no current provisions for disaster recovery. Some offices within EPA are already experiencing the strain of keeping up with the current pace of paper documents.

Although the Agency has a records management strategy, it has not yet been fully implemented throughout the Agency. Records management standards and procedures to address the Agency's record-keeping problems must be in place to support any automated document storage and retrieval system.

The effects of the current document systems are expected to eventually impact virtually every office within the Agency. Therefore, a plan of action to rectify current problems and prevent future ones should be investigated.

SECTION 4 - SUMMARY OF FUNCTIONAL REQUIREMENTS

The effort of the Environmental Protection Agency (EPA) to protect the nation's land, air, and water systems requires the maintenance of extensive, detailed documentation to support actions taken. These documents, by law, must be accessible to the public, but confidential information may not be revealed. In addition, these documents are used in litigation proceedings; therefore, their integrity must be preserved.

It is apparent that the exclusive use of paper record keeping is not effective for the document storage and retrieval requirements of the Agency. The volume of documents to store has been increasing at a rate that has exceeded, or will soon exceed, available storage space. Dealing with such volumes of paper is very labor intensive. In addition, in terms of the EPA's security objectives of integrity, confidentiality, and availability, paper record keeping methods are cause for concern.

The requirements summarized in this section were identified as the result of personal interviews with EPA regional and Headquarters staff, in addition to a review of requirements analyses done previously for the Agency. These requirements are discussed below and summarized in Exhibit 4-1.

4.1 CONSERVE AND/OR MINIMIZE STORAGE SPACE

The requirement for the conservation and /or minimization of document storage space in those offices with records management problems is universal.

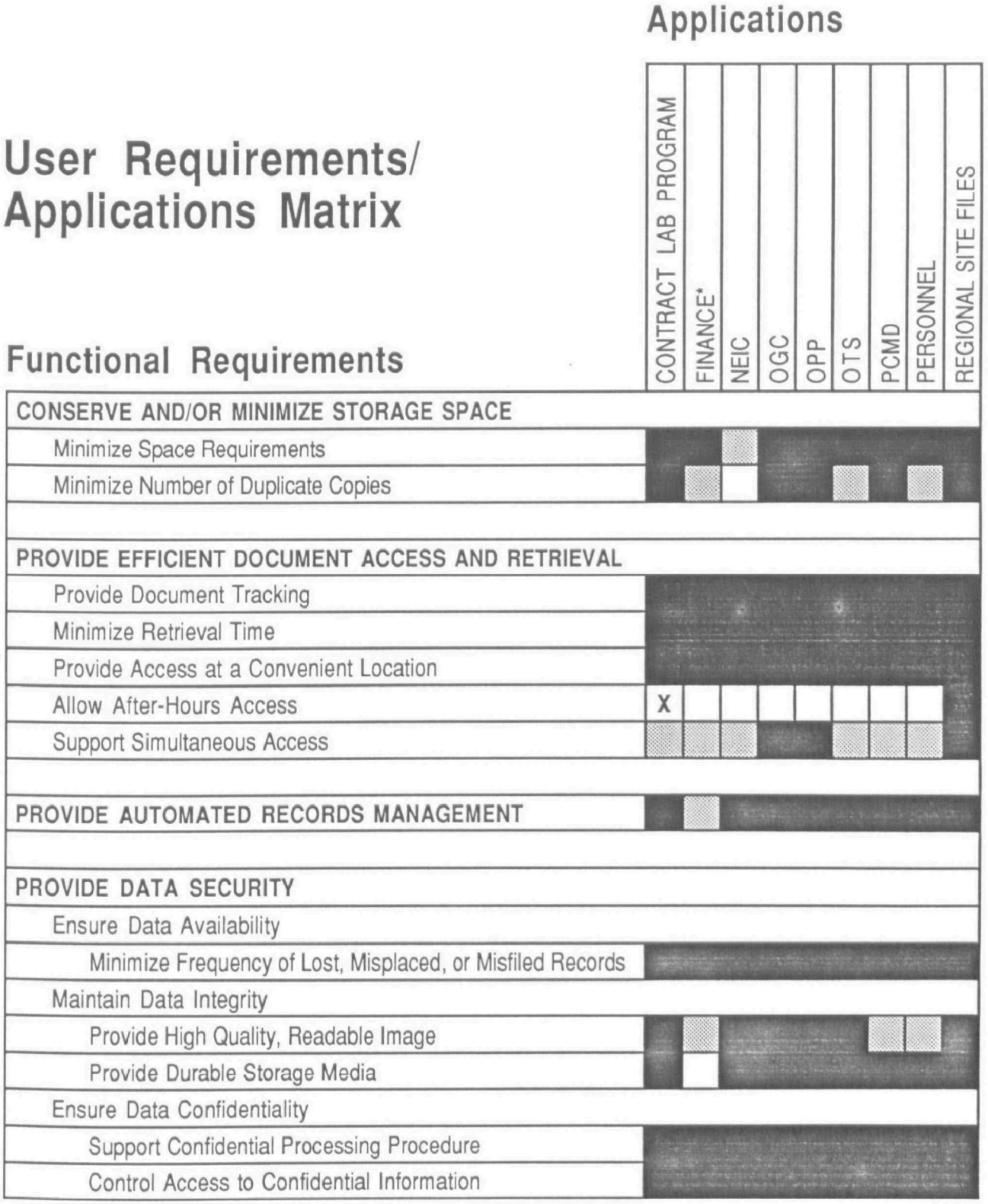
Many present storage systems, using paper and some microform, are not meeting current requirements for space conservation. The volume of documents to be stored is often higher than expected and space set aside for document storage inadequate. Considering projected annual growth rates, which can be as much as 15 percent, the problem will worsen quickly unless changes are made.

4.1.1 Minimize Space Requirements

All the people interviewed for this study who have records management problems want to minimize the amount of space required to store their paper documents.

The Headquarters Operations and Client Services Division (HOCSD) of the Office of Administration and Resources Management, Office of Human Resources Management needs to reduce the amount of space required to store and access large numbers of paper documents. HOCSD stores Official Personnel Folders (OPFs) containing personnel information for each of the approximately 6,000 Headquarters employees, position descriptions for each new Headquarters job,

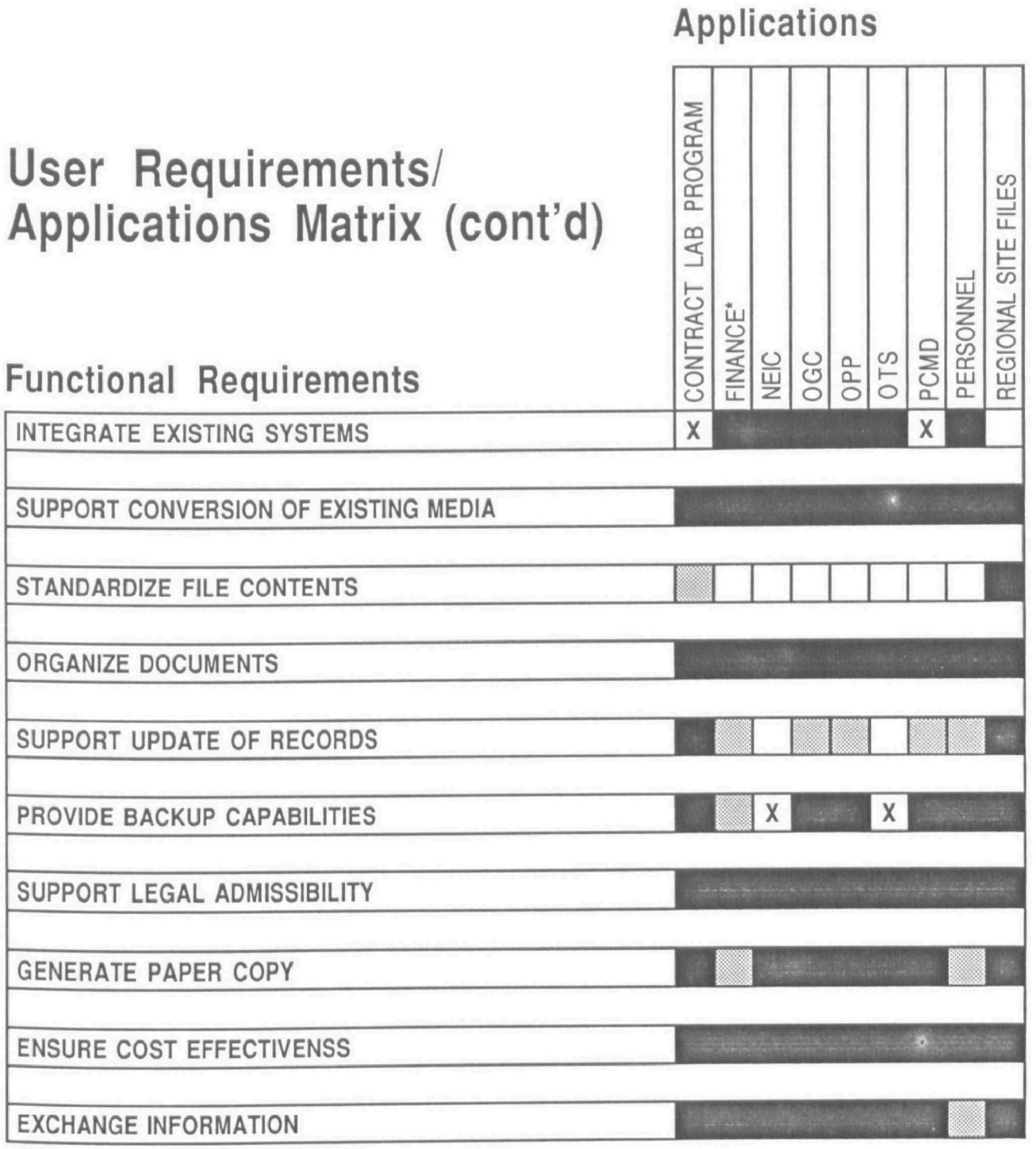
User Requirements/ Applications Matrix



** Headquarters Office Accounting Branch (HOAB) and Financial Management Office*

Exhibit 4-1

User Requirements/ Applications Matrix (cont'd)



LEGEND

- X — Requirement Not Identified
- Moderate Requirement
- Not A Requirement
- Important Requirement

** Headquarters Office Accounting Branch (HOAB) and Financial Management Office*

Exhibit 4-1

and employment activity documents which include applications received for job openings at Headquarters. The OPFs, which take up the majority of Personnel's storage space, fill approximately 500 linear feet. They are stored in the Headquarters personnel file room in four Lektriever storage cabinets, in standard shelving units, and on the floor due to insufficient storage space.

The folders stored in the Lektrievers are packed so tightly together that it is difficult to retrieve a single folder and it is extremely difficult, if not impossible, to insert new folders in these cabinets. The file room is filled beyond its capacity. There is an immediate and critical need to reduce the required storage space for these documents.

The Headquarters Accounting Operations Branch (HAOB) needs to minimize the space required to store its large number of paper documents. These documents are stored in the HAOB file room, the warehouse in the Waterside Mall, and in the Federal Records Center. The files stored in the file room alone take up a large amount of space. They include: time cards (595 linear feet); travel vouchers and commercial invoices (330 linear feet); payroll/personnel files (300 linear feet); and miscellaneous documents such as cancelled checks, parking permit charges, disbursement payments, and time sheets (180 linear feet).

The Procurement and Contracts Management Division (PCMD) also needs to reduce its document storage requirements. PCMD processes and stores large numbers of paper documents such as: preaward documents, contract files (active and closed), and cost-related materials. The preaward documents are stored in the PCMD contract specialists' offices. The large volume of active contract files and the relatively smaller volume of cost-related materials are stored in the file room of the Fairchild Building. These documents take up approximately 1,800 linear feet (roughly 3,350,000 pages). An additional three million document pages (i.e., unsuccessful proposals and closed contract files) are stored off-site at the Federal Records Center. PCMD is expecting an additional 1.1 million document pages per year, which represents a growth rate of approximately 15 percent per year.

The regions interviewed are near capacity or have exceeded available space for records storage. The volume of documents to store, however, continues to increase. Estimated growth rates for the volume of documents to be stored are at least 15 to 20 percent per year. Using these growth projections, the document volume will double within five to seven years.

Region V Superfund site records consisted of 4,120 linear feet in April 1988 and are projected to more than double by 1991. To date, the projected growth rate has proven accurate. Conservatively estimating each shelf-foot of paper as 1,900 pages, within two years, more than 15 million pages of documentation will need to be organized and accessible.

The Contract Laboratory Program currently has an estimated 21 million pages, which require storage in several warehouses. These documents grow at an estimated rate of six million pages per year and must be stored indefinitely.

It was common to learn that records are stored in cardboard boxes under desks and in empty offices. Inadequate storage space has also fostered the use of commercial storage facilities. The use of these alternative facilities adversely affects the organization and accessibility of information, increases storage costs, and impacts the security of documents. The use of occupied offices for excessive amounts of storage also makes the work environment unpleasant and potentially hazardous.

4.1.2 Minimize Number of Duplicate Copies

The number of duplicate copies of documents must be reduced.

The retention of multiple copies of documents contributes to a shortage of storage space. It is not unusual for working copies of the same document to be kept by many people, thus increasing the amount of paper that must be stored.

Currently, the Office of General Counsel (OGC) produces and stores many duplicate copies of paper documents. Duplicate copies of documents are produced during the internal regulatory review process, in which each member of a working group (consisting of members of the program offices affected by the regulations and OGC attorneys) receives a copy of the proposed regulation. Also, the OGC stores duplicate copies of proposed regulations. After the internal review process is completed, copies of the proposed regulations are kept by both OGC attorneys and in the publicly-accessible dockets.

The Procurement and Contract Management Division (PCMD) stores duplicate copies of proposals until the contract is awarded. Sometimes the preaward processing can take longer than one year. In addition, PCMD receives multiple copies of all proposals.

Copies of contract sections, such as delivery orders and work assignments, are stored by both the Financial Management Division and the Contracts Management Division at RTP. Other documents, including some SF-50s, are stored by both the Headquarters Operations and Client Services Division, and the Headquarters Office of Accounting Branch.

In Region VII, it is fairly common for many copies of a document to be maintained. This is considered appropriate in certain cases, such as for civil referral packages. One reason for duplicate copies is the lack of procedures for borrowing and lending documents. In addition, Office

of Regional Counsel attorneys and media specialists keep duplicate copies because the site files are in poor condition.

In Region VIII, various offices and divisions send copies of information from their files to the Remedial Project Manager to become part of the site file. The list of offices and divisions includes Regional Counsel, Hazardous Waste Management, Environmental Services, Community Relations, Finance, Federal Facilities, and Grants. Each of these offices maintains information in their files which is duplicated in the site file.

4.2 PROVIDE EFFICIENT DOCUMENT ACCESS AND RETRIEVAL

Documents must be accessible and retrieval time must be minimized.

Access to stored documents should be improved and retrieval time minimized. To accomplish this, the ability to locate and track documents must be improved, the retrieval time must be reduced, the location of storage facilities must be convenient, the ability to obtain files after regular hours must be available, and the ability to gain access to records in use by someone else is required.

4.2.1 Provide Document Tracking

In Region I, users request documents from the central files that were never incorporated into the central files. Time is spent trying to locate these documents. To alleviate this problem, the central records manager wants to number and inventory all documents and create an on-line index. This will indicate what documents are in the central files, allowing users to make more informed requests.

Region IV currently uses an automated indexing/check-in/check-out system and believes it has improved their records management. They want to upgrade the current system to include more information (keywords).

There is a sign-out system for the product registration jackets maintained by the Office of Pesticide Programs (OPP), but often it is not used and significant time is spent trying to locate specific jackets. To address this problem, OPP wants an automated method of tracking the flow of documents so that they are easy to locate.

The Office of Toxic Substances must perform an annual audit of all Premanufacturing Notification documents they receive. They require an automated document storage and retrieval system that will both support and simplify this process.

The Pesticides and Toxics Litigation Division of the Office of General Counsel (OGC) collects such vast quantities of information during the course of litigation that it is difficult for them to keep track of what they have. OGC wants a system to track and store all the information they receive, so they know what information they have received and can make more effective use of it.

4.2.2 Minimize Retrieval Time

Retrieval time is variable across the Agency, but most offices and regions want to decrease time spent retrieving documents.

Retrieval time for paper files depends on the location and organization of those files, the quantity of paper being retrieved, the quality and training of the staff retrieving and filing documents, and the number of requests at any given time. Often, inactive files are stored at a different location than active files, so retrieving them takes more time.

To support litigation, records from multiple offices and organizations may need to be retrieved quickly. Contract negotiation records, detailed financial records documenting charges for site remediation, and backup documentation maintained by contractors may be necessary to support an enforcement action.

Formal requests for information, including Freedom of Information Act (FOIA) requests, have been increasing. Regions and offices believe that excessive staff time is spent collecting information and responding to requests. One reason cited was that large volumes of paper are frequently needed for FOIA responses and are difficult to retrieve.

The Procurement and Contracts Management Division staff manually locates and retrieves documents necessary to respond to FOIA requests. This is a time consuming, labor intensive process. In addition, individuals often store active contract folders in their work areas to minimize retrieval time since on average, a person refers to the active folders assigned to them three to five times a day. Time spent retrieving folders stored in their own well-organized desk would average 15 seconds while going to the centrally located file room, locating records, and then returning to their office requires ten to fifteen minutes.

In Region V, it is possible to retrieve a document from the central files in two to three minutes, which is adequate. However, not all documents can be retrieved this quickly. The Superfund records manager felt users had little confidence that documents could consistently be found within a few minutes. Region V does not necessarily want to speed up document retrieval, but rather to ensure that documents are consistently retrieved within a reasonable timeframe.

Three of the regions use commercial or warehouse storage for documents. Region V uses commercial storage facilities for less active documents. They have approximately 1,800 linear feet of documents in commercial storage. In an average week 20 boxes of documents are retrieved from this facility. The storage facility promises 24-hour retrieval time, which means that 24 hours after information is requested they receive the boxes which contain the documents.

Document retrieval requests to the Office of Toxic Substances Toxic Chemical Release Inventory staff currently average approximately 800 per week and are expected to increase. Much of the information is retrieved for quality assurance, legal, or FOIA purposes. With this volume of documents, the retrieval process becomes time-consuming and labor intensive.

The National Enforcement Investigations Center indicates that the ability to perform automated text searches of documents to identify what to retrieve has been successful on a pilot basis and would be a desired capability. In addition, the Office of Toxic Substances is investigating an automated storage and retrieval system and would like the ability to perform text searches to minimize their document retrieval time.

The Pesticides and Toxic Substances Litigation Division of the Office of General Counsel (OGC) wants the ability to perform a text search, in order to support their retrieval needs. OGC wants to scan and store documents, then later determine which documents to retrieve based on whether a specific word or term is contained in the text of the document.

4.2.3 Provide Access at a Convenient Location

The physical location of a central document storage and retrieval facility must be convenient to users.

When selecting a location for document storage, convenience of the location is considered, but cannot always be achieved. Factors which weigh heavily in determining the location of storage facilities are cost and the availability of adequate floor space.

In Region I, most Remedial Project Managers find documentation in the records center easily accessible, but attorneys find that being in a separate building from the central records center hampers document accessibility. The effect of limited access has resulted in the attorneys holding original documents for extended periods of time.

4.2.4 Allow After-Hours Access

After-hours access of documents from the central storage facility is required.

Paper record-keeping requires staff to file and retrieve documents to fulfill user requests and to control access to confidential information. This means staff must be present at all times that access is allowed; therefore, access times are restricted. There is a growing need for access after regular hours, which may be fueled by increasing Superfund cost recovery efforts.

In Region V, retrieval requests are received for retrieval on weekends and after hours. Region V wants a system that is operational virtually 24 hours a day, seven days a week, that does not need attention other than during regular business hours or when problems arise.

The Region VII Superfund records manager thinks authorized staff members should be able to access centrally maintained records during nights, weekends, and holidays to the maximum degree feasible.

4.2.5 Support Simultaneous Access

Simultaneous access of documents is required.

The ability for many people to access documents at the same time must be provided. In many program offices, when one person has records checked out and another needs access to those records, time is spent locating the records and making duplicate copies of the document. The time involved and cost of producing the duplicate copy are obvious, but the hidden costs of maintaining duplicate documents which may contain confidential information and the questionable integrity of multiple, possibly unmaintained copies must also be considered.

In Region V, simultaneous access to a document is needed periodically. The Superfund records manager indicated that the ability for 12 persons to access a record simultaneously is adequate.

The Region VII Superfund records manager said up to three people may need access to the same document at one time. Region VII wants to ensure that document review can be performed without unduly restricting access to the records.

Region VIII has not experienced much need for simultaneous access: this occurs only three or four times in a six month period. However, they expect this need to increase as they incorporate more current documents into the central files.

The Office of General Counsel (OGC) requires simultaneous access to a single document by several people on a daily basis. For many of the activities of OGC, project teams are formed and all members of the team need copies of the same document. For example, in Pesticides and Toxic Substances Litigation, the litigation team requires simultaneous access to a document by several people. OGC regulatory review teams also have the same requirement. Generally between five and twenty people can require access to the same Premanufacturing Notification case file at one time.

The Office of Pesticides and Toxic Substances has several applications for which simultaneous access to a single document by several people in different geographic locations is required. For example, there is a lot of "competition" for Office of Pesticide Programs product registration jackets. And there is often a need for several people to review the same submission document for the Office of Toxic Substances Toxic Chemical Release Inventory. Generally, between five and twenty people may require access to the same Premanufacturing Notification case file at one time.

Some program offices and regions are not sure if simultaneous access is needed or indicate it is unnecessary. Some, like Region II, believe it would be beneficial, but have no documented knowledge of conflicts for document access.

4.3 PROVIDE AUTOMATED RECORDS MANAGEMENT

Records management is currently very labor intensive, time-consuming, and should be automated.

In the regions, the amount of time spent by Remedial Project Managers (RPMs) and attorneys to manage records is significant. RPMs usually maintain the current active site files at their desk or work area. They file, retrieve, and track document locations, and in some cases schedule appointments for document viewing. Attorneys review documents which contain confidential information to determine what information can be released to the public.

In Region VII, RPMs and attorneys spend two to eight hours per week on clerical tasks associated with records management. There is little use of clerical staff for filing, retrieving, tracking, or refiling of Superfund documents. The RPMs and attorneys expressed dissatisfaction with the amount of time they had to spend on records management.

In Region VIII, file users devote 5 to 20 percent of their time to records management. The primary users are RPMs and attorneys, who indicated this is too much time to devote to records management.

At Headquarters, all incoming documents must be individually reviewed in the Pesticides and Toxic Substances Division of the Office of General Counsel (OGC). Not including litigation, it is estimated that the office processes an average of 1,900 to 2,800 pages per day. During litigation, the volume of incoming documents increases. Once reviewed, many of the documents are never used again simply because it is so time-consuming to keep track of them. OGC cannot take advantage of all the information received because it is too labor intensive to sort out the useful documents.

The Headquarters Operations and Client Services Division (HOCSD) processes and maintains paperwork on each of the nearly 6,000 EPA Headquarters employees. Because HOCSD "is a paper factory" dealing with large volumes of documents, they indicated a need for an automated records management system to support their basic file storage and retrieval needs.

4.4 PROVIDE DATA SECURITY

Data security is a universal requirement.

The EPA's security policy focuses on three objectives: confidentiality, integrity, and availability of data. Data confidentiality is ensured when sensitive information is protected from disclosure. The data integrity objective is attained if the quality of the data is protected from corruption. Data availability focuses on preventing data loss and ensuring data is available to users.

4.4.1 Ensure Data Availability

Data availability is required.

4.4.1.1 Minimize Lost, Misplaced, or Misfiled Records

The frequency of lost, misplaced, or misfiled records must be reduced.

Currently, documents are frequently lost, misplaced, or misfiled. The information contained in the Superfund site files must be available for retrieval by a variety of users, who include Remedial Project Managers, attorneys, interested citizens, and college students.

The three main reasons for lost, misplaced, or misfiled documents are: unfiled records because staff cannot keep pace with the large volume of records; inadequate control procedures, resulting in the loss of records from the official files; and, even in offices with satisfactory control procedures, files are sometimes misfiled or misplaced because of the high volumes of documents processed.

At the Office of Pesticide Programs, approximately 15 to 20 percent of the product registration jackets can not be located when needed. This occurs because the procedures for checking out the jackets are often not followed and because it is difficult to track who is using a jacket.

About ten percent of the time, contract documents at the Procurement and Contract Division (PCMD) cannot be found, even though there are check-out procedures in place for the PCMD file room. Some contract documents are checked out and kept by contract specialists for several years. In these circumstances, documents are sometimes misplaced by the contract specialist. Sometimes, the contract specialist leaves the organization without returning the contract file to the file room.

A study of Region VIII records management showed that five to ten percent of attempted document retrievals cannot be accomplished because the document is missing from the site file.

In Region VII, established procedures for borrowing documents are not enforced. Documents are misplaced or lost in a variety of ways: storage units are left unlocked; the file room doors are left open when the room is unattended; borrowed documents are not signed out; and the file contents are not intact when returned.

Misplaced or lost records can prevent regions and offices from responding to requests for information, providing records needed for audits by the Inspector General and the General Accounting Office, providing records for litigation, and from performing activities integral to the Agency.

4.4.2 Maintain Data Integrity

Data integrity is required.

Users specifically requested high-quality, readable images on a durable storage medium.

In addition, the integrity of the data in Superfund site files must be ensured. These files are retrieved for a variety of uses such as determining what actions to take on a site, making decisions on removal procedures at a site, litigation, FOIA responses, and research. Users must be certain that the data has not been tampered with and is current.

4.4.2.1 Provide High-Quality, Readable Image

A high-quality, readable image is important for the integrity of documents.

Because the Agency's documents are used for decisions and litigation, it is important that all pertinent information be available. If a document cannot be read, it cannot be used. Documents that are unclear may be misread.

Time affects the readability of all documents. Other controllable factors can influence document readability. For example, working documents used at desks and work areas are subject to smudges, stains, and fading from exposure to sunlight, which can render them unreadable. If an original document (rather than a copy) is used as a working document, information may be lost.

Storage conditions, such as temperature and humidity, influence the readable life of documents. No carbon required (NCR) copies and heat-sensitive paper used in duplicating machines and printers tend to fade quickly. Any paper document can mildew or fade and film media may fade.

The Office of Pesticide Programs (OPP) maintains product registration jackets which contain all official documents for a specific registered product. These documents, particularly the product label, contain unstructured information which is generally numbers and text. OPP wants high resolution for storing images of the product labels.

Readability of documents is a primary requirement of the Office of General Counsel (OGC). OGC is concerned that some documents which are second or third generation copies may not be easily read. Since the documents contain text, diagrams, and handwriting, readability must be ensured.

4.4.2.2 Provide Durable Storage Media

Durable storage media are required so that documents can be maintained for the lengths of time specified by law.

Different types of documents must be maintained for different lengths of time, from one month to permanently, as set forth in the EPA document disposition schedules.

At Headquarters, the Procurement and Contracts Management Division maintains all unsuccessful proposals for seven years. All contract information is on-site while active, which can be from three to ten years, and then is stored off-site after the contract is closed out. Closed-out

non-Superfund documents are retained off-site for six years while closed-out Superfund contract information is maintained on-site for ten years.

The Superfund Administrative Records must be maintained in the region for up to 20 years after cost recovery action is complete. While stored in the region, documents are not kept under ideal archival conditions. They are subject to damage from handling and are stored in environments where temperature and humidity are not controlled to archival standards. After the regional storage, the documents are archived for permanent storage.

Region VII has made few efforts to arrange for appropriate conditions for long-term storage of semiactive records regarding temperature and humidity controls.

Region VIII maintains Superfund site files in the regional offices for two years after cost recovery, then at the Federal Records Center for the next 20 years, and finally the documents are transferred to the National Archives and Records Administration for permanent storage.

The National Enforcement Investigations Center, The Contract Laboratory Program, and the Office of Toxic Substances Toxic Chemical Release Inventory must retain their documents indefinitely. The bulk of these documents are stored off-site because the on-site storage facilities are insufficient to handle large volumes of documents for an indefinite period of time.

4.4.3 Ensure Data Confidentiality

The ability to ensure confidentiality of portions of documents and of entire documents is required.

Confidential information at the EPA can include: enforcement sensitive information, contract-related information, confidential business information, employee-related information, attorney work products, and attorney-client privileged materials. Confidential information contained in documents must be protected from the time of document creation or receipt, throughout the storage life, until final document disposition is complete.

4.4.3.1 Support Confidential Processing Procedures

Document processing procedures must address the issue of security of confidential information during the time documents are being prepared for storage and while they are stored.

Region I and Region VII Superfund records management personnel express concern that they are unaware of any comprehensive guidelines specifying what information is confidential. Region

I creates redacted copies of confidential documents, which have the confidential information blocked out, and maintains both the original and redacted versions. If "confidential" only appears on the first page of a document, there is confusion about what information within the document is confidential and should be redacted. Comprehensive guidelines from Headquarters regarding Superfund site file confidentiality are desired.

Many program offices process confidential information. For example, the Office of General Counsel, the Office of Pesticide Programs, the Office of Toxic Substances, the Office of Solid Waste and Emergency Response, the Procurement and Contracts Management Division, the Headquarters Accounting Operations Branch, the Headquarters Operations and Client Services Division, and the National Enforcement and Investigations Center all process confidential information. Any storage and retrieval system and storage medium used for Agency applications must support special processing requirements needed to maintain the confidentiality of information.

4.4.3.2 Control Access to Confidential Information

Access to confidential information must be controlled.

Preventing unauthorized access to documents containing confidential information is a common concern.

At the Procurement and Contract Management Division (PCMD), many of the records contain confidential business information or pre-award procurement information which could result in non-competitive procurement if divulged. Therefore, only members of the PCMD staff are authorized to access the records. Although locked doors with card entry and locked file storage equipment are used; records may be left unsecured at times on top of desks, unfiled in the file room, and in unlocked file cabinets during working and non-working hours. Most of these problems are due to difficulty in managing the large volume of records.

In the regions, only some Superfund documents are confidential. Region VIII estimates that up to 50 percent of a Superfund site file may be classified as confidential. In Region VII, some files that contain confidential information are left on desk tops or in unlocked drawers. Region VII also indicates that documents containing confidential information are not always stored separately from the rest of the other documents in the files.

Multiple levels of control are needed to manage confidential data. For public access, entire documents or only portions of documents which include some confidential data must be made available. Documents which are primarily confidential, and to which public access is not allowed, must also be managed.

Headquarters Operations and Client Services Division, Headquarters Accounting Operations Branch, and the Procurement and Contracts Management Division control access to confidential information by maintaining them in a secure area and restricting access to only authorized personnel. In these as well as other offices working with confidential information, the ability to redact certain parts of documents before sending them outside of the office is an important requirement.

The Office of Toxic Substances (OTS) Premanufacturing Notification (PMN) program has Confidential Business Information (CBI). Virtually all of the PMN documents submitted to OTS contain CBI, which must be protected as required by TSCA CBI procedures.

4.5 INTEGRATE EXISTING SYSTEMS

An automated records management system using any type of storage medium must integrate with users' existing systems.

Currently, documents are stored on paper and microform. In some cases, indexes to the documents are stored on a mainframe system. Several Headquarters users indicated that an automated records management system using any type of storage medium must be able to be used in conjunction with existing systems, without requiring the conversion of these existing systems to the new medium.

The Office of Pesticide Programs (OPP) supports several document indexing systems on the IBM mainframe. Rather than "reinventing the wheel," OPP wants a storage and retrieval system capable of integrating with their existing ADABAS indexing systems. OPP also wants software that does not require customization and wants the ability to use EPA standard local area network architecture.

The Headquarters Accounting Operations Branch (HAOB) provides financial and operational support to all Headquarters offices and payroll services for the entire Agency. They currently use several automated systems: the Integrated Financial Management System, the EPAYS Personnel/Payroll System, and the Time and Attendance Personnel Payroll System. HAOB wants an automated time card system, as well as a travel voucher and commercial pay system, to be integrated with their existing automated systems.

The Office of Toxic Substances (OTS) Toxic Chemical Release Inventory utilizes an IBM mainframe data base to store information extracted from incoming documents. Currently, data is entered into a PC tracking system, written to a magnetic tape, and loaded to the mainframe. The mainframe data base application is used to generate error notifications to submittors, who must return the corrected information to OTS. Although this data base contains only several years of data, the

ability to integrate an automated document storage and retrieval system with the existing system should be available.

4.6 SUPPORT CONVERSION OF EXISTING MEDIA

A new storage medium must support the conversion of existing documents or media to the new medium.

Currently, documents are stored on paper and microform. In those cases where the users would like to completely convert their existing documents or application, conversion of these documents and applications to a new medium must be supported.

For the regional site files, this conversion must be structured to store all documents related to a particular site on one medium. For some Headquarters applications, documents are currently stored on several types of media and complete conversion to a new medium, if desired, must be supported.

The Office of Toxic Substances converts Premanufacturing Notification documents submitted under the Toxic Substances Control Act to microfiche. They currently receive and generate over 40,000 document pages per month which need to be converted and they expect this number to increase. In addition, there is a backlog of over 600,000 pages. They currently can convert 34,000 pages to microfiche per month, but want the ability to process at least 60,000 pages per month.

4.7 STANDARDIZE FILE CONTENTS

Files should contain only relevant, useful information.

Documents which are needlessly maintained waste storage space. Files should contain only information which is useful or meaningful for decisions, litigation proceedings, and other uses deemed necessary by the Agency.

In Region VII, Superfund site files contain all site-related documents, even if trivial or redundant. The regions have specific questions about the need to retain draft documents that have been superseded, duplicate copies of final documents that have been annotated, unvalidated data, phone memos, and notes from conversations.

Current guidelines specifying what information to retain in the Superfund site files and Administrative Record are broad, leaving many decisions to the regions. Some regions expressed a desire for more specific guidelines from Headquarters.

4.8 ORGANIZE DOCUMENTS

Organization of existing and future documents to support indexing and retrieval is required.

Although all interviewees agreed that documents must be organized and that the organization method employed should be flexible enough to handle future needs, there was controversy regarding how this should be accomplished.

A system which mirrors the current paper filing system was requested and would be the easiest to implement since it is a known, currently used system. Although there were exceptions, most offices and regions organized the files within each program in a consistent manner. Among different programs, however, there was no consistency.

The Procurement and Contracts Management Division (PCMD) wants a system to organize and access their documents by using keywords such as contract number, modification number, and site name. This type of indexing will support PCMD's current way of doing business, quick access, and keyword searches.

Both the EPA Headquarters Operations and Client Services Division (HOSCD) and the Headquarters Accounting Operations Branch (HAOB) want to continue to organize their files by social security number. Currently, the Official Personnel Folders are indexed and located by social security number while HAOB's time cards are indexed by social security number, fiscal year, and pay period. The personnel payroll information shared by HOSCD and HAOB is currently organized by social security number.

A standard file structure and standard document management procedures are requested by some regions for the Superfund regional site files.

The easiest system to implement is not necessarily the best system. Over the long term, the most benefits will be gained from the organization which is easiest to use. The most useful method of organization, the benefits, and the tradeoffs of uniform standards must be evaluated.

4.9 SUPPORT UPDATE OF RECORDS

Fast, easy, and timely update of records is a universal requirement.

A problem noted in Region III, where paper record keeping is used, is that updates to the official files may be delayed several months. Region V processes an average of 3,500 document pages

per day for storage, which is approximately 73,500 documents per month. Users receiving outdated information because files aren't updated in a timely manner lose confidence in the official files.

The Headquarters Operations and Client Services Division updates position descriptions annually and the Official Personnel Folders (OPFs) as needed, sometimes on a daily basis. Generally documents are added to the OPF; however, if a document contains errors, the document itself will be corrected.

Both the Office of Toxic Substances and the National Enforcement Investigations Center require the ability to add documents as they arrive; however, they do not require the ability to edit or annotate existing documents.

The Procurement and Contracts Management Division may infrequently require the ability to modify some preaward documents but once a contract is awarded, no contract documents may be modified. Additional documents are, however, added to the contract file as they are received or generated.

4.10 PROVIDE BACKUP CAPABILITIES

The ability to backup data must be provided.

Any storage medium is subject to damage and/or loss from disasters, such as fire. A secure, up-to-date, off-site backup copy of all documents is important.

Region VII wants to ensure that critical regional Superfund site documents are adequately backed up. Currently most records are not systematically backed up.

At the Procurement and Contract Management Division, there is no backup copy of many records. PCMD indicated that critical sections of their files can be reconstructed for litigation by obtaining documents from various offices within the Agency. This may be sufficient for an isolated case of a lost record, but may be inadequate if a major disaster were to occur.

The Headquarters Operations and Client Services Division is concerned that there are no backup procedures for its documents, because of the significant loss if documents are damaged or destroyed. Although some of the information could be obtained from other offices, there would be no way to completely recreate these files; except by relying on copies, where available, maintained by each employee. It is also important to note that all OPFs are kept in the same file room, increasing the chances for all documents to be destroyed if a disaster should occur.

Many offices, such as PCMD and OGC, have a requirement to maintain documents that are used in court cases. The loss of information from such documents could affect legal proceedings.

Some offices specifically identified document backup as a requirement; while in other offices, because no apparent document backup procedures are in effect, one might assume that a backup capability is important.

4.11 SUPPORT LEGAL ADMISSIBILITY

Legal admissibility of the records must be unquestioned.

Interviews universally indicated that documents must be legally admissible. For example, Superfund and Contract Laboratory Program documents are often used to support enforcement and cost recovery actions. National Enforcement Investigations Center, Office of General Counsel, and Procurement and Contracts Management Division documents may also be used in litigation.

Paper and microform records are currently used and both are legally admissible. When microform was being considered for use in the Procurement and Contracts Management Division, the legality of microform records was questioned. At that time, a legal decision was obtained from the Office of General Counsel, which confirmed the legality of microform records and set usage guidelines. These usage guidelines addressed the creation of microform records and the destruction of the original documents.

Although microform is considered legally admissible, some attorneys feel that original documents must be available for litigation. This is an issue that has been debated for many years and may remain an issue for years to come.

The Business Records Act provides for admission of records created in the regular course of business by stating:

> If any business, institution, member of a profession or calling, or any department or agency of government, in the regular course of business or activity has kept or recorded any memorandum, writing, entry, print, representation, or combination thereof, of any act, transaction, occurrence, or event, and in the regular course of business has caused any or all of the same to be recorded, copied, or reproduced by any ... process which accurately reproduces or forms a durable medium for so reproducing the original, the original may be destroyed in the regular course of business unless its preservation is required by law. Such reproduction, when satisfactorily identified, is as admissible in evidence as the original in any judicial or

administrative proceeding whether the original is in existence or not....

The Federal Rule of Evidence 803(6) describes a record of regularly conducted activity.

> Records of regularly conducted activity. A memorandum, report, record, or data compilation, in any form, of acts, events, conditions, opinions, or diagnoses, made at or near the time by, or from information transmitted by, a person with knowledge, if kept in the course of a regularly conducted business activity, and if it was the regular practice of that business activity to make a memorandum, report, record, or data compilation, all as shown by the testimony of the custodian or other qualified witness, unless the source of the information or the method or circumstances of preparation indicate lack of trustworthiness.

If a new storage medium is selected, the EPA must obtain a decision about its legality and establish usage guidelines.

4.12 GENERATE PAPER COPY

The ability to produce a paper copy of the document must be available.

There was universal agreement from the offices and regions that the ability to produce paper copies must be provided. The most frequently cited reason was to be able to respond to information requests (FOIA and other).

Region V wants to keep approximately 1,000 linear feet of very active documents in paper form, to make them available for check-out. Region I wants the ability to obtain paper copies of any of their documents.

Another use of paper copies is to provide a required copy at or near a Superfund site. Although microform can normally be used for this purpose since libraries all over the country usually have microform readers, paper is sometimes required. Paper copies can be transported to any location and no special equipment is required to read paper copies.

The Office of Toxic Substances Toxic Chemical Release Inventory wants the ability to produce a printed copy of any of their documents.

The Procurement and Contracts Management Division responds to many FOIA requests and would like the ability to generate a paper copy of their documents.

The Office of General Counsel (including the Pesticides and Toxic Substances Litigation Division) does not require original documents, simply the ability to generate printed images of the documents as needed.

4.13 ENSURE COST-EFFECTIVENESS

Any automated storage and retrieval system must be cost-effective.

Many users emphasize the need for a cost-effective records management solution. Although they are faced with storage, retrieval, and processing burdens, users are concerned that any automated system would be more costly than they could afford, given limited resources. Several asked whether resources would be available to support acquisition of an automated records management system.

The Office of General Counsel (including the Pesticide and Toxic Substances Litigation Division) indicates that an automated storage and retrieval system would be a viable solution to their records management problems, however it must be cost-effective. They think any automated systems currently available are too labor intensive and costly to implement.

The Office of Pesticide Programs wants an automated system capable of quick, simultaneous multi-user access from standard workstations and which could be integrated with their existing systems. However, it must be affordable and cost-effective.

The Headquarters Operations and Client Services Division strongly stated its need for an automated records management system and asked whether resources would be available to them for the acquisition of an automated storage and retrieval system.

4.14 EXCHANGE INFORMATION

An automated storage and retrieval system must support the exchange of information, either locally or to remote sites.

A number of users indicate that the ability to exchange information, either on a local area network or to remote locations, is critical to their operations.

The Headquarters Accounting Operations Branch provides payroll services for the entire Agency. These services include the processing of time and attendance information and processing payroll information. Currently, the ten EPA regional offices, the Research Triangle Park offices,

and offices in Las Vegas and Cincinnati send time and attendance information to Headquarters for processing.

The remaining Agency financial processing requires the exchange of information from remote locations. The Financial Management Office (FMO) in Research Triangle Park performs financial processing for all Agency contracts and receives information from the ten regional offices, Headquarters, Las Vegas, and Cincinnati. The Cincinnati office processes all Agency Interoffice Agreements and receives information from the other 13 FMOs.

The Office of Pesticide Programs exchanges information between Waterside Mall, a contractor site, and offices in Crystal City. In addition, within the Crystal City building, they require the ability to exchange information using a local area network.

The National Enforcement Investigations Center (NEIC) indicates that an automated storage and retrieval system would be most effective if they could share information with the EPA regional offices.

The regions indicate there was little information exchange among regions for Superfund site files, although information exchange within a region may be important and is not always possible currently. For personnel, payroll, and NEIC applications, it appears that an automated storage and retrieval system should support information exchange. There are probably other applications not identified in this study for which regional information exchange is required.

SECTION 5 - STATEMENT OF TECHNICAL OPTIONS

The technologies considered for document storage are microform and optical disk. These are considered optical storage media because they store miniaturized pictures or images of documents. Microforms include microfilm and microfiche. Optical disks include CD-ROM and WORM disks.

These optical media are appropriate for storage of documents which contain handwriting, drawings, and other information which could not be easily reproduced by typing text into a computer. Storage and subsequent retrieval of information contained on optical media requires the use of specialized equipment.

These technologies are described, in detail, below.

5.1 MICROFORM

Microforms store photographic images on rolled or flat card film. Microforms are similar media that include microfilm and microfiche. Microfilm stores images on a roll of film; microfiche stores images on a flat film card.

Microforms have been in use for years. The first microphotograph was produced in 1853. Since that time, microforms have evolved and are now used on a daily basis in many types of businesses and industries. People all over the country are familiar with this technology.

Microforms are easy to copy and mail. Therefore, they are an easy and efficient method of providing information to users that are not located in the immediate area, as long as they have access to a reader. Most public libraries throughout the country have at least one microfilm or microfiche reader available for public use.

5.1.1 Microfilm

Microfilm is available in several formats. The most popular film widths are 16mm and 35mm. Film is also available in 70mm and 105mm widths. All film widths can be mounted on an open reel, and the 16mm and 35mm widths can also be contained in cartridges or cassettes. Cartridges and cassettes are used to provide protection for the film and make it easier to handle. Some cameras use the cassettes for undeveloped film; for others open reel film must be used.

Training is required to process microfilm, even for highly automated systems. Documents must be prepared and photographed, then processing involves developing and duplicating the film. It may also involve loading cartridges, cassettes, or microfilm jackets, and indexing.

5.1.1.1 Preparation

The first step in creating microfilm is document preparation.

Microfilming documents before they have been handled extensively can result in faster and easier preparation, and a better microfilm image. The easiest documents to film are those that have a high contrast level between the background and printed information.

The amount of handling a document has experienced before being photographed can affect the quality of the microfilm image. Tears, stains, and other damage related to document handling can be just as obvious on the film image as they are on the original document. Repairs should be made, if possible, before filming.

The contrast level of a document can also affect the quality of the microfilm image. Faded documents or documents with a colored background and/or nonblack ink may require special techniques to be used during photography; sometimes, a good image cannot be obtained.

To redact (block out) confidential information on a document, a paper copy of the document must be made. The copy is then altered by inking out or covering the confidential information before photographing.

Documents are easiest to process when batched or grouped. Once batched, all staples, clips, and bindings must be removed from the documents.

5.1.1.2 Creation

Each page of a document is photographed, in sequence, onto microfilm. Remaining documents in the batch are processed, also in sequence. If microfilm cassettes are used, they may be removed before they are full and reinserted at a later time. This allows related documents to be stored on the same roll of microfilm.

If a nonredacted copy of a document that contains confidential information is filmed, it should be filmed onto separate rolls of microfilm because of the lack of control over what information on a roll of microfilm is accessed.

After photographing is complete, the documents must be reassembled and stored. All documents should be retained until the quality of the microfilm image is determined to be acceptable.

Developing or processing the film is usually an automated process which can be done in normal room lighting. Output speeds of the processors vary considerably.

Developed microfilm of any size can be mounted on an open reel. If 16mm or 35mm film is used, it may be loaded into a cassette or cartridge, or cut into short strips and loaded into microfilm jackets.

Microfilm jackets are composed of two clear sheets of plastic separated into 16mm or 35mm channels. Cut strips of microfilm are inserted into these channels.

Often the "master" film produced from photographing the documents is retained on an open reel and stored as an archival copy that is not handled except for duplication.

5.1.1.3 Image Quality

The image quality of microfilm will depend in part on the type of film used and its properties. Over time, the image can deteriorate from the use and handling the film is subjected to.

Three types of film used for microfilming are silver halide, diazo, and vesicular films. Silver halide film is used for source document filming and production of duplicates. Diazo and vesicular films are used for making duplicate microfilms.

Properties of the films used affect the clarity of the microimage. Qualities to consider are film speed, resolving power, granularity, and density.

Film speed is an indication of sensitivity to light. The higher the rating number, the faster the film, and the more sensitive it is to light. High speed film is required for use in some types of microfilming cameras because a short exposure time is necessary. This short exposure time can result in a microimage that is not equal in quality to the original source document because of a grainy appearance and lack of detail.

Resolving power refers to the ability to record fine detail. It is measured in terms of lines per millimeter. The higher the resolving power, the more detailed the image that can be recorded on the film. Films with a higher resolving power can produce a superior microimage.

Granularity is a measure of coarseness of the grain. The higher the value of granularity, the lower the quality of the microimage. When a microimage is magnified for viewing or paper copy production, it will appear more grainy.

Density indicates the degree of contrast that can be produced. The greater the density, the greater the contrast and the sharper the microimage. The perfect density for a master film used to produce copies may be different from the ideal density of a film for viewing and printing.

The image can be affected by use and handling of the microfilm. Handling of film, for viewing or duplication, causes deterioration. This is especially true for open reel microfilm, which is more subject to fingerprints and tears than film housed in a cartridge or cassette. For any microfilm, a tiny particle of dirt in a reader can cause marks across several images as the film is scrolled.

5.1.1.4 Capacity

The most common microfilms used are 16mm or 35mm films with a simplex orientation. Using the simplex mode, a single row of sequential images is created down the length of the film.

Microfilm, for these applications, can store 2,500 - 3,000 images of 8.5 by 11 inch documents per cassette or roll of film. The images are stored in the order they were photographed onto the film.

5.1.1.5 Updatability

Because of its sequential nature, microfilm is not easily updatable. This can make it hard to work with, but also provides a security advantage because it is relatively safe from unauthorized insertions or changes.

Outdated information contained on microfilm can be spliced out and insertions can be spliced into a microfilm. This is a time-consuming process and affects the durability of the film.

Updatable microfilm has been developed, but its use is normally restricted to microfiche.

Microfilm jackets allow the records to be updated by simple removal/insertion of the cut microfilm strips. The jackets are very time-consuming to maintain, so typically only a master microfilm is maintained in a jacket, and the jacket is not available for general use. Instead, microfiche is produced from the jacket and used for retrieval.

5.1.1.6 Duplication

Once developed, the original microfilm becomes a "master" that can be copied. Microfilm of any size can be duplicated to create another roll of microfilm.

When film is duplicated, sharpness of image is lost. Sharpness of image is measured using resolution chart patterns. Normally, with each generation of duplication one resolution chart pattern is lost. This means that a film created by duplicating an original master film will lose one resolution

chart pattern. If this film is in turn used as a master, another resolution chart pattern will be lost. For most applications, a film should not be used as a master past the fourth generation.

When 105mm roll film is duplicated, the duplicate roll is often cut into microfiche. The 16mm and 35mm microfilm can be cut and inserted into microfilm jackets for use as a master for creating microfiche. Microfiche can be created from the jacket by using a suitable fiche-to-fiche duplicator.

5.1.1.7 Storage

Storage conditions affect the life of microfilm. This is one of the reasons separate archive and working copies are kept of film that must be preserved. The archive microfilm can be stored under ideal conditions and not used for everyday retrieval.

Standards exist for archiving microfilm, as established by the National Bureau of Standards. Both microfilm and microfiche can be prepared to archival standards. The expected archival life of properly developed and stored black and white film is over 100 years. The National Archives and Records Administration (NARA) has accepted microform for long-term storage.

Storage conditions for archival film include storage in a clean well-ventilated room with filtered air. The temperature for black and white film must remain below 70 degrees Fahrenheit and the humidity must be maintained between 30 and 40 percent.

Dry process microfilm and other microfilm not produced or maintained to archival standards will have a shorter useful life, averaging approximately 25 years.

5.1.1.8 Indexing

Documents stored on microfilm can be indexed.

This can be done by photographing a unique page number or code as part of the image of each page. An index is then created linking the identifiers for the microfilm and page to the document name. The inclusion of bibliographic information and keywords (identifying the contents and/or subject of the document) in the index can be helpful.

Indexes are usually created and used on computers, which means the purchase of additional hardware and software in addition to the standard microfilm equipment. For large document collections, automated indexes, if well designed, can speed up identification and retrieval of documents.

5.1.1.9 Retrieval

Microfilm is read by inserting the film or cassette in a reader and advancing to the desired document. Manual procedures are usually used to find the correct reel or cassette and place it in a reader, perhaps aided by an automated index.

With reel film, the film must be manually threaded through the reader. Cartridges or cassettes, used with the appropriate microfilm readers, allow the microfilm to be viewed without the microfilm being handled. After the cassette/cartridge is placed in the reader, it is automatically threaded.

Document images are projected on a screen in front of the user. The user must progress sequentially through the pages recorded on the film to locate the desired information. Given that up to 3,000 images may be stored on each cassette, it may take several minutes to reach the desired document. When finished, the microfilm must be rewound and refiled. If a cassette/cartridge system is used, the film is automatically rewound.

Microfilm does not allow multiple users to read the same document, or any other document stored on the same film, at one time. Multiple copies of the film can be made, but each person that needs access must have a copy of the microfilm and a reader.

5.1.1.10 Paper Copies

Paper copies can be made from microfilm.

Printers which are designed for this purpose are usually combined with the microfilm readers. These printers often produce copies which fade over time, so recopying the original paper copy may be necessary.

5.1.2 Microfiche

Microfiche is a flat sheet or card of microfilm. It is available in various sizes, but the 148mm by 105mm size (approximately 6 by 4 inches) is the National Micrographics Association (NMA) standard, which supersedes the Council on Scientific and Technical Information (COSATI) standard that was mandatory for all Federal agencies.

As with microfilm, training is required to process microfiche. The most common methods of producing microfiche are to prepare and photograph documents, duplicate microfilm jackets, or duplicate an existing microfiche.

5.1.2.1 Preparation

Preparation of microfiche is identical to the preparation of microfilm, described in Section 5.1.1.1 of this document.

5.1.2.2 Creation

Creation of microfiche is identical to the creation of microfilm, described in Section 5.1.1.2 of this document.

5.1.2.3 Image Quality

The image quality of microfiche identical to that of microfilm, described in Section 5.1.1.3 of this document.

5.1.2.4 Capacity

Microfiche contains multiple images arranged in a grid pattern. For storage of 8.5 by 11 inch documents, NMA standards call for a grid of 98 frames on a 148mm by 105mm fiche. Frames are arranged in seven horizontal rows with 14 frames contained in each row.

Larger documents can also be accommodated using a different grid format.

5.1.2.5 Updatability

Standard microfiche cannot be updated. This can make it hard to work with, but also provides a security advantage because it is safe from unauthorized insertions or changes.

A type of updatable microfiche has been developed, allowing new images to be added to existing fiche. This is accomplished by exposing and processing one or more individual grid positions on the "master," rather than the entire microfiche.

Techniques are available that allow an existing image to be erased from the master film and replaced with an updated image in the same physical location. A preferable technique is to void the existing image and place the new image in an unused area of the master fiche. This method saves the old image for audit trail and file integrity purposes.

To void an old image, it must be marked to indicate that it has been superseded, but still remain readable. This is easily accomplished by manually placing a colored dot on the old image

using a magic marker. When a user sees a marked image, they need to search through the following images for the superseding image.

When changes are frequent, or extensive, multiple microfiche may be needed to contain updates.

5.1.2.6 Duplication

Once developed, the original microfiche becomes a "master" that can be copied to produce microfiche or continuous roll microfilm containing microfiche images.

When film is duplicated, sharpness of image is lost. Sharpness of image is measured using resolution chart patterns. Normally, with each generation of duplication one resolution chart pattern is lost. This means that a film created by duplicating an original master film will lose one resolution chart pattern. If this film is in turn used as a master, another resolution chart pattern will be lost. For most applications, film should not be used as a master past the fourth generation.

Continuous roll microfilm containing microfiche images can be duplicated to create another roll of microfilm. This duplicate roll can then be cut into microfiche.

Duplicate microfiche can be produced using a fiche-to-fiche duplicator.

Microfiche can be created from a microfilm jacket by using a suitable fiche-to-fiche duplicator.

Individual microfiche can also be used to create 105mm continuous roll microfilm using a fiche-to-roll duplicator.

5.1.2.7 Storage

Storage conditions affecting the life of microfiche are identical to those for microfilm, described in Section 5.1.1.7 of this document.

5.1.2.8 Indexing

Documents stored on microfiche can be indexed.

An area at the top of each microfiche card is reserved for identification information. This information is printed in type large enough to read without magnification. Title lines and fiche

sequencing numbers may be placed in this area, which may be color-coded.

NMA standards provide for a grid index of the contents of the microfiche. Each row is alphabetically identified from top to bottom, beginning with "A," and each column is numerically identified from left to right, beginning with "1." The grid code can be photographed as part of the image of each page.

An index of the information contained on the microfiche, referencing the grid code, can be placed on the microfiche itself. A user would select a fiche based on the identifying information at the top of the fiche, then look at the index contained on the fiche to determine which grid they wish to view. For small document collections, this may be sufficient.

For larger document collections, a separate index can be created linking the identifiers for the microfiche and the grid location to the document name. The inclusion of bibliographic information and keywords (identifying the contents and/or subject of the document) in the index can be helpful.

Indexes are usually created and used on computers, which means the purchase of additional hardware and software in addition to the standard microfiche equipment. For large document collections, automated indexes, if well designed, can speed up identification and retrieval of documents.

5.1.2.9 Retrieval

Microfiche is read by inserting the fiche into a reader and locating the desired document. Manual procedures are used to find the correct microfiche and place it in the reader, perhaps aided by an automated index.

Microfiche readers are mechanically simpler than microfilm readers. The microfiche is placed between two horizontal glass plates in the reader. These glass plates can be moved by the user to pass individual images stored on the microfiche over the light source, projecting them on the screen for viewing. When finished, the microfiche must be removed and refiled.

Microfiche does not allow multiple users to read the same document, or any other document stored on the same fiche, at one time. Multiple copies of the fiche can be made, but each person that needs access must have a copy of the microfiche and a reader.

5.1.2.10 Paper Copies

Paper copies can be made from microfiche.

Printers which are designed for this purpose are usually combined with the microfiche readers. These printers often produce copies which fade over time, so recopying the original paper copy may be necessary.

5.2 COMPUTER OUTPUT MICROFORM

Computer output microfilming is defined by the National Micrographics Association (NMA) as a method of converting data from a computer into human-readable language on microfilm.

The computer output can be produced on microfilm without first being printed on paper. Electronic machine-readable data is accepted as input to a computer output microform (COM) unit, normally from magnetic tapes. The COM unit converts the data to human-readable information and stores it on microfilm.

COM units can produce microfilm in 16mm, 35mm, 70mm, and 105mm widths, either as continuous roll microfilm or microfiche. Some units can produce more than one width of film. The most widely produced COM formats are 16mm continuous roll microfilm that has been loaded into cartridges and microfiche.

Several methods are used to create an image on microfilm, but more recent developments use a laser beam to record information on dry silver film. Other systems use microfilm which requires standard processing.

Dry silver film is developed with heat right in the COM unit and requires no further processing. This type of film has a life of approximately 25 years when stored according to standards.

Unlike microfiche produced from photographing source documents, there is no single standard format for microfiche produced on a COM unit. The grid index standards are the same for microfiche produced using either method.

The updatability, duplication, and storage of COM-produced microfilm or microfiche would be the same as for microfilm or microfiche produced from photographing source documents.

COM units can incorporate indexing techniques during the creation of the microfilm or microfiche. Indexing techniques can be used for manual or automated retrieval systems. Common methods used include index frames, flash targets, bar coding, blips, and optical coding.

In addition to alphanumeric data, some COM units are capable of producing business graphics, which are graphic representations of statistical data. This requires more sophisticated hardware and software.

5.3 COMPUTER AIDED RETRIEVAL

The term "computer aided" can be applied to a vast array of techniques for automating part or all of the retrieval process. Anything from a simple, automated index to a sophisticated videomicrographic enhancement system can be considered in this category.

The goal of this technology is to speed up retrieval of information. The degree to which this goal is accomplished is dependent on the level of technology selected and the design of the system.

Computer aided retrieval is generally reserved for large document collections because of the expense involved in automation. Generally, the more sophisticated and automated the system, the more it will cost. The more sophisticated microfilm systems can be as expensive as an optical disk system.

5.3.1 Computerized Index

For a simple system, an index code is developed to uniquely identify a roll of film or a fiche and each image contained on the film. This index code is filmed as part of each image on the film.

Information about each document is entered into a computerized data base for subsequent reference. This information would include the index code, bibliographic information, and possible keywords to identify the contents and/or subject of the document.

To retrieve information stored on microform, a user would determine which roll or fiche they wanted to view by inquiry into the data base. The film or fiche would be manually selected and inserted into a reader. The user would manually advance the film to the appropriate image.

A more advanced system of this type that can be used with continuous roll film would use microfilmers and readers that automatically encode the index mark onto the film or track the number

of the image. This allows the reader to automatically advance the film to the proper image for viewing.

5.3.2 Automated Display Systems

Automated microform display systems are available that consist of a microcomputer with a film "juke box." These programmed systems combine the advantages of a computerized index with the ability to select, load, and display stored microform images based on selection information and commands entered by the user, without the user ever handling the microform.

For these systems, each user needs a complete microform juke box file, an intelligent microimage terminal, and a CRT screen.

5.3.3 Videomicrographic Enhancement

With videomicrographic enhancement, only one central microfilm juke box file is needed. As with automated display systems, the rolls of microfilm are selected and loaded by robotics operating under computer control, based on selection information and commands entered by the user.

The microfilm image is presented to a charge coupled device (CCD) scanner which digitizes it. This digitized image can be made available to any number of workstations attached to a local area network (LAN).

5.4 OPTICAL DISK

Optical disks store digitized images on disks made of various materials. Two types of optical disks that are available are compact disk/read-only memory (CD-ROM) and write once read many times (WORM) disks. These two types of optical disks differ significantly in the way they are created and in their ability to be updated. These differences represent a clear distinction between CD-ROM and WORM.

Optical disks are related to compact disks (CDs), which have become a popular way of recording music. Many people are familiar with the plastic compact disks with the mirror-like surface and the compact disk players connected to stereo systems. Optical disks and drives (players) are similar, but they are designed to work with computers.

Optical disks have been available since the 1970s. Until recently, many available products lacked promised capabilities. Now, promises have matured into viable products.

Information can be stored on optical disk using either facsimile format or the American Standard Code for Information Interchange (ASCII) format. Using either format, information is stored as digital data.

Generally, when data is stored in fax format, what is stored are the sequences (coordinate locations) of '0' (white or space) and '1' (black or line) bits of a character, much as coordinates on a video screen are described for bit-mapping. Storing data in facsimile format, however, involves storing the sequences of the '0' and '1' bits on optical disk. The facsimile format of storing data on optical disk by specifying these sequences is what enables text, handwriting, diagrams, maps, photos, and any other type of image to be stored.

Data stored in facsimile format can be compressed into CCITT Group 3 and CCITT Group 4 formats. These formats define scan resolutions and a data compression algorithm for each format. The CCITT Group 4 format is the most recent and uses a more efficient data compression algorithm than CCITT Group 3 format.

When data is stored in ASCII format, a single character is represented by 7 bits. This 7 bit representation of a character requires less storage space than its comparable facsimile format sequence representation. However, there are only 128 ASCII characters, which means only 128 alphanumeric and special characters can be represented in ASCII. For this reason, data storage in ASCII format cannot support handwriting, diagrams, maps, photos, and other non-alphanumeric or special character images.

Optical disk storage is a significant technology that offers storage capacities far beyond those available using any other media.

5.4.1 CD-ROM Optical Disks

Like CDs, CD-ROM disks are read-only disks with a multi-layered sandwich construction. The outside layers of a CD-ROM disk are transparent plastic; inside, there is a layer of reflective material.

Mastering and production guidelines exist for CD-ROM disks and a standard format has been agreed upon by key vendors in the market. The existence of these standards allows information to be read from the disk in the same way, regardless of the host computer or operating system.

CD-ROM is most often used for storage and mass distribution of information that doesn't readily change, such as reference and bibliographic/index information. CD-ROM does not support

on-going addition of information. Rather, it is a method of storing and distributing information that is unlikely to change, for use by large numbers of people.

Storing documents on a CD-ROM disk involves document conversion and/or preparation, writing the prepared information to magnetic tape, creating a master disk from the magnetic tape, and finally pressing the CD-ROM disks. This mastering and duplication process takes several days to complete.

5.4.1.1 Preparation

Printed documents must be converted to electronic storage. This can be accomplished by keying in the data or scanning the documents. Keying in or scanning documents is easiest when a clean, clear copy is provided that has a high contrast level between the background and printed information.

To key in documents, they must be readable. Once the data is entered, it must be proofread carefully. The type of data that is recorded is restricted by the type of information that can be keyed in.

For scanning, all staples, clips, and bindings must be removed from the documents. Tears, stains, and other damage related to document handling should be repaired, if possible, before scanning.

One of the methods used to control access to confidential information in CD-ROM systems involves storing two copies of the document, one redacted copy and one complete copy. When keying in documents, a redacted copy can be created by not entering the confidential portions of a document. For scanning, a redacted paper copy may be scanned, or processing software may allow redaction of a document as it is viewed on a video screen after scanning.

Documents stored electronically on magnetic tapes or floppy disks can be processed without first being printed on paper, if the processing hardware is capable of reading information stored on the media. This may save some preparation time.

Documents need to be formatted into a standard page format and organized for storage on CD-ROM disks. Index information must be created for use in retrieving the information.

Access to confidential information could be controlled by retrieval software; however, this method, used alone, does not provide good security. It would also be necessary to ensure that retrieval is only attempted on computer systems with the proper retrieval software. Information is

stored on the disk in a standard format, allowing the disk to be read on any computer system with the necessary hardware and software.

A more secure method of controlling access to confidential information stored on a CD-ROM disk is to store documents containing confidential information on separate disks and restrict access to those disks.

Once stored electronically, organized, and indexed, the documents are written to a magnetic tape. This tape is used for creation of the master disk.

5.4.1.2 Creation

A CD-ROM disk is created by producing a master disk and then pressing copies, much as a phonographic record is pressed. The creation of the master is an automated process which accepts information contained on a magnetic tape for input. All information to be recorded on the master disk, and subsequent copies, must be placed on the master disk at one time. CD-ROM does not support incremental addition of information. Once the CD-ROM disk is pressed, it cannot be changed or added to.

The developers of CD-ROM specified strict mastering and production guidelines. A "High Sierra" standard format was announced in 1987, when key vendors in the market agreed on standards for the arrangement of information on the disk.

Master disks are expensive to manufacture, costing several thousand dollars to produce. The data preparation phase is usually the most expensive, costing tens of thousands of dollars. This cost can vary considerably depending on the format, amount of standardization, and recording media of the documents to be prepared. The actual mastering process usually costs between two and four thousand dollars. After the master is produced, copies are relatively inexpensive.

Pressing copies of the master disk is also an automated process. This process records information on the CD-ROM disk by creating pits in the reflective tracks.

5.4.1.3 Image Quality

The quality of a facsimile image will depend on the number of dots per inch (dpi) recorded by the scanning equipment and the number of dpi displayed by retrieval equipment.

For facsimile data, the number of dpi recorded is a limiting factor in the quality of image that can be displayed. For this reason, users that plan on upgrading their retrieval equipment in the

future often scan at a higher dpi density than their current retrieval equipment will display. This provides the advantage of a higher quality image when the display equipment is upgraded.

For information stored in the ASCII format, the number of dots per inch displayed by retrieval equipment will be the most important determinant of the image quality.

The fact that information is stored digitally is advantageous because the quality of the image is maintained when duplicate disks are produced. The data can be copied indefinitely with no degradation of the image.

5.4.1.4 Capacity

Large quantities of information can be placed on a CD-ROM disk, but a disk does not have to be filled to capacity. Using ASCII format, standard 5.25 inch disk can store up to 600M bytes of data, or 200,000 pages of documents (at 3,000 bytes per page). Using facsimile format, a standard 5.25 inch disk can store about 8,5000 pages of documents (at 70,000 bytes per page).

5.4.1.5 Updatability

To make a change, a new master disk must be created and new copies pressed. Master disks and pressed copies cannot be updated.

CD-ROM disks are pressed from a master disk; therefore, all information must be placed on the master disk before copies are pressed. Disks cannot be incrementally updated to add information. Once a master disk is generated, no alterations can be made.

5.4.1.6 Duplication

CD-ROM disks are always produced by creating a master and then pressing copies from the master.

Although a pressed CD-ROM disk cannot be used as a master disk, it can be used to recreate the master magnetic tape. This tape can then be used to create another master disk.

The production of a master disk is expensive, although pressing copies is relatively inexpensive. This cost breakdown generally makes CD-ROM unsuitable for small runs, but cost-effective for wide distributions of large volumes of information. Usually, at least one thousand CD-ROM disks are pressed from each master disk.

5.4.1.7 Storage

CD-ROM disks can be stored in normal room conditions without detriment to the media. They are unaffected by humidity, and will not mildew. Reasonable temperatures are tolerated; however, they should not be subjected to temperatures high enough to cause softening or melting of the plastic layer.

Electromagnetic damage experienced with magnetic storage media such as floppy diskettes or hard Winchester disks is not a problem experienced with CD-ROM disks.

CD-ROM disks last at least ten years. Some manufacturers are projecting a 20-year life for the disks.

5.4.1.8 Indexing

During document preparation, index information is entered to facilitate retrieval. The types of index information entered during document preparation will affect the features that can be provided by the retrieval software.

Features that may be provided by the retrieval software include the capability to identify or locate documents using bibliographic information, reference information, or keywords that identify the contents and/or subject of the document.

5.4.1.9 Retrieval

Software must be written or purchased to gain access to information stored on a CD-ROM disk. This software normally includes a user interface and retrieval capabilities. The ease of use and speed of retrieval will be affected by the software written or selected.

To view a document stored on a CD-ROM disk, a user would go to a microcomputer workstation that either has a CD-ROM drive or is connected to a network with access to a CD-ROM drive. Using the retrieval software, the user would identify the document they want to view.

If software is used to control access to confidential information stored on a CD-ROM system, the user may be required to enter a password or some type of identification before they are allowed to view the confidential document.

Once the document is identified, the storage location is known and the drive can reach the correct storage point on the disk in a fraction of a second. The CD-ROM drive uses a laser beam

and light detector to retrieve information recorded on the disk. The document is then displayed for the user.

CD-ROM juke boxes that hold multiple CD-ROM disks are available. These juke boxes select and robotically load disks into drives based on selection information entered by the user. Juke boxes can be connected to a single workstation or a network.

Since CD-ROM capabilities can be connected with a network, and multiple workstations can use a network, multiple persons can access a disk, and even the same document, at the same time. If dial-up access is allowed to the network, users at remote sites could view the documents.

5.4.1.10 Paper Copies

Paper copies can be produced on printers connected to the workstation or network, if the software allows this capability.

5.4.2 WORM Optical Disks

WORM disks can be written once and read many times. The entire disk does not need to be written at one time; information can be added incrementally. This characteristic is a primary distinction between CD-ROM and WORM. With WORM, once information is written to a disk, it cannot be erased or written over, however a changed version may be written to the disk. With CD-ROM, users are unable to add any information to the disk.

A WORM disk consists of a three-layered sandwich and an airspace. The outside layers are either glass or plastic; the inside layer is a reflective surface. They are available in sizes of 5.25 inches, 8 inches, 12 inches, and 14 inches.

A major application for WORM technology is document storage. Electronic document storage systems are being used to speed the flow of information in paper-intensive industries. Since stored data cannot be erased, WORM is also ideal for archiving and backup purposes.

Storing documents on a WORM disk involves converting printed documents to electronic storage, indexing, and writing the information to the disk.

5.4.2.1 Preparation

Printed documents are scanned to convert them to electronic storage. Preparing documents for scanning involves removing staples, clips, or bindings, and repairing any damage resulting from document handling. Scanning documents is easiest when a clean and clear document is provided that has a high contrast level between the background and printed information.

Individual pages of a document are passed through a scanner, which digitizes the image. Documents may be passed through a scanner one page at a time, or multiple pages can be scanned by loading them into a feeder.

Using a workstation connected to the scanner, the operator verifies that the scanned image is acceptable and enters indexing information. The operator may also denote confidential sections of the document.

One of two methods used to control access to confidential information stored on a WORM system involves storing two copies of the document, one redacted copy and one complete copy. A redacted paper copy may be scanned or processing software may allow redaction of a document as it is viewed on a video screen after scanning.

The other method uses more sophisticated retrieval software to redact confidential information from the one stored copy of a document as it is displayed. In this case, processing software must allow flagging of confidential information as it is viewed on a video screen after scanning.

Information stored electronically on magnetic tapes or floppy disks can be processed for storage on WORM disks if the processing hardware is capable of reading information stored on the media.

Hardware is available that allows information existing on microfiche to be digitized and stored on WORM disks without first being printed on paper.

Once the information is prepared, it is written to a WORM disk using a WORM drive.

5.4.2.2 Creation

Several techniques are used to record data on a disk. The techniques all use a laser to record the data on disks, but the materials used to compose the disks can vary with each technique. The techniques are ablative, bimetallic alloy, bubble forming, and dye polymer.

Using the ablative method, the laser creates small pits on the metal alloy surface to record information. Disks created using this method last about ten years.

The bimetallic alloy method, a variation of the ablative approach, employs the laser to heat two metallic layers, causing them to fuse. The developer of this method claims disks created in this manner will last 100 years.

Forming bubbles to record data is accomplished by using the laser to heat a layer in the disk, causing decomposition. It is this decomposition which forms a bubble.

The least expensive method of recording data is the dye polymer method. A dye polymer layer in the disk is heated by the laser, causing a change of color. These disks last about five years.

Regardless of the method used to record data, it is stored on the disk using either a sequential or linked file structure. The best file structure for an application must be determined by considering factors specific to the application, such as the frequency of update and required retrieval time frames. Once stored, the original image cannot be changed, but files can be updated either by adding new images or by storing modified versions of existing images.

To date, the proliferation of WORM technology has been hampered because of a lack of technical standards. Standards are now being set. Some WORM drives now available conform to the emerging standard which the American National Standards Institute (ANSI) is developing for optical disks. The standard is now under review by the International Organization for Standardization.

5.4.2.3 Image Quality

The image quality of a WORM optical disk is identical to that of CD-ROM, described in Section 5.4.1.3 of this document.

5.4.2.4 Capacity

WORM disks hold large amounts of data. They are available in sizes of 5.25 inches, 8 inches, 12 inches, and 14 inches. Using ASCII format, an 800M byte, 5.25-inch WORM disk can store up to 260,000 pages of documents (at 3,000 bytes per page). One 2,000M byte, 12-inch disk can store up to 650,000 pages. Using facsimile format, a 5.25 inch 800M byte WORM disk can store 11,400 pages of documents (at 70,000 bytes per page). A 12-inch WORM disk can store 28,500 pages in facsimile format.

Document storage systems normally use the larger size disks because of their higher capacity. These systems may also use a disk juke box, which provides access to several disks.

5.4.2.5 Updatability

Updating information that exists on a WORM disk is accomplished by adding the new information to the disk, therefore superseding the previous version of the information.

If information is stored on the disk using the sequential file structure, the entire file is rewritten. This is the simplest method, but may waste disk space if only minor changes are made to documents.

The linked structure requires only the sectors (portions of data recorded on the disk) changed to be rewritten, and a pointer to the updated sector is written. The linked structure conserves disk space, but will increase retrieval time for documents that are changed frequently.

The fact that information cannot be erased or written over once written to a WORM disk provides the benefit of preserving an unalterable record of the original document and subsequent changes.

5.4.2.6 Duplication

Information on WORM disks can be copied directly to another WORM disk. This makes them an attractive alternative to CD-ROM disks when smaller numbers of disks are to be distributed.

Information stored on WORM disks can also be used to create magnetic tapes.

5.4.2.7 Storage

WORM disks can be stored in normal room conditions without detriment to the media. They are unaffected by humidity and will not mildew. Reasonable temperatures are tolerated; however, if plastic disks are used, they should not be subjected to temperatures hot enough to cause softening or melting of the plastic layers.

Electromagnetic damage experienced with magnetic storage media such as floppy diskettes or hard Winchester disks is not a problem experienced with WORM disks. They are almost invulnerable to corruption, short of fire or vandalism.

5.4.2.8 Indexing

During document preparation, index information is entered to facilitate retrieval. The types of index information entered during document preparation will affect the features that can be provided by the retrieval software.

Features that may be provided by the retrieval software include the capability to identify or locate documents using bibliographic information, reference information, or keywords that identify the contents and/or subject of the document.

5.4.2.9 Retrieval

Software must be written or purchased to gain access to information stored on a WORM disk. This software normally includes a user interface and retrieval capabilities. The ease of use and speed of retrieval will be affected by the software written or selected.

To view a document stored on a WORM disk, a user would go to a microcomputer workstation that either has a WORM drive or is connected to a network with access to a WORM drive. Using the retrieval software, the user would identify the document they want to view.

If software is used to control access to confidential information stored on a WORM system, the user may be required to enter a password or some type of identification before they are allowed to view the confidential information.

Once the document is identified, the storage location is known and the WORM drive can reach the correct storage point on the disk in a fraction of a second. The WORM drive uses a laser beam and light detector to retrieve information recorded on the disk.

If no confidential information is contained in the retrieved document, or if a user is authorized to view confidential information, the complete document is displayed. If software is used to redact a document as it is displayed and a user is not allowed to view confidential information, then only the portions of the document that are not confidential are displayed.

Juke boxes that hold multiple WORM disks are available. These juke boxes select and robotically load disks into drives based on selection information entered by the user. Juke boxes can be connected to a single workstation or a network.

WORM, like CD-ROM, can be used over a network with multiple stations. This allows multiple persons to access a disk, and even the same document, simultaneously. If dial-up access is provided on the network, users at remote sites could view the same documents.

5.4.2.10 Paper Copies

Paper copies of documents can be produced on printers connected to the workstation or network, if the software allows this capability.

SECTION 6 - COMPARISON OF FUNCTIONAL REQUIREMENTS AND TECHNICAL OPTIONS

This section provides an evaluation of the ability of paper and each of the optical technologies to fulfill the requirements outlined in the Summary of Functional Requirements.

Each requirement, the ability of each storage method to fulfill the requirement with a basic system, and technical options are evaluated. In their ability to address the requirements identified in the interviews, there is only one difference between CD-ROM and WORM. This difference is significant, however, allowing WORM to respond to more identified requirements. WORM supports incremental addition and update of data stored on the optical disk; CD-ROM does not. Although further analysis is required, several interviewees indicated the ability to update records was required. Exhibit 6-1 summarizes the ability of each technology to meet the identified requirements.

The level of automation can have a major impact on the retrieval of stored information. Functions that affect retrieval of information that can be automated include indexing, controlling access to confidential information, retrieval, check-in/check-out, and refiling.

For the purpose of this evaluation the definition of a basic system and of additional options are described below. The level of automation attained with each system is also described.

PAPER

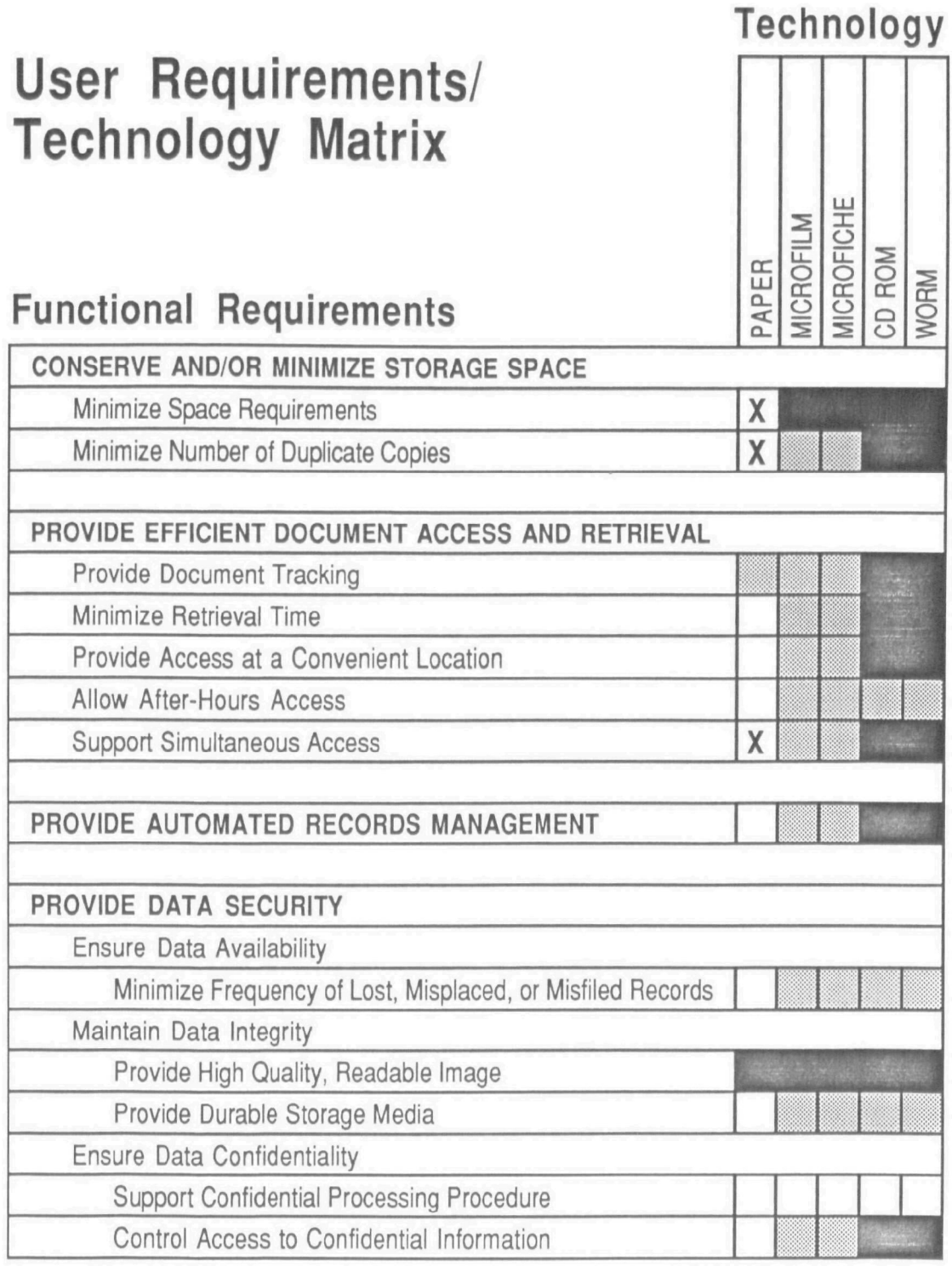
A basic paper document storage system is a totally manual system.

Equipment for this system includes file folders, filing cabinets, notebooks, binders, and boxes.

Central file room personnel are responsible for controlling access to confidential information, retrieval, check-in/check-out, and refiling of the documents. This method of records management is very labor intensive.

Optional equipment available to automate indexing, assist with check-in/check-out, and assist with access control includes microcomputers with appropriate software and bar code equipment.

User Requirements/ Technology Matrix

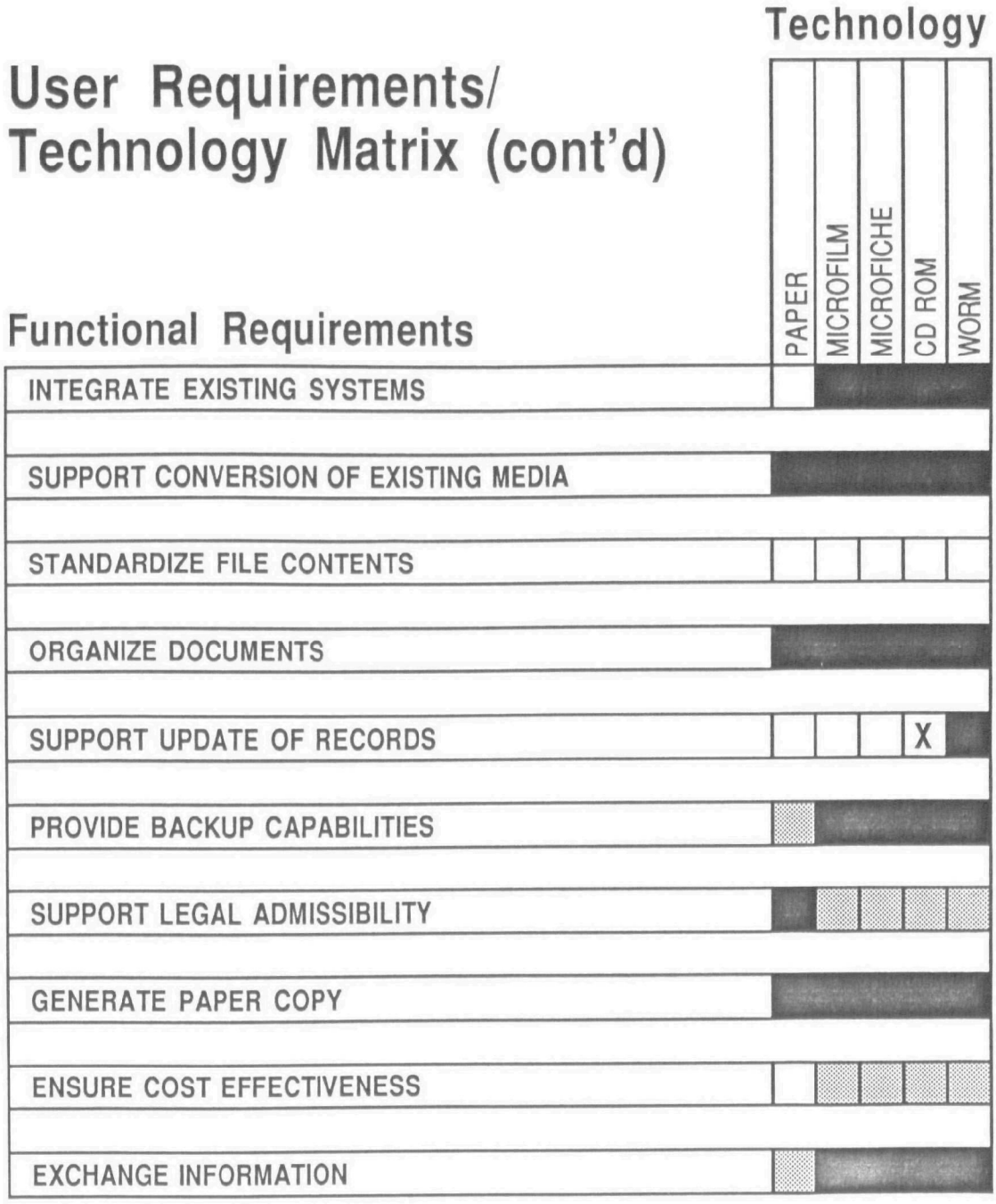


LEGEND

- X — Not Possible
- Unlikely to Meet Requirement
- Somewhat Able to Meet Requirement
- Likely to Meet Requirement

Exhibit 6-1

User Requirements/ Technology Matrix (cont'd)



LEGEND

- X — Not Possible
- Unlikely to Meet Requirement
- Somewhat Able to Meet Requirement
- Likely to Meet Requirement

Exhibit 6-1

MICROFILM AND MICROFICHE

A basic microform system combines a semi-automated production system with a manual retrieval system.

Production equipment for this system includes film, microfilm cameras, film processors and duplicators, splicing equipment, and readers with printers.

Storage equipment includes rooms with climate and air quality control, racks or cabinets, cassettes, cartridges, reels, and binders.

Retrieval equipment includes readers, and readers with printers.

Central file room personnel are responsible for controlling access to confidential information, retrieval, check-in/check-out, and refiling of the microforms. Users would be responsible for loading the microform into a reader and locating the desired document.

Optional equipment available to automate indexing, assist with check-in/check-out, and assist with access control includes microcomputers with appropriate software and bar code equipment.

Automated indexing and access control, and the elimination of the need for check-in/check-out, can be provided by a videomicrographic enhancement system. Equipment for this optional system includes videomicrographic enhancement equipment, a network, appropriate workstations, and a printer. To fully automate this system, a juke box is required.

Videomicrographic enhancement systems add many of the same costs incurred with optical disk systems to the cost of a basic microform system.

CD-ROM

A basic CD-ROM optical disk system combines a semi-automated production system with a semi-automated retrieval system.

Production equipment for a CD-ROM disk system includes tape drives and/or printed document scanners, disks, mastering and pressing equipment.

Storage equipment includes a file or cabinet for storage of disks.

Retrieval equipment includes microcomputer workstations, appropriate software, a network, a CD-ROM drive, and a printer.

Central file room personnel are responsible for retrieving, loading, and refiling disks. Indexing and access control is automated and the need to check out documents is eliminated.

Optional equipment available to fully automate retrieval includes a disk juke box.

WORM

A basic WORM optical disk system combines a semiautomated production system with a semiautomated retrieval system.

Production equipment for WORM disk systems includes disks, microcomputer workstations with appropriate software, a printed document scanner, and a WORM drive. These workstations may also be used for retrieval of information.

Storage equipment includes a file or cabinet for storage of disks.

Retrieval equipment includes microcomputer workstations, appropriate software, a network, a WORM drive, and a printer.

Central file room personnel are responsible for retrieving, loading, and refiling disks. Indexing and access control is automated and the need to check out documents is eliminated.

Optional equipment available to fully automate retrieval includes a disk juke box.

6.1 CONSERVE AND/OR MINIMIZE STORAGE SPACE

6.1.1 Minimize Space Requirements

The volume of documents stored on paper can be reduced by using any of the optical storage media. In the following paragraph, a comparison is made of the ability of each media to store 2,500 pages of paper.

Storing 2,500 pages of 8.5 by 11 inch paper would require approximately one linear foot os storage space. In order to store the images of these 2,500 pages one of the following would be required:

- one roll of microfilm
- twenty-six 4 by 6 inch microfiche
- 1.25 percent of a 5.25 inch (600MB) CD-ROM disk in ASCII format and 29.2 percent in facsimile format
- 0.375 percent of a 12 inch (2000MB) WORM disk in ASCII format and 8.75 percent in facsimile format.

The reader will note that if WORM optical disk were chosen to store the 2,500 pages, only a fraction of a 12-inch WORM disk would be required.

WORM optical disk is a very compact storage medium. One 12-inch 2,000MB WORM disk can store 650,000 pages of information in ASCII format. If the same information were stored on a different media, one would require one of the following:

- 260 linear feet of shelf space
- 260 rolls of microfilm
- 6,760 microfiche (4x6 inches)
- 4 CD-ROM disks (5.25 inch, 600MB).

If the information on a 12-inch 2,000MB WORM disk were stored in facsimile format, 28,500 pages could be stored. If the same information was then stored on a different media, one would require one of the following:

- 11.4 linear feet of shelf space
- 12 rolls of microfilm
- 297 microfiche (4x6 inches)
- 4 CD-ROM disks (5.25 inch, 600MB).

6.1.2 Minimize Number of Duplicate Copies

Duplicate copies of documents exist so that more than one person can use the information contained in the document at the same time. The best way to reduce the need for duplicate copies is to make it convenient to use a shared copy. This can be accomplished with videomicrographic enhancement or optical disk systems.

PAPER

With paper documents, sharing one copy is not always possible or convenient. With paper document storage, it will not be possible to substantially reduce duplication.

MICROFILM AND MICROFICHE

With microfilm and microfiche, multiple copies of documents are normally maintained. It is possible to maintain only one copy of information, if a videomicrographic enhancement system is used.

CD-ROM AND WORM

A basic CD-ROM or WORM system has the potential to reducing duplicate copies. A conveniently located workstation can be made available using a network, so that a document can be viewed as quickly and conveniently as if each person had their own copy, thereby eliminating the need for duplicate copies.

6.2 PROVIDE EFFICIENT DOCUMENT ACCESS AND RETRIEVAL

6.2.1 Provide Document Tracking

Tracking documents includes knowing what information is stored and where it is located. An index can provide a reference of what information is stored and where it should be stored.

For information available for check-out, check-in/check-out tracking can indicate if it is available from the central file, or who has it checked out. Because they are cumbersome, manual tracking systems are not considered.

PAPER

For paper storage systems, optional hardware and software must be obtained to provide automated document tracking. With this type of system, an index and check-in/check-out tracking may be provided.

MICROFILM AND MICROFICHE

Microfilm and microfiche are subject to the same treatment as paper documents, unless a videomicrographic enhancement system is used. In that case, an index is provided and information is not checked out, so it is always available.

CD-ROM AND WORM

A basic CD-ROM or WORM optical disk system provides an index. Information is not checked out; therefore, it is always available.

6.2.2 Minimize Retrieval Time

Well-designed automated systems reduce retrieval time. Generally, the more retrieval functions that are automated, the faster the retrieval. Retrieval functions that can be automated include document identification, verification of access authorization, locating the document, and document retrieval or display.

PAPER

A basic paper document storage system is not automated. With optional equipment and software, the document identification function can be automated and assistance can be provided for verification of access authorization. Locating the document may be very time-consuming because the volume of information to search through is the largest of any storage media. The search may be further complicated by misfiling.

MICROFILM AND MICROFICHE

A basic microfilm or microfiche system is very similar to a paper system, but the volume of information and potential for misfiling are reduced. Document identification can be more difficult, if not automated, because documents cannot be scanned without inserting them into a reader. Using a videomicrographic enhancement system with a juke box, fully automated retrieval is possible.

CD-ROM AND WORM

Basic CD-ROM and WORM optical disk systems can provide automated document identification and verification of access authorization. Locating the correct disk and inserting it in the drive would be a manual process. Document retrieval and display are automated. If a disk juke box is used, fully automated retrieval is possible.

6.2.3 Provide Access At A Convenient Location

A central repository allows documents to be shared, but is not always conveniently located. With videomicrographic enhancement or optical disk systems, access to centrally stored documents can be provided at a user's desk.

PAPER

Paper is voluminous to store, and the volume of documents can be a factor in selecting a location for a central storage facility. This may force the central storage facility to be located a good distance from where users are located, making it inconvenient and time consuming to access documents. If the documents have been checked out, additional time must be taken to locate and gain access to the documents.

MICROFILM AND MICROFICHE

Microfilm and microfiche are not as voluminous as paper; therefore, the location of the central storage facility may be more convenient. If the microform has been checked out, additional time must be taken to locate and gain access to the microform.

The use of a videomicrographic enhancement system eliminates the need to check out microforms and can provide access to the central files at the user's desk through use of a network.

CD-ROM AND WORM

CD-ROM and WORM optical disk systems provide the most compact storage of all the media. The location of the central storage facility can be convenient. With a basic optical disk system, access to the central files can be provided at the user's desk through use of a network.

6.2.4 Allow After-Hours Access

With manual retrieval systems, central file room personnel must be present whenever access to documents is allowed. Personnel are required to check access authorization, retrieve, and refile documents. Fully automated systems provide the advantage of being available whenever people need access, without requiring personnel to be present.

PAPER

Paper storage systems are manual systems, and cannot be upgraded to fully automated systems. Central file room personnel must be present whenever access to documents is allowed.

MICROFILM AND MICROFICHE

Basic microfilm and microfiche systems are manual systems and require central file room personnel to be present during times that access to documents is allowed. If a videomicrographic enhancement system with a juke box is used, microform systems can be fully automated.

CD-ROM AND WORM

A basic CD-ROM or WORM optical disk system would require central file room personnel to be present to retrieve, load, and refile disks during hours that access is provided. The option of a disk juke box can provide a fully automated system.

6.2.5 Support Simultaneous Access

Simultaneous access of one document by multiple persons in different physical locations can be provided by a videomicrographic enhancement system or an optical disk system.

PAPER

A paper document storage system cannot provide this capability.

MICROFILM AND MICROFICHE

A basic microfilm or microfiche system cannot provide this capability. A videomicrographic enhancement system can support simultaneous access.

CD-ROM AND WORM

A basic CD-ROM or WORM optical disk system provides this capability.

6.3 PROVIDE AUTOMATED RECORDS MANAGEMENT

Areas of file management that were cited for requiring too much time were filing, retrieving, and tracking documents, and review of documents to determine what information can be released to the public.

Filing, retrieving, and tracking documents can be automated to save time. Determining what information can be released must remain a manual process. Once a document is reviewed, the confidential portions can be permanently recorded as such, eliminating the need to review the document each time information is requested.

PAPER

Paper storage systems cannot be automated to reduce records management time. Well-organized files can minimize time spent dealing with records management, but the volume of paper documents makes them difficult to handle.

MICROFILM AND MICROFICHE

A basic microfilm or microfiche system is not automated. It does offer some improvement over paper storage by reducing the volume of information to manage. If a videomicrographic enhancement system with a juke box is used, filing, retrieving, and tracking can be automated.

CD-ROM AND WORM

A basic CD-ROM or WORM optical disk system provides automated tracking and reduces the volume of information to manage. If a juke box is used, filing and retrieving are automated.

6.4 PROVIDE DATA SECURITY

6.4.1 Ensure Data Availability

Records are lost, misplaced, or misfiled due to human error. This can be substantially reduced through the use of automated retrieval and refiling systems provided with the use of a juke box.

PAPER

Documents stored on paper are prone to being lost, misplaced, or misfiled. Entire files, or pages within a file, can be lost, misplaced, or misfiled.

MICROFILM AND MICROFICHE

Microfilm and microfiche offer some improvement over paper records because individual pages cannot be lost, misplaced, or misfiled. It remains possible to lose, misplace, or misfile an entire roll or a fiche. If a videomicrographic enhancement system with a juke box is used, the retrieval and refiling of the media is automated.

CD-ROM AND WORM

CD-ROM and WORM optical disks offer further improvement because more images of documents can be recorded on one disk. If a disk juke box is used, retrieval and refiling is automated.

6.4.2 Maintain Data Integrity

6.4.2.1 Provide High Quality, Readable Image

A good, readable image can be recorded on any of the media.

Printed documents with a particularly low level of contrast between the background and printed information can pose a problem for any of the storage media. Low-contrast documents, in printed form, are difficult to read and reproduce. It may be difficult to record a good image on optical media from these documents.

Reproduced paper or microform documents will lose resolution with each generation, thereby becoming less readable. Optical disks can be reproduced indefinitely without any loss of resolution.

6.4.2.2 Provide Durable Storage Media

For each of the media categories, the choice of quality or type of materials affects the durability of the document image. Information stored on paper or microform is subject to damage from handling and is more sensitive to environmental conditions than optical disks are. If paper or microforms are used for everyday retrieval, they cannot be expected to last as long as projected.

PAPER

For paper documents, high quality bond paper will last for hundreds of years if stored under proper conditions. Proper conditions include protection from handling, fire, flood, and humidity or dampness, which can encourage damage from mildew. Printed images created using erasable or lift-off inks are prone to flaking. Heat sensitive paper and no-carbon-required copies fade over time and are adversely affected by heat.

MICROFILM AND MICROFICHE

Microfilm and microfiche prepared and stored according to archival standards can be expected to last at least a hundred years. These standards specify the type of film and processing techniques to use, as well as temperature, humidity, and air quality controls for storage. Microforms must also be protected from handling, fire, flood, and humidity or dampness.

CD-ROM

CD-ROM disks can be counted on to last at least ten years. Some manufacturers are projecting a life of at least 20 years, but this has not been proven yet. The disks must be protected from fire or temperatures high enough to soften or melt the outer plastic layers.

WORM

Manufacturers of WORM disks are projecting a life of from 5 to 100 years, depending on the composition of the disk and the recording method used. The technology has not been available for the longest projected life of the media; therefore, disks claiming the longest life have not been proven yet. WORM disks must be protected from fire and disks with plastic outer layers must be protected from temperatures high enough to soften or melt the plastic layers.

Unlike paper or microfilm, duplicate copies of optical disks can be produced without loss of resolution. Making new copies periodically would allow the information to be stored perpetually, with no loss of image quality.

6.4.3 Ensure Confidentiality

6.4.3.1 Support Confidential Processing Procedures

Determining the procedures that should be followed to protect confidential information from unauthorized access during conversion of the data for storage is a policy issue that would have to be considered once a specific technology is selected.

6.4.3.2 Control Access To Confidential Information

Access to confidential information can be controlled using any of the storage media. An automated retrieval system that controls access to confidential information eliminates the need for central file room personnel to regulate access.

PAPER

Access to documents stored on paper must be manually regulated by file room personnel. This may be accomplished with the aid of a microcomputer index that contains indicators for

confidential documents and/or an automated list of those authorized to view confidential data.

MICROFILM AND MICROFICHE

Access to microfilm and microfiche is regulated the same way that paper is, unless a videomicrographic enhancement system is used. With a videomicrographic enhancement system, software can be developed to automate access control.

CD-ROM AND WORM

Using a basic CD-ROM or WORM optical disk system, access to confidential information can be controlled with automated software procedures that require a password or other identifying information to be entered by the user before confidential information is revealed.

6.5 INTEGRATE EXISTING SYSTEMS

Paper, microfilm, microfiche, CD-ROM, and WORM are all capable of being integrated with existing systems, based on hardware, software, and application constraints. In order to address the ability of each medium to effectively integrate with existing systems, further in-depth analysis is required for each application. Program offices must also perform cost benefit analysis, in-depth systems design, and any other activities as required by the FIRMR.

6.6 SUPPORT CONVERSION OF EXISTING MEDIA

Current documents are primarily stored on paper, with some use of microfilm, microfiche, and electronically readable media. These media can be converted to any of the optical storage media.

PAPER

Information stored on any of the current media can be converted to paper. Documents currently stored on paper would need no conversion, while microfilm and microfiche images can be printed on paper using a printer combined with a reader. Electronically readable information can be converted to paper by printing the document.

MICROFILM AND MICROFICHE

For conversion to microfilm or microfiche, paper documents can be photographed. Maps and oversized documents may not be convertible, or may have to be filmed in sections, depending on the equipment purchased. Microfilm and microfiche would need no conversion. Electronically readable information can be converted to computer output microfilm (COM).

CD-ROM

To create a CD-ROM disk, paper documents can be keyed in or scanned. Maps and oversized documents may have to be scanned in sections. Information stored on microfilm or microfiche can also be keyed in by data entry personnel or scanned by machine. Digital information can be stored on CD-ROM.

WORM

Paper documents can be keyed in or scanned for storage on a WORM disk. Maps and oversized documents may have to be scanned in sections. Microfilm and microfiche can be keyed in by data entry personnel or scanned by machine. Digital information can be written to a WORM disk.

6.7 STANDARDIZE FILE CONTENTS

Determining what information should be kept in the files is a policy issue, not an issue technology can be used to solve.

6.8 ORGANIZE DOCUMENTS

All of the storage media are capable of organizing existing and future documents. However, there are significant distinctions between the media in terms of ease of organizing documents. Paper is the most time-consuming to organize, while information stored on WORM can be automatically indexed.

6.9 SUPPORT RECORD UPDATE

Manual update is sufficient for very small volumes of documents with a small volume of updates. As document or update volumes increase, an automated system becomes more important. The best system to use with a large volume of documents to provide fast, easy, high-volume updates is a WORM system.

PAPER

Very small, consistently organized paper systems can be manually updated quickly and easily. Once the files grow, or become disorganized, updates are no longer quick or easy.

MICROFILM

Microfilm can be updated by splicing the film to remove outdated information and to add new information, but this is a difficult, time-consuming process. Splicing also affects the durability of the film. A microfilm jacket is easier to update, but updating is still a time-consuming process.

MICROFICHE

Microfiche can be updated if updatable microfiche film is used. Updatable microfiche film is not as durable as other types of film used for microfiche.

CD-ROM

Information stored on a CD-ROM optical disk is not updatable.

WORM

Updating a WORM disk is easy. New information is keyed in or scanned (if in printed form), written to an unused area of the disk, and the index or file pointers are updated. The original version of the document remains on the disk, unchanged. This provides a history of the document from the original version through all subsequent changes, if the original file pointer data is maintained.

6.10 PROVIDE BACKUP CAPABILITIES

Any of the media can be duplicated to provide a backup copy.

Backup documents do not have to be kept in the same media as the on-site reference documents. If they are kept on two separate media, the backup copy should be capable of recreating whatever media is used for on-site reference.

Duplicating paper documents is usually not a good method of backup because it is unwieldy and doubles storage space requirements. For paper documents, it may be desirable to use the printed documents as off-site backup or archival documents, and use another media for on-site reference. This would reduce the on-site storage space requirements and provide backup documentation.

6.11 SUPPORT LEGAL ADMISSIBILITY

Paper is the only form of media that is unquestionably admissible in court. Alternate storage media, such as microform or optical disks, have not been tested and proven to the same degree.

The Business Records Act and the Federal Rule of Evidence 803(6) provide that alternate storage media produced in the normal course of business are as legally admissible as paper. The wording of these documents suggests they would apply to optical disk as well as microfilm storage.

Actual tests of admissibility in court have accepted and rejected both microform and optical disks. A prevailing reason for rejection was that the alternate storage media was created in preparation for the court case, not in the normal course of business.

Most people express reluctance to rely solely on alternate storage media until a high-level court, possibly the Supreme Court, rules it unquestionably admissible. Until this happens, the burden of paper documents cannot be completely eliminated.

An approach that can be used to reduce primary storage space, while still retaining access to original documents should it prove necessary, is to use a combination of different storage media. Alternate media can be used for on-site storage, and everyday use and original paper documents can be archived. This approach provides a secure, off-site backup, and the benefits gained by use of an alternate storage media.

6.12 GENERATE PAPER COPY

All of the storage media are capable of producing a paper copy of a document.

PAPER

A xerographic duplicate can be made of information stored on paper.

MICROFILM AND MICROFICHE

Microfilm and microfiche images can be printed on paper using a printer combined with a reader.

CD-ROM AND WORM

Information stored on CD-ROM or WORM optical disks can be printed.

6.13 ENSURE COST EFFECTIVENESS

In order to determine the comparative cost effectiveness of each of the media, a detailed cost-benefit analysis would have to be performed, based on the detailed requirements of each application.

6.14 EXCHANGE INFORMATION

All of the media support data exchange; however, electronic systems allow quick exchange of data without the transfer of the physical storage media. The ability of each media to support data exchange depends on hardware, software, and application constraints.

SECTION 7 - CONCLUSION

7.1 ESTIMATED NUMBER OF SYSTEMS

An estimate of the number of Image Processing Systems which may be required can be expressed as optical disk jukebox ("Jukebox Systems") and optical disk systems not including a jukebox ("Basic Systems"). An estimation model was used and is presented in Exhibit 7-1.

The model presented in Exhibit 7-1 assumes that the storage capacity of a Jukebox system is 200 GB. Also, since document storage estimates for the regional applications were varied and difficult to validate, a conservative estimate of one Jukebox and one Basic system was assumed in all regions except Regions II and V, which are the largest EPA regional offices. In Regions II and V, two Jukebox and one Basic systems are assumed to be reasonable estimates for all regional applications including the Superfund site files. Finally, the model assumes that once 15 2GB optical disks are filled with data, a jukebox would be required for storing and mounting them, as opposed to having the disks manually mounted and dismounted in the optical disk drives.

In determining the estimated number of Jukebox and Basic systems, the model considers two issues: first, the existence of a distributed processing environment or remote locations; and second, the estimated bytes of document storage required for the next five years.

The number of remote locations in a distributed environment is important in determining the number of Basic systems since communication is required between locations. Therefore, in all distributed environments where storage and processing are centralized but remote locations require access and communication with the central location, a Basic system is assumed necessary to support this access via host-to-host communication. Step 1 of the model addresses this aspect of the estimation process.

The estimated bytes of document storage required by each application are based on information obtained during phone and personal interviews. If document storage requirements were not available through interviews, they were then obtained from published documentation. To calculate the storage requirements, 1,900 pages are assumed per linear foot. It is assumed an 8 1/2" by 11" page would require 70,000 bytes of WORM storage in facsimile format.

The results, using this estimation model, are presented in Exhibit 7-2. Based on the assumptions stated above, the estimated storage requirements, and the limited scope of this analysis, it is reasonable to assume that the EPA requires 33 Jukebox systems and 80 Basic systems.

Systems Estimation Model

(Step 1)

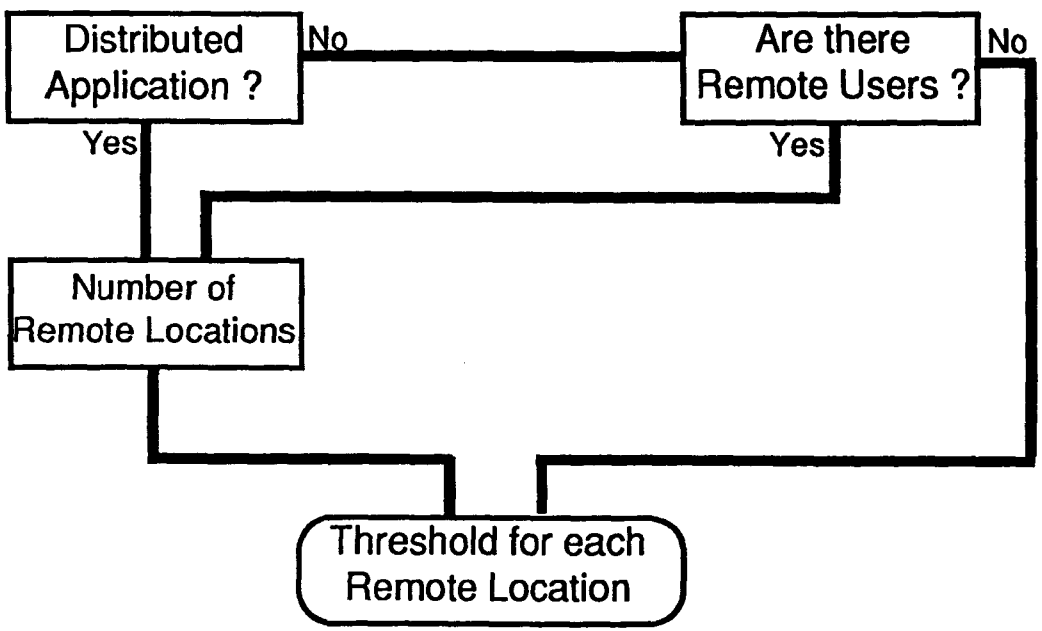


Exhibit 7-1

Systems Estimation Model
(Step 2)

Purpose:
For each stand alone system or remote host, step 2 is used to determine the size of the host.

Assumptions:
This model is based on a series of thresholds comparable to those defined by the IPS RFP. Exceeding any single threshold effects the estimated number of systems. The RFP assumes 70,000 bytes per page. This model assumes 15,000 pages per GB of optical storage.

Optical Storage Threshold
- less than 30GB = Basic (Level II)
- more than 30GB = Jukebox (Level I)

Magnetic Storage Threshold
- less than 5GB = Basic (Level II)
- more than 5GB = Jukebox (Level I)

Access Threshold
- less than 16 Simultaneous Users = Basic (Level II)
- more than 16 Simultaneous Users = Jukebox (Level I)

Online Optical Storage Threshold
- less than 2GB = Basic (Level II)
- more than 2GB = Jukebox (Level I)

Exhibit 7-1

Estimated Number of Systems

Applications	Number of Remote Locations	Total 5-yr. Storage Estimate	Est. Level I Systems	Est. Level II Systems
Contract Lab	13	3150 GB	8	13
Finance	13	431 GB	2	12
NEIC*	0	NA	0	1
OGC–all applications	2	7 GB	0	2
OPP–all applications	1	516 GB	2	1
OTS-TRI	0	215 GB	1	0
OTS-PMN	1	253 GB	1	1
PCMD	0	940 GB	3	11
Personnel	13	134 GB	1	13
STARS	14	137 GB	2	15
Testing**	0	NA	1	1

Note: No storage estimate for backup is included. Backup will not require Level I or Level II systems. Backup may require Optical Platters or Magnetic Media.

* *NEIC requires 1 Level I System for an optical disk pilot.*

** *NDPD standard operating policy is to provide a testing and development system for EPA distributed systems.*

Exhibit 7-2

Estimated Number of Systems

Applications	Est. Level I Systems	Est. Level II Systems
Reg 1 Site File	1	1
Reg 2 Site File	2	1
Reg 3 Site File	1	1
Reg 4 Site File	1	1
Reg 5 Site File	2	1
Reg 6 Site File	1	1
Reg 7 Site File	1	1
Reg 8 Site File	1	1
Reg 9 Site File	1	1
Reg 10 Site File	1	1
GRAND TOTAL	33	80

One Level I and one Level II are assumed for all regions but the two largest, Regions 2 and 5. In Regions 2 and 5, two Level I and one Level II are assumed.

Exhibit 7-2

7.2 FOLLOW-ON DETAIL ANALYSIS

The requirements analysis in this document was performed to determine EPA's overall requirements for automated document storage and retrieval. In addition to a requirements analysis, this document includes a mission needs analysis, a statement of available technology options, and a comparison of the ability of each technology to meet the identified requirements.

The results of this analysis should be used as the basis for an in-depth systems design and analysis and a cost-benefit analysis, as defined by the EPA System Design and Development Guidance document. It is assumed that each program office with automated document storage and retrieval requirements will follow the steps outlined in this methodology to identify the document storage and retrieval solution that can best meet its needs.

The steps of this methodology, which each program office should perform, are described in the EPA System Design and Development Guidance document. They are:

- Perform Preliminary Design and Options Analysis, including Operational and Technical Feasibility Analysis, Life Cycle Cost-Benefit Analysis, and Option Selection and Documentation;

- Perform System Design, including System Detailed Requirements Analysis and Detailed Design;

- Perform System Development, including System Production and Programming, Testing and Evaluation, and System Integration; and
- Perform System Implementation.

This analysis addresses several specific EPA program offices and functions with known document storage and retrieval requirements. Almost certainly there are other EPA functions which have or will have document storage and retrieval requirements. These offices should also conduct the type of detailed analysis described above. In performing the Agency Automated Document Storage and Retrieval Requirements Analysis, it was not possible to contact all EPA program offices. A single, two hour interview to elicit general functional requirements was performed with those offices contacted. Furthermore, limited documentation was available for review. Therefore, while this requirements analysis presents a representative summary of the Agency's requirements, it by no means provides a complete or detailed statement of all requirements for all program offices.

The requirements identified by this analysis, which are presented in Exhibit 4-1, include:

- Conserve and/or minimize storage space;
- Provide efficient document access and retrieval;
- Provide automated records management;
- Provide data security;
- Integrate existing systems;
- Support conversion of existing media;
- Standardize file contents;
- Organize documents;
- Support record update;
- Provide backup capabilities;
- Support legal admissibility;
- Generate paper copy;
- Ensure cost effectiveness; and
- Exchange information.

The technologies described in this document represent those most likely to be available to the Agency. Currently, EPA is a multi-media environment and may continue to be, because of the limitations of any single technology to meet all user requirements. Most of the technologies discussed in this analysis are currently, in some form, used in the Agency. Further in-depth analysis, including in-depth system design, cost benefit analysis, configuration analysis, and any other activities required by the FIRMR should be performed prior to implementation by each program office with records management requirements.

APPENDIX A
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