COORDINATED ADP PLAN

prepared for

THE U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF PLANNING AND MANAGEMENT

CONTRACT NO. 68-01-2792

index systems inc.

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I. MANAGEMENT SUMMARY

I. MANAGEMENT SUMMARY

During the period August 24, 1974 to December 13, 1974 Index Systems, Inc. conducted an automated data processing (ADP) planning study for the Office of Planning and Management (OPM) within the United States Environmental Protection Agency (EPA). This report presents (1) our findings and conclusions resulting from this study, and (2) a coordinated plan of action for managing computer equipment, facilities, new system development activities and data processing personnel.

This management summary summarizes the key results contained in the report. It is divided into five sections, as follows:

- Planning Objectives and Scope
- Project Approach
- Summary of Findings
- Coordinated Action Plan Summary
- Report Organization

1. PLANNING OBJECTIVES AND SCOPE

The purpose of this study was to prepare a coordinated Agency-wide 5-year ADP plan. The Office of

Planning and Management realized that it was essential to develop a 5-year coordinated ADP plan whereby it could manage and control the use of computing resources throughout the Agency. OPM was concerned particularly with reducing ADP costs to an appropriate level and with aligning the resulting computer usage with overall Agency priorities.

As a result, the following five planning objectives were identified:

- Inventory major EPA computer systems and document their cost, purpose and justification
- Prepare an action plan to modify or eliminate current systems and develop new systems consistent with overall Agency priorities and budgetary constraints
- Forecast Agency ADP expenditures for computer equipment, personnel and contractors to implement this plan and support Agency needs for the next five years
- Develop an equipment strategy for supporting the computer hardware requirements imposed by this plan
- Develop budgetary, personnel and other management policies to implement the plan and to control ADP usage in the future

2. PROJECT APPROACH

The activities undertaken to achieve the planning objectives were conducted in seven steps, as follows:

(1) Review and categorize current and proposed systems.

Existing system documentation was reviewed and system managers were interviewed concerning the purpose, cost, and operating characteristics of each of EPA's major application systems. These systems were grouped into application classes corresponding to the general type of function provided.

(2) Identify ADP requirements of environmental missions.

Strategy papers were reviewed and program managers were interviewed concerning each environmental mission's current and projected needs for ADP support. An overall environmental strategy was identified across all the media (air, water, pesticides, etc.) and types of ADP support (application classes) were associated with each activity comprising this overall strategy. Individual mission needs were identified by associating current and projected mission activities with their corresponding application classes.

(3) Evaluate the cost-effectiveness of Agency systems.

Based on the application class profile of Agency needs, individual systems were analyzed as to their relative cost-effectiveness in meeting their mission objectives. Systems were compared in similar application classes with regard to technical design and implementation practices which affected their operating and development costs. In addition, the relative needs of the environmental missions were compared by identifying the environmental strategy activities in which each mission was engaged. As a result, systems which support non-essential needs were identified.

(4) Review ADP management policies.

EPA policies for managing ADP resources were identified and analyzed. These policies included budgetary practices, system development procedures, contractor administration and management, and personnel development and expertise. These policies were compared with those used by other Government agencies and private corporations.

(5) Prepare a list of system, technical and management changes.

A series of changes and modifications were identified to align ADP usage with identified EPA needs and to reduce and contain ADP expenditures within levels approved by Congress. These changes consisted of system changes or eliminations, computer equipment strategies, and management and personnel policy guidelines.

(6) Prioritize the list of proposed changes.

The list of proposed changes was reviewed with Agency officials and prioritized to conform with overall EPA objectives as indicated by Agency appropriation requests. This prioritization reflected also the feasibility and interdependence of certain of the proposed actions.

(7) Prepare a staged implementation plan for ADP.

An action plan was developed from the prioritized list of changes. Agency resources, including computing equipment, manpower and contractor funding, that were needed to implement this action plan were identified. The action plan was staged over a multi-year period to conform with the resource expenditure limits imposed by Congress. In addition, management policies were recommended both for implementing the plan and for controlling on-going ADP usage.

3. SUMMARY OF FINDINGS

(1) The current allocation of data processing resources at EPA is out of proportion to overall Agency priorities.

ADP resources consist of ADP personnel, contractor monies and ADP fund sub-allowances which pay for timesharing and computer equipment. These resources are allocated to program offices as part of the normal EPA budgetary process. Because EPA employs an incremental budgeting philosophy, most ADP resources are allocated in proportion to prior year usage rather than to current year needs. As a result, certain program offices and certain older application systems have received funding far out of proportion to their contribution to overall Agency goals and objectives.

(2) Research and enforcement activities will require increased ADP support in the future.

Throughout the Agency, there is an over-concentration of ADP resources expended in support of tracking, reporting, trend and monitoring applications, and a corresponding under-utilization of computers in support of basic scientific research. The largest percentage of ADP resources in the past have been expended on large national data bases and on-going administrative systems. Research personnel, by contrast, have tended to use ADP to support special short-term studies and rarely have constructed large, elaborate, on-going systems.

Enforcement personnel at EPA have begun only recently to issue permits and prosecute violations of environmental regulations. Consequently, they had not developed any large ADP applications and, accordingly, their ADP usage has been quite low. However, as more programs reach the enforcement stage, increased ADP support will be required to process forms, to detect violators and to expedite litigation.

(3) Technical design features affect significantly the cost of operating Agency systems.

Similar functions, such as environmental quality monitoring, are supported by completely different types of systems in different Agency offices. These different types of systems have different growth characteristics and cost profiles. For example, the air systems tend to store most information on inexpensive off-line storage devices. On the other hand, the water systems keep most of their information on more expensive on-line storage in order to facilitate interactive retrieval of water data. The costs for off-line storage are relatively stable over time, whereas the costs for on-line storage increase directly with increases in data volume. This difference in system design philosophy occurs despite the fact that both the air and water programs are charged with similar responsibilities regarding the maintenance of national environmental data bases. This same pattern exists among many other groups of Agency systems.

(4) Current ADP management policies do not extend beyond the formal allocation of computer time to program offices.

Although ADP resources include computer time, contractor monies and ADP personnel, only computer time is controlled formally by the Office of Planning and Management (OPM) through sub-allowances of the ADP Fund to program offices. Contractor expenditures for new system development and for the hiring of new ADP personnel remain at the discretion of the program offices. This occurs despite the fact that OPM is responsible for monitoring total ADP expenditures and for supplying computer support for all operational Agency systems. Recently, OPM has established procedures which require program offices to prepare feasibility studies for new system development proposals. However, this requirement does not empower OPM to judge the actual need for the proposed system, but only to forecast the impact of the new system on computer time.

(5) The increasing cost of ADP is attributable primarily to the proliferation of new application systems and to the uncontrolled expansion of existing systems.

ADP costs have increased within EPA as more program offices have developed application systems to expedite their workloads. However, current management policies have not required that new systems conform to overall Agency priorities but only that they be approved by the sponsoring office. As a result, many systems have been developed that fail to service actual Agency-wide needs. Many Headquarters-designed systems, such as the hazardous materials system, TADS, or the General Point Source File (GPSF), have been justified on the grounds that they support regional needs, but in practice, they have failed to service actual regional requirements. Still other systems, such as the several Agency bibliographic systems, have been developed from scratch even though comparable systems already existed.

(6) The pricing and availability of computer time have contributed to poor service and excessive costs.

Most Agency application systems are operated on EPA computers at Optimum Systems Inc. (OSI) in Washington, D.C., and at Research Triangle Park (RTP) in Durham, North Carolina. The RTP facility is especially well-suited for modeling, statistical and other scientific applications. However, at present, limited communications capabilities prevent RTP from providing general computing support to Agency-wide users.

Current Federal policies cause considerable expense and disruption in service because they require frequent changes in service bureau vendors. Since RTP is an EPA-leased facility, the Agency has avoided these forced changes. However, EPA has experienced such disruption in converting to OSI, which is a vendor owned facility, and will be required to convert again in fiscal 1976. Consequently, the Agency wishes to shift most of its ADP workload onto government-owned computers both to eliminate conversion costs and to reduce overall operating charges.

In addition, current budgetary policies tend to encourage wasteful uses of computing resources. Personnel ceilings and separate funding of ADP and other program monies have prompted many managers to view computers as an essentially free resource and to use ADP accordingly. Other policies have allowed free usage of EPA systems by the states, thereby preventing an adequate assessment of the worth of these systems to users.

(7) ADP personnel at EPA are well-compensated but do not possess all of the technical and management skills required by the Agency.

EPA spends approximately $7.2 million annually in salaries for ADP personnel. The salary levels are in some cases as much as 40% higher than national averages. Yet, despite these compensation levels, EPA is deficient in certain key ADP technical and management areas. These deficiencies are attributable to EPA's difficulty in recruiting and retaining qualified ADP personnel. These difficulties, in turn, are attributable not to the absence of financial rewards,but rather to the absence of technically interesting or professionally challenging ADP opportunities within the Agency. Most personnel are scattered throughout the Agency in relatively low-level support functions. The only career paths available within the Agency tend to be within the program offices. Hence, qualified professionals tend to equate their own career goals with the needs of their own program offices and do not develop the more general skills needed to support Agency-wide development projects.

4. COORDINATED ACTION PLAN SUMMARY

The coordinated action plan consists of a series of systems development, hardware, personnel, and management changes which should take place over the next five years. Chapter V of this report presents a detailed discussion of the rationale and impact of each action. This section presents the summary of costs, cost savings, action steps and policy changes comprising this plan.

(1) ADP expenditures for computer equipment, contractors and personnel will decrease as a result of the elimination of marginal systems, the shifting of workloads to RTP and the establishment of more stringent management controls.

Exhibit 1-1, following this page, presents the ADP costs for (1) computer equipment and timesharing, (2) systems development and (3) personnel, for each of the next five years as required by the proposed ADP plan. (None of the costs in this chart, or elsewhere in this report, have been adjusted for inflation.) The estimated current year expenditures are based on FY'75 spending rates as incurred during the study period. This current year estimate does not reflect any funding limitations which OPM may impose to bring FY'75 expenditures within the spending constraints imposed by Congress.

Exhibit 1-1
U.S. Environmental Protection Agency
Five Year ADP Budget ($000)

	CURRENT	1976	1977	1978	1979	1980
Computer Equipment and Timesharing	13,773	10,881	8,849	9,415	10,650	10,111
Systems Development and Other Contract Expenditures	6,033	5,922	5,602	4,632	4,532	4,532
Personnel	7,200	7,000	6,600	6,200	6,200	6,200
Total ADP Expenditures	27,006	23,803	21,051	20,247	21,382	20,843

The overall reduction in ADP expenditures from $27,006,000 in 1975 to $20,843,000 in 1980 is attributable primarily to the elimination of marginal applications, the shifting of scientific computing to RTP and the imposition of more stringent management and budgetary controls. Although this budget forecast includes allocations for the planning and development of new ADP applications, primarily within ORD and OEGC, it does not reflect the impact of new legislation upon overall Agency needs or priorities since such legislation could not be predicted accurately during the course of this study.

(2) EPA will save almost $28 million over the five year period.

Exhibit 1-2, on the following page, summarizes the resulting cost savings provided by the plan. These cost savings, both annual and cumulative, represent actual cost reductions over current expenditure levels for computer equipment and timesharing, contractors and ADP personnel salaries. They do not indicate the still higher cost savings measured by comparing the budget expenditures to the costs which would be incurred if no action were taken and Agency systems

Exhibit 1-2
U.S. Environmental Protection Agency
Projected Cost Savings ($000)

	1976	1977	1978	1979	1980
Annual Savings	3,203	5,955	6,759	5,624	6,163
Cumulative Savings	3,203	9,158	15,917	21,541	27,704

were allowed to grow without budget constraints. Each of these savings areas is discussed in detail in Chapter V of this report.

(3) The computer equipment strategy involves the development of two Agency computer centers.

Central to the recommendations of the coordinated ADP plan is the development of an Agency-wide scientific computing center at RTP. This facility would be centered around the Univac 1110 computer and would utilize the existing RTP staff and design philosophies employed by current RTP systems. An enhanced communications network and some programming modifications would enable most EPA models and trend and monitoring systems to operate on the Univac computer.

Most other Agency systems including administrative and enforcement tracking and reporting systems would continue to operate on the OSI computer or its replacement. The hardware requirements for these non-scientific systems have been identified and could be serviced adequately by a facility computationally equivalent to one IBM 370/158. By 1978, a computing facility of this scope should be created by EPA through the lease or purchase of its own computing equipment. Exhibit 1-3, on the following page, summarizes these proposed EPA computer equipment requirements over each of the next five years.

(4) <u>EPA would save $6.2 million in addition to the proposed $28 million savings by exercising its purchase option for the Univac computer at RTP</u>.

EPA was offered an extremely attractive purchase option for the Univac 1110. If, by February 1975 EPA can obtain Congressional approval and funding, it may purchase the Univac computer for approximately $1.8 million. The plan proposed herein calls for the use of the Univac computer for at least the next five years. Present Univac lease rates are $1.6 million per year. Therefore, the cost for continuing to rent the Univac would be $8 million over five years (i.e., $1.6 million per year for five years). If, on the other hand, EPA exercised its purchase option now and expended the extra $1.8 million, its subsequent lease charges each year would drop to zero. Thus, EPA could save $6.2 million over the next five years if it exercised its purchase option ($8 million lease charges less one-time $1.8 million current year capital expenditure).

Exhibit 1 - 3
U.S. Environmental Protection Agency
Computer Equipment Requirements

COMPUTER EQUIPMENT REQUIREMENTS

	Current	1976	1977	1978	1979	1980
Washington	2 IBM 370/158	2 IBM 370/158	IBM 370/158	Non-scientific Data Center IBM 370/158	IBM 370/158	IBM 370/158
RTP	Univac 1110 2 x 1	Univac 1110 2 x 1 Faster tape units	Univac 1110 2 x 1	Univac 1110 4 x 2 256K word extra memory Increased disk storage	Univac 1110 4 x 2 etc.	Univac 1110 4 x 2 etc.
Other			Install Communications Network		Selective Installation of regional minicomputers	

(5) <u>Thirteen systems are affected directly by the action plan</u>.

The action plan consists of a series of staged activities affecting the development, design and operation of Agency systems, and of the providing of necessary resources and management policies to implement these actions. Exhibit 1-4, on the following page, summarizes the 13 major systems or groups of systems which are affected directly by these action steps. For example, it is proposed that the General Point Source File (GPSF) be separated into distinct enforcement and water systems to support separately the compliance tracking requirements of OEGC and the effluent monitoring requirements of OWHM. Several systems, such as PEMS and TADS, would be eliminated entirely, whereas other ADP applications, such as word processing, would lose their ADP Fund support. Detailed planning studies are proposed also for OPM, ORD and OEGC to consolidate and streamline existing systems and procedures and to coordinate the development of new systems for enforcement tracking and scientific research, especially in energy-related areas.

Exhibit 1-4
U.S. Environmental Protection Agency
Systems Affected by Five Year Plan

SYSTEM	OFFICE	ACTION
GPSF	OEGC, OWHM	Separate into compliance and effluent data base systems
PEMS	OEGC	Eliminate
Word Processing	OWHM, ORD	Fund with program monies
Program Management	ORD	Eliminate
STORET	OWHM	Modify and shift to RTP
TADS, SIRS	OWHM	Eliminate
Bibliographic Systems	OAWM	Eliminate or fund with program monies
SEAS and Lake Pollution Model	ORD	Shift to RTP
Administrative Systems	OPM	Streamline systems
Dun and Bradstreet	OPM	Cancel service
Enforcement Systems	OEGC	Prepare detailed plan for integrating and developing new application systems
Regional Modeling	Regions	Shift to RTP
Research System	ORD	Prepare detailed plan for improving scientific services

(6) ADP personnel would be organized into four groups.

Data processing personnel within the Agency would be organized into four groups responsible for (1) serving regional and research center users, (2) supporting environmental program needs, (3) managing the RTP and OSI computer facilities, and (4) overseeing ADP budgets and new development projects. This regrouping would require a shift of technical development personnel from the program offices to the computer facilities and to the development groups, and an increased concentration of project management and functional specification personnel within the program offices. This regrouping would result in the elimination of approximately 64 ADP positions throughout the Agency. Exhibit 1-5, on the following page, indicates the impact of this regrouping upon the deployment of ADP personnel throughout EPA's offices. The Exhibit indicates the anticipated ADP salary expenditures within each office during each year of the plan.

(7) EPA management policies should include the establishment of project management standards, expanded budgetary reporting and improved ADP quality controls.

The ADP management guidelines, as described in the coordinated plan, are designed to control ADP

Exhibit 1-5
U.S. Environmental Protection Agency
Distribution of ADP Personnel Salaries in $ Millions

	Current	1976	1977	1978	1979	1980
OPM	1.6	1.7	1.4	1.4	1.4	1.4
OEGC	.2	.4	.8	.6	.6	.6
OWHM	1.8	1.7	1.2	1.2	1.2	1.2
OAWM	1.0	1.0	1.0	1.0	1.0	1.0
ORD	1.9	1.5	1.7	1.5	1.5	1.5
Regions	.7	.7	.5	.5	.5	.5
Total	7.2	7.0	6.6	6.2	6.2	6.2

expenditures while improving data processing services provided to Agency users. These guidelines involve the establishment and enforcement of rigorous system development standards and project management procedures. They involve also the expansion of formal ADP budgeting to include ADP personnel and contractor expenditures and the establishment of controls to limit or prevent overruns of these ADP budget ceilings. The management guidelines direct OPM to assume responsibility for ADP quality control through the establishment of system and data standards and through periodic auditing of major ongoing application systems.

5. REPORT ORGANIZATION

The remainder of this report is organized into four chapters discussing ADP usage at EPA, the Management of ADP Resources, Problem Areas, and the Coordinated ADP Plan, respectively. In addition, five technical appendices present (1) an inventory of major EPA systems, (2) an explanation of application classes, (3) a description of current EPA computer equipment and facilities, (4) a description of the cost projection calculations used in the report, and (5) a presentation of project management and development guidelines.

II. ADP USAGE AT EPA

II. ADP USAGE AT EPA

This chapter describes the usage of ADP at EPA. The activities comprising EPA's environmental control strategy and the relationship of these activities to the organizational units which comprise the Agency are outlined. Also, in this chapter, the Agency's data processing systems are grouped into application classes based upon the functions that they perform. The functional support provided by these application classes is then related to the environmental objectives and activities conducted by the major EPA organizational units. As a result of this mapping, the data processing usage and needs of each organizational unit are identified and characterized, thereby forming the cornerstone for the development of the coordinated ADP plan.

1. THE AGENCY'S ENVIRONMENTAL STRATEGY CONSISTS OF SIX PRINCIPAL ACTIVITIES.

As an independent regulatory agency, EPA is charged with the responsibility of setting standards for environmental pollution and enforcing these standards within a framework of the existing anti-pollution legislation. In support of its regulatory mission, EPA monitors and analyzes the environment and conducts scientific studies on the causes and effects of pollution, the technology of pollution control, and the environmental consequences of man's actions. In carrying out its mission, as defined by the legislation, the Agency must perform six major activities, as follows:

- Identify the present state of the environment - This activity involves identifying and reporting to Congress and the public the present state of the environment including current and potential environmental problem areas.
- Determine the environmental quality necessary to protect public health and welfare - This activity includes setting pollution level objectives, such as goals for swimmable and fishable waters.
- Identify and develop methods to control pollution - This activity includes developing the necessary abatement strategies and programs to achieve pollution level objectives.
- Implement abatement and control strategies - This activity includes setting specific standards and regulation for attaining and maintaining environmental quality, such as effluent guidelines and permits.
- Enforce abatement policies and regulations - This activity involves utilizing the enforcement authorities provided by Federal legislation to achieve compliance with the environmental standards and regulations.
- Monitor compliance with regulations - This activity includes continual surveillance and tracking of the compliance actions of individuals, private enterprise and governmental bodies which are required to satisfy the abatement regulations.

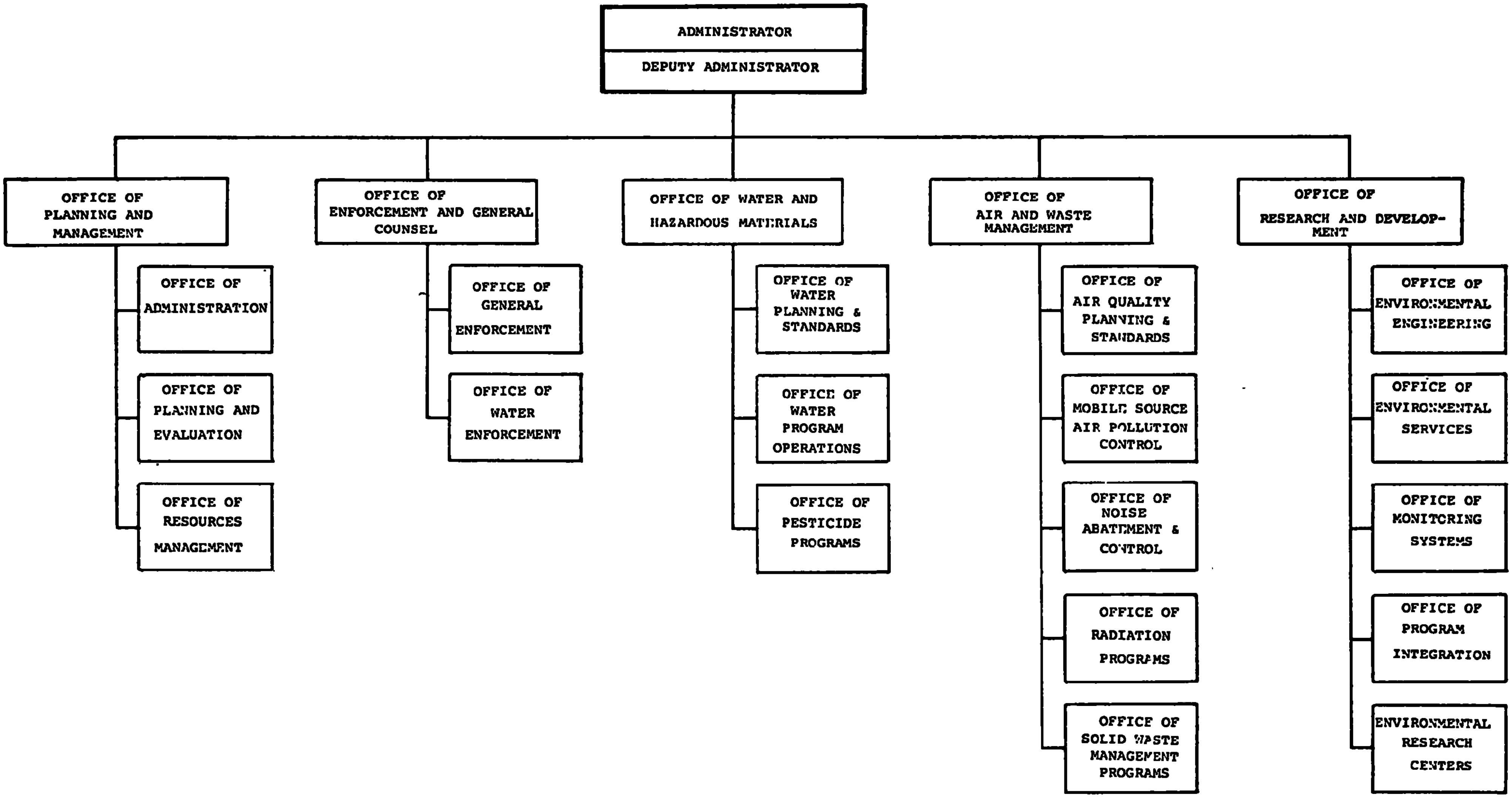
2. ENVIRONMENTAL ACTIVITIES ARE DIVIDED AMONG SIX MAJOR ORGANIZATIONAL UNITS.

To perform the required activities for each of the environmental problem areas identified by legislation, the EPA Administrator has divided the Agency into six major organizational units, as shown in Exhibit 2.1 following this page. Appendix A contains detailed information regarding the primary responsibilities and missions of each office, the staff employment level, the general type of staff, the principal geographic location, the major relevant legislation, and the current ADP expenditures. In addition, Appendix A provides a detailed breakdown of the major ADP systems utilized by each organizational unit or office. Each of the six major organizational units are outlined below:

Office of Planning and Management (OPM) - The Office of Planning and Management has Agency-wide responsibilities for ten major activities, as follows:

- Program evaluation
- Resource management, including administering a program planning-budgeting system
- Budget preparation and execution
- Organization and management systems
- Personnel policies and operations
- ADP management and operations
- Facilities and space management
- Contracting and procurement services
- Grant policies and procedures
- Comprehensive audit program

Exhibit 2-1
U.S. Environmental Protection Agency
EPA Organization Chart



The 1065 positions (11% of the total EPA employment) within the Office of Planning and Management are organized into offices of staff support and three offices under Deputy Assistant Administrators (DAA's); namely, (1) the Office of Administration, (2) the Office of Planning and Evaluation, and (3) the Office of Resource Management.

Office of Enforcement and General Counsel (OEGC) - The Office of Enforcement and General Counsel has responsibility for the conduct of enforcement activities on an Agency-wide basis. This includes the development and execution of programs for water, air, noise, radiation, pesticides, and solid waste enforcement, including the development of procedures, regulatory material, guidelines, criteria, and policy statements designed to bring about actions by individuals, private enterprise, and governmental bodies to improve the environment. The Office of Enforcement and General Counsel provides also legal services to all organizational elements of the Agency including legal opinions and litigation support. The 448 positions (5% of the total Agency employment) of OEGC are organized into offices of staff support, an Office of General Counsel, and two offices under DAA's; namely, the Office of General Enforcement and the Office of Water Enforcement.

Office of Water and Hazardous Materials (OWHM) - The Office of Water and Hazardous Materials has responsibility for program policy development and evaluation, environmental and pollution sources standards development, guidance and technical support of regional program activities, and selected demonstration programs. The 1080 positions (approximately 12% of the Agency's total employment) are organized into an office of staff support and three offices under DAA's; namely, (1) the Office of Water Planning and Standards, (2) the Office of Water Program Operations, and (3) the Office of Pesticides Programs.

- The Office of Air and Waste Management (OAWM) - The Office of Air and Waste Management has responsibility for seven major activities, as follows:

  - Develop national standards for air quality and emission standards for new stationary sources and for hazardous pollutants
  - Assess the national air pollution control program and its success in achieving air quality goals
  - Provide assistance to the States, regional offices, and industry through manpower training and technical information
  - Maintain a national air programs data system
  - Develop abatement strategies to control noise pollution
  - Disseminate information and perform research in the management of solid waste disposal
  - Investigate the environmental and health effects of radioactive substances and processes

  The 992 positions (11% of the total EPA employment) of this office are organized into offices of staff support and five DAA-level offices.

- The Office of Research and Development (ORD) - The Office of Research and Development is responsible for the development and conduct of research and demonstration programs in pollution sources, environmental sciences, monitoring systems, and pollution control technology. ORD provides direct supervision of the activities of the Environmental Research Centers and their associated laboratories. ORD is responsible also for the quality control and standardization of the analytical techniques utilized by the Agency. The 1856 positions of ORD (20% of the total Agency employment) are distributed among staff offices, five Environmental Research Centers, and four offices under DAA's; namely, (1) the Office of Environmental Engineering, (2) the Office of Environmental Sciences, (3) the Office of Monitoring Systems, and (4) the Office of Program Integration.

- Regional Offices - The operating programs of the EPA are carried out by ten regional authorities which cover the entire United States. Each of these clusters of states is headed by a Regional Administrator who reports to the EPA Deputy Administrator. Each Region has its own coordinated EPA anti-pollution effort and decentralized authority for the development of strong local programs for pollution control and abatement.

3. THERE ARE EIGHT APPLICATION CLASSES OF COMPUTER SYSTEMS SUPPORTING MAJOR EPA MISSIONS.

Eight classes of computer usage have been defined for computer systems at EPA. The purpose of this classification is to provide an aid to understanding the use of computers at the Agency and to group individual systems for cross comparisons. These classes have been identified, as follows:

- Tracking and Reporting Systems
- Trend and Monitoring Systems
- Technical Data Bases
- Word Processing Systems
- Bibliographic Systems
- Modeling and Scientific Systems
- Laboratory Automation
- Special Studies

Each of these application classes has unique functional characteristics which differentiate them from each other as shown in Exhibit 2-2, following this page.

The principal Agency activities, such as implementing abatement control strategies, tend to utilize the functional characteristics provided by specific application classes. Exhibit 2-3, following Exhibit 2-2, illustrates the primary application classes of systems used by each of the principal Agency activities. As shown in this exhibit, enforcement activities tend to require tracking and reporting support, whereas environmental quality objectives and strategy determination rely more heavily upon modeling and scientific ADP support.

All the major computer systems within the Agency and the application class each system is most closely associated with are shown in Exhibit 2-4, following Exhibit 2-3.

The following sections describe briefly the eight application classes. A more detailed description of each application class is contained in Appendix B.

(1) Tracking and reporting systems track schedules, record dollar expenditures, and provide conventional administrative reports.

Exhibit 2-2
U.S. Environmental Protection Agency
Functional Characteristics of Application Classes

	TRACKING & REPORTING	TREND & MONITORING	TECHNICAL DATA BASES	WORD PROCESSING	BIBLIOGRAPHIC	MODELING & SCIENTIFIC	LAB AUTOMATION	SPECIAL STUDIES
USE	Administration and Operational Control	Research Reports	Basic Research	Secretarial Replacement	Literature Search	Scientific Research	Reduce Manpower, Increase Control	Reports on Specific Topics of Interest
PERSONNEL REQUIREMENTS	High Data Entry Volume	High Data Entry Volumes	Low	Depends on Nature of the Work	Low Compared to Manual Library	Low Data Entry but Skilled Analysts Needed	Low	Depends on Type of Study
OPERATING COST	Depends on Volume of Data Traded	Increases With Time	Stable	Lower or Higher than Secretaries Depending on the Work	Depends on Demand and System Design	Depends on Complexity of the Model & Frequency of Use	Low - One Time Capital Investment	Depends on Type of Study
GROWTH IN SIZE	Stable, If Volume Is Constant	Increase with Time	Grows Only If New Subjects Added	Stable After Initial Startup	Increase with Time	None After Model Is Built	Size Fixed when Installed	Grows to Peak, then Eliminated
TRADOFFS	Manual Files If Summaries not Frequent	Retain Summary Data Only	Printed Manuals	Central vs Stand Alone vs Manual	Few Alternatives if Needed	Simple vs Complex Model	Automation vs no Automation	Depends on Type of Study

Exhibit 2-3
U.S. Environmental Protection Agency
Application Classes Serving Principal Environmental Activities

Principal EPA Activities \ ADP Application Classes	TRACKING & REPORTING	TREND & MONITORING	TECHNICAL DATA BASE	WORD PROCESSING	BIBLIOGRAPHIC	MODELING & SCIENTIFIC	LAB AUTOMATION	SPECIAL STUDIES
1. Identify Present State of the Environment		✓			✓			✓
2. Determine Required Environmental Quality						✓		✓
3. Develop Methods for Controlling Pollution						✓	✓	
4. Implement Abatement Control Strategies	✓		✓	✓				
5. Enforce Abatement Control Strategies	✓							
6. Monitor Compliance with Regulations		✓					✓	

Exhibit 2-4
U.S. Environmental Protection Agency
Application Classes of Major Systems

	TRACKING	TREND & MONITOR	TECHNICAL DATA BASE	WORD PROCESSING	BIBLIO-GRAPHIC	MODELING & SCIENTIFIC	LAB AUTO-MATION	SPECIAL STUDIES
OPM	FMS GICS DIPS TSSMS Personal Property							✓
OEGC	CDS GPSF PEMS							✓
OAWM		SAROAD	NEDS		SWIRS NOISE APTIC	RAPS		✓
OWHM	GICS GPSF SIRS/ SPCC	STORET GPSF	TADS PARCS	BTS		Estuary Models		✓
ORD	GICS Program Manage-ment			BTS		SEAS Lake Pollution RAPS	Cincin-nati Pro-ject	✓
REGIONS	GICS GPSF CDS PEMS FMS DIPS	SAROAD STORET GPSF	NEDS SAROAD			Air Diff-usion & Indirect Source Models		✓

All parts of the Agency use tracking and reporting systems for administration and operational control. However, the major users of these systems are within the Office of Planning and Management, and the Office of Enforcement and General Counsel. Computerized tracking systems frequently are used to accommodate large volumes of data for reporting purposes and to provide summary information on many different attributes.

These systems are characterized by high data entry requirements. Their operating costs tend to increase as data within their system files increase. However, certain implementation alternatives, such as the judicious use of off-line storage, can be used to stabilize these costs. Manual files represent the primary alternative to these systems.

(2) Trend and monitoring systems build data bases of technical information over time.

Trend and monitoring systems are used to construct national data bases of environmental quality information. They are used primarily within the air and water programs.

These systems are characterized by high data entry volumes and by increasing operational costs over time due to the ever increasing size of their data files. This increase can be stabilized, however, through the use of off-line storage and summary data.

Many users have been critical of the design and operation of these systems because they have failed frequently to meet their scientific needs. The Agency's trend and monitoring systems were developed to provide very general data support, although it has been suggested that the development of systems to meet more precise and narrower objectives should have yielded systems which would better serve the needs of researchers and analysts.

(3) A technical data base is a mechanized catalogue.

A number of catalogue items, each having several parameters, are contained in technical data bases. They are used as reference tools to provide information to researchers. The Technical Assistance Data System (TADS) stores scientific information such as boiling point, toxicity, and color on over 800 hazardous substances. The Pesticides Analysis Retrieval and Control System (PARCS) catalogues data on pesticides, and the National Emission Data System (NEDS) contains air pollution emissions data. The difference between this application class and tracking and reporting systems is that technical data bases associate a single, fixed set of parameters with each item.

Technical data bases are characterized by a low volume of data entry and stable cost curves. The primary alternatives to computerized technical data bases are manually maintained handbooks and catalogues.

(4) Word processing systems are used to reduce secretarial work and to facilitate document preparation.

Word processing systems automate secretarial typing tasks. Textual information is input to the system, modified in an interactive process, and output in a retyped and corrected version.

The benefits of word processing systems are dependent on the nature of the clerical workload. If a document is typed only once, or undergoes drastic and extensive revisions each time it is retyped, word processing equipment provides few advantages over manual procedures. However, for large documents that undergo frequent minor revisions, an automated system can be of considerable benefit.

Word processing systems are of two basic types: central service and stand alone. A centralized service that the Agency uses is Bowne Timesharing, Inc. which runs on a large computer in New York. The Agency also uses numerous small self-contained, stand alone systems in many offices. The stand alone systems are fixed price facilities, whose costs are independent of volume. The Bowne charges are based on usage volume. Stand alone systems are cheaper for heavy usage, and Bowne is more economical in supporting occasional service needs.

(5) Bibliographic systems identify technical and scientific literature on specified subjects.

Bibliographic systems use the processing capabilities of a computer to search a very large set of book and journal abstracts to find publications relevant to specific subjects. The user specifies his areas of interest and the machine searches for all articles matching his search criteria. He receives either a list of reference numbers, citations or full abstracts, depending on the design of the particular bibliographic system.

These systems are characterized by substantial abstracting expenditures and variable operating costs, depending upon the particular implementation strategy employed. The cost of these systems increases over time as the number of abstracts in the system grows, unless the system operators continually purge outdated articles and maintain the data base at a fixed size.

(6) <u>Modeling and scientific systems support the scientific and socio-economic research activities within the Agency</u>.

The use of computer models to simulate real events and activities provides a valuable research and planning tool. Performing experiments on a real system (river, city, or the nation's economy) many times would be prohibitively expensive, infeasible, or even potentially dangerous. The effects of alternative activities and conditions can be studied safely and without risk, using computer models.

Most of the Agency's modeling work to date has focused on physical systems (e.g., air flow, rivers and lakes) and has been used to gain fundamental scientific understanding about the environment. Also models are being used by regulation and enforcement personnel within EPA to evaluate control strategies.

Modeling and scientific applications tend to be independent of other Agency systems. They are designed and operated to service a special research need. Their operating costs and characteristics vary widely depending upon frequency of use, volume of data processed, and complexity of numerical techniques employed.

(7) Laboratory automation involves the use of small dedicated computers to control and monitor instruments.

Experiments can be controlled, data collected and analysed, and records maintained automatically through the use of lab automation. The Agency has called upon experts from the Lawrence Livermore Laboratories to assist in the design and implementation of EPA's lab automation systems. Both development and operation of these systems will be financed with Program funds.

The benefit of laboratory automation will be to increase productivity, rather than to lower cost. The data processing expenditures on laboratory automation will increase as hardware is acquired and will then decline after all the laboratories are equipped. Because the hardware is dedicated to the laboratory use and will be purchased rather than leased, only maintenance expenses will be recurring.

(8) Special studies are used to generate reports in response to congressional inquiries and to support special research projects.

Special studies represent an application class only in the budgetary sense. They represent one time non-recurring computer expenditures used to generate special reports from existing data bases, from newly constructed models, or from specially designed data bases.

Special studies may be extremely short in duration, such as special reports on construction grants. An answer to a specific outside inquiry may take only a few days and may be paid for out of operational budgets on current systems. At the other extreme, a study may take several years and require a special staff and separate funding. The Regional Air Pollution Study (RAPS) system and the California sulphur dioxide study are examples of large scale studies.

4. EACH EPA OFFICE HAS SPECIFIC ADP NEEDS.

This section describes the current and anticipated future ADP needs of the major EPA organizational units.

(1) OPM needs ADP to support the record-keeping and management decision-making associated with administering the Agency's affairs.

OPM needs ADP support primarily to automate the clerical activities associated with administering the Agency's work. The systems which already have been developed for this purpose, for the most part, are expensive to operate. The high cost of these systems is attributable primarily to the large volume of detailed information which is assembled and reported. Yet this detailed information has not improved significantly the ability of top managers to control and administer Agency affairs. The widespread and varied activities of the Agency require an Agencywide management information system of relevant aggregate information to support the coordinated evaluation and control of EPA activities. The Program-Planning-Budgeting (PPB) system, for example, which relates dollars, programs, and missions, could be expanded beyond its current use in the annual budgeting cycle to be an integral part of the on-going strategic planning and tactical management of the Agency. Current administrative uses of ADP and any future systems development should be directed toward creating an integrated information system for supporting the administrative and managerial decisions of the Agency.

Except for the need to better integrate management information, the functional requirements of OPM are expected to remain stable over the next few years, and the demand for ADP to support these functional activities should remain flat or decrease as technical efficiencies are introduced.

(2) OEGC needs increased data processing support to facilitate the detection and prosecution of chronic polluters.

The Office of Enforcement and General Counsel is charged with developing and implementing programs to insure that corporations and other businesses conform to pollution control guidelines and regulations. As more media programs progress into the enforcement phase, the influx of paper-processing associated with the tracking, monitoring and litigation comprising these enforcement activities will require increased computer support for handling the growing workload. The nature of this required computing support falls into the following categories:

- Compliance tracking and monitoring to insure that permittees have conformed to the stipulations of EPA or state-issued permits.
- Enforcement action tracking indicating the date, type and outcome of actions taken against particular violators.
- Data quality controls to insure that chemical samples which are to be used in litigation conform to judicial chain of evidence requirements.
- Summary reporting which provides Headquarters with information concerning the activities of regional and state enforcement divisions.

(3) <u>OWHM needs ADP to monitor the quality of the nation's waters and the issuance of construction grants</u>.

The major need for ADP support by OWHM will continue to be the maintenance of large water quality and pesticides data bases and the monitoring of construction grants. Relative to other environmental media, EPA's water programs are the most advanced with respect to the six environmental activities identified earlier. However, changes will occur as the monitoring activity of OWHM shifts from "random" monitoring to more systematic monitoring using sampling techniques and permanent monitoring stations. The introduction of standardized monitoring stations and sampling techniques will lower the volume of stored data but will increase the accuracy and usefulness of the resulting national data bases. With the exception of a small increase in modeling activity, such as river basin planning models, no major new applications of ADP are anticipated in the near future. Also, the trend of delegating increasing authority to the states should keep OWHM's ADP requirements relatively stable over the next few years.

(4) OAWM needs ADP to monitor the quality of the Nation's air and to support on-going research in other categorical programs.

OAWM needs ADP primarily to maintain the national air quality data systems, and to perform modeling and other statistical analysis. Air programs, like the water programs, will continue to use computers to support their monitoring activities. However, the use of ADP to support these activities is expected to continue at a constant rate for the next few years. OAWM will be augmenting its effort in two areas in the near future: (1) energy-related studies, such as analyzing the impact and control of pollution generated by power stations, and (2) mobile source pollution studies, such as examining the economics and social impact of an increase in gasoline taxes, parking bans, etc. The effect of this shift in the Office's ADP requirements will be to increase the need for more modeling and research support.

The other offices within OAWM, such as Radiation, Noise and Solid Waste, tend to be relatively minor users of ADP. Their largest usage, at present, is in the area of bibliographic services. There is also some minor use of modeling within each of these program areas. These modeling applications will continue at or slightly above their current levels into the future with particular emphasis upon diffusion models in radiation and simulation models in noise.

(5) ORD needs increased ADP support for modeling and scientific research.

The current ADP usage of ORD is applied, for the most part, to the operation of program management systems, statistical analyses, and laboratory automation. It is apparent, however, that the Agency currently is not employing ADP to its maximum advantage in support of scientific activities. The nature of the research process is such that scientists and technicians need convenient and reliable ADP tools to perform their work. Furthermore, the activities of ORD are frequently at the cutting edge of the Agency's work, and in this capacity ORD is frequently called on to perform immediate, high priority projects. These projects and special studies often require rapid and responsive ADP support in order to get the job completed in the most effective manner. Therefore, ORD will require more reliable, responsive, and human-factored ADP services in the future.

(6) The regional offices need ADP to support enforcement, administration and environmental quality analysis.

The principal ADP activities of the Regions are in the areas of enforcement compliance and monitoring, administration, and air and water quality analysis. The characteristics of this usage and projected future usage are determined by the needs of the corresponding Headquarters offices. However, as environmental program responsibilities are shifted to state agencies, the regional offices will expend increasing resources providing technical assistance to the states and monitoring the resulting performance of the local programs. Consequently, the regional use of ADP will shift from clerical processing and filing of materials associated with executing environmental programs to reporting summary statistics concerning the activities of state agencies. The regions also will increase their use of Agency-developed models relating to power stations, mobile source pollution, river basin planning and the disposal of hazardous materials.

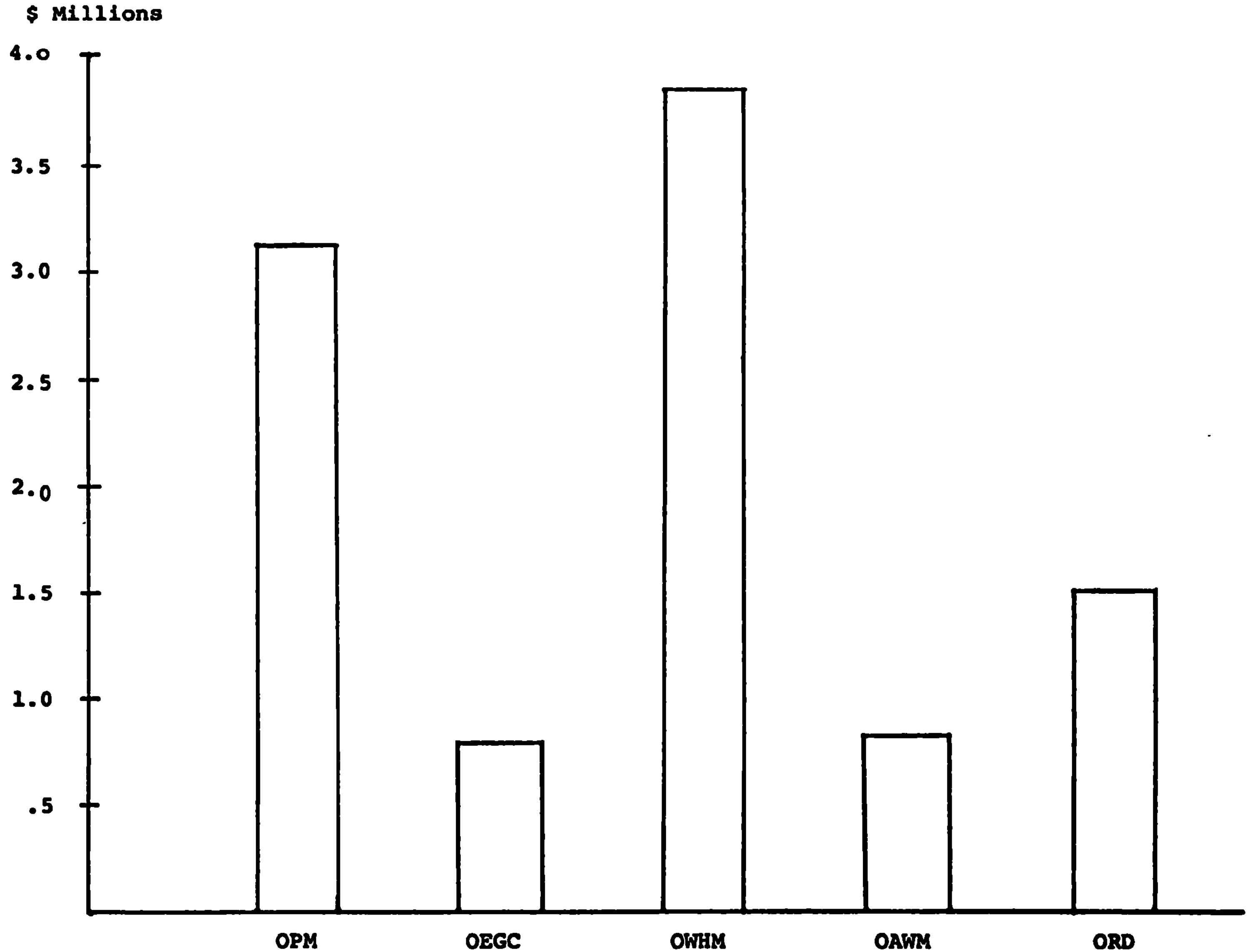
5. OWHM AND OPM ARE RESPONSIBLE FOR MOST ADP EXPENDITURES.

Exhibit 2-5, following this page, shows the allocation of the Agency's ADP timesharing costs among the five Headquarters organizational units. The program usage in the Regional Offices has been allocated to the appropriate Headquarters program offices. As illustrated in the exhibit, the largest ADP usage is in OWHM and OPM.

- OPM's high proportional usage is attributable to conversion and administrative costs associated with the Research Trinagle Park (RTP) Computer Center and to the operation of several expensive administrative systems.
- OWHM's ADP expenditures are attributable primarily to the operation of the STORET system.

ORD, which has one of the largest Agency operating budgets and has been allocated approximately 20% of EPA's full-time positions, makes relatively little use of ADP by

Exhibit 2-5
U.S. Environmental Protection Agency
ADP Timesharing Expenditures by Office



comparison. Furthermore, almost one-third of ORD's ADP usage is for program management or word processing rather than for research and scientific activities.

6. <u>THE COORDINATED ADP PLAN SHOULD REALLOCATE ADP RESOURCES TO CONFORM WITH AGENCY PRIORITIES BY PLACING GREATER EMPHASIS UPON SCIENTIFIC APPLICATIONS</u>.

The preceeding sections described EPA strategies, organization, ADP utilization and current and future ADP needs. The key observation resulting from this discussion is that <u>ADP resources are not distributed currently in ways necessary to satisfy overall Agency needs</u>. Instead, certain program areas and application classes tend to dominate ADP usage. The coordinated ADP plan in Chapter V will present a series of action steps designed to rectify this imbalance by modifying or eliminating non-essential systems and by developing new applications to satisfy pressing Agency needs. These steps will result in a general shift in ADP usage away from clerical and operations-oriented data collection and reporting applications and towards increased use of data processing to support the basic scientific activities of the Agency.

III. MANAGEMENT OF ADP RESOURCES

III. MANAGEMENT OF ADP RESOURCES

This chapter describes policies and procedures currently used in managing data processing resources within the Agency. This discussion is organized into three sub-sections concerning computer equipment and facilities policies, management of systems development, and ADP staffing.

1. THE AGENCY CURRENTLY IS USING TWO PRIMARY COMPUTER FACILITIES.

EPA primarily uses computers in Washington and in North Carolina. Optimum Systems, Inc. (OSI) is a commercial vendor located in Washington operating IBM computers for EPA. The Agency itself operates a Univac 1110 computer at its Research Triangle Park (RTP) facility in Durham, North Carolina. In addition, EPA uses computing facilities provided by the National Institute of Health (NIH), Informatics (ENVIRON), Bowne Time Sharing (BTS), Health Services Administration (HSA), and the Department of the Interior (USGS). Dedicated mini-computers also are used for specialized systems at Agency laboratories.

The following table summarizes this usage:

Location	Purpose
OSI	General Purpose Data Processing
RTP	General Purpose Data Processing
NIH	General Purpose Data Processing
ENVIRON	Text Searching/Bibliographic
BTS	Word Processing
HSA	Financial Management
USGS	Personnel System (DIPS)
Agency Offices and Labs	Special Applications

Each of these facilities is described in more detail in Appendix C.

(1) <u>The Washington and RTP facilities support most of the application needs of the agency</u>.

Most of the data processing needs of the Agency require conventional computer hardware and software support. Only word processing and lab automation require special features not available normally from a general purpose digital computer. Although some bibliographic systems make special use of the capabilities of the ENVIRON system offered by Informatics, other comparable systems are run at OSI and RTP.

Exhibit 3-1 on the following page, illustrates the distribution of application classes by computer vendors currently used by EPA. Note that OSI and RTP support the same application classes except for tracking and reporting systems, which are not operated at RTP at present.

(2) EPA is consolidating computer services onto the Washington and RTP facilities.

During FY 1974, over 85% of the ADP timesharing budget was spent on the OSI and RTP facilities. The current distribution of usage is shown in the table below:

Facility	FY'74 Expenditures ($000)
OSI	6,034
RTP	2,043
NIH	1,462
ENVIRON	527
BTS	570
HSA	317
USGS	390

The use of outside services will decline further as additional systems are consolidated onto the two

Exhibit 3-1
U.S. Environmental Protection Agency
Distribution of Application
Classes by Computer Facilities

	TRACKING & REPORTING	TREND & MONITOR	TECHNICAL DATA BASE	WORD PROCESSING	BIBLIO-GRAPHIC	MODEL & SCIENTIFIC	LAB AUTO-MATION	SPECIAL STUDIES
OSI	✓	✓	✓		✓	✓		✓
RTP		✓	✓		✓	✓		✓
ENVIRON	✓		✓		✓			
BTS				✓				
NIH	✓					✓		
HSA	✓							
USGS	✓							
MINICOMPUTERS							✓	

facilities. For example, the Grants Information Control System (GICS) has just been moved from NIH to OSI, and the Mobile Source System will move to OSI shortly.

(3) <u>The OSI and RTP computer centers differ in terms of configuration flexibility.</u>

The current OSI contract and the Federal regulations which govern the use of the RTP facility influence the configuration of the respective equipment. For example, the current OSI contract requires that only two spindles be available for mounting off-line private packs. This requirement resulted from EPA users' preference for on-line storage of data. If this preference changed, OSI could add more off-line spindles quickly and easily. More generally, OSI is required by contract to provide a certain level of ADP service consistent with Agency demands. Consequently, as Agency workloads increase or change, OSI modifies its equipment configuration so as to support these changes.

The RTP facility, by contrast, cannot respond as rapidly as OSI to demands for configuration changes. Since it is an Agency facility, major equipment upgrades must conform to Federal equipment approval procedures and therefore may take up to three years to implement. If done more than two times, these upgrades may require a new facility Request for Proposal (RFP). Consequently, RTP has installed enough excess capacity to withstand a three-fold increase in daily work level so as to avoid the need for a major upgrade.

(4) OSI provides better communication support than RTP.

At present, the OSI facility is much more available to non-local users. The Agency supports currently several hundred low and medium speed terminals at Headquarters, the NERCS, and in the regions. Each terminal is capable of communicating with the OSI and RTP facilities. The OSI facility currently supports over 190 on-line communications ports. RTP has six medium speed and 58 low speed ports. Although the computer equipment is as capable as OSI of communications with EPA's geographically distributed user base, RTP requires significant upgrading of its medium speed communications facilities before it can become more widely available for Agency use.

(5) The system designer must make an explicit decision on which facility an application is to be developed and run.

All EPA applications cannot run equally well at RTP and OSI. Since OSI runs IBM 370 computers and RTP supports a Univac 1110 configuration, OSI has more system software and proprietary software packages available to it than RTP. Application programs developed for use on the IBM facility, in many cases, will not be transferrable to the Univac 1110. Many of the IBM software systems used by the Agency (EASYTRIEVE, IRS and MARK IV) are not available currently on the Univac equipment. Consequently, the system designer has fewer alternatives available to him on the RTP facility. In most cases, even application programs written in a language supported by both facilities, e.g. COBOL, cannot be transferred easily.

(6) Differences in pricing policies at OSI and RTP influence the types of processing performed at each installation.

OSI charges comparatively higher rates than some service bureaus for computer time but less than others for on-line storage. This structure favors a large trend and monitoring system at the expense of more computational programs. OSI also has modified their pricing scheme, at Agency request, to favor on-line, interactive applications over batch processing.

OSI bills communications charges to the Agency according to the number of hours of connect time used. Most of OSI's costs for communications are fixed price leased lines or WATS lines. Their contract rates must thus be set to recover these fixed costs at the expected usage level. Any usage above these levels generates considerable profit for OSI if no equipment is added. As usage level per line increases, rates should decrease. Also, since communication costs are fixed, the unit charges cannot be lowered unless utilization increases. Any other change in rates would have to be offset with increases elsewhere.

The pricing scheme at RTP is different from OSI, because the equipment and operational costs are fixed. The charge per resource hour for the facility is adjusted periodically to recover costs. As usage goes up, rates decrease. The computer charges are set to recover equipment rental, supplies, maintenance and facilities management costs.

RTP is using currently the standard UNIVAC billing formula. Because of the on-line orientation of the 1110, the formula charges more for tape operations than disk activity. This pricing scheme penalizes those systems which are built to use the lower cost tape storage and rewards systems which store data on disk.

(7) EPA uses outside contractors to manage its facilities.

Headquarters has little expertise in facility management. Its current responsibilities require only the contract management of its major facility, OSI. The OSI contract delegates the responsibility to the contractor for computer planning and operations, physical plant planning and operations, and system software support.

The Agency staff is primarily responsible for management of the OSI contract, negotiations on rate changes, operation of TSSMS and preparation of charge back notices to Agency users. Design and programming support is provided by OSI rather than by MIDSD.

The Data Systems Division at RTP is directly responsible for installation and operation of the Univac 1110.

The equipment procurement was handled by the Agency, and the hardware is located in an EPA facility. When the Agency operated an IBM 360/50, the branch personnel ran the facility. The Univac 1110 requires more personnel support than did the IBM machine, and consequently, a facilities management contract has been signed to provide the operations staff for the machine. The Agency office at RTP provides systems analysis, and programming support to users to the extent possible, and also assists in contracting for outside vendor-supplied services.

The role of the Data Systems Division at RTP differs from MIDSD in two respects. Because the Univac 1110 is government-based, the RTP staff is directly responsible for operational issues. MIDSD, by contrast, contracts for the rate structure charged by OSI for machine usage. At RTP the personnel in the Data Support Branch have a more technical background, and thus offer more technical support to EPA users than is normally provided by MIDSD.

2. GOVERNMENT PRACTICES INDUCE EPA TO UNDERTAKE CONVERSIONS OF MAJOR SYSTEMS TO NEW FACILITIES.

Since its inception, the Agency has been undergoing a continual shifting of its systems from one operating environment to another. When EPA was created in 1970 out of other Federal Agencies and Departments, most of EPA's data processing remained on the computer systems provided by the predecessor Departments. Over time EPA consolidated this processing load to the degree that it could justify its own computing center. However, Government policies forbid an Agency from obligating Federal funds for more than one year at a time. Although computer facility contracts can be written and renewed annually, Federal contracting practices do not encourage the continued renewal of such contracts year after year without competitive bids. Hence, EPA has tended to issue RFP's for computer vendors approximately every three years.

Any conversion of systems from one location to another will require a period of parallel operations. The old facility should be maintained for one to two months before it can be discontinued. At current OSI usage levels, this conversion costs $0.5-1 million. In addition, some systems will require program conversion or reprogramming, even when moved to another machine of the same type. These combined costs easily can exceed $1 million.

In a few cases, the Agency has been forced to convert because a government computer service facility has restricted its availability. For example, the NIH computer work load has grown to the point where they have required EPA to terminate its usage of their facility.

3. CURRENT ADP USAGE IS CONTROLLED AND BUDGETED FROM A SPECIAL FUND MANAGED BY THE OFFICE OF PLANNING AND MANAGEMENT.

The ADP Fund is budgeted by Management Information and Data Systems Division (MIDSD) of OPM. Timesharing costs are allocated among each of the major EPA budget categories. These costs are appropriated as part of the Agency budget process. ADP budget planning is based on last year's expenditures, incremented by changes in scope or direction of major Agency programs. No zero base budgeting has been required by Agency policy.

In the future, all ADP users will be including ADP cost projections in their budgets. A charge-back mechanism initiated in July, 1974, will be used to monitor actual usage against budgeted usage. Individual ceilings will be established to prevent total ADP fund overruns.

In order to better monitor ADP usage, MIDSD has been operating the Timesharing Services Management System (TSSMS) to track timesharing expenditures by program element. TSSMS produces monthly statements for each ADP sub-allowance holder, indicating ADP cost-to-date. The system tracks computer charges from OSI, BTS, ENV, HSM, NIH, USG, and several smaller service bureaus. During FY'75, RTP will be added. TSSMS will form the basis of chargebacks to sub-allowance holders.

4. ADP MANAGEMENT CONTROL IS A HIGHLY DECENTRALIZED PROCESS AT EPA.

Agency management policies provide program and regional managers with a great deal of decision-making authority. ADP management control, accordingly, is distributed throughout the Agency.

(1) Senior EPA management has not guided development efforts through the setting of Agency policies or project priorities.

Only recently have the pressures of budget constraints and lack of support for meeting program objectives focused senior management attention on the issue of ADP. The needs analysis for system development has been a bottom-up process, originating from the lower levels of the Agency. Senior management has not controlled strategically the growth of ADP usage or coordinated its usage between programs. Very few interprogram trade-offs are made in the allocation of ADP Fund monies. In addition, very little software has been developed, with the exception of a few administrative systems, which was intended to be shared between programs with similar functional requirements.

(2) Less than five percent of the ADP personnel costs are spent on the planning and control of ADP within the Agency.

Very few resources have been allocated to support adequate planning and control of the ADP expenditures at EPA. In terms of volume, most of these resources are located presently within ORD as part of their Program Management activities and have very little influence on Agencywide practices. MIDSD, within OPM, is the other locus of activity.

Allocation of ADP Fund monies is made on the basis of past requirements. Very little zero-base budgeting of ADP resources is done within the Agency. Program offices are asked to project their needs based on last year's requirements and some sense for next year's incremental needs. These projections are accumulated to specify agencywide requirements.

(3) New systems are developed by program offices without regard to overall Agency priorities.

New system development projects are initiated by program personnel in response to information needs or personnel shortages. Since new development is funded from program budgets, Agency managers are concerned only with the cost benefits of system development versus other potential program projects. Furthermore, program managers have little concern for operational cost implications of development projects, since the operating costs for the resulting systems are provided by the ADP Fund, and thereby, are independent of other program budgets. As a result, new systems are developed reflecting the local needs and availability of program funds rather than the overall priorities of the Agency as a whole.

(4) New policies and procedures for the justification, procurement, and development of new systems are being developed by MIDSD of OPM.

Under the authority of EPA Order 1210.3A (6/4/73), the Director of MIDSD must approve requisitions for ADP equipment, studies, and services. The policies and procedures governing this approval process are described in EPA Order 2800.1 (4/2/74), wherein all

ADP requisitions must be justified on the basis of a feasibility study to ensure conformance with government and Agency standards, to ensure that alternatives have been considered, and to provide for audit benchmarks.

MIDSD also is preparing the Agency's first ADP manual. This manual will impose needed standards on Agency development activities. It will cover the following five areas:

- Development Cycle of EDP Systems
- ADP Resources Available on an Agencywide Basis
- Obtaining ADP Equipment and Services from Non-EPA Sources
- Standardization of Data Elements and Representation
- Documentation Standards and Requirements

For this manual to be effective, care must be taken to insure that the standards are implementable and that a mechanism is provided to insure adherence to these standards.

(5) <u>The Agency lacks an information source to provide management with an accurate, timely profile of ADP expenditures for system development and the status of development projects.</u>

ADP project costs are composed of ADP Fund monies, ADP personnel costs, and program funds spent on outside contractors. Consequently, no consolidated reporting on ADP project costs is produced regularly. Because development is highly decentralized and because there are no clear standards for acceptance testing and installation, many projects cannot separate what monies they are spending on development from funds spent on maintenance or other related expenditures. Furthermore, no Agencywide project control standards exist to test the status of projects and to identify variances from planned specifications, development costs, or operational cost estimates.

As a result, project control, acceptance testing, installation, and operation of software developed by contractors has been undermanaged. Few systems developed for the Agency by contractors have been installed on time or within budget. This poor record is attributable to a lack of definitive design specifications and to the absence of management controls to identify and rectify variances from planned specifications or quality criteria.

5. <u>EPA SPENDS APPROXIMATELY $7.2 MILLION ANNUALLY ON AGENCYWIDE ADP PERSONNEL SALARIES</u>.

Exhibit 3-2, following this page, presents the distribution and cost of full and part-time Agency personnel by organization and geographic location as indicated in the October 1974 "Organizational Schedule of Employees". As indicated in the Exhibit, there are approximately 454 people categorized currently as ADP personnel within the Agency. Included in this category are personnel who spend 50% or more of their time using ADP, who work in an organizational group which is defined as an ADP unit, or whose job titles indicate ADP responsibilities. The total salary level for these personnel is $7.2 million, or approximately $16,000 per person. These personnel are deployed quite evenly throughout the Agency with the exception of OEGC, which has very few ADP professionals.

The major pockets of Agency ADP expertise reside in the Washington, D.C. and Durham, N.C. areas. The Headquarters offices and the Research Triangle Park facility account for almost 75% of the Agency's ADP personnel. This distribution occurs because most ADP personnel were located in these areas prior to the formation of

Exhibit 3-2
U.S. Environmental Protection Agency
Distribution of ADP Personnel and Personnel Costs ($000,000)

	OPM	OEGC	OWHM	OAWM	ORD	Regions	TOTALS
Washington	65 people $1.1 M	3 people $ .1 M	105 people $1.8 M	1 person	37 people $ .7 M		211 people $3.7 M
Durham	28 people $ .5 M			64 people $ .8 M	34 people $ .5 M		126 people $1.8 M
Other		6 people $ .1 M		11 people $ .2 M	52 people $ .7 M	48 people $ .7 M	117 people $1.7 M
TOTALS	93 people $1.6 M	9 people $ .2 M	105 people $1.8 M	76 people $1.0 M	123 people $1.9 M	48 people $ .7 M	454 people $7.2 M

the EPA, and because these two locations contain the major equipment facilities of the Agency.

6. <u>EPA SALARY LEVELS FOR ADP PERSONNEL ARE HIGHER THAN THE NATIONAL AVERAGES, BUT THESE LEVELS HAVE NOT BEEN SUFFICIENT TO DEVELOP A SUPERIOR INTERNAL ADP STAFF</u>.

EPA data processing personnel have been classified into three categories for comparative salary analysis as shown in the following table:

Role	Average Annual Salary	National Averages	Averages for Government Agencies
ADP Management and Supervision	$27,000	$19,000	$22,000
Analysis/Programming	$18,000	$14,300	$15,000
Operations/Clerical Support	$ 9,700	$ 8,000	$ 9,500

The data used to support this classification was generated from the "Organizational Schedule of Employees", through interviews with a sample of section and branch directors, and through inferential analysis of ADP work products. Comparative salary levels for industry and government are based on a survey conducted and printed in <u>Infosystems</u> September, 1974.

A gross analysis of these data indicates that Agency ADP managers and supervisors are paid over 40% more than their private industry equivalents, and analysts and programmers are paid 25% more than their counterparts. Notwithstanding these high compensation levels, system development and project management appear to be the very areas in which EPA is weakest in ADP support. This weakness, therefore, cannot be attributed to insufficient salary levels. Rather, this weakness is attributable to EPA difficulty in developing or attracting qualified personnel for career and professional reasons rather than for financial reasons.

With the data available, the study team was able to draw five general conclusions about the status of EPA's skills inventory, as follows:

- There is no senior management at EPA with a significant background in ADP.
- Most EPA analysts are functionally (program) oriented and have little experience in the management of large ADP system development projects.
- Most non-scientific programming is contracted outside.
- Insufficient skills exist for EPA to exploit properly technological developments in the areas of data base management software, communication and on-line systems software, and mini-computers.
- EPA presently does not employ the resources necessary to manage a major on-line facility such as at RTP or OSI without the use of outside facility management contracts.

7. <u>THE ADP PLAN SHOULD PROVIDE MORE EFFECTIVE ADP SERVICE AT LOWER COST THROUGH THE DEVELOPMENT OF A COORDINATED EQUIPMENT STRATEGY, THE INTRODUCTION OF REVISED BUDGETARY POLICIES, AND THE REDEPLOYMENT OF TECHNICAL PERSONNEL.</u>

This chapter has described the policies and procedures currently used to manage data processing resources within the Agency. The key observation resulting from this discussion is that ADP services are currently more expensive and less effective than they should be because, until recently, ADP management policies have been only a minor concern of top EPA management. The ADP plan presented in Chapter V will present a series of policy and procedural recommendations to control and coordinate the utilization of ADP resources. These policies will include a hardware and equipment strategy coordinated with the system development steps comprising the plan, a proposed redeployment scheme for ADP personnel and a set of budgetary, project management and system development guidelines for insuring that ongoing Agency computer usage is controlled and consistent with EPA objectives and needs.

IV. PROBLEM AREAS

IV. PROBLEM AREAS

This chapter describes several problem areas in which the use and provision of data processing resources fail to satisfy essential Agency needs. These problem areas concern factors affecting the control of current and new system development and usage, the pricing and delivery of computer time and the recruitment and deployment of ADP personnel.

1. THE INCREASING COST OF DATA PROCESSING WITHIN EPA IS DUE PRIMARILY TO THE PROLIFERATION OF APPLICATION SYSTEMS AND THE UNCONTROLLED EXPANSION OF EXISTING SYSTEMS

Data processing costs within EPA have increased as program managers grow increasingly aware of the ways in which ADP can be used to circumvent their personnel limitations and as existing trend, monitoring, tracking and reporting systems have expanded well beyond their original design assumptions.

(1) The scope of many application systems either exceeds or fails to service the actual needs of EPA users.

Many systems operating at EPA today were developed at predecessor agencies such as the Department of

Interior or the Department of Health, Education and Welfare. Although these systems may have been cost-justifiable at their inception, their current costs no longer seem in line with Agency priorities.

Some systems have come to utilize highly sophisticated data processing equipment and techniques even though users could be serviced adequately by simpler and less costly alternatives. For example, the Noise library information system costs approximately $500 per retrieval for computer time, whereas comparable, though simpler, EPA library retrieval systems in other program offices provide similar services at a fraction of this cost. Ambient environmental quality data bases in the air (SAROAD) and water (STORET) programs are designed to service similar needs, namely, to provide a repository of information for modeling and environmental quality planning and reporting. Nonetheless, restricted features, such as the absence of interactive usage, make the cost of the air system but a small percentage of the cost of the water system.

Many Headquarters systems provide national data bases of technical environmental information. These systems increase in size and in cost as more and more information is included. The justification for these data bases is based heavily on the support they will provide to researchers, enforcement personnel and to environmental quality planners. Since system designers insist that it is impossible to anticipate all the information that future users will require, they design these systems to include a broad range of potentially interesting environmental parameters. However, the purported users have found that the assembled data is rarely suitable for their needs. Researchers and planners have found that information contained in national data bases, such as STORET, require so much filtering and "cleaning" that it is oftentimes faster and cheaper to assemble manually the required data. Enforcement personnel likewise have found that national system data is insufficient for court use and that special redundant sampling must be conducted by regional surveillance and analysis staffs to assemble judicially acceptable evidence for litigation.

(2) <u>Many Headquarters designed systems have been justified on the grounds that they support regional needs but these systems have failed to prove useful in practice</u>.

Program managers at Headquarters often have found uses for computer systems which would simplify or expedite their own work. Frequently, however, these uses cannot be cost-justified based on the Headquarters provided benefits alone. Therefore, many managers have designed or proposed systems which were purported to service regional users as well. Frequently, the purpose of these systems was described as relieving the clerical or paper-work burden that national programs would otherwise impose on the limited resources of local staffs. However, many of these systems have either failed to service regional needs or have increased the paperwork burden imposed on regional staffs.

The oil and hazardous materials system, TADS, was described by Headquarters personnel as providing an indispensible service to regional users. Regional users, by contrast, indicated that they found the system of little use and that a well designed loose-leaf notebook could provide more efficient and practicable service. Similarly, the

General Point Source File (GPSF) had been proposed originally to support regional and state enforcement personnel. Yet many of the features of the system, such as the encoding of reported Discharge Monitoring Report conditions, actually increase regional workloads without providing corresponding benefits. Regional personnel indicated, as a general rule, that most Headquarters systems fail to assess regional needs, and, therefore, produce added burdens on local personnel without providing corresponding promised benefits.

(3) The lack of Agencywide review and coordination have led to redundant and costly systems.

Each program office retains primary responsibility for conceiving, promoting, financing and developing systems to support program needs. Until recently, most such system ideas were never reviewed by anyone outside of the originating office. Consequently, many systems were designed and many dollars were expended "reinventing" systems which already existed in other program offices. For example, there are currently four separate library abstract retrieval systems operated for Noise, Solid Waste, Pesticides and Air. Each of the system users have similar requirements, yet the four systems were designed and programmed independently, and still operate on three separate computer facilities.

Due to this absence of formal coordination, EPA personnel with specialized expertise or experience were not called upon to assist in the development of related systems. Consequently, design and management principles, such as editing or data base administration, that were introduced into the development process of some systems were absent in the development of others. User groups were unable to learn from the experiences of others. Today, this same pattern exists among the ten regions. Most have developed independently their own GPSF back-ups and mailing list programs. A more regular and formal sharing of expertise and software would help reduce these redundant efforts and lower overall Agency ADP expenses.

(4) Most feasibility studies for new systems failed to justify why the systems were needed.

The study team's review of several feasibility studies failed to uncover evidence justifying the need for the proposed systems. The absence of such justification made it difficult to judge the merits of the proposed requests. Furthermore, it raised the possibility that the program managers may not have considered fully the possibility of using simpler manual systems to satisfy their needs. Rather, the only alternatives presented, in most cases, showed that one computer system approach was less costly than another. In few cases were there any indications of the consequences of not building a system at all. Therefore, it was quite difficult for non-program personnel to assess the benefits which the proposed systems would provide. More generally, we were impressed by the dearth of conventional systems analytical effort and expertise implicit in these feasibility studies and in the comments of users in the field.

(5) Sound project management controls have not been imposed on contractors.

Many systems developed for EPA have exceeded original budgets and/or have failed to work as specified. These problems are indicative of EPA's lack of expertise in the management of development projects and in the associated performance which should be expected from contractors. In many cases, contractors have been hired to program systems only to discover that the potential system users continue to change the functional capabilities required of the system. Few milestones and formal acceptance conditions for contracted work normally are specified.

The absence of sound project management controls is not surprising since most systems are contracted for by program offices which do not themselves contain the technical expertise necessary to manage such contracts. The required feasibility studies help make program managers aware of the likely costs and time frames of such development efforts. However, these studies are so new that no proposed systems have yet been developed. Therefore, it is difficult to assess the accuracy of the development and computer time estimates contained in these studies.

(6) Delays have been introduced into the development process by requiring feasibility studies to be approved by Headquarters.

Several program managers were quite irate over delays which they attributed to bureaucratic red tape and nit-picking. The contract officer for the lab automation project, for example, indicated that a six month delay was caused by a disagreement between the developer and Headquarters concerning the computer language in which the system would be written. The project officer for the SWIRS system indicated that he was forced to expend resources examining the feasibility of two separate computer systems, neither one of which was relevant to his problem. More generally, users throughout the Agency have indicated that they distrusted the technical competence of the Headquarters review staff and that they felt projects were delayed for unsound technical reasons. These users indicated that Headquarters staff did not appreciate fully the pressures under which program managers operate, and that, as a result, delays were imposed by Headquarters without due regard to the impact of these delays upon mission objectives.

2. THE PRICING AND AVAILABILITY OF COMPUTER TIME HAVE CONTRIBUTED TO POOR SERVICE AND EXCESSIVE COSTS

Most of EPA's application systems are operated on EPA computers at Optimum Systems Inc. (OSI) or at Research Triangle Park (RTP) and are paid for from a special

ADP fund managed within the Office of Planning and Management. Several systems, however, continue to operate at other computer centers, either because the systems require special facilities not provided by the EPA computers, or because program managers have not yet shifted their applications to Agency computers.

The shift of Agency workloads onto the OSI and RTP computers was motivated by a desire to reduce ADP costs and increase control and coordination over ADP utilization. It was believed that a reduction in computer vendors used by the Agency would lead to lower computer charges as a result of volume discounts and a simplified EPA negotiating posture. In addition, such a consolidation would relieve program managers from the burdens of separately negotiating ADP contracts.

The following six sections discuss problems which have arisen which reduce the effectiveness of these policies.

(1) Current policies cause considerable expense and disruption in service due to frequent changes in computer vendors.

The Federal Government requires that Federal funds not be obligated for more than one year at a time.

Consequently, contracts with computer vendors last only one year and must be renewed annually. Government practices encourage Agencies to open such contracts for competitive bids periodically. The Agency's contract with OSI was a result of just such a competitive bid. However, whenever a new vendor is selected, all application systems must be converted to the new vendor's computer configuration. These conversions require that all users retest their systems on the new vendor's equipment to insure that coding conventions and design assumptions are consistent with the new computer configuration.

The time necessary to change vendors and to perform required system tests detracts from resources needed to pursue mission objectives. Agency sources estimate that the cost of shifting computer vendors costs approximately $1 million. These costs do not include the disruption in service occasioned by the switch. In the past, EPA has underestimated these conversion costs and loss of mission service into the cost-benefit analysis used to select a vendor. Therefore, the Agency disrupted services and incurred conversion costs to a greater extent

Agency officials now are investigating the possibility of purchasing their own equipment (the Washington Computer Center) as a means of stabilizing service to users and avoiding these repeated conversion costs.

(2) Maintaining data bases on-line is very expensive, but rarely required.

Much of the information contained in EPA data bases is kept in on-line disk storage. This form of storage enables users to access desired information readily at their terminals in a short time. In addition, the systems designed to utilize such on-line storage generally require less operator intervention and simpler coding. However, the costs of maintaining all this on-line storage can be enormous. The STORET system, for example, currently keeps all its data on 30 on-line IBM 3330 disks. These disks cost approximately $1200 per month each, or over $430,000 per year for all 30 disks. Yet most uses of STORET data are not time sensitive, and could be serviced by the overnight reporting which off-line storage would entail.

(3) <u>Time delays are introduced and local management controls are inhibited by current accounting conventions.</u>

EPA personnel cannot use the OSI computing facility unless an account number is requested and approved by the EPA contract officer. This procedure prevents anyone from using the computer without first gaining the approval of the program manager or a designated ADP coordinator who is responsible for the sub-allocation of funds within his office or division. However, this process can take anywhere from a week to several months to complete depending upon the efficiency of the procedures adopted within program offices and the workload of the OSI contract officer.

Because of these delays, users employ account numbers which have been issued previously for other purposes. In this way, accounting statistics indicating the type and amount of computer usage by program element grow misleading. Local data systems branch chiefs and system managers want users to employ proper account numbers so as to better monitor computer usage. These branch chiefs and managers would have better information, thereby, with which to forecast future needs and to plan accordingly. However, so long as users continue to employ account numbers which have been assigned for other purposes, managers will be hindered from establishing the controls which will service best EPA information needs.

(4) <u>Budgetary policies tend to encourage wasteful uses of computing resources</u>.

EPA currently employs an incremental budgeting approach for projecting annual ADP costs. Each program mission is asked to forecast its anticipated yearly ADP requirements. Within most program areas, these forecasts represent a simple percentage increase over the preceding year's expenditure. This policy tends to favor the less efficient and more costly uses of ADP resources and tends to discourage new uses of ADP in areas which have not previously benefited from computerization. Consequently, the budgeting process does not force examination of the relative values of competing demands for limited ADP resources but instead tends to favor the entrenched and frequently overly costly uses of Agency data processing.

(5) Non-ADP budget constraints increase the use and cost of ADP.

Computer expenses are paid from a specially budgeted ADP Fund. Each program manager receives a sub-allowance from this fund to cover his group's computer usage. Program managers also receive separate allowances for personnel and for other program activities. However, Congress had imposed a personnel ceiling limiting the number and types of EPA full-time employees. Program managers have found that they can use ADP money to pay for services, such as word processing, for which they would otherwise need to allocate personnel. Thus, managers are prone to use ADP, even when computers are not cost-effective, as a means of freeing positions for use in other areas. Likewise, managers have operated expensive computer systems which were not cost-effective rather than spend program funds for related services. The Office of Research and Development, for example, operates an elaborate and expensive research milestone tracking system on a computer even though a simpler manual system might prove less costly. Their desire to maintain this system on a computer is motivated by their wish to allocate program dollars and personnel to other applications. Consequently, ADP usage and costs have risen in order not to exceed program and personnel ceilings.

(6) Free services to non-EPA users prevent an adequate assessment of the worth of Agency systems.

Many EPA computer systems allow state, local and private users to access Agency data files and pay for such access with Agency funds. For example, non-EPA users spent over $600,000 of EPA funds on computers during fiscal year 1974. Most of these funds were spent for usage of STORET. Not included in these funds are other "hidden" EPA expenses. For example, the Solid Waste Information Retrieval System (SWIRS) serves more corporate and academic users than it does government agencies at the federal, state and local levels combined.

Given this "free" resource to non-EPA groups, EPA managers cannot assess the value of these systems to non-Agency groups. If outside users were required to spend their own funds for such usage, even if these funds were taken from Agency grants, then the worth of these systems could be better assessed.

3. EPA PRACTICES INHIBIT THE RECRUITMENT AND DEVELOPMENT OF ADP PERSONNEL

The Environmental Protection Agency consists primarily of scientists, engineers, lawyers and clerical personnel. Data processing is viewed by these groups as a tool to service their needs in pursuing Agency objectives. Accordingly, the personnel required to manage and deliver these computer services have been viewed as somewhat peripheral to the mainstream of Agency activities. The following four sections discuss problems in the deployment of technical ADP personnel which have resulted from this attitude.

(1) The scattering of ADP personnel throughout the Agency inhibits the development of ADP managers and senior technical personnel.

Computer programmers and analysts are spread quite thinly throughout the programs, regions and laboratories. Most regional offices, for example, contain no more than two or three professional programmers. Many Environmental Research Centers supplement their small ADP staff with scientists or engineers, who spend time coding their own programs. Since computer expertise is scattered throughout the Agency, few projects developed in-house ever involve more than one or two programmers. More complex systems are contracted for outside. As a result, EPA personnel rarely get any experience in systems analysis, design or management skills which are needed for promotion to more senior technical or management levels. Because of the paucity of technical personnel in any one location, a "critical mass" of ADP personnel never forms. Without such a "critical mass", more senior personnel cannot be profitably employed nor can their skills be exercised. More specifically, ADP skills and expertise require an environment for development consisting of a technical peer group of at least five or six ADP personnel. Without such concentrations of personnel, in-house ADP efforts will continue to be limited to simple, short-term programming assignments.

(2) The limited opportunities for advancement within EPA hinder the recruitment and retention of qualified ADP personnel.

Because EPA does not view ADP as part of the mainstream of its operations and because technical groups are kept small, ADP personnel grow disenchanted with the opportunities for career advancement within the Agency. Skilled programmers find that they can develop their skills more effectively in other Agencies or in private industry. The only way an ADP specialist can advance within the Agency is if he develops expertise in a particular application area, such as air or water. In this manner he can progress within the relevant program area. Yet, such advancement does not develop in him the requisite perspective or insights necessary to manage ADP activities. At present, there are no technically based managers of ADP above the level of branch chief throughout the Agency. More importantly, there are no paths by which technical personnel can aspire to higher positions, given the current deployment of personnel. As a result of this situation, program managers have found it difficult to hire or retain qualified ADP personnel. In the few areas where qualified technical personnel have remained, such as in the water programs, a critical mass of technical experts had been formed in a predecessor Agency prior to the creation of EPA.

(3) <u>The absence of senior ADP personnel limits the ability of system developers to analyze properly the functional requirements of program managers</u>.

Most new system ideas within EPA originate from needs which are felt or anticipated by program personnel. These needs are translated into system terms by contractors and in-house personnel who usually report administratively to the managers responsible for initiating the new system ideas. Consequently, these developers are somewhat hesitant to question or criticize their manager's ideas. In particular, they are reluctant to examine the feasibility of satisfying the program need through non-computer methods. Since contractors are eager to get large development jobs, and since in-house personnel rarely have such opportunities to gain visibility from higher level managers, both groups tend to encourage the development of systems which might not be fully cost justified. An adequate review of system proposals can be performed best by more senior personnel with broader Agency perspectives who need not depend upon the proposed development project to enhance their own chances for career advancement.

(4) <u>The absence of Agencywide experts in modeling, statistics and numerical analysis prevents scientists from using ADP in the most effective manner</u>.

Throughout the Agency there are individuals who are proficient in the use of mathematical techniques to analyze and solve environmental problems. However, these individuals tend to be responsible for conducting special environmental research projects. They are not responsible for assisting other Agency scientists in the use of mathematical methods to analyze data quality, model efficiency or statistical reliability of computational algorithms. Some individuals, such as those performing toxicology research at the Cincinnati NERC, have written their own statistical package because of inadequacies they have identified in EPA supported statistical packages. These revised statistical routines could be made available to other researchers, but are not dissemanated because currently there is no central clearinghouse for dissemanating such information. Consequently, researchers may be using various mathematical techniques or software packages which are inappropriate for their purposes because these researchers have no resource within the Agency to turn to for assistance.

4. THE COORDINATED ADP PLAN SHOULD RECTIFY IDENTIFIED PROBLEMS WITH THE SYSTEM DEVELOPMENT AND USAGE, COMPUTER PRICING AND AVAILABILITY, AND PERSONNEL RECRUITMENT AND DEPLOYMENT

This chapter has identified several problem areas concerning the cost and management of system usage, equipment pricing and personnel motivation. The key observation resulting from this discussion is that the absence of a clear, coordinated long term plan for ADP within the Agency has allowed numerous technical and management problems to arise. The action steps, equipment strategy and personnel and management policies presented in the next chapter deal with each of the problems identified. Furthermore, the plan provides a coordinated framework within which particular policy issues concerning the allocation of ADP resources can be resolved in an ongoing manner.

V. COORDINATED ADP PLAN

V. COORDINATED ADP PLAN

The preceding chapters have described the usage and management of data processing at EPA and have identified specific problem areas which contribute to the increasing cost and decreasing control of ADP activities within the Agency. The five year coordinated ADP plan, which follows, has been developed to adjust computer usage to conform to Agency-wide needs and objectives and to reduce and control subsequent ADP expenditures through the establishment of ADP management policies, standards, and guidelines.

More specifically, this plan is designed to trim the current uses of ADP which capture and store vast quantities of little-used information and to replace these uses with more science-oriented programs and facilities. This shift in emphasis will be accomplished, in part, through the creation of an Agency-wide scientific data processing center at RTP and, in part, through the introduction of more stringent management controls to insure the justification for current and proposed new information systems.

This chapter presents the coordinated plan for the cost, allocation, and management of data processing resources at EPA in five sections, as follows:

- ADP Plan Summary
- System Development Actions
- Computer Equipment and Facilities Strategy
- ADP Staffing
- ADP Management Policies

ADP PLAN SUMMARY

This section presents the summary of costs, cost savings, action steps and policy changes comprising the five year ADP plan for the Environmental Protection Agency. Subsequent sections and Appendices contain a more detailed discussion of the steps comprising this plan and the estimated costs and cost savings associated with each action.

1. ADP EXPENDITURES WILL DECREASE BY $ 6 MILLION ANNUALLY BY 1980.

   Exhibit 5-1, on the following page, presents the ADP costs for computer equipment and timesharing , systems development and personnel for each of the next five years as required by the proposed ADP plan. (None of the costs in this chart, or elsewhere in this report, have been adjusted for inflation.) The estimated current year expenditures are based on FY'75 spending rates as incurred

Exhibit 5-1
U.S. Environmental Protection Agency
Current and Projected ADP Expenditures ($000)

	CURRENT	1976	1977	1978	1979	1980
Computer Equipment and Timesharing	13,773	10,881	8,849	9,415	10,650	10,111
Systems Development and Other Contract Expenditures	6,033	5,922	5,602	4,632	4,532	4,532
Personnel	7,200	7,000	6,600	6,200	6,200	6,200
Total ADP Expenditures	27,006	23,803	21,051	20,247	21,382	20,843

during the study period. This current year estimate does not reflect any funding limitations which OPM may impose to bring FY'75 expenditures within the spending constraints imposed by Congress.

The overall reduction in ADP expenditures from $27,006,000 in 1975 to $20,843,000 in 1980 is attributable primarily to the elimination of marginal applications, the shifting of scientific computing to RTP and the imposition of more stringent management and budgetary controls. Although this budget forecast does include allocations for the planning and development of new ADP applications, primarily within ORD and OEGC, it does not reflect the impact of new legislation, which might be passed in the future, upon overall Agency needs or priorities, since such legislation could not be predicted accurately during the course of this study.

Exhibit 5-2 , on the following page, summarizes the resulting cost savings provided by the plan. These cost savings, both annual and cumulative, represent actual cost reductions over current expenditure levels. They do not indicate the still higher cost savings measured by comparing the budget expenditures to the costs which would be incurred if no action were taken and Agency systems were allowed to grow without budget constraints.

Exhibit 5-2
U.S. Environmental Protection Agency
Projected Cost Savings ($000)

	1976	1977	1978	1979	1980
Annual Savings	3,203	5,955	6,759	5,624	6,163
Cumulative Savings	3,203	9,158	15,917	21,541	27,704

2. THIRTEEN SYSTEMS ARE AFFECTED DIRECTLY BY THE ACTION PLAN.

The action plan consists of a series of staged activities affecting the development, design and operation of Agency systems, and of the providing of necessary resources and management policies to implement these actions. Exhibit 5-3 , on the following page , summarizes the 13 major systems or groups of systems which are affected directly by these action steps. A subsequent section of this plan describes each of these actions and systems in detail and presents a quarter by quarter scenario for thier implementation.

3. THE COMPUTER EQUIPMENT STRATEGY INVOLVES THE DEVELOPMENT OF TWO AGENCY COMPUTER CENTERS.

Central to the recommendations of the coordinated ADP plan is the development of an Agency-wide scientific computing center at RTP. This facility would be centered around the Univac 1110 computer and would utilize the existing RTP staff and design philosophies employed by current RTP systems. An enhanced communications network and some programming modifications would enable most EPA models and trend and monitoring systems to operate on the Univac computer.

Exhibit 5-3
U.S. Environmental Protection Agency
Systems Affected by Five Year Plan

SYSTEM	OFFICE	ACTION
GPSF	OEGC, OWHM	Separate into compliance and effluent data base systems
PEMS	OEGC	Eliminate
Word Processing	OWHM, ORD	Fund with program monies
Program Management	ORD	Eliminate
STORET	OWHM	Modify and shift to RTP
TADS, SIRS	OWHM	Eliminate
Bibliographic Systems	OAWM	Eliminate or fund with program monies
SEAS and Lake Pollution Model	ORD	Shift to RTP
Administrative Systems	OPM	Streamline systems
Dun and Bradstreet	OPM	Cancel service
Enforcement Systems	OEGC	Prepare detailed plan for integrating and developing new application systems
Regional Modeling	Regions	Shift to RTP
Research System	ORD	Prepare detailed plan for improving scientific services

Most other Agency systems including administrative and enforcement tracking and reporting systems would continue to operate on the OSI computer or its replacement. The hardware requirements for these non-scientific systems have been identified and could be serviced adequately by a facility computationally equivalent to one IBM 370/158. By 1978, a computing facility of this scope should be created by EPA through the lease or purchase of its own computing equipment.

4. <u>ADP PERSONNEL WOULD BE ORGANIZED INTO FOUR GROUPS</u>.

Data processing personnel within the Agency would be organized into four groups responsible for (1) serving regional and research center users, (2) supporting environmental program needs, (3) managing the RTP and OSI computer facilities, and (4) overseeing ADP budgets and new development projects. This regrouping would require a shift of technical development personnel from the program offices to the computer facilities and to the development groups, and an increased concentration of project management and functional specification personnel within the program offices. This regrouping also would result in a $1 million reduction in annual personnel salaries and the elimination of approximately 64 ADP positions throughout the Agency.

5. <u>EPA MANAGEMENT POLICIES SHOULD INCLUDE THE ESTABLISHMENT OF PROJECT MANAGEMENT STANDARDS, EXPANDED BUDGETARY REPORTING AND IMPROVED ADP QUALITY CONTROLS</u>.

The ADP management guidelines, as described in the co-ordinated plan, are designed to control ADP expenditures while improving data processing services provided to Agency users. These guidelines involve the establishment and enforcement of rigorous system development standards and project management procedures. They involve also the expansion of formal ADP budgeting to include ADP personnel and contractor expenditures and the establishment of controls to limit or prevent overruns of these ADP budget ceilings. The management guidelines also direct OPM to assume responsibility for ADP quality control through the establishment of system and data standards and through periodic auditing of major ongoing application systems.

SYSTEM DEVELOPMENT ACTIONS

This section describes the staging of system audits, evaluations, modifications and new development activities comprising the ADP plan. Each of these actions affect specific systems or groups of systems.

1. PRIMARY SYSTEM DEVELOPMENT ACTION STEPS WILL LAST FOR TWO YEARS.

In order to implement the overall coordinated plan and to achieve Agency ADP objectives, a series of action steps were developed and prioritized. Because many of the recommended steps require lead times and because several steps could be undertaken only after earlier steps had been completed, the action steps have been phased over time to conform with the availability of Agency resources and to expedite the completion of activities that are prerequisites to other action steps. The resulting phased action plan covers a two year period.

(1) Major action will be initiated during the first quarter of 1976.

Exhibit 5-4, on the following page, lists each of these actions, their estimated elapsed time, their estimated contractor and EPA personnel costs, and the resulting savings in computer and personnel costs. These action steps, which are described in detail in Section 2 on a system by system basis, involve (1) the elimination of the PEMS, ORD program management and bibliographic systems, (2) the evaluation and potential elimination of Bowne Time Sharing, TADS and SIRS (SPCC),

1976 FIRST QUARTER

System	Action	Elapsed Time	Contractor Cost ($000)	EPA Personnel Cost ($000)	Annual ADP Fund Savings ($000)	Annual Personnel Savings ($000)
GPSF	Install Stop-gap	--	--	--	-120	--
	Cease Funding	--	--	--	554	150
	Develop Replacement Similar to NEDS to Run at RTP	12 months	300	100	--	--
PEMS	Eliminate	--	--	--	150	--
Bowne Timesharing	Word Processing Study	3 months	30	10	--	--
ORD Program Management	Eliminate	--	--	--	410	324
STORET	Charge States for Communications	--	--	--	50	--
	Charge States for STORET Usage	--	--	--	600	--
	Reduce On-line Data	6 months	60	40	--	--
	Reprogram for Shift to RTP	12 months	600	200	--	--
TADS/SIRS(SPCC)	Evaluate Need	3 months	10	--	--	--
Bibliographic Systems	Fund with Program Monies, Eliminate, or Charge Users	--	--	--	200	--
SEAS	Shift to RTP	6 months	--	--	--	--
Lake Pollution Study	Shift to RTP	6 months	--	--	--	--
Administrative Systems	Evaluate Paper Flows and Procedures	6 months	100	20	--	--
Dun and Bradstreet	Cancel Service	--	--	--	12	--
OEGC	Detailed Plan	3 months	60	20	--	--

(3) installation of a stop-gap enforcement GPSF and development of a replacement effluent system, (4) modifications to STORET, SEAS and Lake Pollution modeling in preparation for shifting them to RTP, (5) an evaluation of the paper flows and procedures employed in OPM, (6) cancellation of the Dun and Bradstreet service, and (7) a detailed ADP plan for OEGC.

The estimated development costs for implementing these and subsequent actions are based on estimation procedures described in Appendix D. The anticipated cost savings in computer and EPA personnel expenditures are based on current system costs as presented in Appendix A.

(2) New system development will continue through the remainder of 1976.

During the remainder of 1976 initiated actions will continue and new system development will begin. Exhibit 5-5, on the following page, indicates the quarter by quarter actions which will occur during 1976. Following their three month evaluations, Bowne Time Sharing, TADS and SIRS (SPCC) will cease ADP Fund support.

Exhibit 5-5
U.S. Environmental Protection Agency
System Actions

System	Action	Elapsed Time	Contractor Cost ($000)	EPA Personnel Cost ($000)	Annual ADP Fund Savings ($000)	Annual Personnel Savings ($000)
			1976 SECOND QUARTER			
Bowne Timesharing	Eliminate	--	--	--	570	180
TADS/SIRS (SPCC)	Eliminate	--	--	--	150	88
			1976 THIRD QUARTER			
SEAS	Shift to RTP	--	--	--	300	--
Lake Pollution	Shift to RTP	--	--	--	200	--
Administrative Systems	Implement Study Recommendations	--	--	--	50	70
	Modify Systems and Program Technical Efficiencies	9 months	200	100	--	--
STORET	Reduce On-line Data	--	--	--	180	--
			1976 FOURTH QUARTER			
Enforcement Tracking System	Design and Program	12 months	400	200	--	--

During the third quarter of 1976, modeling systems will be shifted to RTP, the results of the OPM study will be used to streamline administrative systems, and STORET on-line data will be reduced. In addition, a new OEGC tracking system will begin development during the last quarter of 1976.

(3) Major development projects will be completed in 1977.

Throughout 1977, major development projects or system modifications will be completed. Following the installation of a new communications system in the first quarter of 1977, (which is described below in the equipment and facilities strategy section of this report) the RTP computer center will be ready to operate as the new scientific data center for EPA. At this time STORET, regional modeling, and GPSF, all of of which require better communication support, will begin operation at RTP. Exhibit 5-6, on the following page, lists the quarter by quarter development actions which will take place in 1977. In addition to the installation of new RTP systems, the administrative system changes and new enforcement tracking system will be completed in 1977.

Exhibit 5-6
U.S. Environmental Protection Agency
System Actions

System	Action	Elapsed Time	Contractor Cost ($000)	EPA Personnel Cost ($000)	Annual ADP Savings ($000)	Annual Personnel Savings ($000)
		1977 FIRST QUARTER				
STCRET	Shift Operations to RTP	--	--	--	2,520	400
	Program New Retrieval Capabilities	9 months	400	100	--	--
Regional Modeling	Shift Workload to RTP	--	--	--	200	--
Mobile Source Enforcement	Start Using System at RTP	--	--	--	--	--
ORD	Detailed Plan	6 months	100	50	--	--
GPSF	Install at RTP	--	--	--	504	150
		1977 THIRD QUARTER				
Administrative Systems	Install Changes	--	--	--	150	200
Energy Data System	Program	9 months	300	100	--	--
STORET	Install New Retrieval Capabilities	--	--	--	--	--
		1977 FOURTH QUARTER				
Enforcement Tracking System	Install	--	--	--	-400	-200

A special ORD planning study also will be initiated in 1977, as will the development of a new energy data system.

2. PROPOSED ACTIONS AFFECT THIRTEEN SYSTEMS OR GROUPS OF SYSTEMS THROUGHOUT THE AGENCY.

This section describes the action steps presented in the preceding charts. Systems, which are affected by a series of actions over several quarters, are discussed only once.

(1) GPSF should be divided into a compliance system and an effluent data base system.

Although an earlier audit of the General Point Source File (GPSF) identified an Agency-wide need for effluent water data which is provided to GPSF, the priority of such data given its potential cost was not evaluated pending this Agency-wide study of ADP requirements. A review of the air programs indicates that air enforcement requirements can be serviced by a relatively simple tracking system (CDS). The repository of effluent air data is the National Emission Data System (NEDS) which stores its information on magnetic tapes. The anticipated costs of storing all

Discharge Monitoring Report water effluent data in GPSF are several millions of dollars annually by 1979, given current systems design.

The Office of Enforcement and General Counsel is in the process of developing their own stop-gap system to the GPSF compliance monitoring functions along the lines of CDS, which is used in air enforcement. This stop-gap system will be operational by fiscal year 1976 and is estimated to cost $120,000 annually. We recommend that effluent data, which is needed by water analysts, be stored in a separate NEDS-like facility. This facility would store most data off-line at the RTP computer center and would be designed and operated similarly to NEDS.

Consistent with an OMB request, Agency managers have decided to cut off funds for GPSF usage by October, 1975. Starting in the first quarter of FY '76, the NEDS-like replacement system should be designed and programmed. Development is estimated to cost $300,000 in contractor funds and $100,000 in EPA personnel time. Development time is estimated to be 12 months. This and other development estimates are based on principles described in Appendix D.

(2) <u>The pesticides enforcement management system (PEMS) should be eliminated</u>.

The PEMS system tracks pesticide enforcement actions taken by regional enforcement personnel. Headquarters requires summary data about actions to facilitate enforcement strategy formulation. The current data base contains information on approximately 6,000 actions, or an average of 600 actions per region per year. Manual record-keeping in the regions could manage this volume of data easily. Regions could submit monthly or quarterly summary reports to Headquarters. Therefore, PEMS could be eliminated without affecting the performance of the pesticides enforcement division.

(3) <u>A word processing study should be conducted to facilitate the payment of word processing expenses from program monies rather than out of the ADP fund</u>.

Word processing has been used throughout the Agency to increase clerical productivity and thereby reduce report production expenses. The ADP fund currently pays for all word processing using Bowne Time Sharing (BTS). This use cost approximately $530,000 in fiscal year 1974. Several managers implied that they had come to use BTS because of certain other features that the system offered. For example, one manager indicated he prepared documents on BTS because BTS could photocompose a final copy far more rapidly than could the Government Printing Office. Since the added expense for this procedure was paid from the ADP fund, and since he had little other need for ADP, he found BTS a relatively cost free alternative compared to paying for word processing or printing services with program monies.

Since program managers view the use of BTS as a relatively cost free alternative, they do not tend to evaluate its use in terms of overall Agency expenditures. Furthermore, since virtually all BTS usage is designed to reduce clerical expenses and since new advances in word processing technology, such as stand alone processors and high-speed composition and duplication equipment, make BTS only one of several alternatives, it appears inappropriate for the ADP fund to continue to pay for BTS usage. Instead, program managers should pay for their usage of word processing whether provided by BTS, another vendor, or in-house office equipment. In this way managers could make their own local cost benefit decisions regarding the allocation of their resources to meet their objectives.

To facilitate this shifting and reprogramming of word processing funds, we recommend that a word processing study be conducted. This study would examine current uses of word processing throughout the Agency, and would provide guidelines and assistance to program managers in shifting their processing loads. We estimate that such a study would cost $30,000 in contractor funds and $10,000 in EPA personnel time. The study is estimated to require three months elapsed time.

(4) The program management system in the Office of Research and Development (OR & D) can be eliminated.

The current program management system within the Office of Research and Development reflects the relatively complex and sophisticated procedure adopted by that office for allocating resources to meet objectives and for tracking the performance of research activities. The computer system used by the program management group provides a tool for allocating resources and tracking performance against milestones at a very detailed level. The cost of this ADP usage is approximately $410,000 per year.

A recent study, conducted for the Agency by the National Research Council, criticized this management approach and recommended that far more discretion and authority should be delegated to the research centers and laboratories. They further stated that the detailed allocation and milestone setting conducted by Headquarters was deleterious to the research process. As a result of this study, the Agency has been reviewing its research management philosophy and will delegate far more responsibility to non-Headquarters administrators. As this delegation takes place, the level of detailed information which must be manipulated and analyzed at Headquarters will decrease substantially. Consequently, the rationale which justified the development of the program management system will cease to apply. Therefore, we expect that the volume of relevant Headquarters program management data will be manageable using manual methods, and that the need and cost for the system will be eliminated.

(5) Pending the results of a system audit, STORET costs may be reduced substantially by reducing on-line storage and by shifting operations to RTP.

STORET is currently the largest and most expensive system within EPA. Its large costs (approximately $2.8 million in fiscal year 1974) are attributable to the following three causes:

- It maintains 30 on-line disk packs costing approximately $430,000 per year.
- State and local users have free access to the system, costing approximately $600,000 per year.
- Large amounts of data stored within the system are erroneous, misleading or irrelevant to the needs of primary users.

Notwithstanding these problems, the system managers have offered two arguments for continuing to operate the system in its current interactive form:

- Providing free interactive capabilities has provided the most reliable means of inducing states to enter water quality data.
- Maintaining data on-line has proven to be the only way of insuring the availability of sufficient spindles to run a STORET job.

Because of these concerns, the Agency has decided to conduct a management and technical audit of the STORET system. We concur with this approach and would expect that this audit will identify areas for incurring substantial cost savings.

Nonetheless, we feel that current expenditures for water quality data systems are far out of proportion to the benefits which STORET provides. Given a similar objective, the air system, SAROAD, has managed to amass air quality data, and yet has managed to service its functional objectives for but a fraction of the cost of STORET. Consequently, we believe that STORET costs can be reduced substantially by adopting certain of the design strategies adopted by SAROAD, such as off-line non-interactive operation.

Particular action steps which we anticipate would be compatible with the audit results are as follows:

- Charge states for the communications and OSI computer costs of using STORET, or stop subsidizing state usage by requiring them to contract directly with OSI.
- Reduce on-line data to the 18,000 reporting stations with sufficient meaningful data to produce the annual national and state water quality reports.
- Redesign and reprogram STORET to operate on the RTP computer in a SAROAD-like fashion.
- Extend the reporting and graphics capabilities of the redesigned and reprogrammed system.

Note that the redesign and reprogramming of STORET reflects a change in scope from the current system. The revised STORET would provide only limited retrieval and data manipulation capabilities to non-EPA users. Such non-Agency users would fund their own ADP support from grant monies as needed.

The following table summarizes the costs and potential savings of each action:

Action	Completion Date	Development Cost ($000)	Annual Savings ($000)
Charge states	1976-1st qtr.	---	650
Reduce on-line data	1976-3rd qtr.	100	180
Redesign and Reprogram for shift to RTP	1977-1st qtr.	800	2920
Program new retrieval capabilities	1977-3rd qtr.	500	---

Charging states for communication and computer costs would lower EPA costs by $650,000 and could be implemented in the first quarter of 1976. The reduction of on-line data will take three months and cost $60,000 in contractor funds and $40,000 in EPA personnel time, but will result in an annual cost savings of $180,000. We estimate that STORET reprogramming will cost $600,000 in contractor funds and $200,000 in EPA personnel time, and will last 12 months. After the revised system is installed at RTP, the additional reporting and graphics programs will cost $400,000 in contractor funds and $100,000 in EPA personnel time, and will take nine months to develop. Note that these cost estimates assume that SAROAD software and operating procedures will be available for adaptation to the water systems.

(6) <u>The oil spills systems can be replaced by manual systems.</u>

Two systems, Technical Assistance Data System (TADS) and Spill Information Retrieval System (SIRS), are used currently to support personnel who monitor oil and hazardous materials spills. Both systems operate in an on-line interactive manner.

The TADS system is a repository of technical data about particular hazardous materials which may be present in a waterway after a spill or other mishap. The system is designed to retrieve technical information for identified materials or to identify those materials which possess selected characteristics. The objective of the system is to provide regional and local analysts with a tool whereby they rapidly can identify and adjudge the toxicity of foreign materials discovered in a waterway.

Regional analysts indicated, however, that they rarely, if ever, use the system. Rather, they said that they tend to be able to recognize readily most foreign substances found in their local waters. They do find the data about particular substances, which are contained within the system, of much value. These same analysts, however, noted that a legible and updatable notebook containing such information could provide the same service at a lower price.

The TADS system currently costs approximately $50,000 per year to operate. Its replacement by a manual filing system would save all or most of this annual expense without seriously impairing analyst activities.

The SIRS system provides on-line retrieval concerning spill events. It will be replaced shortly with a Spill Prevention Control and Countermeasure System (SPCC) to be run at the OSI facility for an estimated $100,000 per year. SPCC will be used to record spill events and compliance plans filed by offenders. These compliance plans will be reviewed for possible prosecution should the offender experience a subsequent spill. Since this data will be organized by offender and since compliance plans will be retrieved by offender, it is unclear what special advantage computerization offers over conventional manual filing of forms. That is, a well-organized filing system within each region with paper copies mailed to Headquarters would appear to satisfy most user needs. Tallies of spills by region or basin or other categories likewise could be prepared manually.

We recommend that brief system audits be conducted to confirm these findings. We anticipate that these audits would last three months and would cost $10,000 in contractor funds.

(7) <u>Agency bibliographic systems are underutilized and should be consolidated or eliminated to reduce costs</u>.

EPA currently operates four separate abstract retrieval systems in air (TENIS), noise, solid waste (SWIRS) and pesticides. Each of these systems is designed differently, despite the fact that they are intended to service the same needs, namely, to direct researchers to articles on selected topics. The total cost for all four systems exceeds $300,000 annually. Interviews with Agency librarians indicated that the usage of these systems is quite low. Reviews of system usage with project officers revealed that some of these systems are used primarily by non-Agency personnel. This use was attributed to Agency objectives of disseminating information and educating the public on environmental matters as defined in enabling legislation.

The production and data entry of literature abstracts are provided by outside contractors, primarily the

Franklin Institute and Informatics. The Agency is paying currently almost $1 million per year in program monies for these services. Based on these expenditures and on the relatively low usage of these systems, as described in detail in Appendix A, we recommend that program managers reevaluate the need for these systems. If program managers insist upon the need for such facilities, then they should pay for required computer services from program monies and should operate the systems on contractor computers. Non-EPA users would be required to pay the contractor for access, and EPA would refrain from indirectly subsidizing non-Agency users. Affected programs could, of course, subsidize directly public interest group usage by direct grants of program monies.

(8) <u>The SEAS and Lake Pollution study models should be shifted to RTP</u>.

The Strategic Environmental Assessment System (SEAS) and the Lake Pollution studies both consist of mathematical models operated in batch mode. Both systems are written predominantly in FORTRAN and would be operable on the RTP computer with minor programming changes. Therefore, we recommend that these systems be shifted to the RTP facility. We expect that the shifting of these systems will take approximately six months. Minor programming changes, if any, can be made by Agency personnel or contractors who are paid from the ADP development funds which have already been budgeted for these projects.

(9) The Office of Planning and Management should analyze the need for all the capabilities provided by current administrative systems.

The Office of Planning and Management (OPM) is spending over $1 million annually on administrative systems for grants administration (GICS), financial management (FMS), personal property (PPS), payroll and personnel information (DIPS), plus several smaller special purpose systems. Although our review of these systems did not reveal computer applications which were unnecessary, we nonetheless were concerned about the level of administrative systems expenditures given the ostensible scientific and regulatory nature of EPA. This level of expenditure suggests a relative overemphasis on administrative forms and paperwork versus a comparative underemphasis on science and enforcement. We expect that the justification for the large administrative system expenditures are indicative of this overemphasis on administrative activities. Therefore, we recommend that a review of administrative practices be undertaken to identify unnecessary paperwork and reporting requirements. This review will reveal capabilities provided by existing administrative systems which are not essential to Agency management and which therefore can be eliminated.

We estimate that such a review would take six months and cost $100,000 in contractor funds and $20,000 in EPA personnel. We expect that the results of this study would result in cost savings of $50,000 per year in ADP usage (as well as additional savings in other OPM operations). These cost savings will result from a streamlining of paper processing flows and from a corresponding reduction in administrative usage of ADP as these paper processing burdens are reduced. We further anticipate that this study will identify technical inefficiencies in related administrative systems which will require design and programming changes. We anticipate that this system development work would last nine months and cost approximately $200,000 in contractor funds and $100,000 in EPA personnel time. These revised systems would there-upon cost the Agency approximately $150,000 per year less than at present.

(10) <u>The Dun and Bradstreet service should be cancelled</u>.

EPA currently pays Dun and Bradstreet $106,000 per year for information on all commercial and industrial firms in the United States. This data costs $12,000 per year to maintain on 24 magnetic tapes. Headquarters has been purchasing this data in anticipation of providing users in the regions and at Headquarters with information for mailing lists and demographic analyses. However, there has been relatively little usage made of this information to date. We recommend that the service be cancelled and renewed only if and when particular user requests justify the expense of this service. At such time, alternative resources, such as the Bureau of the Census data files, should be investigated for possible usage.

(11) <u>A prioritization of OEGC ADP needs should be conducted as part of a detailed plan for integrating and developing enforcement systems</u>.

The Office of Enforcement and General Counsel is confronted with a substantial increase in paper processing resulting from the implementation of the enforcement phases of environmental programs. Given the limited number of enforcement personnel at Headquarters and in the regions, there is a natural proclivity to use computer resources to supplement their limited staff. Within each of the enforcement areas (air, water, pesticides) separate systems have been built or are under construction (CDS, GPSF, PEMS). Several regions have built their own back-up or extension systems to support their own workloads. The mobile source enforcement division also has developed a separate tracking system.

In order to coordinate all these efforts and to better assess enforcement needs, we recommend that OEGC conduct a detailed planning study to prioritize their program needs and to evaluate the man-machine tradeoffs available for supporting these needs. We estimate that this study will last three months and will cost $60,000 in contractor funds and $20,000 in EPA personnel time.

We anticipate that this study will identify the need for and characteristics of an enforcement tracking system. We have estimated that this system will take 12 months to design and implement, and will cost

$400,000 in contractor funds and $200,000 in EPA personnel time. The development of this system will not create any direct ADP savings, but it will enable OEGC to cope with its growing paper processing burdens without requiring a substantial increase in clerical staff.

(12) Regional modeling should be shifted to RTP.

The new communications network is estimated to be installed in the first quarter of 1977. At that time, regional users will be able to communicate with the RTP computer center more effectively than at present. Regional modeling and scientific programming should then be shifted to the Univac at RTP. We estimate that this shift will reduce regional ADP costs by approximately $200,000 per year.

(13) The Office of Research and Development should conduct a detailed planning study to provide improved ADP and ADP-related support to Agency scientists.

ORD has the largest operating budget of any office in EPA, yet it has used a relatively small percentage of ADP resources. Although some modeling and scientific applications, such as SEAS, are major users of computers, most Agency scientists tend to make little use of ADP resources to support scientific investigations.

We recommend that ORD analyze the potential uses of data processing to enhance their research activities. In particular, we suggest that ORD examine the following areas:

- Cost-justifiable uses of lab automation
- Development of systems in support of energy research
- Deployment of personnel with modeling and statistical expertise amongst the NERC's
- Development of sampling techniques to lessen the need for nation-wide environmental data banks
- Development of data quality control techniques and methods for EPA trend and monitoring systems.

We estimate the cost of this study to be $100,000 in contractor funds and $50,000 in EPA personnel time. The study would last six months. As a result of the study, we anticipate the development of an Energy Data System which would cost $300,000 in contractor funds and $100,000 in EPA personnel time. The system would take nine months to develop and would operate at RTP.

3. NORMAL SYSTEM DEVELOPMENT EXPENDITURES WILL BE REDUCED BY $1.5 MILLION BY 1979.

System development projects are funded from program budgets and conducted by EPA and contractor personnel. The overall ADP budget for outside contractors is determined by MIDSD based upon the feasibility studies and other ADP contracting which is communicated to Headquarters. The largest portion of these contractor expenditures are for special studies, data, consulting system maintenance, and new design and programming activities.

We have reviewed the proposed expenditures submitted to MIDSD during fiscal year 1974, as presented in Exhibit 5-7. These expenditures are estimated to be $6 million. We have estimated that the level of service from contractors required by EPA for "normal" ADP services will remain constant less adjustments for services no longer needed given the impact of the action plan described above. To these "normal" costs must be added the special one time expenses for performing the evaluations and modifications comprising this action plan.

The table following Exhibit 5-7 lists ADP contractor expenditures which are included in the current $6 million ADP contractor total but which will no longer be needed as a result of the proposed action plan. Each of these expenditures is for normal system maintenance, programming modifications, data, audits, and other actions which are conducted routinely for systems which will be eliminated or modified, or for non-recurring costs, such as the System 2000 data management package, which has been purchased by EPA. Appendix A contains a more detailed description of each of these Agency systems, including an indication of these "normal" contractor expenditures.

Exhibit 5-7
U.S. Environmental Protection Agency
Distribution of ADP Contractor Expenditure Requests

	System Study and Design	Maintenance	Proprietory Software and Data	Total
Headquarters	1,454	803		2,257
MIDSD	648	653	360	1,661
NERCS	1,066	840		1,906
Regions	65	153		218
Total	3,233	2,440	360	6,033

	($000)	($000)
1974 Baseline Level		6,033
Reductions or Modifications to Baseline Level		
GPSF	240	
PEMS	40	
TADS	60	
Lab Automation	20	
STORET	285	
ORD Program Management	95	
Bibliographic Systems	25	
SPCC	100	
Dun and Bradstreet Data	106	
System 2000 (one time charge)	130	
RTP Facility Management (included in equipment charges)	400	
	1,501	
		(1,501)
Revised Baseline		4,532

The revised "normal" baseline expenditure level is estimated to be $4,532,000. The special expenditures required to implement the action steps recommended above are, as follows:

FY 1976

	($000)
Word Processing	30
STORET	660
TADS/SIRS/SPCC	10
Administrative Systems	230
OEGC Plan	60
GPSF	300
Enforcement Tracking	100
Special Expenditures	1,290
Baseline	4,532
Total	5,922

FY 1977

	($000)
	--
Administrative Systems	70
STORET	400
Enforcement Tracking	300
ORD Plan	100
Energy Data System	200
Special Expenditures	1,170
Baseline	4,532
Total	5,602

FY 1978

Energy Data System	100
Special Expenditures	100
Baseline	4,532
Total	4,632

Thus, the estimated contractor expenditures in 1976, 1977, and 1978 are $5,922,000, $5,602,000, and $4,632,000 respectively. In the following years, expenditures should return to the revised baseline level of $4,532,000 per year. The following table summarizes these annual contractor expenditures and indicates the corresponding savings over current contractor expenditure levels:

Year	Contractor Expenditures ($000)	Annual Savings Over Current Contractor Expenditures ($000)
Current	6,033	--
1976	5,922	111
1977	5,602	431
1978	4,632	1,401
1979	4,532	1,501
1980	4,532	1,501

COMPUTER EQUIPMENT AND FACILITIES STRATEGY

This section presents the computer equipment action plan and cost estimates for providing sufficient computing resources to support the coordinated ADP plan. It also describes the organizational impact of certain equipment recommendations. This section is divided into six sub-sections, as follows:

- Required Computing Capacity
- Equipment Action Plan
- RTP Computing Center
- Telecommunications
- Washington Computer Center
- Other ADP Equipment and Services

1. <u>THE COMPUTING CAPACITY REQUIRED BY EPA IS DIVIDED INTO THREE CATEGORIES.</u>

The required computing capacity associated with this plan is divided roughly into three categories, as follows:

- Scientific uses, such as modeling, trend and monitoring, and special studies
- Operational uses, such as tracking and reporting, and technical data bases
- Other uses, such as lab automation, word processing and bibliographic systems

Under the coordinated plan, scientific application support would be provided by the RTP computer center, operational support would be provided by a non-scientific facility such as OSI, and other uses would be eliminated or funded by program monies without using Agency computing facilities.

(1) Scientific uses of ADP will double the utilization of the Univac 1110.

The scientific uses of ADP will increase over the next five years, especially in the areas of modeling and special studies. Trend and monitoring applications will tend to stabilize and will demand fewer resources than at present because of the redesign of several on-line water systems. The shift of STORET, GPSF, SEAS, and other modeling to RTP are estimated to increase the RTP utilization by approximately 200 resource hours per month. These estimates are based upon current resource utilization at OSI adjusted for the higher power of the Univac machine and for system changes resulting from the proposed development plan. This overall increase in resource hour utilization represents approximately a doubling of the utilization of the Univac 1110 at RTP. As regions and NERC's turn to RTP for computing support, there will be increased needs for better telecommunications with RTP. This doubling in utilization also will require an increase in storage devices such as disks and tapes.

(2) Agency operational systems will require only half of the current OSI computing capacity.

The elimination or streamlining of many of the current tracking and reporting systems, and the shift of much of the modeling and monitoring systems to RTP will reduce dramatically the computing workload in Washington. Efforts to control the proliferation of on-line storage at OSI and the shifting of water data bases to RTP likewise will reduce the amount of disk storage required. However, whereas Central Processing Unit (CPU) utilization at OSI will decline by 50% or more, disk storage and communications processing will decline at a lesser rate because of the retention of data base information retrieval and interactive processing systems in Washington.

(3) Other uses of ADP will require no support from Agency computer facilities.

In line with our recommendations, program use of word processing, lab automation and bibliographic services will no longer be funded from the ADP fund and will no longer operate on EPA facilities. Those systems which continue to operate will be funded from program budgets and will run on contractor machines. Consequently, these applications will not impose any additional computing requirements upon Agency equipment and facilities planning.

2. THE EQUIPMENT ACTION PLAN COVERS A PERIOD OF FIVE YEARS.

Because of the lead time necessary for ordering and installing ADP equipment within the government, it is necessary to coordinate the equipment action steps with the system development and staffing actions comprising the coordinated plan. Exhibit 5-8, on the following page, indicates particular actions which must be taken each year to implement the plan.

In 1976 actions will be taken to reduce the number of on-line disks at OSI and to upgrade the tape drives at RTP. An OSI replacement will be installed by January, 1976. Work will begin also to install a new communications network and to gain approval for the creation of a non-scientific data center. By FY '77 processing workloads will be shifted to RTP as the new communications network is installed. As a consequence, the OSI replacement will reduce on-line storage further and will eliminate one of the IBM 370/158 computers. In 1979 the non-

Exhibit 5-8
U.S. Environmental Protection Agency
Annual Equipment Actions Comprising the ADP Plan

Year	Action
1976	. Eliminate 15 Disks at OSI
	. Install Faster Tape Drives at RTP
	. Install OSI Replacement
	. Begin Communications Network Installation
	. Initiate Actions for the Creation of a Non-scientific Data Center
1977	. Shift Workload to RTP
	. Install Communications Network
	. Eliminate 10 More Disks at OSI
	. Eliminate One IBM 370/158
1978	. Install Non-scientific Data Center
	. Augment Univac 1110
1979	. Selectively Install Regional Minicomputers

scientific data center will be installed and the Univac 1110 will be augmented. In 1979 and 1980 regional and laboratory data centers will be developed selectively on a cost reduction basis using minicomputers.

Exhibit 5-9, on the following page, illustrates the type of equipment which will be in use at EPA as a result of these actions. Note that we have assumed, as part of this plan, that the IBM 1130 and IBM 360/30 at Cincinnati will have been replaced by a Remote Job Entry (RJE) terminal during 1975. We have assumed also that the IBM 360/50 at RTP will have been delivered to GSA.

(1) Major actions will be initiated in 1976.

During Fiscal Year 1976, work will begin to install an EPA communications network and to establish a Non-scientific Data Center. During FY '76, an OSI replacement will be installed in Washington.

EPA should expect an 8% increase in hardware costs reflecting IBM's industry-wide increase in lease charges for its equipment. Charges for convention and parallel

Exhibit 5-9
U.S. Environmental Protection Agency
Computer Equipment Requirements

COMPUTER EQUIPMENT REQUIREMENTS

	Current	1976	1977	1978	1979	1980
Washington	2 IBM 370/158	2 IBM 370/158	IBM 370/158	Non-scientific Data Center IBM 370/158	IBM 370/158	IBM 370/158
RTP	Univac 1110 2 x 1	Univac 1110 2 x 1 Faster tape units	Univac 1110 2 x 1	Univac 1110 4 x 2 256K word extra memory Increased disk storage	Univac 1110 4 x 2 etc.	Univac 1110 4 x 2 etc.
Other			Install Communications Network		Selective Installation of regional mini-computers	

operation of the new facility will cost upwards of $1 million in 1976. As systems are eliminated during 1976, there will be a reduction in disk requirements at OSI. RTP also will be replacing its current tape drives with higher performance models at no increase in cost.

(2) <u>Workloads will be shifted from Washington to RTP in 1977</u>.

As a result of system development activity during 1976, scientific and monitoring systems will shift to RTP in 1977. The new communications network will be installed connecting Washington, RTP, the regions and the laboratories. As a result, the computer requirements in Washington will be halved, thereby enabling one IBM 370/158 to be eliminated from the Washington facility. Several disk drives will be removed as well.

(3) <u>A Non-scientific Data Center will be installed in 1978</u>.

By 1978, the steps required by Federal regulations will be completed for the installation of the Non-scientific Data Center. This will be essentially a government leased computer comparable in scope and power to the computer used by the OSI replacement in 1977. Cost for conversion to and parallel operation of this new facility will be approximately $500,000 during 1978. The increased processing load at RTP may require also a slight increase in the power of the Univac computer at RTP. We have assumed an upgrading of the current Univac 1110 2x1 to a Univac 1110 4x2 with 256,000 extra words of memory and a two thirds increase in disk capacity. This upgrading will cost approximately $90,000 per year and will increase the Univac performance by approximately 50%. This upgrading can be accomplished whether EPA owns or leases the Univac machine.

(4) EPA will begin to analyze the cost justification for installing regional minicomputers in 1979 and 1980.

As the computing load within EPA settles down, the Agency will begin to analyze the cost benefits of selectively replacing regional and laboratory terminals with minicomputer-based local data centers. These centers will be justified only if they reduce local hardware costs and provide local computing support capable of supplanting the need to access or utilize Agency-wide computers. This analysis will not be made, however, until EPA has brought its overall ADP usage under better control and has aligned this usage with overall Agency priorities.

3. THE RTP COMPUTING CENTER WILL SUPPORT EPA'S SCIENTIFIC COMPUTING WORKLOAD.

The Univac 1110 at Research Triangle Park (RTP) in Durham, North Carolina, currently supports the ADP requirements of the research and air program activities conducted at RTP. Although the Univac is capable of supporting a nation-wide communications network, its current usage is limited primarily to the RTP user community.

(1) Agency-wide scientific, modeling, trend and monitoring applications should be shifted to RTP to utilize the better computational and design support offered and to lower overall Agency ADP costs.

The data processing resources required by scientific and operational applications differ considerably. The Univac computer provides the more powerful central processing power required by scientific systems. The IBM equipment in Washington is better suited to the on-line, interactive processing characteristic of tracking and reporting systems.

The data processing and air program staff at RTP have developed cost-effective systems to support air trend and monitoring requirements. These systems have utilized data quality and storage controls which could be applied to water and other media systems.

Since the Univac is leased by EPA, and since it is used currently at only about 25% of capacity, additional Univac workloads will not increase Agency computer costs. By contrast, charges at OSI are dependent upon computer usage. Hence, shifting of workloads to RTP which reduce OSI computing loads will lower overall Agency computer costs.

(2) New systems developed at RTP should employ the design principles used in current RTP systems.

The staff at RTP has benefited from the experiences of other system designers at EPA. Prior to constructing the air data base, SAROAD, the RTP staff analyzed the design and usage of the corresponding water system, STORET. Based on this analysis, the RTP designers made substantial changes to the SAROAD system architecture. These changes have enabled SAROAD to operate at a fraction of the cost of analogous water systems. Correspondingly, as systems are redesigned to operate at RTP, the results of this earlier analysis should be incorporated into the new systems. In particular, systems which are intended to perform similar functions (same application class) should tend to employ similar design philosophies.

(3) The RTP technical staff should be expanded over time.

As more systems are shifted to RTP over time, there will be increased need for EPA-supplied technical support from the RTP staff. During the first two years of this plan, most support will be needed to assist Headquarters personnel in the redesign of systems which are operating at OSI but which will be shifted to RTP. We anticipate that RTP will be called upon to provide special assistance in the following five areas:

- Hardware and communications support for interfacing with the Univac equipment
- Operating system support and user training
- Operations control and management of the Univac job stream
- Input data quality analysis and control

Numerical analysis, statistical and modeling assistance

(4) <u>The Univac's processing capacity should be increased in 1978.</u>

Although the Univac 1110 is several times more powerful than an IBM 370/158, the modeling and scientific applications at RTP still may grow sufficiently to warrant an increase in the computing capacity of the Univac. Because of the hardware design of the Univac machine, this extra capacity can be provided at a relatively nominal price. An additional central processing unit (CPU), 256,000 words of memory and a two thirds increase in disk capacity can be added to the current configuration at a cost of $90,000 per year. These changes will increase the system's computing capacity by approximately 50%. Yet this augmentation will increase annual RTP equipment charges by only 6% (assuming a $1,600,000 per year lease). We have assumed that this augmentation would occur in 1978, by which time all of the relevant Washington systems would have been moved to RTP.

(5) <u>EPA should purchase the Univac in 1975 and thereby save $6.2 million in five years</u>.

EPA was offered an extremely attractive purchase option for the Univac 1110. If, by February, 1975, EPA can obtain Congressional approval and funding, they may purchase the Univac computer for approximately $1.8 million extra. The plan calls for the use of the Univac computer for at least the next five years. Present Univac lease rates are $1. 6 million per year. Therefore, the cost for continuing to rent the Univac would be $ 8 million over five years ($1.6 million per year for five years). If, on the other hand, EPA exercised its purchase option now and expended the extra $1.8 million, its subsequent lease charges each year would drop to zero. Thus, EPA could save $6.2 million over the next five years if it exercised its purchase option ($8.0 million lease charges less $1.8 million current year capital expenditure). Note that these savings are over and above all those indicated in the rest of this plan. For budgeting purposes, we have made the conservative assumption that EPA will be forced to lease the Univac.

4. THE CURRENT TELECOMMUNICATIONS PLANNING MODEL CAN BE USED BY EPA WITH MINOR MODIFICATIONS.

The Agency uses a mix of leased phone circuits, Wide Area Telephone Service (WATS)lines, and ordinary phone lines to provide communication from users to the main computers at OSI and RTP. The Agency has a current inventory of 400 low speed terminals and 42 medium speed terminals located in 24 different locations around the country. Currently, over 85% of all communications traffic is directed to the Washington, D. C. computers and only 15% is handled by RTP.

Information and Communication Applications, Inc. (ICA) has performed a study for the Agency proposing a telecommunications network to satisfy EPA's communication needs. ICA analyzed several network configurations using different combinations of WATS lines, leased lines, multiplexors and concentrators. The ICA network proposal assumed that the Agency workload would remain located at the current sites. Since the five year coordinated ADP plan includes the shift of substantial processing workloads to RTP, the ICA model will have to be rerun under the revised processing load distribution assumptions to determine the most appropriate communications configuration. ICA has retained all of its model data and has indicated its ability to rerun the simulation for several hundred dollars.

5. A DATA CENTER SHOULD BE ESTABLISHED TO PROCESS EPA'S NON-SCIENTIFIC WORKLOAD.

Although scientific and monitoring systems will be shifted to RTP, a residue of tracking and reporting and technical data base systems will continue to operate on the OSI or OSI-replacement computer.

(1) A single IBM 370/158 will be sufficient to process the non-scientific workload.

The remaining non-scientific workload will be approximately one-half of the current OSI processing load. Consequently, a single IBM 370/158, or equivalent, will be sufficient to support this workload. IBM equipment is particularly well-suited to this type of processing because of its hardware architecture and software support, which facilitate non-scientific interactive processing.

(2) EPA should lease or buy an IBM 370/158 or equivalent computer by 1978.

By 1978, the magnitude of the non-scientific workload will be well defined and will no longer be growing significantly. Consequently, total computing charges can be reduced if EPA directly leases or purchases a computer to support these needs. The Agency has referred to this computer and its associated operating staff, peripherals, etc. as the "Washington Computer Center", and is in the process of preparing a detailed feasibility study, as required by government regulations.

(3) The geographic location of this center is an organizatonal rather than technical matter.

To date, Agency planners have assumed that this non-scientific center would be located in the greater Washington area. Although we concur with the need for such a facility, we find that the specific geographical location of this center is relatively independent of technical considerations. Rather, the specific location of this center appears to be dependent on staffing and organizational issues. The technical capabilities of the equipment and the cost for staff and supplies will be approximately the same wherever the center is located.

6. MOST ADP EQUIPMENT AND SERVICES OPERATING OTHER THAN AT RTP OR OSI CAN BE CONSOLIDATED.

EPA uses currently a variety of outside service bureaus and miscellaneous data processing equipment. Much of this equipment can be consolidated or eliminated.

(1) EPA should continue to shift its computing workloads onto EPA computers.

EPA has been shifting programs from outside service bureaus onto Agency-managed computer facilities. This policy has five benefits, as follows:

- Reduces the dependency upon outside, unsupported computing features and thereby provides greater flexibility for Agency planners
- Provides EPA management with better controls and information about the types and common requirements of Agency systems
- Protects EPA systems from policies established by other Agencies, such as NIH
- Facilitates the consolidation and standardization of Agency computing procedures and policies
- Provides economies of scale in computer equipment leasing or purchase

Therefore, we concur, and with the exception of special services such as those provided by the

Department of the Interior's payroll system, our plan encourages EPA to continue this policy.

(2) Lab automation should be evaluated and funded by programs.

As has been discussed earlier in this report, lab automation is an experimental project which should be initiated, funded, managed, and evaluated by the affected programs. Equipment already purchased in Cincinnati may become available for other Agency purposes, however, if the experiment fails or is modified. For example, one of the enforcement laboratories, which had been participating in the experiment, is being disbanded. Hence, the minicomputer which had been purchased for that lab can now be used instead to provide a remote job entry terminal in Cincinnati. The particular use of equipment, therefore, should continue to reflect program priorities and needs, and should be reallocated as appropriate.

(3) Regional data centers should be developed selectively in 1979 and 1980.

Several regions and research centers have expressed interests in augmenting their current processing capabilities with local minicomputers. They contend that much of their computing needs can be satisfied locally and that they thereby can reduce their dependency on national data processing facilities.

The development of such local centers, however, will require more sophisticated local expertise and a more rationalized processing workload. The primary thrust of this coordinated plan is to bring the total ADP utilization within EPA under better control and to align such utilization with Agency priorities. To achieve this result requires a significant effort throughout the agency. By 1979, however, we expect that ADP utilization will be aligned fully with Agency needs. Rather than allow further proliferation of marginal ADP projects, at this time, therefore, we recommend that the development of regional centers be delayed until EPA has been able to define more precisely its primary computing needs and policies. At that time, local centers may be created selectively, if they conform with these Agency-wide priorities, and if they are cost-justifiable.

ADP STAFFING

As part of the overall ADP plan, we have projected development cost estimates assuming the participation of EPA technical personnel. These assumptions were based on the current levels and distributions of ADP personnel. The paragraphs that follow describe the recommended deployment and cost of these personnel, the augmentation of in-house expertise by the usage of outside contractors, and the improvements required in EPA technical and management skills.

1. ADP PERSONNEL SHOULD BE ORGANIZED INTO FOUR GROUPS.

Data processing personnel should be organized into four groups supporting (1) regional users, (2) programs, (3) facility management, and (4) the Office of Planning and Management.

(1) Regional ADP staffs should be maintained at current levels until 1977.

It is anticipated that many local systems will be replaced through the availability of properly designed Headquarters and program-sponsored systems. This should free the time of regional staffs to play a greater role in Agency system planning and functional review. However, by 1977, when major systems have been shifted to RTP and when the data entry and regional support roles for administrative and water program systems have been diminished, regional ADP staffs should be reduced by approximately 30%. Affected development personnel within the regions can be shifted to Agency-wide development projects; clerical personnel can be shifted to non-ADP support functions.

(2) <u>Program ADP staffs should contain fewer development personnel</u>.

Program offices should not attempt to maintain redundant ADP capabilities within their staffs. Instead, program staff should be selected for their expertise in ADP program requirements specification. The duties of program staff should include:

- Participation with OPM in prioritizing program needs, and specifying functional requirements
- Review and signoff of project plans, design specifications, and acceptance procedures for all program-related systems development
- Management of the expenditure of program monies on ADP

Liaison with OPM on ADP issues affecting program performance

The personnel responsible for these duties should, in most cases, report directly to the program manager. A staff of not more than three to five people per program should be adequate.

(3) The technical and management staff associated with the OSI and RTP facilities should be upgraded significantly.

Because of the geographic separation, technological differences and application orientations at the OSI and RTP facilities, we recommend that the ADP staff associated with each facility be charged with three basic responsibilities: Facility Management, System Support, and Application Development.

Facility management will require few EPA personnel, since contractors operate the computer facilities at both OSI and RTP. Instead, the responsibilities for facility management will consist primarily of facility planning and contract management. Consequently, only a few staff members will be required to perform these duties.

The system support resources at each facility need substantial upgrading. Personnel are needed to support facility and system software planning, communication system design, data base design and control, new system acceptance and integration, and standards enforcement. Approximately 15 new or redeployed personnel will be needed to fill these assignments.

Application systems development personnel will be needed to assist program personnel in the technical design and implementation of systems on the EPA computer facilities. Initially, developmental resources should focus on system identification and specification and leave development to outside contractors. As the Agency matures and the need for wholly new application software subsides, the Agency can expect to do a greater percentage of its development in-house. However, within the time-frame of this plan, the developmental groups should concentrate on (1) systems identification and specification (with the support of program office staff), (2) developmental contract management and project control, (3) completed software maintenance and (4) operation. A development resource including at least 10 new or redeployed personnel (from the program offices) will be needed to meet the Agency's requirements.

(4) <u>The Office of Planning and Management will oversee ADP budgets and computer utilization and assist the programs in the development of new application systems</u>.

The Office of Planning and Management will continue to be responsible for managing overall Agency ADP resources and for allocating ADP Fund sub-allowances on a prioritized basis. In this role, it will continue also to review new system development proposals for their potential impact upon Agency ADP resources. However, OPM should take increased responsibility for assisting program managers in designing and developing application systems, and in managing the use and performance of outside contractors, and in coordinating the activities of systems personnel at RTP and Washington with the program needs of Headquarters, regional and laboratory users.

2. <u>PERSONNEL COSTS FOR ADP CAN BE REDUCED BY $1 MILLION BY FY'78</u>.

The Agency presently supports a larger ADP staff than is required to implement the recommended systems development plan outlined above. Exhibit 5-10,on the following page,

Exhibit 5-10
U.S. Environmental Protection Agency
Distribution of ADP Personnel Salaries in $ Millions

	Current	1976	1977	1978	1979	1980
OPM	1.6	1.7	1.4	1.4	1.4	1.4
OEGC	.2	.4	.8	.6	.6	.6
OWHM	1.8	1.7	1.2	1.2	1.2	1.2
OAWM	1.0	1.0	1.0	1.0	1.0	1.0
ORD	1.9	1.5	1.7	1.5	1.5	1.5
Regions	.7	.7	.5	.5	.5	.5
Total	7.2	7.0	6.6	6.2	6.2	6.2

outlines the estimated salary budget for ADP personnel over the next five years which is required to implement the plan. Ahthough this budget calls for a staff reduction of almost 14%, many of these personnel still will be required to provide essential Agency services in areas where ADP support has been curtailed. For example, personnel who have been classified as ADP staff because of their use of word processing will continue to provide similar documentation support. But as word processing ceases to be included under ADP, these personnel will no longer be included as ADP staff.

These changes represent an estimated reduction by 1980 of 64 positions distributed as follows:

OPM	-	13 position reduction
OEGC	-	25 position increase
OWHM	-	38 position reduction
OAWM	-	no change
ORD	-	25 position reduction
Regions	-	13 position reduction

The reduction in ADP staff in OPM, OWHM and ORD is attributable primarily to the reduction in program office technical development activities and the reduction or elimination of several systems, primarily in OWHM. The staff increase in OEGC will support the increased ADP project management and user training responsibilities associated with the development of new enforcement systems. The reduction in regional staffs is attributable primarily to the decreased regional responsibilities which will result from modifications to Headquarters systems.

3. THE AGENCY SHOULD CONTINUE TO USE CONTRACTORS FOR FACILITIES MANAGEMENT AND MAJOR SYSTEMS DEVELOPMENT.

The Agency is shallow in a number of key ADP technical and management skills. Some of these gaps are high priority and must be filled by the development or recruitment of qualified Agency personnel. Certain jobs, however, such as the operation of the OSI and RTP facilities and the programming of new application software, can be contracted without jeopardizing Agency goals. Since EPA is a relatively young Agency, it is justified in using extensive amounts of outside support while building its basic portfolio of systems. In this way, EPA can free its staff to concentrate on planning and control issues.

Even if EPA personnel ceilings were lifted, thereby allowing the hiring of more in-house ADP staff, the use of contractors for major development activities would still be necessary. Since the majority of Agency system development projects will occur early in the five year plan, there would be little time to find, hire, and orient EPA personnel with the specialized skills needed to implement the plan. Furthermore, a substantial increase in EPA development staff would be unwise given the relatively limited need for massive new development activity after 1977.

4. EPA SHOULD DEVELOP A BETTER SKILLS PROFILE OF ITS ADP PERSONNEL.

The current personnel reports are insufficient for proper review and control of ADP employment policies in the Agency. ADP employee information should be collected into a more usable form and supplemented with technical data describing employee skills such as formal training, experience with various computer equipment and system software, experience in the use of various languages and data management systems, Agency experience by project, and experience in handling various lines of ADP management responsibility. This information could be used to identify Agency ADP skill gaps, identify applicable resources when initiating a new ADP project, and provide a base of information for career guidelines and counseling.

The personnel needed to support the advanced technology and complex system organization presently employed by EPA should possess the skills presented in the following table:

<u>ADP Management and Supervision</u>

- System Development Project Management
- Equipment Facilities Management
- Outside Contractor Management
- ADP Planning and Control Administration

<u>Analysis/Programming</u>

- Functional Analysis and Design by Media and Application Type
- Application Design and Programming
  - Business Application Programming
  - Scientific Application Programming
- Systems Design and Programming
  - Computer System Programming
  - Data Base Programming
  - Maintenance Programming
- Hardware, Communications, and System Software Evaluation and Analysis

<u>Operation/Clerical Support</u>

- Computer Operators
- Data Input/Output Control Clerks
- Keypunch and Typing Clerks

5. <u>ADP TECHNICAL AND MANAGEMENT EXPERTISE MUST BE UPGRADED</u>. Despite the unusually high average wage level of EPA data processing personnel, the Agency has a number of serious deficiencies in its current profile of ADP skills which must be filled quickly if ADP planning deadlines are to be met.

As indicated earlier, the Agency supports a high average ADP salary, especially for ADP supervisory and management positions. Nonetheless, EPA suffers from weaknesses in those very same areas. Reasons for this discrepancy include the fact that good ADP management talent is scattered throughout the Agency in areas of low-level ADP responsibility. In many cases, government seniority and correspondingly high wage levels have not prepared an individual to assume managerial level ADP responsibilities. The qualified ADP management talent within the Agency must be identified and put into positions of expanded responsibility and control within the organizational framework identified above.

Since the Agency presently does not contain all the ADP personnel resources needed, it needs to upgrade its current skills profile. A more exact deficiency list will evolve as the Agency's ADP skill profile is developed in detail. However, it is clear that EPA has need for qualified professionals in the following five areas:

- ADP management and supervision
- System development project management
- Systems design and programming, including systems software, data base, and maintenance programming
- Hardware, communications, and system software analysis (especially data base management)
- Documentation control

These needs will be satisfied over time by the redeployment of qualified staff members, through the retraining of ADP personnel and by the selective replacement of existing staff with qualified new personnel.

ADP MANAGEMENT POLICIES

1. MIDSD SHOULD BE RESPONSIBLE FOR ADP USAGE AND SHOULD ESTABLISH AND ENFORCE PROJECT MANAGEMENT STANDARDS.

As noted above, MIDSD has begun to define Agency policy regarding ADP development practices. They are working currently on an ADP Manual. As this manual is completed, they should continue to focus upon the following three major activities:

- Planning and budgeting for ADP resources
- Assisting in the justification, initiation and development of new EPA systems
- Monitoring the status of ADP systems and administering ADP Fund expenditures

(1) Each year MIDSD should update the Agency's five year ADP plan and assemble the coming year's ADP budget.

The ADP planning process initiated with this report should continue as an ongoing process by the Agency. Each year MIDSD should reaffirm ADP objectives, reassess ADP resources, and establish priorities and schedules. This process should provide the background against which MIDSD will budget for the next fiscal year. Periodically, the Agency should zero-base budget its ADP expenditures, rather than budget incrementally every year.

(2) MIDSD should identify ADP needs and assist program offices in the development of new systems.

MIDSD should identify project priorities as part of the planning process. To facilitate this planning and prioritization, MIDSD should be involved also in reviewing development requests from the program offices and in evaluating these requests on their own merits and in terms of their conformance to overall Agency priorities. In addition, the planning process itself should identify the need for certain projects, such as consolidation, conversion, or system upgrading. In addition to evaluating development proposals in terms of the overall plan, OPM should offer program offices technical and functional design guidance, contractor selection support and assistance in the procurement of necessary financial and technical resources.

(3) MIDSD should establish project management procedures and should conduct periodic audits of major operational systems and of lengthy development projects.

The Agency must protect itself against the costly project overruns that have characterized most of its system development efforts in the past. MIDSD should establish proper project management controls to monitor development progress against planned specifications and milestones. Appendix E contains a planning and control procedure for identifying and controlling such development projects.

Periodic system audits of operational systems and long development projects should be prepared by project independent review teams to guarantee that each system continues to justify its future costs when measured against anticipated benefits. The Agency must implement a review process that has the authority to terminate ADP expenditures on systems which can no longer be justified, regardless of costs already incurred.

2. <u>ADP BUDGETING PROCEDURES AND CONTROLS SHOULD BE EXPANDED TO INCLUDE PROGRAM MONIES SPENT FOR PERSONNEL AND CONTRACTOR SUPPORT</u>.

MIDSD presently budgets and controls the use of the ADP fund. However, to provide the Agency with accurate ADP expenditure information, as required by Federal budgetary and accounting authorities, additional cost elements must be included in formal ADP budgets. In order to capture this information, MIDSD should expand its systems and procedures in the following three ways:

- Develop formalized ADP contractor and personnel reporting system
- Establish budget ceilings for contractor personnel, Agency personnel, contractor computer, and ADP fund expenditures
- Enforce ceilings placed on contracted ADP support and ADP fund usage

(1) <u>During FY'75 MIDSD should develop an expanded ADP reporting system</u>.

The Timesharing Services Management System (TSSMS) now provides the Agency with the ability to review ADP Fund expenditures by program element. This capability must be expanded to provide the following profile by program element:

- Development costs: Agency personnel, contractor personnel
- Management, operations, and maintenance costs: Agency personnel, contractor personnel
- Computer expenditures: ADP Fund, computer charges included in contractor agreements.
- Other direct ADP expenses.

(2) <u>MIDSD and program offices together should establish total program ADP expenditure ceilings</u>.

In order for the Agency to adhere to its long term ADP plan, program monies for contractor and Agency personnel must be budgeted and controlled. MIDSD should work with each program office during the budget cycle to insure that program monies for ADP contractor support and ADP personnel support are budgeted within the guidelines set forth in the Agency's ADP plan.

(3) Ceilings set on ADP contractor costs and computer time expenditures included in development contracts should be enforced.

Through the use of TSSMS, MIDSD intends to enforce fixed ceilings on ADP Fund expenditures. Based on the information provided by the ADP cost reporting system described above, MIDSD could be given also the authority to enforce limitations placed on contractor ADP costs. In particular, program ADP overruns for contractors should be funded from an Agencywide ADP contingency reserve administered by OPM rather than from general program funds.

3. THE TECHNICAL STAFF SUPPORTED BY OPM SHOULD ENFORCE ADP QUALITY CONTROL STANDARDS.

The amount and complexity of ADP use within the Agency dictates the need for standards and quality control. The technical support staff within OPM should be assigned the responsibility to develop and enforce these standards. These standards should govern the following three areas:

- ADP development
- Data quality
- Computer performance

(1) OPM should establish ADP development standards for use by program offices.

Ongoing development projects in response to program needs require project standards and controls. EPA should be careful, however, to avoid the imposition of overly-detailed, burdensome and overly bureaucratic procedures. A clear set of usable guidelines are described in Appendix E. In addition, standard design practices should be established to realize the economies of scale achievable from operating EPA systems on the Agency's own computer facilities. To this end and within the guidelines of the ADP plan, OPM should analyze and select the technological innovations it wishes EPA systems to employ.

(2) EPA should establish data entry and data base maintenance standards to insure the integrity of system information.

Because the data bases maintained by EPA are public information and are used to support legislative and environmental actions, it is important to insure that information stored in these data bases is accurate. OPM technical staff members should develop standard system and procedural techniques for the design and operation of all data base systems to insure the quality of information stored in these systems. The periodic audits already recommended for all systems should include reviews of data quality control.

(3) A periodic audit of computer usage should be conducted by OPM to prevent the Agency from spending more on computer equipment than is required.

Since the Agency presently maintains a portfolio of dissimilar, non-cooperative, and technically contentious software, the computers utilized cannot be managed for maximum efficiency. Therefore, the OPM technical staff should review periodically in detail the current and projected computer utilization patterns. This analysis should result in hardware/software configuration recommendations to increase overall efficiencies of operation. The use of computer performance analysis packages, such as those provided by Boole and Babbage, and others, will facilitate this analysis. In addition, guidelines should be produced which steer the way to an application portfolio which both meets EPA functional needs and is compatible with Agency hardware/software technical efficiency strategies.

APPENDIX A

INVENTORY OF CURRENT SYSTEMS

APPENDIX A - INVENTORY OF CURRENT SYSTEMS

The major ADP software systems currently in use in the Environmental Protection Agency are described in this appendix. For the purposes of exposition all systems currently in use have not been described here (only those with an annual operating cost on the order of $100,000 or more), however, the 20 major systems contained in this appendix account for approximately 80% of the Agency's annual ADP budget.

The following section contains a brief summary of this appendix. This summary is followed by detailed system descriptions presented within sections describing the Agency organizational units which they support.

I. SUMMARY

As shown in Exhibit A-1, on the following page, the EPA is divided into five major Headquarters offices under Assistant Administrators (AA's) and ten regional offices under Regional Administrators. The Headquarters offices are responsible for planning and management, enforcement and general counsel, water and hazardous materials, air and waste management, and research and development. The regional offices are responsible for translating policies and technical directions generated at Headquarters into effective operating programs in each geographic area.

Exhibit A-2, following Exhibit A-1, shows the Agency's annual ADP expenditure for each AA-level office. In this exhibit, and throughout this appendix, the regional usage of ADP has been allocated to the Headquarters organizational unit that has primary responsibility for the system. The principal application of ADP in each of the AA-level offices is as follows:

- Office of Planning and Management (OPM) - Tracking and reporting systems for administration
- Office of Enforcement and General Counsel (OEGC) - Tracking and reporting systems for enforcement

Exhibit A-1
U.S. Environmental Protection Agency
EPA Organization Chart

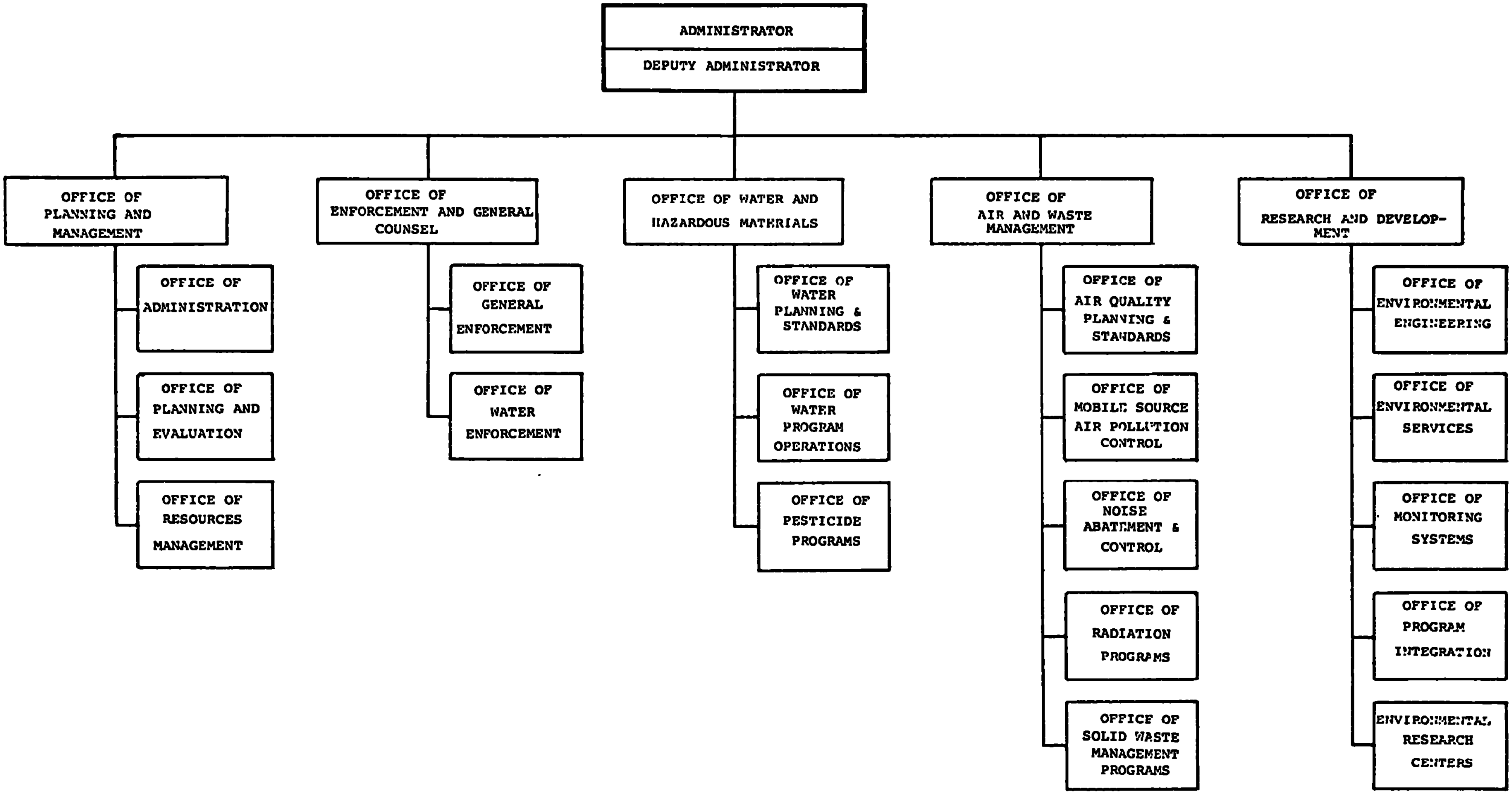
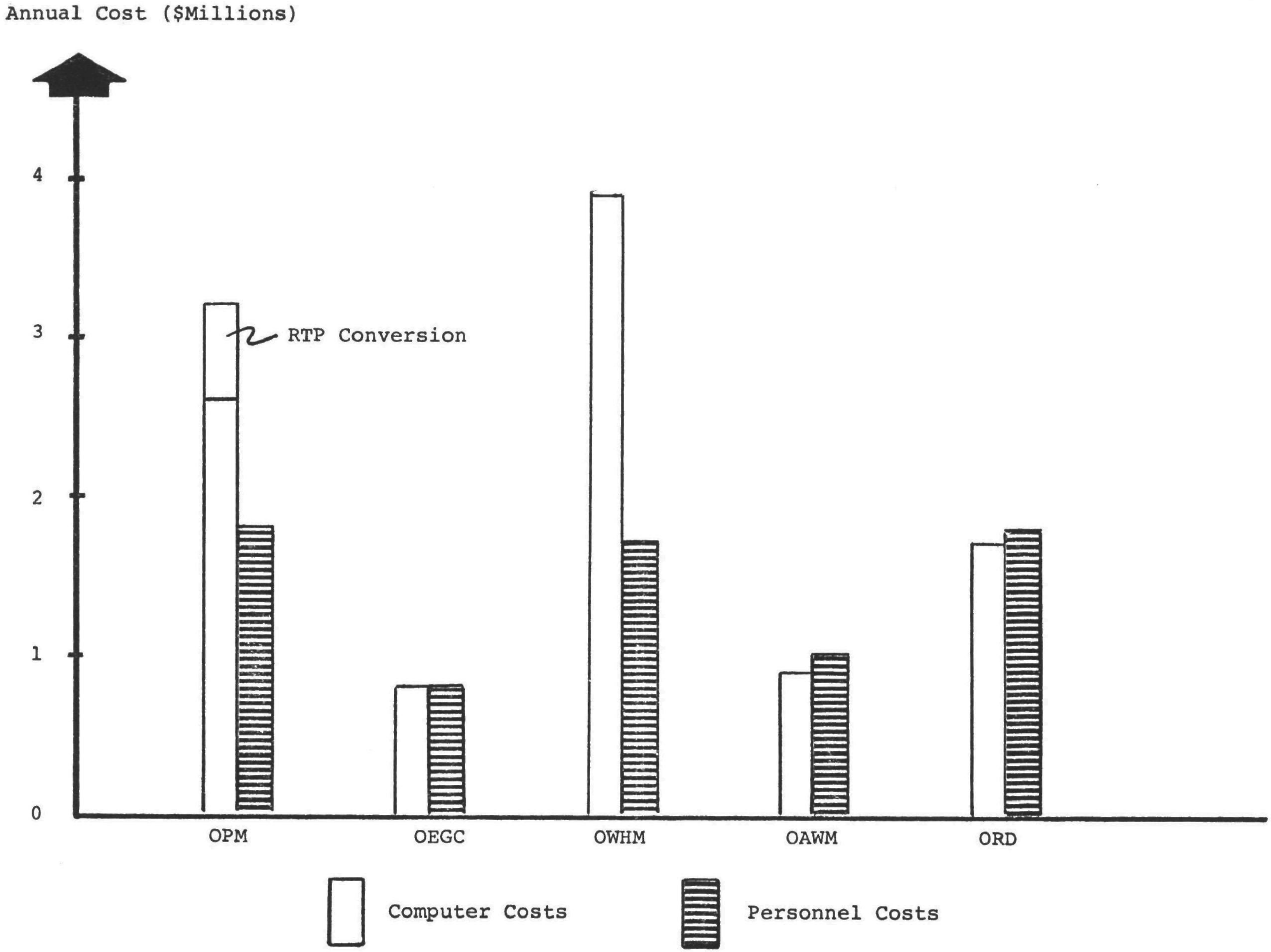


Exhibit A-2
U.S. Environmental Protection Agency
Annual Computer and ADP
Personnel Costs by AA Office



- Office of Water and Hazardous Materials (OWHM) - Trend and monitoring systems for assessing national water quality and tracking of construction grants

- Office of Air and Waste Management (OWHM) - National air quality data systems and bibliographic systems

- Office of Research and Development (ORD) - Program management systems, modeling, and laboratory automation

A more detailed breakdown of the Agency's ADP systems by Deputy Assistant Administrator (DAA) level offices is presented in the remaining sections of this appendix. For each DAA-level office the following information is shown: (1) the principal geographic location, (2) the authorized number of full-time positions, (3) the general type of staff (e.g., administrative, legal, scientific), (4) the primary organizational responsibilities, (5) the major relevant legislation, if applicable, and (6) the major ADP systems the office is responsible for.

The major ADP systems covered by this appendix are listed in Exhibit A-3, on the following page. The system discussions include a brief statement of purpose, the current annual operating costs, the primary users, a description of the system, the operating characteristics, and additional comments. Current operating costs include FY '74 timesharing costs as indicated in the year-end Time Sharing Service Management System report, personnel costs allocated by the study team from the October, 1974 "Organizational Schedule of Employees", and contractor costs as discovered through interviews or as recorded on expenditure requests submitted to OPM. Contractor and personnel costs have been associated with particular systems even though these costs may not be attributable directly to the office sponsoring the system.

U.S. Environmental Protection Agency
Major ADP Systems in Use in the Agency

System	Acronym	Annual Cost ($000)	Type of System	AA	DAA
Compliance Data System	CDS	246	Tracking and Reporting	OEGC	OGE
Financial Management System	FMS	685	Tracking and Reporting	OPM	ORM
General Point Source File	GPSF	1,475	Trend and Monitoring	OEGC	OWE
Grants Information and Control System	GICS	248	Tracking and Reporting	OPM	OA
Lab Automation	---	520	Lab Automation	ORD	---
National Emissions Data System	NEDS	786	Technical Data System	OAWM	OAQPS
Noise	---	420	Bibliographic	OAWM	ONA
Personnel/Payroll System	DIPS	785	Tracking and Reporting	OPM	DIPS
Pesticides Analysis Retrieval and Control System	PARCS	892	Technical Data Base	OWHM	OPP

Exhibit A-8
U.S. Environmental Protection Agency
Major ADP Systems in Use in the Agency

System	Acronym	Annual Cost ($000)	Type of System	AA	DAA
Pesticides Enforcement Monitoring System	PEMS	150	Tracking and Reporting	OEGC	OGE
Program Management System	---	834	Tracking and Reporting	ORD	---
Solid Waste Information Retrieval System	SWIRS	355	Bibliographic	OAWM	OSWM
Spill Information Retrieval System	SIRS	250	Tracking and Reporting	OWHM	OWPO
Storage and Retrieval of Aerometric Data	SAROAD	470	Trend and Monitoring	OAWM	OAQPS
Storage and Retrieval System for Water Quality Data	STORET	4,029	Trend and Monitoring	OWHM	OWPS
Strategic Environmental Assessment System	SEAS	1,025	Modeling	ORD	---
Technical Assistance Data System	TADS	79	Technical Data Base	OWHM	OWPO
Technical Environmental Information System	TENIS	435	Bibliographic	OAWM	OAQPS
Word Processing - ORD	BTS	170	Word Processing	ORD	---
Word Processing - OWHM	BTS	341	Word Processing	OWHM	OWPS

II. OFFICE OF PLANNING AND MANAGEMENT (OPM)

The Office of Planning and Management has Agencywide responsibilities for the following major activities:

- Program evaluation
- Resource management, including administering a program-planning-budgeting system
- Budget preparation and execution
- Personnel policies and operations
- ADP management and operations
- Facilities and space management
- Contracting and procurement services
- Grant policies and procedures
- Comprehensive audit programs
- Organization and management systems

The 1065 members (11% of the total EPA employment) of OPM are organized into offices of staff support and three offices under Deputy Assistant Administrators, as follows:

- Office of Administration
- Office of Planning and Evaluation
- Office of Resources Management

OPM has used ADP primarily to automate the clerical activities associated with administering the Agency's work. Exhibit A-4, on the following page, lists the major systems in use by OPM. Current costs for conversion, operation, and administration of the computer center at Research Triangle Park (RTP) are listed also.

1. OFFICE OF ADMINISTRATION

(1) Principal Geographic Locations. Washington, (61%) RTP (23%) Cincinnati (16%)

(2) Size of staff: 725

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

- Development and operation of programs for organization and management systems, controls, and services
- Personnel policies, procedures, and operations
- Personnel, physical, and document security and inspection
- Management information systems development and coordination of Agency ADP applications
- ADP operations on service bureaus and Agency computers
- Facilities and space management
- Agency safety programs
- Contracting and procurement services
- Grants policies and procedures

Exhibit A-4
U.S. Environmental Protection Agency
Major Systems in Use in OPM

Name	Acronym	ANNUAL COST ($000) Computer	Personnel	Contract Support	Type of System
Grants Information & Control System	GICS	165	77*	6	Tracking and Reporting
Personnel/Payroll System	DIPS	600	156*	29	Tracking and Reporting
Financial Management System	FMS	317	368*	--	Tracking and Reporting
Other Systems	---	708	766*	106	---
RTP Conversion	---	640	---	---	---
RTP Administration	---	800	432	---	---
	Totals	3,230	1,799	141	

*Region's annual cost of $230,000 has been distributed proportionally among the systems designated above

- General administration and support services

- Other areas of administration management, including records management, committee management, directives management, and an Agency library system. (The responsibilities for the above functions are not limited to EPA Headquarters, but extend to Agency field establishments.)

(5) Major Systems:

The Office of Administration utilizes several computer systems which are designed to support all the other EPA offices. Most of these computer systems are tracking and reporting systems, such as the grants system and the personnel/payroll system. These systems record, summarize, and report operational information for use in the day-to-day administration of the affairs of the Agency.

- <u>Grants Information and Control System (GICS)</u>

  - Purpose:

    The GICS system tracks the processing of every grant application and unsolicited proposal received by the Agency. Both Headquarters grants and state and local assistance grants are monitored by the system.

  - Annual Cost:

Computer	Personnel	Contract Support
$165,000	$73,000	$6,000

- Primary Users:

  Grants administration personnel in Regional and Headquarters offices use GICS for operational control. The Headquarters offices of Grants Administration, Water Operations, and Research and Development also use the system for summary analysis and reporting of agency-wide activity.

- Description:

  GICS is a tracking and reporting system used to monitor the scheduled events in the life cycle of a grant. Information is entered into the system indicating the date on which the following actions occur:

  - application received
  - application sent for review
  - grant awarded or denied
  - grant budget established
  - project completed

  The system tracks the flow of administrative paperwork associated with EPA grants to insure timely processing. The system alerts management when a projected date has passed without a corresponding system input indicating that the scheduled event has taken place. Standard reports include exception reports of grants which are behind schedule, and full listings of all grants in process.

  In addition, the administrative areas within Headquarters, the regions, and the NERC's can each generate reports to meet their own needs. The Headquarters office of Grants Administration produces a monthly listing of grant programs for use by the general public. Quarterly, a booklet is prepared which lists all grants issued by the Agency. Special statistical reports can be programmed also to retrieve grant data.

  Seventy-five percent of the operational use of the system by Headquarters is for the purpose of preparing special reports in response to external inquiries from Congress, other EPA offices, and other groups.

- Operation:

  The system operates in an IBM environment, using the Wylbur text-editing system for input, and the IRS report writer system for output. Input to the system is performed at the user's convenience through the teleprocessing network. Updates to the system are run on a regularly scheduled basis every Friday night at 7:30 p.m. Corrections are processed by the following Wednesday at which time report programs may be run against the data base.

- Comments:

  Current problems include obtaining higher user acceptance and utilization of the system without violating the FY75 budgetary sub-allocation ceilings. During FY75 the system was moved from NIH to OSI. The cost of parallel operation required by this conversion will result in a budget overrun if current levels of usage are maintained.

  The Grants Administration Division indicated that it may be possible to reduce costs by answering certain requests manually in the future instead of preparing special programs. Thus, the Office of Administration feels it is possible, in some cases, to substitute manual processing of the data for ADP usage.

. <u>Personnel/Payroll System (DIPS)</u>

- Purpose:

  The Departmental Integrated Personnel Services system (DIPS) is a centralized personnel processing and payroll system which services the needs of the entire Agency.

- Annual Cost:

Computer	Personnel	Contract Support
$600,000	$148,000	$29,000

- Primary Users:

  DIPS is used by personnel management offices in Headquarters, the regions, and the NERC's.

- Description:

  DIPS is a tracking and reporting system. The system itself was developed at the Department of the Interior, and the payroll portion of the system is operated on the USG computer. The Department of the Interior supports not only EPA, but Interior and several other government agencies as well. EPA, therefore, benefits from the resulting economies of scale provided by the Department of Interior's specialized expertise in running the system.

  The system produces payroll checks for all people in the Agency, except for commissioned officers. A wide range of personnel management reports also are produced by the system.

- Operation:

  The operation of the system is divided between OSI and the USG computers. All personnel changes in the agency are input to the system from Agency offices at Headquarters and in the regions. Magnetic Card Selectric terminals are used to transmit the data to personnel files on OSI. This use of terminal input from offices outside of Washington has increased the timeliness of the system by eliminating the delays which were experienced when information from the regions was sent by mail.

  The input for the previous bi-weekly period is transferred from OSI to USG for payroll production on a regular basis. After the payroll has been run the data files at USG are transferred back to OSI. The updated DIPS data files are then available for production of personnel management reports for the Headquarters and regional offices. These personnel reports are programmed in IRS by the local users. In addition, the staff at USG will produce, upon request, special study reports for users at Headquarters.

- Comments:

The level of service provided by the payroll portion of the system is quite good and appears to be cost-effective. The personnel files supply a wide variety of data capable of satisfying most requests for information. The chief complaint of the users is that biweekly updating of the personnel data is not timely enough. Users indicated that two to four week old personnel data was inadequate for their needs. As a result, some offices have created their own parallel systems that are updated as changes are entered.

The operation of the DIPS system has not been moved from USG to OSI because the body of special expertise and capability which has been developed at USG would be expensive for the Agency to duplicate. As mentioned earlier, EPA benefits from the USG operation of DIPS through the economies incurred by spreading operation and maintenance costs across the several agencies using the USG system.

The DIPS user task force has proven successful in providing regular feedback from users to the system developers. This is a technique that should be more widely applied throughout the Agency during the initial development and ongoing maintenance of large central systems.

2. OFFICE OF PLANNING AND EVALUATION

(1) Principal Geographic Location: Washington

(2) Size of Staff: 58

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

- Evaluation and development of new approaches for Agency-wide program evaluation activities in coordination with the Office of Resource Management relating these activities to Agency goals for identification of program policy and resource needs
- Compiling selected statutory reports to Congress
- Providing procedural management, planning, and evaluation of Agency standards, regulations, and guidelines mandated by law or otherwise scheduled for Federal Register publication, including coordination of their development, clearance, and promulgation
- Conducting economic evaluation of Agency programs, policies, standards and regulations, including the establishment of abatement cost, cost/benefit analysis, impact assessments, and monitoring of plant closings throughout the Nation.
- Consulting on and providing analytical assistance in the areas described above to senior policy and program officials
- Coordination functions with relation to energy policy matters

(The responsibility for the above functions is not limited to Headquarters, but extends to Agency field establishments.)

3. OFFICE OF RESOURCES MANAGEMENT

(1) Principal Geographic Location: Washington

(2) Size of Staff: 185

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

- Development and operation of resources management programs for the Agency, including administering a PPB system in accordance with OMB directives
- Budget formulation, preparation, and execution, including funding allotments and allocations
- Financial management and services, including developing and maintaining accounting systems, fiscal controls, and systems for payroll and disbursements
- Program analysis
- Program reporting
- Control and monitoring of interagency agreements

(The responsibilities for the above functions are not limited to EPA Headquarters, but extend to Agency field establishments.)

(5) Major Systems

- Integrated Financial Management Systems (FMS)

  - Purpose:

    The Financial Management System is a centrally operated system serving the financial information needs of all elements of the Agency. The purpose of the system is to allow a manager to monitor commitment activity against authorized obligations.

- Annual Cost:

Computer	Personnel	Contract Support
$ 317,000	$349,000	-

- Primary Users:

FMS is used by financial managers at the division level or higher in all Headquarters offices, regions, and the NERC's

- Description:

FMS is a tracking and reporting system which provides an automated capability for monitoring commitments versus obligations in the expenditure of funds throughout EPA. Major obligations of the Agency are tracked by the system. Primary system outputs are status and summary reports. These reports depict appropriations by object class, and obligations by program element and sub-object class.

- Operation:

FY74 was the first year that the system ran in a terminal environment allowing access by all users in the Agency. Prior to that year, input documents were transmitted to Headquarters by mail. Although the system is located centrally on the HSA computer, fifteen independent files are maintained for the fifteen accounting areas of the Agency. Input is transmitted directly from the Headquarters offices or regions over teleprocessing lines, the inputs are verified on a periodic basis, and the update program is run weekly to create a new master file for report production. Each of the users has access to a wide range of reports which can be run using any of the fifteen accounting area data files.

The system uses the IBM IRS software package for generating reports. It currently operates on the Health Services Administration computer, which is a government-owned facility. A shift of the FMS system to the OSI computer is currently under review.

- Comments:

The Financial Management Office has expended considerable efforts in monitoring and evaluating the cost-benefits of operating the FMS system. A detailed analysis of the accounting data maintained by the computer operating system identified that a particular report was responsible for significant expenditures. By evaluating and modifying the content of the report, costs for running the report were reduced by over 90% with no reduction in its usefulness.

The FMS system provides a good example of design trade-offs which result in the effective use of computer resources in the tracking of commitments.

The system covers only six percent of all the Agency's commitments, but which represent 95% of the total commitment dollar value. In this way, the operational cost of the system is reduced, while still providing effective support for financial management within the Agency.

4. OTHER COMPUTER SYSTEMS USED IN OPM

- Purpose:

Numerous smaller systems for administrative support of the agency are operated by OPM. Most of these systems are tracking and reporting systems for monitoring property, money, expenditures, schedules, or budget figures. During FY74-FY75, the conversion costs of starting up the RTP computer center also have been allocated to this office.

- Annual Cost:

	Computer	Personnel	Contract Support
Other OPM Systems	$700,000	$727,000	$106,000
RTP Conversion	640,000	-	-
RTP Administration	800,000	432,000	-

(RTP Administration costs consist primarily of ORD and OAWM computer usage which has not yet been allocated.).

- Primary Users:

OPM systems are used internally by various staff groups in the conduct of normal operations.

- Descriptions:

Personal and Leased Property System

This system supports accounting records on receipt and transfer of property, property adjustments, and transfer of excess property as required by the GAO. The master file contains 43,000 records. Six reports are produced by the system for use by Inventory Control Centers, custodial offices and accountable area officers. Input comes from remote terminals at the inventory control centers and is stored on WYLBUR data sets. The current annual computer cost of running the system is $134,000.

Contracts Information System

CIS is a tracking system for top management which provides data on all contracts of $2500 or more. Contract status is monitored through RFP, evaluation, negotiation, contract preparation, review and award phases. Bi-weekly summaries of funds obligated are produced by the system. Input is entered on-line to WYLBUR data sets. The current annual computer cost of running the system is $75,000.

Library Management System

This system maintains a printout of 4,500 journals and 5,500 book holdings available from 37 libraries within EPA. Data are updated from on-line terminals semi-annually. Reports of holdings are produced by title, library, author, subject, catalogue and accession number. The printouts are used to cross-reference holdings throughout the agency. The current annual computer cost of running the system is $30,000.

Time Sharing Service Management System

TSSMS summarizes time-sharing computer expenditures of all agency offices. All major EPA computer vendors supply accounting data on actual usage. This information is summarized monthly and notices of expenditures against ceilings are prepared for all EPA sub-allowance holders. The system is used to monitor computer costs. Input is entered automatically from accounting tapes or manually through on-line terminals. IRS is used to generate the reports. The current annual computer cost of running TSSMS is $76,000.

Dun and Bradstreet Index

Dun and Bradstreet is under contract to supply the agency with current information on all industrial and commercial firms in the U.S. Currently, 3,000,000 records are contained on 24 magnetic tapes. This information can be used for mailing lists, or demographic analysis of the industrial makeup of geographic areas. Available information includes name, address, geographic location, SIC, sales volume, number of employees, and net worth. The current annual computer and contract support cost associated with this system are $12,000 and $106,000 respectively.

Resource Management Information System

This system maintains a file containing current resource allocations by sub-element and organization. It is used during the budgeting process to present program planning data. It provides allowance and authorized sub-element data to the Financial Management System. The current annual computer cost of running the system is $65,000.

RTP Conversion

The $640,000 cost this year of installing a Univac 1110 computer at RTP, and of converting existing programs to the new machine is charged to OPM.

RTP Administration

The $800,000 annual cost of computer operations, maintenance of the Univac 1110 Executive System, usage accounting, user service, name and address system and general administration are recurring costs and are charged to OPM at RTP. An undetermined percentage of this $800,000 cost represents OAWM and ORD usage which has not yet been charged out. EPA is in the process of developing an improved charge-out method for the Univac machine.

Headquarters Administration

All other OPM uses of computers including support of System 2000, the Systems Directory, vendor files, general administration, and special studies cost approximately $316,000 per year.

III. OFFICE OF ENFORCEMENT AND GENERAL COUNSEL (OEGC)

The Office of Enforcement and General Counsel has responsibility for the conduct of enforcement activities on an Agencywide basis. This includes the development and execution of programs for water, air, noise, radiation, pesticides, and solid waste enforcement, including the development of procedures, regulatory material, guidelines, criteria, and policy statements designed to bring about actions by individuals, private enterprise, and governmental bodies to improve the environment. The Office of Enforcement and General Counsel also provides legal services to all organizational elements of the Agency including legal opinions and litigation support. The 448 members (5% of the total Agency employment) of OEGC are organized into offices of staff support, an Office of General Counsel, and two offices under DAA's:

- Office of General Enforcement
- Office of Water Enforcement

OEGC currently uses ADP primarily for tracking and reporting on the compliance schedules. Exhibit A-5, on the following page, lists the major systems in use by OEGC.

U.S. Environmental Protection Agency
Major Systems in Use in OEGC

Name	Acronym	ANNUAL COST ($000) Computer	Personnel	Contract Support	Type of System
Compliance Data System	CDS	50	21*	175	Tracking and Reporting
Pesticides Enforcement Monitoring System	PEMS	150	---	---	Tracking and Reporting
General Point Source File	GPSF	560	675**	240	Trend and Monitoring
Other Systems	---	5	145	---	---
	Totals	765	841	415	

* In OAWM
** 400 in OWHM, 230 in Regions

1. OFFICE OF GENERAL ENFORCEMENT

(1) Principal Geographic Location: Washington

(2) Size of Staff: 141

(3) General Type of Staff: Legal

(4) Primary Responsibilities:

- Provides program policy direction to Agency enforcement activities in air, noise, radiation, pesticides, and solid waste program areas
- Formulates enforcement policy and designs enforcement programs involving testing and surveillance of vehicles to accomplish effective enforcement of motor vehicle emission standards
- Develops and issues Agency policies, guidelines and regulations pertaining to citizen suits and the exercise of the Agency's authority to inspect facilities and to require record keeping, reports, emission sampling, and monitoring by owners and operators of facilities
- Reviews scientific analyses of pesticide samples and determines enforcement actions needed to achieve compliance
- Reviews all decisions involving the cancellation or suspension of pesticide registration, and determines enforcement actions needed to achieve compliance

(5) Major Relevant Legislation:

Noise Control Act of 1972

Clean Air Act

Solid Waste Disposal Act

Federal Insecticide, Fungicide and Rodenticide Act

Federal Food, Drug, and Cosmetic Act

1954 Atomic Energy Act

(6) Major Systems

- Compliance Data System (CDS)

  - Purpose:

    State Implementation Plans (SIPS) regulate the amount of airborne pollutants which may be discharged into atmosphere from stationary point sources. EPA has the responsibility to monitor the state programs, in order to insure that the SIP's are adequately enforced. CDS is used to track the completion of the actions specified in State Implementation Plans (SIPS) for major sources of five primary air pollutants.

  - Annual Cost:

Computer	Personnel	Contract Support
$50,000	$21,000	$175,000

  - Primary Users:

    Regional Offices use the system to monitor state and local activity. Headquarters uses the system to monitor the regions and prepare special reports.

  - Description:

    Throughout the nation there are 250,000 stationary sources of significant air pollution, each discharging 25 or more tons of pollutants per year into the air. The air enforcement effort has focused on the 20,000 major sources (each emitting over 100 tons of pollutants per year) that account for 80% to 85% of all pollutant emissions.

    The states develop implementation plans designed to bring sources of air pollution within specified discharge limits. After the plan is developed, the states then enter the compliance schedule dates comprising these plans into CDS. Schedules include dates for completion of planning, engineering, start of construction, and end of construction. Event completion is reported by the states and is entered into the system by EPA. Weekly reports are provided to the regions of scheduled events to be monitored. Each month the states receive listings of events scheduled, overdue actions, and preprinted questionnaires on current air quality for those sources scheduled to come into compliance.

- Operation:

The system is run centrally on OSI. Input data from the regions may be submitted at any time during the week. On a scheduled basis the data entered by the states is processed by the edit program and errors are returned to the states for correction. When corrections have been made, the update program is run to update the master tape file. The following morning, reports are generated and sent to the regions over the RJE terminals in each region. These reports include:

- future schedules
- overdue actions
- state questionnaires
- list of all sources
- statistical reports

- Comments:

CDS requires substantial data input from the states without providing comparable benefits in return. The regions use the reports to monitor how well the states are doing their job. The meaningfulness of weekly reports is reduced because only 60-65% of the schedules are on the system. In addition, the compliance dates tend to peak, reducing the utility of the reports as a scheduling tool.

CDS is currently being used only for air quality enforcement. However, air and water quality compliance programs are quite similar in nature. In both media areas the emphasis is on stationary sources which are monitored on a regular basis over a period of years. The same system should be able to serve the compliance tracking needs of both programs.

A Comprehensive Data Handling System (CDHS) was developed by EPA for use by the states in managing their air quality programs. CDHS includes a State Enforcement Management System which is coordinated with CDS. In addition to supporting state needs, it automatically generates the data for CDS. This coordination of state needs with the central EPA activities, is desirable and should be adopted in all areas of activity throughout the Agency.

CDS is coordinated also with the National Emissions Data System (NEDS). State questionnaires are produced using both CDS and NEDS data.

- Pesticides Enforcement Monitoring System (PEMS)

  - Purpose:

    PEMS is a tracking and reporting system which monitors the results of actions taken by the pesticides enforcement staff. Summary statistics of violations detected are used to develop enforcement sampling strategy.

  - Annual Cost:

Computer	Personnel	Contract Support
$150,000	-	-

- Primary Users:

  The primary users of PEMS are the pesticides enforcement staff in EPA regional offices and at Headquarters.

- Description:

  Each region can produce a report indicating what enforcement actions have been initiated in the region, and why the action was taken. The system receives data about manufacturers from the pesticides system, PARCS. PEMS records a history, by manufacturer, of all enforcement actions taken. Actions may be started because the manufacturer failed to register, or because a sampling indicates that the product is in violation of its registration conditions. Currently 6,000 actions have been recorded in PEMS. Of all actions initiated, 2,000 have detected violations by the manufacturer.

- Operations:

  PEMS is a centrally operated system running on OSI. Data is entered by the regions and reports are prepared for regions at their request. Weekly reports list actions, while nightly turnaround is available to answer special requests for information.

2. OFFICE OF WATER ENFORCEMENT

(1) Principal Geographic Location: Washington, Cincinnati, Denver

(2) Size of Staff: 134

(3) General Type of Staff: Legal

(4) Primary Responsibilities:

- Provides program policy direction to the water and water supply enforcement activities of the Agency, including direct supervision of technical program direction of regional water enforcement activities

- Develops Agencywide objectives and programs for water enforcement activities, including the development of procedures, regulatory material, guidelines, criteria, and policy statements designed to bring about actions by individuals, private enterprise, and governmental bodies to improve the quality of water

- Reviews and approves state permit programs and provides assistance or adjudicatory hearings and legal aspects of case preparation

- Maintains Agency overview regarding status of compliance of permit requirements enforceable by EPA and the states

- Coordinates preparation, quality control, and evaluation of permit data in support of the National Pollutant Discharge Elimination System (NPDES)

- Evaluates performance of water enforcement program of the regions and of the states

(5) Major Relevant Legislation:

Federal Water Pollution Control Act

Marine Protection, Research, and Sanctuaries Act

Fish and Wildlife Act

Public Health Service Act

(6) Major System

- General Point Source File (GPSF)

- Purpose:

  The purpose of the General Point Source File (GPSF) is to track the issuance of NPDES permits to effluent dischargers into the nation's waterways and to identify dischargers who fail to comply with the conditions of their permits.

- Annual Cost:

Computer	Personnel	Contract Support
$560,000	$605,000	$240,000

- Primary Users:

  The primary users of GPSF are regional enforcement personnel and regional and state water quality analysts. Enforcement and water analysts at Headquarters also use system summary reports.

- Description:

  GPSF is a partially operational general data base management system which has been designed by EPA to support the national water program. GPSF is designed to support three primary functions, as follows:

  . MICS - This function assists permit branch personnel in the tracking of permit application processing. Each step of the application process is recorded. Summary reports then can be produced identifying processing bottlenecks.

  . Compliance Schedules - This function tracks the compliance of permittees with the schedule of construction actions required as part of their permit conditions.

  . Discharge Monitoring Reports - This function captures and analyses the chemical composition of effluents discharged into the waterways. If the chemical composition exceeds the limits specified in the corresponding permit, an exception report is generated.

- Operating:

  GPSF is designed to operate on the OSI computer. Data is entered and edited on WYLBUR data sets. Once transactions have been edited successfully, they are entered into the GPSF update file. The update program is run one to two times per week. Data which is updated successfully is stored in system files for subsequent retrievals. A generalized report writer is being designed to provide users with the ability to format their own reports. Special reports have been developed also to service regular ongoing reporting requirements.

- Comments:

  A system audit was conducted in 1974 to judge the operability of the GPSF system. At that time, the update and several reporting subsystems were found to be unreliable. As a consequence, GPSF development funds were frozen pending the development of a back-up enforcement system and a redetermination of the cost/benefit of the services to be provided by a fully-operational system. Particular concern has been exhibited subsequently over the projected tenfold increase in operating costs that full utilization of system facilities would entail.

3. OTHER COMPUTER SYSTEMS USED BY OEGC

Other computer usage by OEGC is primarily for Mobile Source Air enforcement. Work in this area includes fuels, recalls, and imported vehicle monitoring. The current annual computer and personnel costs associated with these activities are $5,000 and $145,000, respectively.

IV. OFFICE OF WATER AND HAZARDOUS MATERIALS (OWHM)

The Office for Water and Hazardous Materials develops abatement strategies in the areas of water pollution, oil spills, and pesticides. OWHM has responsibility for program policy development and evaluation, environmental and pollution sources standards development, guidance and technical support of regional program activities, and selected demonstration programs. The 1080 members (approximately 12% of the Agency's total employment) are structured into office of staff support and three offices under DAA's:

- Office of Water Planning and Standards
- Office of Water Program Operations
- Office of Pesticide Programs

The major use of ADP by OWHM is the maintenance of large water quality and pesticides data bases. Exhibit A-6 on the following page lists the major systems in use by OWHM.

1. OFFICE OF WATER PLANNING AND STANDARDS

(1) Principal Geographic Location: Washington

(2) Size of Staff: 208

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Development of an overall program strategy for the achievement of water pollution abatement
- Coordination of all mational water-related activities within the water program strategy, and monitoring national progress toward the achievement of water quality goals
- Development of effluent guidelines and water quality standards
- Development of effective state and regional water quality planning and control agencies
- Development and maintenance of a centralized water program data system including compatible water quality, discharges, and program data files
- Development of national accomplishment plans and resource and schedule plans for programs
- Development of effluent limitation guidelines and procedures for the evaluation of applicable abatement and control technologies needed in setting enforceable requirements for industry compliance
- Working closely with other Headquarters offices, regional offices, states, and other Federal agencies to assure that all useful water-related data become available to system users and that there is a minimum of overlap, duplication, and incompatibility among water-related data systems

(5) Major Relevant Legislation:

Federal Water Pollution Control Act

Marine Protection, Research, and Sanctuaries Act

Fish and Wildlife Act

Public Health Service Act

(6) Major Systems:

- Word Processing

  - Purpose:

    Word Processing is used to reduce the typing load of secretaries in the agency. Letters, reports, and regulations can be prepared more rapidly with fewer personnel by using such facilities.

  - Annual Cost:

Computer	Personnel	Contract Support
$280,000	$61,000	-

  - Primary Users:

    The Effluent Guidelines Division of OWHM is the chief user of word processing.

  - Description:

    Regulations, reports and letters are entered into the system by typing them on a typewriter connected to the system. Once the text has been entered it can be modified and changed with a variety of editing commands. Coded commands to the system allow words, sentences and paragraphs to be changed, replaced and moved about by the operator. The significant difference from manual retyping is that with a word processing machine, only those parts of the document which are changed have to be retyped or edited by the operator. The machine automatically reformats the entire document as needed. The use of such systems is most valuable for producing documents which undergo repeated, minor changes over time.

- Operation:

  Bowne Time Sharing (a specialized service bureau) is used for all word processing currently performed for the Agency on large scale computers. It has supported the production of over 1,000 regulations over the past 2-1/2 years.

- Comments:

  The availability of a resource to allow a rapid turn-around of documents is a very valuable one for program managers within the agency. In the past, however, the cost associated with this facility has not been borne directly by the program manager, as is the case with secretarial labor. This fact has contributed to a more rapid growth in the use of Bowne Time-sharing services in the past few years than would be expected under a cost charge-back scheme.

  In addition to Bowne Time-sharing, many stand alone word processing systems of varying levels of technical sophistication are available for use by program managers. Throughout the Agency, several copies of a system manufactured by Lexitron Inc., costing approximately $17,000 per system (purchase price), are currently being used instead of Bowne Time-sharing services to produce lengthy documents in an efficient fashion.

  While alternative methods of word processing are not totally equivalent in capabilities, the cost trade-offs of secretaries versus stand alone type systems (Lexitron) versus centralized timesharing (Bowne) should be considered explicitly by program managers. For example, a yearly expenditure of $284,000 for Bowne Time-sharing services in one year is equivalent to an outright purchase of 16 Lexitron systems.

Hardware failures on a centralized computer affect all users of the facility, whereas, the failure of a stand alone system affects only part of the user community. This factor should be considered in evaluating alternative ways of supporting the word processing needs of the Agency.

- Storage and Retrieval System for Water Quality Data (STORET)

  - Purpose:

    The stated mission of the STORET system is to provide a national data bank of information on water quality in the United States for analyzing the cause and effect relationships in the field of water pollution. Existing legislation requires that a "data bank" be established, although the regulations do not specify the form this data bank is to take.

  - Annual Cost:

Computer	Personnel	Contract Support
$2,839,000	$835,000	$285,000

  - Primary Users:

    Water quality analysts, technical planners, and researchers use the system. The distribution of computer charges is:

    60% - EPA Headquarters Offices
    20% - EPA Regions
    20% - States, Federal Agencies & Non-Government

- Description:

The STORET system collects and maintains an on-line history of water quality data. The on-line data base grows continuously with time.

STORET provides the user with a wide variety of tools to retrieve, summarize, analyze and display the data in the data base. Several sub-systems access STORET for different purposes. These include:

- Water Quality File - used to analyze trends and current condition of the nation's waterways.
- Automap - a computer file of map coordinates of rivers and hydrological stations.
- City Master - a directory of information on cities.
- Fish Kill File - a file of fish kill events (used primarily by Oregon).
- Construction Grant Need - a grant tracking system like GICS.
- Municipal Waste Needs Facilities Inventory - a file of water treatment needs and facilities.

The data in STORET is used by EPA to produce an annual report on the quality of water in the major rivers of the United States.

Production of both a national report and a regional report on a regular basis is currently mandated by legislation.

Water quality information on several hundred data parameters is stored by the station where the water sample was taken. The system currently has data from over 160,000 stations, though only 18,000 stations have enough data for the trend analysis required by law.

- Operation:

  STORET operates on the OSI computer and utilizes 3.1 billion bytes of on-line disk storage. Data on water quality is solicited from many sources including states, USGS and other Federal agencies. Data is collected by the contributor and entered into the computer via teleprocessing lines. The data is verified and edited by the contributor at his discretion. When the data has been deemed valid, it is added to the data base during an update run.

  To retrieve information from the STORET data base, the user may invoke a wide range of general purpose procedures for plotting, indexing and computation. Reports, charts and plots of STORET data can be produced automatically.

- Comments:

  It is difficult to build one data base of water quality data that will meet all needs. While current data may be adequate for yearly reports, it is not necessarily appropriate for use in mathematical models.

  Most modelling applications require standardized measurement techniques, a number of parameters to permit cross comparisons, and an intensive number of observations taken in a short time period. Because of these characteristics, the data routinely accumulated for STORET is frequently inadequate.

  The operation of the STORET system is quite loosely controlled. Although several hundred different parameters of information have been specified as relevant to water quality, contributors of water quality information are free to provide as many or as few parameters as they desire. The frequency of observations, the methods used to collect data, and the accuracy of the numbers entered into the system are not currently monitored in the operation of the system.

Although these difficiencies reduce the utility of the data currently in the system, steps are being taken currently to improve the quality of new data entering the system. New proposed regulations on water quality should improve the accuracy of data in the system in the future. In addition, Region V has been working with the Office of Research and Development to improve the input editing system.

The structure of the current system is monolithic. All of the data for the entire data base must be resident on-line at all times for the system to function. The extensive reporting and editing routines used to manipulate data in the system are only capable of operating on the entire data base. Data cannot be extracted onto a smaller file for further manipulation by the report processing routines.

2. OFFICE OF WATER PROGRAM OPERATIONS

(1) Principal Geographic Location: Washington

(2) Size of Staff: 178

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Developing national programs, technical policies, regulations and guidelines for water pollution control and water supply
- Providing technical direction and support to regional offices
- Evaluating regional programs with regard to municipal point source abatement and control, oil and hazardous materials spill prevention and response, water supply protection and improvement, and manpower development for water-related activities
- Developing national accomplishment plans and resource and schedule guidelines for program plans

(5) Major Relevant Legislation:

Federal Water Pollution Control Act

Marine Protection, Research, and Sanctuaries Act

Fish and Wildlife Act

Public Health Service Act

(6) Major Systems:

- Technical Assistance Data System (TADS)

  - Purpose:

    The purpose of TADS is to reduce the effects of oil and hazardous materials spills by providing on-line access to information on material characteristics and containment procedures. Field emergency teams can access information directly through terminals or by telephoning someone with a terminal.

- Annual Cost:

Computer	Personnel	Contract Support
$41,000	$38,000	-

- Primary Users:

  The Planning and Standards Division of OWHM appears to be the primary user of the system.

- Description:

  Currently the characteristics of 875 materials which represent water pollution hazards are catalogued on the ENVIRON time-sharing system. (Due to new legislation, plans are to expand to 1300 materials in the future). The system contains 125 possible fields of technical data on each substance.

  To retrieve information from the files, the user specifies a search list of terms. For example, an unknown substance that is green, floats, and smells like rotten eggs can be identified by searching for those attributes.

- Operation:

  In order to satisfy the needs for instant information in the event of spill events, the on-line system is available from the hours of 8:00 AM until 10:00 PM. After these hours, the system may be accessed within one to three hours

  The system is a full text search system requiring the special capabilities provided by Informatics, Inc. Operation is the same as for all ENVIRON systems.

- Comments:

  In 95% of all spill events the identity of the substance is known immediately. In most other cases, EPA personnel reporting to the scene of the incident can identify the substance. Once the name of the substance is known, there is no need for an on-line ENVIRON-based system such as TADS. A printed book would be far more accessable and less expensive to operate and maintain. Even enthusiastic initial users of TADS in the regions found its usefulness to be very low.

  As a tool for doing research related to new regulations, the capabilities of the ENVIRON system are nice to have but not cost justifiable. At the current time, the data in the files is incomplete. A computer search of such an incomplete file is very misleading - it returns answers which appear to be complete without any indication of items which have been omitted because data was unavailable.

. <u>Spill Information Retrieval System (SIRS)</u>

- Purpose:

  SIRS provides an on-line history of all reported spill events. This information is used primarily for analysis and reference in developing preventative programs and regulations for spill incidents.

- Annual Cost:

Computer	Personnel	Contract Support
$100,000	$50,000	$100,000

- Primary Users:

  Regional personnel use the system in their enforcement activities, and Headquarters offices produce summary analyses and reports. Universities and private companies also have access to the system.

- Description:

  When a "spill event" occurs, the offending party must submit a plan for prevention of repetition of a spill event (in accordance with regulations which take effect in January 1975). If another spill occurs, the SIRS file is checked, the prevention plan is reviewed, and the offender is dealt with according to the adequacy of his plan and his implementation of the plan. SIRS contains spill event data (where, when, what, who, and why) on over 7000 spill events. A spill event is the single occurrence of polluting materials being discharged into a body of water (e.g., a barge wreckage which releases oil is a single spill event).

- Operation:

  SIRS is currently operational on the ENVIRON time-sharing system. At present there are approximately 7000 spill event records. When a spill event occurs, the region submits a spill report to Headquarters. This report is then keypunched for entry onto the system. No formal reports are produced. Information is retrieved by using the search capabilities of the ENVIRON system.

  The system is soon to be replaced by the Spills Prevention Control and Countermeasure System (SPCC) which will run on the OSI computer. SPCC will be used to enforce regulations regarding the spillage of materials. SPCC initially will include 3300 records of information on spill events. The data base will grow at a rate of 4000 records per year. There will be a relatively constant cost of $100,000 per year to add these new records.

3. OFFICE OF PESTICIDE PROGRAMS

(1) Principal Geographic Location: Washington

(2) Size of Staff: 610

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Developing sufficient data and appropriate methodologies for assessing the hazards of pesticides

- Developing programs to insure that products are acceptably safe and effective when used as intended

- Developing programs for assuring that products are properly used

- Conducting scientific research and policy studies to support current and new programs of control

(5) Major Relevant Legislation:

Federal Insecticide, Fungicide, and Rodenticide Act

Federal Food, Drug, and Cosmetic Act

Public Health Service Act

Federal Water Pollution Control Act

(6) Major System:

- Pesticides Analysis Retrieval and Control System (PARCS)

  - Purpose:

    The Pesticides Office is responsible for registration of all pesticides used in the nation. PARCS provides a centralized source of information on all pesticides registered in the U.S. Data in the system are used for registration analysis, research, and reporting.

  - Annual Cost:

Computer	Personnel	Contract Support
$500,000	$317,000	$75,000

  - Primary Users:

    The system is used chiefly to support the pesticides registration program. Research on chemicals used in pesticides is also a major source for retrieval requests.

  - Description:

    Currently information on 36,000 pesticides handled in interstate commerce are contained in the PARCS System. Data in this system is highly encoded, for ease and manipulation, and all new data requests are controlled by one central office.

    The PARCS system is used to retrieve information about pesticides on a variety of categories. For example, the system can answer questions such as "list all disinfectants and fungicides containing malathion". The system maintains information on the name and address of producer, ingredients (both active and inert), and the usage category of all pesticides. Retrieval software allows the data to be extracted, analyzed and formatted.

Accident investigation information is also maintained as a separate part of the system.

- Operation:

PARCS runs on the OSI computer. The data files are stored on-line, but access to them is limited to retrieval requests submitted to the pesticides office. Retrievals are currently being run about 500 times per year, which is up sharply from previous years. The work load to maintain the data has increased 30-40% this year due to new legislation requiring that intra-state as well as inter-state pesticides be registered.

Input for changes to the data is done using WYLBUR data sets. This input accounts for 40% of the annual costs. Retrievals are run in batch mode.

Accident information is maintained in a separate file. Data entered by the regions is edited and stored on disk. Requests for information on accidents average one per week. Standard summary reports are produced monthly.

- Comments:

One attribute of this system which is unusual within the agency is the need for security of the data contained in the system. Security is required because of the highly confidential industrial information regarding the formulation of specific products which is stored in the system.

4. OTHER COMPUTER SYSTEMS USED BY (OWHM)

Numerous other smaller computer applications are utilized by OWHM. These include:

- Construction grants monitoring
- Data on interstate carriers
- Use of Automap
- National water supply inventory
- Waste treatment studies & guidelines
- Program management

The current annual computer and personnel costs associated with these applications are $65,000 and $280,000, respectively.

V. OFFICE OF AIR AND WASTE MANAGEMENT (OAWM)

The Office of Air and Waste Management develops abatement strategies for stationary and mobile source air pollution, and coordinates research and abatement activities in the areas of noise pollution, solid waste treatment, and radiation. OAWM has responsibility for the following major activities:

- Develop national standards for air quality and emission standards for new stationary sources and for hazardous pollutants
- Assess the national air pollution control program and its success in achieving air quality goals
- Provide assistance to the states, regional offices, and industry through manpower training and technical information
- Maintain a national air programs data system
- Develop abatement strategies to control noise pollution
- Disseminate information and perform research in the management of solid waste disposal
- Investigate the environmental and health effects of radioactive substances and processes

The 992 members (11% of the total EPA employment) of this office are organized into offices of staff support and the following five DAA-level offices:

- Office of Air Quality Planning and Standards
- Office of Mobile Source Air Pollution Control
- Office of Noise Abatement
- Office of Radiation Programs
- Office of Solid Waste Management

OAWM uses ADP primarily to maintain the national air quality data systems, to construct models, and to perform statistical analyses. Exhibit A-7 lists the major systems in use by OAWM.

1. OFFICE OF AIR QUALITY PLANNING AND STANDARDS

(1) Principal Geographic Location: RTP

(2) Size of Staff: 299

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Develops national standards for air quality, emission standards for new stationary sources, and emission standards for hazardous pollutants
- Develops national programs, technical policies and regulations for air pollution control and assesses their success in achieving air quality goals
- Provides assistance to the states, industry and other organizations through manpower training activities and technical information
- Evaluates regional programs with regard to state implementation plans, technical assistance, and resource requirements for air-related programs

Exhibit A-7
U.S. Environmental Protection Agency
Major Systems in Use in OAWM

		ANNUAL COST ($000)			
Name	Acronym	Computer	Personnel	Contract Support	Type of System
National Emissions Data System	NEDS	300	400	86	Technical Data System
Storage and Retrieval of Aerometric Data	SAROAD	240	200	30	Trend and Monitoring
Technical Environmental Information System	TENIS	100	35*	300	Bibliographic
Noise	---	120	---	300	Bibliographic
Solid Waste Information Retrieval System	SWIRS	105	---	250	Bibliographic
Other	---	---	429	---	---
	Totals	865	1,064	966	

* In OPM

- Develops and maintains a national air program data system, including air quality, emissions, and other technical data

- Provides effective technology transfer through the translation of technological developments into improved control program procedures

(5) Major Relevant Legislation:

Clean Air Act

(6) Major Systems:

- National Emissions Data System (NEDS)

  - Purpose:

    NEDS is a national data bank of information on emissions from major sources of air pollution. The data is used for reporting and for analysis of air quality. The National Inventory report, produced by NEDS, shows emissions data by source classification code for all geographic sections of the country.

  - Annual Cost:

Computer	Personnel	Contract Support
$300,000	$400,000	$86,000

  - Primary Users:

    Regions use the system for planning and control. OAQPS uses NEDS to prepare the National Inventory report. Emissions questionnaires for point sources identified by the Compliance Data System are prepared by NEDS. The system also supplies bulk data for analysis by other EPA offices or researchers outside the Agency.

- Description:

  The master file is organized by state and county. Emissions data is recorded for both point and area air pollution sources. The National Inventory report differentiates area and point source totals, giving subtotals for each, based on source classification code categories. The point source reports identify the source of emissions and list the current data on emission volumes.

  The NEDS reports are used in the regions in the planning of air pollution control activities. The major sources of air pollution can be identified using NEDS. Enforcement actions are prioritized to address the major sources first.

  The system is updated every 6 months with current emission data. NEDS information can be compared with compliance schedules to identify sources which require enforcement follow-up action.

- Operation:

  The system operates on the Univac computer at RTP. The states are required by statute to submit data to NEDS every six months. Data are screened for validity and significance by the statistical services staff of the NERC at RTP. Edited data is then added to the data base.

  The number of sites monitored currently by NEDS has stabilized at 100,000 point sources. For each source, only the current period data values are available from the system. Snapshot dumps of the NEDS data are taken quarterly, however, to retain past values and to permit trend analyses to be made.

  Regions request special reports from NEDS and SAROAD at a rate of about 12 per month.

In addition, approximately 20 requests per year are made for bulk data from NEDS for use in special analysis projects.

- Comments:

  The structure of NEDS provides a system which meets the Agency's needs at a stable cost. Because only current data is retained, operational costs are a function of usage and number of sources, but are independent of time.

  The enforcement of rigid controls on data entering the system plus definition of the techniques allowed in collecting the data, offer the potential for better quality data than is available in the water program. The disadvantage of this design is that the time lag on data updates is longer than in water. It is questionable, however, whether poor data available quickly is better than more accurate data available less rapidly.

  The level of cost of NEDS and all data banks is sensitive to outside forces. The number of requests which are made of the system by Congress and others (and hence the cost of running the system) is not totally controllable by the Agency.

  New interests in environmental quality will lead to expansion of NEDS or the creation of new but functionally similar systems. Lead and sulfates are pollutants which are of concern recently, may be added to the data base in the future.

  The National Air Data Bank staff, which runs both NEDS and SAROAD, notes that there are significant opportunities for improving the efficiency of the systems following the IBM to UNIVAC conversion. The systems have not been modified to match the particular capabilities of the UNIVAC 1110 environment. Savings in this area may well be used in providing additional output capabilities (such as plotting) as well as servicing the increased load of user requests.

- Storage and Retrieval of Aerometric Data (SAROAD)

  - Purpose:

    Air quality in the nation is evaluated by analysis of ambient air data taken from many sites around the nation. This data is stored in SAROAD. Current air quality, annual trend reports, and special studies are supported by SAROAD.

  - Annual Cost:

Computer	Personnel	Contract Support
$240,000	$200,000	$30,000

  - Primary Users:

    Air Quality analysts at Headquarters use the system for annual reports and answering special requests. Regions use the system for special studies for answering contractor and congressional inquiries, and for litigation.

  - Description:

    SAROAD is a software system which uses the National Aerometric Data Bank (NADB) at RTP. The SAROAD programs are general purpose in nature and can be used to generate standard or special reports from the NADB data. A report on air quality in each of 247 air quality control regions is produced quarterly by EPA as required by regulations.

Daily, hourly, and annual pollutant level averages are computed from raw data and made available through SAROAD. The summary averages are available from an on-line file (approximately 40 million bytes in size) while the raw data is stored on 12 off-line tapes if needed for more detailed analysis. Though the system grows with time, disk usage is moderate because only yearly and quarterly summary averages are kept on-line. States are required by law to submit air quality data to EPA every three months. The frequency of data observations may be hourly or daily according to the site.

- Operation:

  Data input from the states is received quarterly on paper forms, cards or magnetic tape. These data are screened manually and by computer to attempt to remove erroneous or suspicious values. In addition, the sampling and analysis methods used to generate the data must conform to EPA requirements before the data may be accepted into the data base.

  The data are summarized by computing various averages. The data must contain enough samples to make the measurements significant, or they will be rejected. The summary averages are added to the disk data base, while the raw data are held off-line.

  When the system was located on the 360/50, SAROAD was available through the communications network. Currently, the Univac 1110 provides only limited accessibility through phone circuits.

  Report requests for SAROAD and NEDS averaged 12 per region per month on the IBM machine. Requests for bulk data from SAROAD average 50 per year.

- Comments:

The Air office conducted a survey of nine states concerning their needs and desires for on-line access to SAROAD. The conclusion of this study was that no great need was felt by the states. Instead, states preferred to run their own systems. They were not disturbed by the prospect of having to pay for use of SAROAD, but felt it would have to be weighed against the cost of using their own systems.

SAROAD is functionally similar but structurally different from STORET. Both have a similar volume of data. However, operating costs for SAROAD are only a fraction of STORET's costs. The quality of information in both systems is only as good as the data received from the states. Though SAROAD spends more effort to assure data accuracy, there is no way to guarantee this accuracy.

Timely updating of SAROAD data and access to the system were both criticized by some regional users. The update schedule has a built-in delay of at least 75 days for data verification. The states want answers to questions like "how many times have we exceeded the standards this year." At least one region maintains an independent copy of the data submitted by the states. This region generates its own reports independent of SAROAD.

. <u>Technical Environmental Information System (TENIS)</u>

- Purpose:

This bibliographic system provides rapid reference to the growing body of air quality technical data. Computer searching for relevant books and articles assists air pollution agencies and other public or private organizations.

- Annual Cost:

Computer	Personnel	Contract Support
$100,000	$35,000	$300,000

- Primary Users:

The system is available through the telecommunications system to all interested users. It is also used to prepare the monthly Air Pollution Abstracts for printing by GPO, which are then mailed to over 2,000 recipients.

- Description:

2,400 retrospective literature searches and 600 SDI searches per year are performed on a file of 65,000 technical documents. Approximately 800 articles per month are added to the system from over 7,000 domestic and foreign journals.

A fixed size on-line file of 55,000 citations allows the user to develop a search criteria list in an interactive environment. When the retrieved set of documents is a manageable size, the user may print the citations (5-9 lines per document) on-line. Full text of the abstracts is retained on magnetic tape for printing by the computer. Alternatively, the user may refer to his own microfiche copies of the abstracts.

Most search requests go through APTIC personnel. They help the user to develop a search strategy and speed the information retrieval process.

- Operation:

Abstracting is done by Franklin Institute at a cost of about $30 per article. Input to the system is prepared on MTST tapes and transferred to computer magnetic tape. The input is edited, corrected and then added to the TENIS permanent tape storage. Printed and microfilmed copies also are provided by Franklin Institute. The system runs on the RTP computer. On-line searching of the citations file is available to all users. The system consists of 10 COBOL programs and was developed at RTP.

- Comments:

  The system is designed such that on-line storage is fixed in size, and on-line data is limited in length. A search strategy can be developed on-line, but the bulk data is held on off-line tapes. The result is a system which is responsive at a reasonable cost.

2. OFFICE OF MOBILE SOURCE AIR POLLUTION CONTROL

(1) Principal Geographic Location: Ann Arbor

(2) Size of Staff: 261

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Conducting a research and development program on low-emission vehicle power systems
- Characterizing emissions from mobile sources and developing programs for their control, including assessment of the states of control technology
- Developing and recommending emission standards and related test procedures for mobile sources
- Carrying out a regulatory compliance program to insure adherence of mobile sources to standards

- Carrying out surveillance activities with regard to mobile source emissions

(5) Major Relevant Legislation:

Clean Air Act

3. OFFICE OF NOISE ABATEMENT

(1) Principal Geographic Location: Washington

(2) Size of Staff: 54

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Coordinating the noise control and noise research programs of all Federal agencies as mandated by Congress
- Expanding and improving the scientific and technological base in critical areas related to EPA's responsibilities under the Noise Control Act of 1972
- Disseminating information on the effects of noise, acceptable noise levels, and techniques for noise measurement and control
- Establishing noise emission standards and labeling regulations for products distributed in commerce as well as noise standards for interstate motor and rail carriers
- Providing technical assistance to state and local governments to facilitate development and implementation of their noise control programs

(5) Major Relevant Legislation:

Noise Pollution and Abatement Act of 1970

Noise Control Act of 1972

(6) Major System:

- Noise File

  - Purpose

    The Noise information service provides technical literature abstracts to government agencies, private firms, and the general public. It is used by EPA in the development of standards and regulations and is available to the states and regions as well.

  - Annual Cost:

Computer	Personnel	Contract Support
$120,000	-	$300,000

  - Primary Users:

    Current users of the system are primarily the members of the Office of Noise Abatement and Control at Headquarters. They use the literature in the Noise file to provide basic information used in drafting regulations.

  - Description:

    The system is a bibliographic system of considerable sophistication. The Noise file operates in an on-line environment on the ENVIRON time-sharing system. It uses free text search of article citations to identify relevant literature for retrieval for the user.

Use of the Noise file allows the inquirer to identify documents which are relevant to a particular subject. For example, a request may be made to identify all articles known to the system which contain the words "airport", "noise", and "Washington D.C."

- Operation:

Informatics, a commercial vendor under contract with the Agency, provides abstracts of 250-300 articles per month from over 7,000 periodicals. For each article selected by Informatics, a citation and abstract are prepared. The citation is entered into the ENVIRON system, which is also run by Informatics.

The user prepares a list of terms relevant to his subject of interest. In an on-line session, all citations are searched by the machine to locate articles matching the search list criteria. The on-line session allows the user to narrow the list of articles retrieved to a manageable number. The abstracts themselves are then printed off-line and mailed to the user.

- Comments:

While the system is easy to use, the Boolean search capabilities are difficult to master. Therefore most users need to be specially trained to use the system.

Even though the search and identification process, which allows the user to select bibliographical abstracts is an on-line process, the actual retrieval of the abstract for use by the inquirer requires a two-day turnaround for the abstract to be printed and delivered. This characteristic of the system significantly reduces the advantage of an on-line service over less expensive systems such as those that are used elsewhere within the Agency (e.g., the TENIS system at APTIC).

The use of ENVIRON is quite expensive. At present, retrievals cost approximately $500 a piece. The turnaround time, sophistication, and hence the cost, of such a system does not seem to be well-matched to the current use made of the information retrieved from the system.

4. OFFICE OF RADIATION PROGRAMS

(1) Principal Geographic Location: Washington

(2) Size of Staff: 199

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Setting basic policies for all Federal radiation programs and for setting specific standards for radiation levels in the general environment
- Establishing surveillance and monitoring to determine levels of environmental radiation
- Providing technical assistance to state and local governments to facilitate development of radiation control programs
- Conducting reviews of federally supported or licensed projects which are a source of environmental radiation

(5) Major Relevant Legislation:

1954 Atomic Energy Act

Public Health Service Act

5. OFFICE OF SOLID WASTE MANAGEMENT

(1) Principal Geographic Location: Washington

(2) Size of Staff: 123

(3) General Type of Staff: Scientific

(4) Primary Responsibilities:

- Providing technical assistance to Federal, state, and local governments
- Demonstrating and encouraging the use of the most advanced practices in solid waste management and technology
- Assisting in the solution of problems of the disposal of toxic and hazardous wastes
- Assisting in creating institutional change at the local level to optimize disposal practices and reduce costs

(5) Major Relevant Legislation:

Solid Waste Disposal Act

(6) Major System:

- <u>Solid Waste Information Retrieval System (SWIRS)</u>

  - Purpose:

    SWIRS is a bibliographic system which provides access to international literature related to solid waste information. It provides references to the latest developments in the field for disseminating technological information.

- Annual Cost:

Computer	Personnel	Contract Support
$105,000	-	$250,000

- Primary Users:

  EPA offices, commercial and industrial organizations, and academia are the primary users of the system. It is also available for the general public (citizen action, students, etc.) All requests for information are processed through one central office. The service is provided without charge to all users.

- Description:

  Abstracts of documents are entered into the system for use in performing literature searches. The SWIRS system uses both keywords and free search text techniques to retrieve articles of interest according to the search specifications provided by the user. A thesaurus of control words is used to locate articles matching the search criteria of the inquirer. The control vocabulary meets current interests. Free text search is used more and more as people begin asking for new subjects in the field.

  Data for the system is produced by the Franklin Institute. They review and abstract all significant articles from approximately 7,000 periodicals. Franklin Institute screens the documents, selects relevant articles, writes the abstract, and creates the input information for the system.

Use of the system by states, private industry and anti-pollution citizen groups, etc., has doubled over the past couple years. Requests for literature searches are now running at the rate of approximately 1500 per year. The number of publications contained in the SWIRS system rose from 15,000 abstracts in 1973 to a projected 32,000 abstracts in 1975.

- Operation:

  Searches to retrieve documents are run in batch mode. A search list is specified and the system retrieves accession numbers of the documents matching the search criteria. The computer prints abstract ID numbers, and the analyst then refers to his own reel of microfilm for reference to the printed abstracts identified by the computer search.

  The operation of the system emphasizes interaction between the person requesting information and the trained analyst actually submitting the request for a literature search. This combination allows for considerable control over the operation of the system. By dealing with trained analysts who are familiar with the system, the efficiency of the search increases and the number of searches (and computer time) required to find a relevant body of literature to satisfy the interests of the inquirer is significantly reduced.

  The system is currently operational on the NIH computer and uses the WYLBUR Public Retrieval System (PRS). Unfortunately, no source code for WYLBUR PRS is available at NIH. Thus, moving the system from NIH to OSI will necessitate reprogramming the system.

- Comments:

  The problem currently facing the SWIRS system is that relocation to the OSI computer is required by the Agency. This will entail significant additional cost for reprogramming the system. At this juncture it is worthwhile to consider the other bibliographic systems used in the Agency as alternative vehicles for providing publications retrieval services for solid waste information. Several such systems exist; the newest is the one used by APTIC.

6. OTHER COMPUTER SYSTEMS USED BY OAWM

Other areas of computer usage by OAWM include radiation programs, highway and airport noise models, technical assistance in solid waste management, and solid waste system demonstrations. The current annual personnel cost associated with these activities is $429,000.

VI. OFFICE OF RESEARCH AND DEVELOPMENT (ORD)

The Office for Research and Development is responsible for the development and conduct of research and demonstration programs in pollution sources, environmental sciences, monitoring systems, and pollution control technology. ORD is also responsible for the quality control and standardization of the analytical techniques utilized by the Agency.

In addition to the above responsibilities, ORD provides direct supervision of the activities of five Environmental Research Centers (ERC) and their associated laboratories. These ERC's and their primary areas of responsibility are as follows:

ERC	Areas of Responsibility
Cincinnati	Water Programs
Corvallis	Water Programs
Las Vegas	Radiation Programs
RTP	Air Programs
Washington, D.C.	Socioeconomic Research

The 1856 members of ORD (20% of the total Agency employment) are distributed among the above ERC's, Headquarters staff offices, and four offices under DAA's as follows:

- Office of Environmental Engineering
- Office of Environmental Sciences
- Office of Monitoring Systems
- Office of Program Integration

Exhibit A-8 on the following page lists the major system in use by ORD.

The program management and word processing systems are used principally by the staff offices at Headquarters. These systems are described below, followed in turn by a description of the form DAA-level offices, the ERC's the major systems used by the ERC's, and other systems in use by ORD.

- Program Management System

  - Purpose:

    This system is designed to aid managers of the Office of Research and Development in allocating office resources to research projects and in monitoring research performance against objectives.

  - Annual Cost:

Computer	Personnel	Contract Support
$410,000	$324,000	$100,000

U.S. Environmental Protection Agency
Major ADP Systems in Use in ORD

Name	Acronym	ANNUAL COST ($000) Computer	Personnel	Contract Support	Type of System
Program Management	---	410	324	100	Tracking and Reporting
Bowne Timesharing	BTS	110	60	---	Word Processing
Strategic Environmental Assessment System	SEAS	300	325	400	Modeling
Lab Automation	---	400	120	---	Lab Automation
Other	---	430	1,061*	---	---
	Totals	1,650	1,890	500	

* 474 for Community Health and Environmental Surveillance System (CHESS)

- Description:

  This system records office resources in manpower and budgeted dollars at a detailed level within each ERC, laboratory, and other research unit within the Agency. This resource information is compared against a prioritized list of research objectives in ten major categories. This comparison indicates the allocation of resources necessary to meet these objectives, subject to budgetary ceilings. Low priority objectives are, thereby, excluded from the current year's actual objectives. This system is used also to track project and task activities within the office against research milestones. At present, there are approximately 1,000 project milestones and 5,000 task milestones tracked.

- Operation:

  This system is operated currently on NIH, OSI, and ENVIRON, but is being modified to operate exclusively on OSI. Programs are run infrequently throughout the year whenever resources ard budgeted or reprogrammed.

. <u>Word Processing</u>

- Purpose:

  Word processing is used to reduce the typing load of secretaries. Letters, reports, and regulations can be prepared more rapidly by using such facilities. Bowne Time-sharing service is used by ORD for word processing.

- Annual Cost:

Computer	Personnel	Contract Support
$110,000	$60,000	-

- Primary Users:

  The Office of Program Management is the primary user of Bowne.

- Description:

  Bowne time-sharing is used for:

  . operation of the program management NEEDS system

  . preparation of issue resource report, project reports, and specifications

  . maintenance and use of mailing keys

  . preparation of program planning procedures and guidelines

- Operation:

  For a description of the Bowne Time-sharing service the reader is referred to the Word Processing discussion contained in the section of this Appendix dealing with the Office of Water Planning and Standards.

1. OFFICE OF ENVIRONMENTAL ENGINEERING

(1) Principal Geographic Location: Washington

(2) Size of Staff: 0 (61 filled)

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

. Planning, coordinating, establishing, reviewing, and assessing a comprehensive Agency research, development, and demonstration program in the area of pollution prevention and control technology

- Regard is given to achieving environmental protection systems which minimize and balance the effect of shifting pollutants to other media

- Planning, establishing, and reviewing research, development, and appropriate demonstration programs aimed at developing and improving technology to prevent, control, and abate air and noise pollution from stationary and mobile sources and water pollution from municipal sources, industrial sources, and non-point sources such as agriculture, mining, and construction

- Planning implementation of an Agency technology transfer program to effectively impact the construction, installation, and operation of environmental pollution control and abatement facilities to assure that the latest practical technologies are made known to potential users.

2. OFFICE OF ENVIRONMENTAL SCIENCES

(1) Principal Geographic Location: Washington

(2) Size of Staff: 0 (38 filled)

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

- Planning, coordinating, establishing, reviewing, and assessing research and development programs aimed at improving and maintaining the quality of the Nation's potable water supplies, and at developing the scientific basis for the protection of human health from environmentally-related insults and establishing and maintaining environmental quality as related to non-human receptors of pollution

3. OFFICE OF MONITORING SYSTEMS

(1) Principal Geographic Location: Washington

(2) Size of Staff: 0 (45 filled)

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

- Planning, establishing, and coordinating an Agencywide standardization and quality control program to assure that environmental data produced by Federal, state, and local agencies are compatible, accurate, and legally defensible

- Planning, coordinating, establishing, reviewing, and assessing research, development, test, and evaluation programs aimed at developing and improving equipment, methodology, and systems needed for environmental monitoring

- Planning, coordinating, establishing, reviewing and assessing research, development, and appropriate demonstration programs aimed at the establishment of effective research information and data systems, including multi-media or multi-pollutant data analysis and special data handling and processing studies

4. OFFICE OF PROGRAM INTEGRATION

(1) Principal Geographic Location: Washington

(2) Size of Staff: 0 (22 filled)

(3) General Type of Staff: Administrative

(4) Primary Responsibilities:

- Assuring that research and engineering strategies and programs are responsive to Agency goals

- Coordinating and developing multi-area policy and strategy studies

- Synthesizing and analyzing outputs from multiple program areas for provision to media, categorical, enforcement and regional offices

- Coordinating all international activities of ORD

5. ENVIRONMENTAL RESEARCH CENTERS

(1) Principal Geographic Locations and Size of Staff:

Location	Staff	
Cincinnati, Ohio	380	
Corvallis, Oregon	454	
Las Vegas, Nevada	190	
RTP (Durham, North Carolina)	539	
Washington, D.C.	0	(27 filled)

(2) General Type of Staff: Scientific

(3) Primary Responsibilities:

- The ERC's have responsibilities for conducting research, development, and demonstration programs in areas assigned to them and for supervising the activities of each center's associated laboratories. The principal program areas assigned to each center are as follows:

ERC	Area of Responsibility
Cincinnati	Water Programs
Corvallis	Water Programs
Las Vegas	Radiation PRograms
RTP	Air Programs
Washington, D.C.	Socioeconomic Research

(4) Major Systems

- Strategic Environmental Assessment System (SEAS)

  - Purpose:

    SEAS is a large computer model designed to forecast the impact of environmental quality level requirements on economic sociological and ecological conditions. The effect of economic and demographic variations on pollutant residual levels also is projected by the model. It is used to study possible consequences of alternative environmental policies and socio-economic trends over a 10-15 year time span.

  - Annual Cost:

Computer	Personnel	Contract Support
$300,000	$324,000	$400,000

  - Primary Users:

    The Office of Research and Development, the Office of Planning and Evaluation of OPM, and special study task forces use the system. Non-EPA users include the Council on Environmental Quality, Federal Energy Administration, Labor Department, Commerce Department, and NIH.

- Description:

  SEAS is the largest modelling effort in ORD. It models all major elements of the economy and the environment and simulates the complex interactions between environmental and economic policies. Elements of the model include such economic factors as durable goods demand, total personal income, the industrial capital structure, inventory levels, domestic and foreign demand, and governmental expenditures. Environmental factors in the model include energy consumption, abatement costs, pollution residual levels, auto usage and area pollution sources. The model has over 250 individual factors.

  The model is used to generate forecasts on the following subjects:

  - national economy
  - additional environmental industry detail
  - energy budgets
  - primary and secondary pollutant residuals
  - treatment costs
  - price, wage and stock levels
  - solid waste levels
  - pollution from transportation (by mode)
  - water heating use and residuals
  - land usage and residuals

- Operation:

  SEAS is written in Fortran and is operated on OSI. Data collected from many different sources are used to create relationships within the model and to drive the operation of the model. The model runs as a batch program. Data are input using an on-line text editor. Output is available in either printed, graphic or machine readable form for use by additional analysis programs.

- Comments:

  The use of the model, and hence its cost, is quite sensitive to external demand for economic analysis of environmental policies. Though development costs can be shifted to outside agencies interested in using the model, actual computer costs for running the model are paid by the Agency.

Lab Automation Project

- Purpose:

  The purpose of the lab automation project is to improve the productivity and accuracy of laboratory operations.

- Annual Cost:

Computer	Personnel	Contract Support
$400	$120	-

- Primary Users:

  Laboratories in the NERC's and regions are the potential users of these systems. The prototype systems are being developed at the Cincinnati NERC and at the Region V laboratories.

- Description:

  The lab automation project is designed to integrate minicomputers in laboratory test equipment. Data from the test instruments would be analysed by the minicomputers and converted into a format suitable for input into other Agency systems such as STORET. In addition, the computers would monitor error drifts in the test equipment and would make numeric or other adjustments to insure more accurate test results. The minicomputers which are used for surveillance and analysis purposes also would maintain an audit trail of samples to insure that data that was accumulated for eventual courtroom use would satisfy judicial "chain of evidence" requirements.

- Operation:

  The lab automation project uses Data General Nova computers installed in each laboratory. Software and technical assistance for the project are being provided by Lawrence Livermore Laboratories, who have successfully developed similar systems in the past.

- Comments:

  The project was funded originally by OPM and ORD. Funding for fiscal year 1975 was terminated by OPM due to budget cuts and to the relatively low priority of the project given overall Agency ADP needs. ORD and Region V allocated approximately $400,000 program funds for the purchase of 4 minicomputers. They had anticipated that OPM would fund development efforts. However, because of the budget cuts, the project has been suspended pending a decision concerning the reprogramming of funds to finance the project.

6. OTHER COMPUTER SYSTEMS USED BY ORD

Other areas of computer usage by ORD include:

- National Eutrophication survey
- economic analysis/research
- ecosystem models
- biomedical research
- grants tracking system
- design of new monitoring techniques
- general management support
- radiation monitoring

The current annual computer and personnel costs associated with the above applications are $430,000 and $1,061,000, respectively.

APPENDIX B

APPLICATION CLASSES OF COMPUTER SYSTEMS

APPENDIX B - APPLICATION CLASSES OF COMPUTER SYSTEMS

Eight classes of computer usage have been defined for computer systems at EPA. The purpose of this classification is to provide an aid to understanding the use of computers at the Agency and to group individual systems for cross comparison.

The sections that follow (1) define each application class, (2) discuss such issues as use, personnel cost, growth, tradeoff considerations, and (3) give examples of Agency systems within each class. The eight application classes are as follows:

- Tracking and Reporting
- Trend and Monitoring
- Technical Data Bases
- Word Processing
- Bibliographic
- Modeling and Scientific
- Lab Automation
- Special Studies

1. TRACKING AND REPORTING SYSTEMS

Tracking and reporting systems are used to compare actual versus expected results. These systems may track schedules or dollars expended, provide inventories or record past events.

(1) Use: These systems are used for administering and controlling Agency programs. They have heavy data input requirements, usually with data collected from a large number of sources. System reports primarily are reformated versions of input data.

The chief benefit over manual file cabinets provided by computerized tracking and reporting systems is their ability to summarize data rapidly and conveniently along a number of different dimensions. In order to realize this potential, however, all data fields used for summarization must be completed. In practice, many EPA systems have fields of information defined for purposes of generating report summaries but for which little data has been entered by the field offices.

(2) Personnel: Tracking and reporting systems require substantial data entry, whether manual or computer records are maintained. Depending on the structure of the computer data collection system, the effort required could be the same as for a manual system. However, in practice, EPA systems tend to require more effort. In some cases, the workload may be doubled when data are recorded manually and then transcribed into machine-readable form.

(3) Cost: The cost of operating tracking and reporting systems depends on the volume of information being tracked by the computer and on the type of access to that data required by the user. If the system merely provides machine-generated listings of entered data with global totals calculated automatically, the cost can be fairly low. If, however, the user is interested in summarizing the items being tracked along many different dimensions, costs can increase substantially. Such flexibility increases the data input and system processing techniques required.

(4) Growth: The growth in cost of tracking systems over time depends on the volume of items monitored. Programs which have ongoing fixed requirements, such as personnel systems and financial monitoring, will

exhibit stable growth patterns over time. Systems designed for a transitory phase of Agency operations (such as the issuance of the initial compliance permits) may have usage grow to a peak and then diminish.

(5) Tradeoffs: One way to reduce the cost of tracking and reporting systems is to require that only significant events (which may be a small portion of the total data volume) be monitored by the system. This approach is used in the Agency's Financial Management System (FMS).

(6) Comments: Because the data required to operate tracking and reporting systems must be entered from many offices in the field, the accuracy of the information is a constant problem. When the user of system output is far removed from the office providing information, the accuracy of input data can be degraded because the user has little incentive to monitor its accuracy. This is true especially in cases where users have never been convinced of the worth of the system, such as with Grants Information Control System (GICS) and Compliance Data System (CDS).

In general, the Headquarters offices of the Agency require excessive detail from the field. Summary information should suffice for Headquarters, in most cases. Where the field user is not himself the user of this detailed information, he often ignores or omits the information. Thus, the credibility and usefulness of the entire system may suffer.

Many tracking and reporting systems, such as CDS and GICS, are developed by Headquarters for use by Headquarters and the regions. Acceptance of these systems by the regions varies widely by region and by system. User education is often neglected, or performed inadequately. In other instances, the trained user may leave. The ability of the system to satisfy field user needs requires good communication among all users. A user committee to sense and respond to needs is an important tool which should be used with more systems.

2. TREND AND MONITORING SYSTEMS

Trend and monitoring systems build data bases of technical information over time. Each item in the data base has several fields associated with it. New fields may be added on a regular basis over time. For example, the STORET system maintains information from water quality measuring stations covering periods since the mid-1930's. For each station, many water quality parameter values are collected. Over time, the number and types of parameters measured and stored have increased.

The purpose of trend and monitoring systems is to monitor field values over time. The STORET system allows the user to note how water quality is changing from year to year by comparing the parameters from a particular station or set of stations.

(1) Use: In contrast to tracking and reporting systems, which support well-defined operational programs, trend and monitoring systems are designed to provide data resources for use by Agency scientists in a wide variety of applications. In practice, however, the use of existing Agency systems for research is limited. The reason for this is that systems such as STORET and SAROAD collect widely scattered information from all over the nation on a periodic basis. By contrast, most research studies tend to require intensive measurements over small areas.

(2) Personnel: The data entry costs required by trend and monitoring systems are quite high. In addition, the quality of data submitted to these systems often

is poor because data enterers generally receive little benefit from the systems, and therefore are not motivated to insure the accuracy of their inputs.

(3) Costs: Because the volume of data collected by these systems increases over time, the cost of these systems is extremely sensitive to the data storage technique employed. A system like STORET, which keeps all input resident on-line, experiences dramatically rising costs. A system like SAROAD, which restricts on-line data to summary information, has more stable operational costs. Even with a system like SAROAD, the amount of computer resources required to search through the entire data base (currently 12 tapes) can increase depending upon the organization and partitioning of off-line data storage.

(4) Growth: The growth in size of a trend and monitoring system is a function of the number of locations and parameters being monitored, and the number of time intervals represented in the current data base.

(5) Tradeoffs: Environmental information (air and water quality information) tends to change quite slowly with time. Once the air or water quality trends for

the time period 1962 through 1972 have been computed, they will never change. Every year only one-tenth of the time interval is updated with new information as the next year's quality data is added to the data base. For reporting purposes, therefore, the use of manually-maintained charts, which are updated as each year's new information becomes available, is a much less costly procedure than reprocessing ten years' worth of data every time a new report is needed.

STORET and SAROAD both have a large body of "general purpose" software to aid the users in retrieving information from the data base. The Agency has chosen to build national data bases and to make them easy to use. However, this policy can prove quite costly. An alternative strategy would be to provide information on an archival basis, similar to a library, where raw data is available for copying, but where the individual users must spend their own funds to manipulate the copied data.

(6) Comment: STORET and SAROAD designers have assumed that the collection of general environmental information, together with tools to access this data, will

be useful. Yet, the intended users of these systems for enforcement, research, modeling, regulation preparation and congressional reporting all have different types of time and data demands. A data base which attempts to satisfy all these demands generally does not prove cost-justifiable. A more cost-effective alternative is to build systems designed to meet specific needs rather than constructing general purpose systems to meet undefined needs.

3. TECHNICAL DATA BASE SYSTEMS

A technical data base is a collection of items having a number of chemical or other scientific parameters. It differs from a trend and monitoring system in that the data base is constant in size over time. As new values enter the system, they replace existing values in the data base. For example, the NEDS system is a technical data base of air quality measurement stations in which each station has a number of emission volume measurements. Semi-annually, new readings of emission volumes are submitted which replace the existing data in NEDS. The data base contains only the current emission levels from each of the stations in the data base.

Other examples of technical data bases include the Pesitcides Registration System (PARCS) and the Technical Assistance Data System (TADS). The General Point Source File (GPSF) is a trend and monitoring system rather than a technical data base (although it is the water program equivalent of NEDS) because it maintains a time history of point source information.

(1) Use: Technical data base systems are used primarily for special studies, such as the annual air quality report. Researchers use the data bases for analysis and for preparation in writing regulations.

(2) Personnel: The data entry requirements to support these types of systems is low compared to other application classes. The major personnel effort required is for retrieval of information from the data base. The creation of programs to retrieve information from the technical data base is the primary activity required by this application class.

Savings are provided by these systems by replacing manual tabulation and analysis with machine computation. To the extent that the data bases are used for this purpose, the savings can be substantial.

(3) Cost: This application class exhibits generally stable cost trends with time. Operational costs change only with changes in the rate of requests. Data maintenance and accessing costs remain stable.

(4) Growth: The size of a technical data base is a function of the number of data elements included. Additions to the data base result from external forces such as legislative changes or new environmental interests. For example, legislative changes in the pesticides area will result in a substantial increase in the number of pesticides covered by the PARCS system. Similarly, new interests in nitrogen dioxide may result in the addition of this parameter to the NEDS data base.

(5) Tradeoffs: The maintenance of technical information in printed form is an alternative to a computerized data base. The feasibility of manual alternatives depends on the rate of change of the information in the data base and on the need to access the data base along many different parameters. The PARCS data base, for example, is accessed along many different dimensions to answer specialized requests and represents a suitable application of machine technology.

The TADS data base, on the other hand, is referenced infrequently other than by the name of the substance of interest. TADS information could be provided to users in notebook form more cheaply and efficiently than on a computer system.

A second factor concerning the need for automation is the size of the data base maintained. A large data base with many hundreds of thousands of values would be difficult to use in printed form. A small data base, of several hundred to several thousand items, could be managed manually irrespective of the nature of information requests.

(6) Comments: The implementation of a technical data base in an on-line interactive environment is very difficult to justify. The types of information required are rarely complex or urgent enough to require this type of environment. The use of qualified technical people to translate user requests into machine format will reduce the cost and complexity of the computer system while maintaining a high level of performance.

4. WORD PROCESSING SYSTEMS

Word processing systems automate secretarial tasks. Textual information is input to the system, modified in an interactive process, and output in a retyped and corrected version.

Two types of word processing systems are used within the Agency. First, Bowne Time Sharing is a centralized service running on an IBM 360 computer in New York, which is accessible through time share terminals throughout the Agency. Second, stand alone systems consist of a terminal, local storage, processing unit, and a typewriter output mechanism, which are all under the control of one typist and located in an Agency office. The Bowne Time Sharing system expenses are paid as a part of the Agency ADP Fund. The cost of stand alone word processing systems, such as the Lexitron system, are funded from program appropriations throughout the Agency.

(1) Use: Word processing systems are used to increase secretarial performance in preparing reports and in updating user and system documentation. Improved accuracy from machine retyping and improved turnaround time for draft revisions are the primary benefits from such systems.

(2) Personnel: Savings realized through use of word processing systems are very sensitive to the number of changes required to the original textual information. If the initial text undergoes extensive changes between each revision, the clerical costs to operate an automated system may be equal to that required to completely retype the document. However, if the document has only a few changes since the original draft, secretarial time may be reduced substantially through the use of word processing.

(3) Cost: The cost of utilizing word processing equipment is added directly to ordinary secretarial costs. The breakeven point for word processing is when the cost for using the machinery equals the savings in secretarial costs of doing the same process manually.

Stand alone word processing systems and secretaries represent a fixed cost to the Agency as compared to Bowne Time Sharing, which is charged on the basis of use. Fixed cost systems are more cost-effective when the volume of usage is high, whereas timesharing is cheaper if only infrequent use is made of the facility.

Cost considerations may, at times, be subordinated to other issues. For example, offices with a requirement to publish regulations or findings within a court-specified deadline require the rapid turnaround which can be provided by word processing systems despite their higher costs.

(4) Growth: Word processing applications do not exhibit intrinsic growth characteristics as do trend or tracking systems. Rather, word processing data files are stored for short periods of time until a final document is produced. At that time, the corresponding system files are purged.

(5) Tradeoffs: The manipulation capability of word processing services provided by Bowne Time Sharing exceed those available from stand alone systems. The value of this capability depends upon the material under preparation. Each office should examine whether a more expensive service, such as Bowne, or one with lesser capabilities and cost, such as Lexitron, should be used.

(6) Comments: Usage of Bowne Time Sharing within the Agency has grown rapidly because of the savings resulting from word processing capabilities and from

the fact that Bowne Time Sharing was provided as a free service, since it is paid for by the ADP Fund, to all Agency offices.

5. BIBLIOGRAPHIC SYSTEMS

Bibliographic systems use the processing capabilities of a computer to search a very large set of book and journal abstracts to find publications relevant to specific subjects. The user specifies his areas of interest and the machine searches for all articles matching his search criteria.

Examples of bibliographic systems used by the Agency include the Solid Waste Information Retrieval System (SWIRS), the Noise System on Environ and the Technical and Environmental Information System (TENIS) used by the Air program.

(1) Use: Bibliographic systems are used primarily by librarians in support of research requests. The services are provided to agency offices and to the public to promote the flow of current technical information.

(2) Personnel: The data entry costs required to support the bibliographic systems are quite high compared to other application classes. These high bibliographic costs are incurred because large volumes of abstract or other textual materials must be keyed into the computer. High-paid contract personnel are needed also to survey the current trade and technical publications, and to select and abstract articles for inclusion in the bibliographic systems. Several systems also use trained analysts to translate librarian or research requests into machine-readable form.

(3) Cost: There is a substantial and constant data entry cost required to maintain bibliographic systems. Abstracts are added to the system on a periodic basis to maintain the currency of system information. The operating costs of bibliographic systems is highly dependent upon the design philosophy adopted. Systems which store only citation numbers and keywords, for example, can be operated inexpensively because of the comparatively small volume of data which must be scanned during a search. By contrast, systems which store full abstracts on-line and provide free text search capabilities are quite costly to operate because

much computer time must be consumed in scanning the relatively larger data volumes of stored information.

(4) Growth: The growth in data base size maintained by these systems is a function of time. As more time passes, more abstracts, citations, keywords and other information are added to system data files.

(5) Tradeoffs: With the current growth of technical information in all fields, it is doubtful whether non-automated procedures can be effective. Tradeoffs primarily involve different implementation strategies for machine-based bibliographic systems. Keyword bibliographic systems are more efficient to operate than free text bibliographic systems. Batch systems which are run by trained operators are less expensive than interactive on-line services.

(6) Comments: The primary factors affecting bibliographic system costs are data storage philosophies and user-interfacing policies. Systems which periodically purge older abstracts can effect tighter control over data base size and thereby control costs. Systems which minimize direct end user system interaction can likewise limit costs by employing simpler and more efficient

search strategies. Both restrictions imply some reduction in user service. However, given the low level of EPA usage of current bibliographic systems, such reduced service would not hinder significantly Agency research activities.

6. MODELING AND SCIENTIFIC SYSTEMS

A computer model is a mathematical simulation of the chemical, biological or socioeconomic behavior of ecosystems to various stimuli. For example, a river flow model might show the impact of discharged pollutants on a river as a distribution of those pollutants throughout the river over time.

The water program uses many models for describing the water flows. The air program is conducting a large modeling program (RAPS) to study the complex interactions of a large metropolitan area with many sources of air pollution. Many small models exist for describing local phenomena, such as the distribution pattern of pollutants from an individual smoke stack. Other models simulate the interrelationship between economic activity and environmental factors.

(1) Use: Models are used in research and in establishing permit conditions. For example, the effect of a new factory is examined by running a model to predict what change the factory will have on the air quality in its surrounding area. The results of the model are then used to determine the kinds of pollution control equipment to be installed during its construction.

(2) Personnel: The data entry requirements for most models are low compared to other application classes. Models are run as needed rather than on a periodic schedule.

(3) Cost: The cost of modeling depends upon the complexity of the individual model. An air diffusion model representing a single smoke stack is far less expensive to operate than one attempting to model all the interactions in an area such as St. Louis.

(4) Growth: Once a model is constructed, it may be expected to remain stable in size and operational cost. The primary growth factor in the modeling and scientific area is the creation of new or more complex models to examine additional characteristics.

(5) Tradeoffs: Models provide the unique ability to study the implications of an action before the action actually occurs. As such, there are a few alternatives to modeling as a tool for gaining understanding of physical phenomena. However, the use of modeling to assess the impact of specific construction or development projects, such as the building of a new power plant or the creation of a new shopping center, may, in some cases, be unnecessary. Only the analysts involved with a particular project can assess fully the cost benefits of using modeling techniques.

(6) Comments: Within the academic community, the use of computer models is rapidly growing. They are being used currently in only a limited fashion at EPA, but may be expected to increase in importance in the future.

7. LABORATORY AUTOMATION SYSTEMS

Laboratory automation systems control complex laboratory test equipment to (1) provide more accurate measurement, (2) simplify data collection and analysis, and (3) reduce the personnel needed to perform laboratory operations.

(1) Use: The Agency currently is studying the use of computers in laboratories. The NERCS, and regional

surveillance and analysis laboratories are the intended users.

(2) Personnel: Laboratory automation reduces manual transcription and analysis of data and thereby frees lab technicians from these clerical duties.

(3) Cost: The cost of laboratory operations may be higher than experienced currently because personnel reductions will not accompany computer installation. The benefit of laboratory automation will be to increase productivity rather than to lower cost.

(4) Growth: The data processing expenditures on laboratory automation will increase as hardware is acquired and decline when all the laboratories are equipped. Because the machinery will be dedicated to the laboratory use and will be purchased rather than leased, only maintenance expenses will provide recurring costs.

(5) Tradeoffs: The only relevant tradeoff to lab automation is continued usage of manual laboratory procedures. The associated cost benefit consideration is whether the added expense of lab automation is worth the added accuracy and productivity provided over conventional laboratory procedures.

(6) Comments: The use of computers in the laboratory should increase the productivity and accuracy of operations performed. However, lab automation has had a bad history of expensive failures. Therefore, EPA should examine carefully the anticipated costs and benefits from such systems and measure these anticipations against the actual consequences of the experimental projects.

8. SPECIAL STUDIES

Special studies represent an application class only in the budgeting sense. They represent one time non-recurring computer expenditures to generate special reports from (1) existing data bases, (2) newly constructed models, or (3) specially-designed data bases.

(1) Use: Special studies are found in all offices of the Agency. In Grants Administration, special studies are used to respond to requests by Congress and other outside agencies. In the water program, a significant modeling effort is underway currently which involves the intensive collection of data from sixty pairs of monitoring stations on a single river. In the air program, the regional air pollution study (RAPS) is a

$20,000,000 special study which extends over a five year period.

(2) Personnel: The personnel requirements for a special study are a function of the type of study being conducted. Large scale projects involving the development of new computer systems require ADP designers, programmers and analysts. Smaller studies, which access existing Agency data files or facilities, require little more than some minor clerical or coding support.

(3) Cost: The cost of special studies varies considerably depending upon the scope and longevity of the project. A response to a Congressional inquiry about the Grants program may cost a few hundred dollars and last a few days, whereas an air monitoring study may last several years and cost many millions of dollars.

(4) Growth: The growth curve of special studies starts at zero, rises to a peak and then decreases back to zero when the study is completed. Only when systems constructed as part of a study are preserved is there any ongoing cost incurred after study completion.

(5) Tradeoffs: There are no tradeoffs to special studies other than refraining from initiating the project itself. Since special studies are begun in response to some Agency need for information, the only relevant tradeoff consideration is the priority of the underlying need itself.

(6) Comments: Many special studies are conducted in response to Congressional inquiries. It would be useful for the Agency to track the cost of responding to such requests. In this way EPA could inform Congress of the costs of providing requested information and thereby help focus or channel future requests to highest priority issues.

APPENDIX C

ADP EQUIPMENT AND FACILITIES

APPENDIX C - ADP EQUIPMENT AND FACILITIES

Data processing equipment and facilities used by EPA include two major computer facilities (OSI & RTP), five other service bureaus, dedicated mini computers, and a large number of terminals. This Appendix describes the nature and the FY'74 expenditure level for each of these equipment categories.

1. OPTIMUM SYSTEMS INC. (OSI)

(1) Location: Bethesda, Maryland

(2) Management: OSI is a commercial vendor supplying computer equipment, services and facilities to EPA under a contract signed originally in January, 1973.

(3) Pricing: OSI computer charges to EPA are based on a complex contractually-specified pricing formula. The elements of this pricing formula include ten factors, as follows:

- Resource hours, which are composed of central processing unit (CPU) seconds and input/output activity as measured by the number of execute channel program (EXCP) instructions initiated. Charges for resource hours are, in turn, based upon job class and execution priorities

- Connect hours, which measure the volume of communications between remote sites and OSI. These charges are based on connect time, distance, and type of communication (low speed terminal or medium speed remote job entry).

- Storage costs for on-line disks, disk pack and magnetic tape rental and storage
- Personnel support for clerical, programming and systems analysis work
- Special forms
- Courier service
- Keypunching
- Microfilm output
- Xeroxing
- Off-line printing

(4) Equipment: The current OSI equipment configuration consists of dual IBM 370/158 computers with 3 million bytes of memory on one machine and 2 million bytes on the other. The configuration also includes 112 disk drives with a total capacity of 11 billion characters, 10 tape drives, and 192 phone circuits supporting remote job entry (RJE) leased, WATS and dial-up lines and low speed terminal leased, WATS and dial-up lines.

The 370/158 computers are members of the System/370 generation of IBM computers. System/370 was originally introduced in 1970 with the announcement of the 370/155 and 370/165. In terms of cost and performance the 370/158 is in the middle of the current line of IBM processors.

In addition to a broad line of peripheral equipment, IBM provides many software packages which operate on the 370/158. The WYLBUR text editing system, the TSO Time Sharing system, the IRS report generation package, and IBM's PL1 programming language are all systems which are used heavily by EPA. While the use of these packages improves efficiency and reduces programming costs, it reduces also EPA's flexibility in moving systems to other vendors' equipment.

(5) Work Load: The OSI facility processes over 25,000 jobs each month. This monthly processing uses 700 resource hours including 200 CPU hours and 80,000 connect hours.

A thirty-day month has 720 available hours. The two OSI computers thus have 1440 available CPU hours. Assuming an 80% machine availability, excluding maintenance and unscheduled outages, there are approximately 1150 available CPU hours per month. Therefore current CPU utilization of 200 hours represents about 17% of the total CPU capacity.

Disk-bound jobs, such as data base and interactive processing, result in lower CPU utilization. Nonetheless, the amount of core available for multi-programming at OSI indicates that total machine utilization could be substantially higher if the central processor were properly matched to the workload. The use of a computer performance analysis package, such as those provided by Boole and Babbage, and other firms, could help OSI to tune their configuration more effectively to EPA's processing load.

(6) Costs: In FY'74, EPA spent over $6 million on services provided by OSI.

2. RESEARCH TRIANGLE PARK (RTP)

(1) Location: National Environmental Research Center, Research Triangle Park, Durham, North Carolina.

(2) Management: The Data Systems Division of EPA located at RTP has contracted with an outside vendor for facilities management of the government leased computer.

(3) Pricing: The formula used to measure the use of resources on the RTP computer is similar to that used at OSI. Elements measured include resource

hours, storage costs, etc. However, RTP uses variable rates adjusted as required to recover the hardware rental and maintenance cost of the RTP facility. In September, the charge out rate was $323 per resource hour.

(4) Equipment: The RTP computer configuration consists of a Univac 1110-2x1 computer with two arithmetic processors and one I/O processor (16 I/O channels). This machine contains 96 thousand words of main storage and 262 thousand words of extended main storage. The configuration also contains one billion bytes of disk storage, 15 tape drives and 64 phone circuits including 4 RJE leased lines, 2 RJE WATS lines, 8 low speed leased lines, 6 hardwired terminals, and 40 dial-up lines.

The 1110 is the latest model in the Univac 1100 series, which dates back to 1964. The 1110 computer was introduced in 1970, and supercedes the earlier 1108 model in terms of price performance. The entire 1100 line of computers is upward program-compatible.

Instead of offering many different model numbers as does IBM, Univac has designed the 1110 to be capable of containing a variable number of processing units. To increase computational power, the user adds processors to his 1110 rather than changing to a different model. The system at RTP currently has 2 (of a possible 4) Command/Arithmetic units, and 1 (of a possible 4) I/O Access units.

The software offered by Univac includes RJE, time sharing, data management packages, and five high level computer languages including Fortran and Cobol. Though Univac has a PL/1 compiler under development, it is not yet available. Therefore, programs written in IBM PL/1 have been converted to Cobol for operation at RTP.

(5) Work Load: The RTP computer processes approximately 16,000 jobs each month. These jobs use approximately 600 resource hours per month.

Although exact figures are not available, we have estimated that the ratio of CPU hours to resource hours is similar to that measured at OSI. This is a conservative estimate because the Univac 1110 processor is approximately 2 to 4 times more powerful than the dual IBM 370/158 machines. Therefore equivalent work performed at RTP should consume fewer CPU hours than at OSI. Using this ratio of 200/700, we have estimated the Univac to be using 175 CPU hours per month.

(6) Costs: Billing rates at RTP are set to recover $190,000 per month in fixed costs or a total of $2,280,000 per year. This covers the costs of equipment rental, telecommunications and maintenance. Additional costs for facilities management and supplies are not charged back to the user at present.

3. OTHER COMPUTERS USED BY EPA

This section describes briefly the six other major computers and computer service bureaus used by EPA.

(1) Health Services Administration (HSA)

HSA's computer is used to operate the Agency's Financial Management System (FMS). Current plans call for this system to be moved to OSI. Expenditures in FY'74 at HSA were $317,500. HSA is a government facility.

(2) Department of the Interior-U.S. Geodetic Service (USG)

The Agency's Departmental Integrated Personnel System

(DIPS) runs on the IBM computer at USGS. The personnel system is operated for the benefit of the Department of the Interior, EPA, and several other government agencies. There are no current plans to move DIPS from USG. Expenditures in FY'74 were $390,400. This is a government facility.

(3) National Institute of Health (NIH)

Many of the programs and systems used by the Agency were developed at NIH before EPA had any major computational facilities. Recently, NIH has been unable to expand their equipment to handle rising work loads, and have therefore requested other agencies to remove their work from the NIH facility. EPA is transfering all work from NIH to the OSI facility. Many systems have been transferred already, but some, such as SWIRS, cannot be transferred, and must be re-programmed. EPA expenditures at NIH in FY'74 were $1,461,624. NIH is a government facility.

(4) Informatics Inc. (ENVIRON system)

Informatics operates a specialized commercial time sharing service on which EPA operates several application systems. NOISE bibliographic information, the oil and hazardous materials Spills Information Retrieval (SIRS) tracking and monitoring system, and the Technical Assistance Data System (TADS) are run on ENVIRON, along with a part of the Office of Research and Development project management system. ENVIRON provides a very sophisticated full text search and retrieval capability. This capability facilitates text manipulation and search as used in various bibliographic applications.

The EPA expenditures on ENVIRON in FY'74 were $526,700. This is a commercially owned and operated facility.

(5) Bowne Time Sharing

Bowne operates a specialized time sharing system for word processing. Text is typed in by secretaries, edited, and retyped in final form. The text also may be retained in the machine for further editing changes in the future. The software used for the word processing system is the proprietary product of Bowne. The Agency spent $569,500 for services on Bowne in FY'74. This is a commercially owned and operated facility.

(6) Minicomputers

The Agency currently has several dozen minicomputers operating as specialized equipment in various parts of the Agency. They are used primarily in laboratories and in other areas to perform data collection tasks. Because most minicomputers are purchased rather than leased, the only operating costs associated with these machines are maintenance charges. The purchase price and maintenance are both funded with program funds instead of with money from the ADP Fund.

4. OTHER EQUIPMENT

In addition to the large scale general purpose computers described above, the Agency also employs a large number of remote terminals to request computer runs, prepare and enter data, and receive printouts of computer results. EPA currently has 500 low speed (10-30 character/second typewriter-like) terminals, and 42 medium speed (200-700 character/second) devices for use in communicating with OSI, RTP and other computer service bureaus.

Procurement requests for lease or purchase of this type of equipment totaled over $990,000 in FY'74. However, though Agency offices must submit procurement requests for ADP equipment to headquarters for approval, funding for these devices usually is provided out of program funds. Therefore the cost for these devices is not included in the ADP Fund expenditure totals.

APPENDIX D

COST PROJECTION CALCULATIONS

APPENDIX D - COST PROJECTION CALCULATIONS

This Appendix describes the procedures used to calculate the costs for consulting and new systems development and for the resulting equipment and timesharing charges for operating Agency systems during the next five years. Sections 1 and 2 describe the estimation procedures as applied to project development costs. Section 3 describes the derivation of equipment and timesharing estimates. Note that all costs both here and throughout the report are unadjusted for inflation.

1. PROCEDURES FOR ESTIMATING CONSULTING AND SYSTEMS DEVELOPMENT COSTS.

A variety of procedures were used for estimating development costs. In no case did we perform a detailed study of system design and implementation characteristics as would be required in a system feasibility study. Rather, we used the following estimation rules in decreasing order of priority depending upon their applicability.

- Use the results of earlier feasibility studies, where appropriate.
- Apply the development and operating costs of similar EPA systems within the same application class adjusted for differences in data volume, number of users, and other special features.

- Apply the development and operating costs of similar non-EPA systems adjusted for technical differences such as system architecture, data base complexity, types of reporting, user interface and operating environment.

Cost estimates for non-development consulting activities such as system audits, planning studies, and evaluations of current procedures were based upon the following factors:

- Scope and magnitude of the consulting assignment
- Number of people and elapsed time appropriate for the project
- Level of interaction with Agency personnel
- Number of people affected by the study
- Travel time and associated expenses

2. <u>COST ESTIMATES FOR CONSULTING AND SYSTEM DEVELOPMENT PROJECTS</u>.

This section presents the underlying assumptions used in developing our overall consulting and system development estimates. All final estimates were rounded to the nearest $10,000 consistent with the level of precision implicit in the estimation procedures. Responses to RFP's or feasibility studies would develop more accurate estimates. Note also that we have not assumed the use of current EPA software such as System 2000. We expect, however, that these packages will be applicable to several of the development projects and may reduce actual costs below our conservative estimates. For estimation purposes we have assumed the following average man month rates:

Contractor-consulting project	$8,000
Contractor-system development	$5,500
EPA personnel	$1,500

Computer time expenses have been included in the overall ADP Fund costs for associated systems. Other expenses have been included for contractors but not for EPA personnel. These cost estimates are presented for eight projects, as follows:

- GPSF development
- Word processing study
- STORET development
- TADS/SIRS evaluation
- Administrative systems study and development
- OEGC plan
- ORD plan
- Energy system development

All estimates are calculated in man months (m.m.).

There are five estimation categories for development projects, as follows:

- Design - functional specification and design, general system design
- Programming - module flowcharting, coding, unit tests
- Conversion - data conversion, full system testing, installation, acceptance testing
- Training - user documentation and training
- Expenses - travel, supplies, clerical support, report production

Consulting estimates have been categorized only into personnel and expense categories.

(1) GPSF Development (12 month elapsed time)

	Contractor	EPA	
Design	12 m.m.	18 m.m.	
Programming	12 m.m.	12 m.m.	
Conversion	14 m.m.	18 m.m.	
Training	10 m.m.	18 m.m.	
Total Manpower	48 m.m.	66 m.m.	
x m.m. cost	x $ 5,500	x $ 1,500	
Total Manpower Cost	$264,000	$99,000	
Expenses	$ 36,000		
Total Cost	$300,000	$99,000	rounded to $100,000

(2) Word Processing Study (3 month elapsed time)

	Contractor	EPA	
Analysis	3 m.m.	6 m.m.	
x m.m. cost	x $ 8,000	x $1,500	
Total Manpower Cost	$24,000	$9,000	
Expenses	$ 6,000		
Total Cost	$30,000	$9,000	rounded to $10,000

(3) STORET Development

Reduce On-Line Data (6 month elapsed time)

	Contractor	EPA	
Design	2 m.m.	6 m.m.	
Programming	2 m.m.	6 m.m.	
Conversion	3 m.m.	8 m.m.	
Training	2 m.m.	8 m.m.	
Total Manpower	9 m.m.	28 m.m.	
x m.m. cost	x $ 5,500	x $ 1,500	
Total Manpower Cost	$49,500	$42,000	
Expenses	$10,500		
Total Cost	$59,500 rounded to $60,000	$42,000	rounded to $40,000

Reprogram for Shift to RTP (12 month elapsed time)

	Contractor	EPA
Design	20 m.m.	30 m.m.
Programming	24 m.m.	30 m.m.
Conversion	24 m.m.	36 m.m.
Training	24 m.m.	36 m.m.
Total Manpower	92 m.m.	132 m.m.
x m.m. cost	x $ 5,500	x $ 1,500
Total Manpower Cost	$506,000	$198,000
Expenses	$ 90,000	
Total Cost	$596,000 rounded to $600,000	$198,000 rounded to $200,000

Develop New Retrieval Capabilities (9 month elapsed time)

	Contractor	EPA	
Design	15 m.m.	15 m.m.	
Programming	15 m.m.	15 m.m.	
Conversion	15 m.m.	18 m.m.	
Training	15 m.m.	18 m.m.	
Total Manpower	60 m.m.	66 m.m.	
x m.m. cost	x $ 5,500	x $ 1,500	
Total Manpower Cost	$330,000	$ 99,000	
Expenses	$ 70,000		
Total Cost	$400,000	$ 99,000	rounded to $100,000

(4) TADS/SIRS Evaluation (3 month elapsed time)

	Contractor
Analysis	1 m.m.
x m.m. cost	x $ 8,000
Total Manpower Cost	$ 8,000
Expenses	$ 2,000
Total Cost	$10,000

(5) Administrative Systems

Systems and Procedures Analysis (6 month elapsed time)

	Contractor	EPA	
Analysis	10 m.m.	12 m.m.	
x m.m. cost	x $ 8,000	x $ 1,500	
Total Manpower Cost	$ 80,000	$ 18,000	
Expenses	$ 20,000		
Total Cost	$100,000	$ 18,000	rounded to $20,000

Administrative Systems Reprogramming (9 month elapsed time)

	Contractor	EPA
Design	6 m.m.	18 m.m.
Programming	9 m.m.	12 m.m.
Conversion	9 m.m.	18 m.m.
Training	6 m.m.	18 m.m.
Total Manpower	30 m.m.	66 m.m.
x m.m. cost	x $ 5,500	x $ 1,500
Total Manpower Cost	$165,000	$ 99,000
Expenses	$ 35,000	
Total Cost	$200,000	$100,000

(6) OEGC Planning Study (3 month elapsed time)

	Contractor	EPA	
Analysis	6 m.m.	12 m.m.	
x m.m. cost	x $ 8,000	x $ 1,500	
Total Manpower Cost	$48,000	$18,000	
Expenses	$12,000		
Total Cost	$60,000	$18,000	rounded to $20,000

(7) ORD Planning Study (6 month elapsed time)

	Contractor	EPA	
Analysis	10 m.m.	12 m.m.	
x m.m. cost	x $ 8,000	x $ 1,500	
Total Manpower Cost	$ 80,000	$18,000	
Expenses	$ 20,000		
Total Cost	$100,000	$18,000	rounded to $20,000

(8) Energy System Development (9 month elapsed time)

	Contractor	EPA	
Design	12 m.m.	18 m.m.	
Programming	12 m.m.	12 m.m.	
Conversion	14 m.m.	18 m.m.	
Training	10 m.m.	18 m.m.	
Total Manpower	48 m.m.	66 m.m.	
x m.m. cost	x $ 5,500	x $ 1,500	
Total Manpower Cost	$264,000	$99,000	
Expenses	$ 36,000		
Total Cost	$300,000	$99,000	rounded to $100,000

3. EQUIPMENT AND TIMESHARING COST CALCULATIONS

In order to estimate the ADP Fund expenditures of the Agency over the next 5 years, as indicated in the coordinated plan, each of the current major systems was examined. Assumptions were made concerning the growth pattern expected for each of these systems. Smaller computer systems at each Assistant Administrator level office were aggregated as "other systems", and their growth estimates were based on the growth trends of the office as a whole. The results of the proposed ADP plan action steps were included also in the projection numbers.

Exhibits D-1 through D-6 present the detailed cost estimates of each major system, categorized by office. Under each system name is a brief description of the assumed growth pattern or a footnote indicating the projection pattern used. These estimates represent growth of current systems and of new systems currently under development. No estimates were made reflecting the impact of inflation, or changes in mission scope caused by new legislation.

For FY'76 and FY'77, cost estimates are shown on a quarterly and annual basis.

Exhibit D-7 presents the EPA equipment and related charges for OSI, RTP, Cincinnati and Headquarters. These charges are in addition to the timesharing charges at OSI and other service bureaus. The total ADP Fund is comprised of both the timesharing and equipment expenditures.

Exhibit D-1
U.S. Environmental Protection Agency
Cost Projections-OPM

SYSTEM	FY75	FY76					FY77					FY78	FY79	FY80
Office of Planning and Management		Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL			
DIPS (*)	612	156	156	160	160	632	163	163	164	164	654	667	680	793
Personal Property (1)	150	37	38	40	41	156	41	41	41	42	165	168	172	175
GICS up 50% in 2 yrs. then +10%/ year	150	62	62	67	67	258	68	68	68	68	272	278	283	288
TSSMS (2)	76	19	19	20	21	79	20	21	20	21	82	82	82	82
FMS (3)	323	82	83	82	83	330	84	84	84	84	336	343	349	356
Other OPM (*)	777	210	210	213	213	846	235	235	197	197	864	866	953	1048
RTP Admin.	R	R					R					R	R	R
RTP Conversion	R	R					R					R	R	R
OFFICE TOTAL	2144	2301					2373					2404	2519	2742

(*) System affected by 5 year plan action steps.
(1) 10% growth in 5 years for system at OSI. Increases are: +2%/year.
(2) Level Cost. System useage expected to remain at current level. Adjustment for 8% OSI Increase in Third Quarter FY '76.
(3) 10% growth in 5 years - Government owned Facility +2%/year.
R Run at RTP and subsumed by RTP fixed costs.

Exhibit D-2
U.S. Environmental Protection Agency
Cost Projections-OEGC

COST PROJECTIONS

SYSTEM	FY75	FY76					FY77					FY78	FY79	FY80
Office of Enforcement and General Counsel		Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL			
PEMS (*)	150			---					---			---	---	---
CDS increase by $500/month/region in 5 years	57	17	18	19	19	73	22	22	22	22	88	102	115	128
GPSF (*)	960			---			---		R	R	---	R	R	R
Interim GPSF Start 1Q'76 level usage	60	30	30	32	33	125	32	33	32	33	130	130	130	130
Other OEGC (*)	36	10	10	6	6	32	6	6	6	7	25	27	30	33
New Enforcement Tracking System (*)											100	400	400	400
OFFICE TOTAL	1263					230					343	659	675	691

(*) System affected by 5 year plan action steps.
R Run at RTP and subsumed by RTP fixed costs.

COST PROJECTIONS

SYSTEM	FY75	FY76					FY77					FY78	FY79	FY80
Office of Water and Hazardous Materials		Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL			
SIRS/SPCC (*)	100	25	---	---	---	25	---	---	---	---	---	---	---	---
TADS (*)	40	10	---	---	---	10	---	---	---	---	---	---	---	---
Bowne Timesharing (*)	285	73	---	---	---	73	---	---	---	---	---	---	---	---
FARCS +100/yr '76 & '77 then flat	525	156	156	169	169	650	193	193	193	193	772	775	775	775
STORET (*)	2839	615	570	625	625	2435	R	R	R	R	R	R	R	R
Other OWHM (1)	68	17	17	18	18	70	21	21	21	21	84	94	105	115
OFFICE TOTAL	3991	3263					856					869	880	890

(1) 10%/year growth +8% OSI Increase Third Quarter FY '76.
(*) System affected by 5 year plan action steps.
R Run at RTP and subsumed by RTP fixed costs.

Exhibit D-4
U.S. Environmental Protection Agency
Cost Projections-OAWM

COST PROJECTIONS

SYSTEM	FY75	FY76					FY77					FY78	FY79	FY80
Office of Air and Waste Materials		Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL			
NOISE cut in '76 then flat usage	120	5	5	5	6	21	5	6	5	6	22	22	22	22
SWIRS cut in '76 then flat usage	120	5	5	5	6	21	5	6	5	6	22	22	22	22
TENIS	R					R					R	R	R	R
SAROAD	R					R					R	R	R	R
NEDS	R					R					R	R	R	R
Other OAWM (1)	198	54	48	52	52	206	57	57	57	57	228	252	277	305
OFFICE TOTAL	438					248					272	296	321	349

(1) 10%/year growth +8% OSI Increase Third Quarter FY '76.
R Run at RTP and subsumed by RTP fixed costs.

Exhibit D-5
U.S. Environmental Protection Agency
Cost Projections-ORD

COST PROJECTIONS

SYSTEM	FY75	FY76					FY77					FY78	FY79	FY80
Office of Research and Development		Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL			
Prog.. Management (*)	530	---	---	---	---	---	---	---	---	---	---	---	---	---
Bowne Timesharing (*)	121	33	---	---	---	33	---	---	---	---	---	---	---	---
SEAS Model (*)	300	75	R	R	R	75	R	R	R	R	R	R	R	R
Lake Pollution Model (*)	200	50	R	R	R	50	R	R	R	R	R	R	R	R
Energy Data System	---	---	---	---	---	---	---	---	---	---	---	R	R	R
Other ORD (*)	430	118	118	128	128	492	140	140	140	140	560	616	678	745
OFFICE TOTAL	1581	650					560					616	678	745

(*) System affected by 5 year plan action steps.
R Run at RTP and subsumed by RTP fixed costs.

Exhibit D-6
U.S. Environmental Protection Agency
Cost Projections-Regions

COST PROJECTIONS

SYSTEM	FY75	FY76					FY77					FY78	FY79	FY80
		Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL			
REGIONAL MGMT. (1)	281	72	72	77	77	298	79	79	79	79	316	322	328	334
REGIONAL MODELING (*)	200	52	52	56	56	216			R			R	R	R
REGIONAL TOTAL	481					514					316	322	328	334
TOTAL AGENCY TIMESHARING COSTS	9898					6692					4720	5166	5401	5751

(1) 20% increase in system use, spread over 5 years plus 8% OSI Increase in FY '76.
(*) System affected by 5 year plan action steps.
R Run at RTP and subsumed by RTP fixed costs.

Exhibit D-7
U.S. Environmental Protection Agency
Equipment Cost Projections

EQUIPMENT COST PROJECTIONS

SYSTEM	FY75	FY76	FY77	FY78	FY79	FY80
Hardware & Other OSI-Reduce backup frequency & charges		-500	-200	-200	-200	-200
Parallel Operation during conversion		1000			1000	
RTP Equipment	1800	1800	1940	2030	2030	2030
Telecommunications	500	500	700	700	700	700
Maintenance	250	250	250	270	270	270
Management	300	300	500	500	500	500
Analysis	50	50	100	100	100	100
Supplies	100	100	100	110	110	110
TOTAL RTP	3000	3000	3590	3710	3710	3710
NERC Cincinnati						
Equipment	155	89	89	89	89	89
Maintenance	20	---	---	----	----	----
Analysis	50	---	---	----	----	----
Supplies	50	---	---	----	----	----
TOTAL CINNC.	275	89	89	89	89	89
Headquarters						
Equipment	300	300	325	325	325	325
Misc.	200	200	215	215	215	215
Supplies	100	100	110	110	110	110
TOTAL HEADQUARTERS	600	600	650	650	650	650
TOTAL EQUIPMENT	3875	4189	4129	4249	5249	4249

TOTAL EQUIPMENT	3875	4189	4129	4249	5249	4249
TOTAL TIMESHARING	9898	6692	4720	5166	5401	5751
TOTAL ADP FUND	13773	10881	8849	9415	10650	10111

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APPENDIX E

THE SIX PHASES OF THE SYSTEM DEVELOPMENT PROCESS

APPENDIX E - THE SIX PHASES OF THE SYSTEM DEVELOPMENT PROCESS

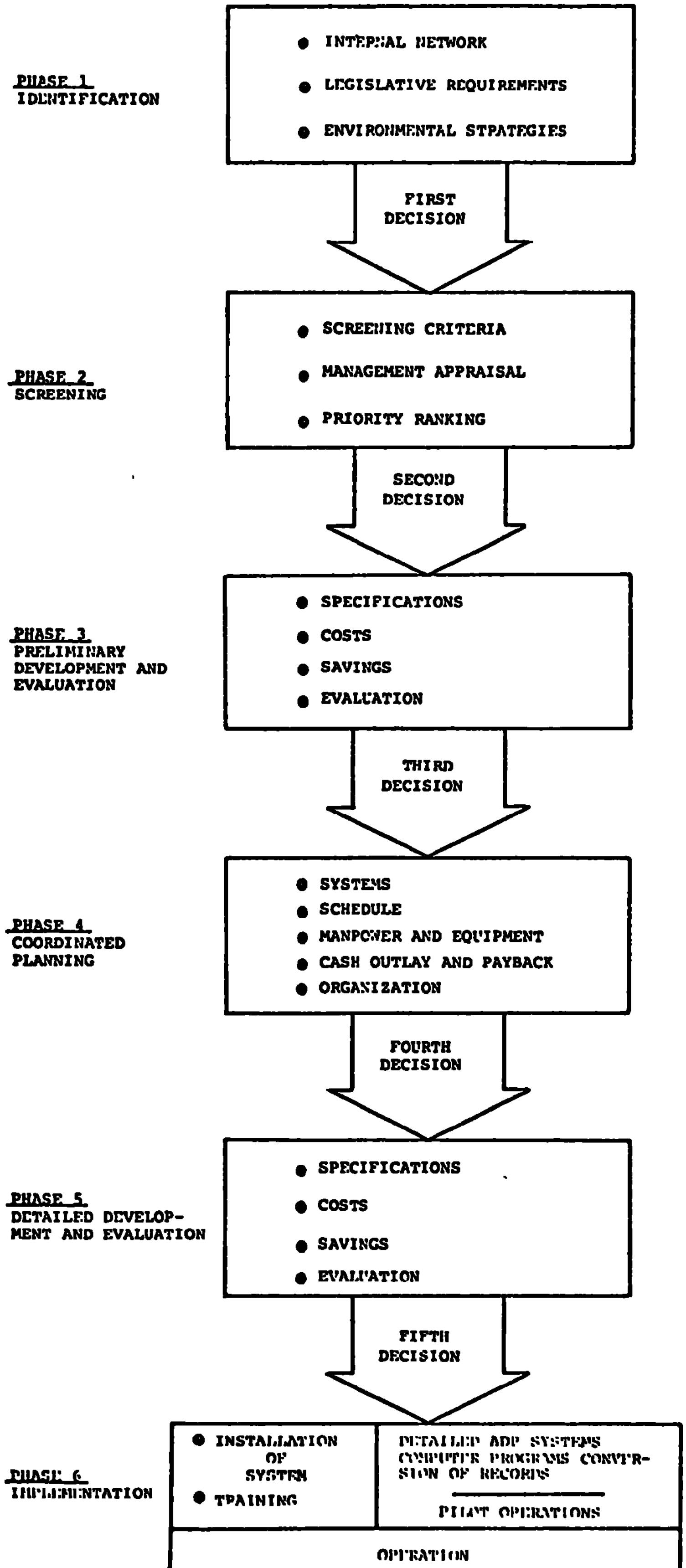
Effective management requires that systems development be divided into six phases to facilitate control. Breaking the systems development process into well-defined phases facilitates management and control by providing checkpoints, at both the beginning and the end of each phase, whereby management can make decisions on both the selection of systems and the control of development costs.

There are six phases into which the systems development process has been divided, as follows:

- Identification of new systems ideas
- Screening of new systems
- Preliminary development and evaluation
- Coordinated planning
- Detailed development and evaluation
- Implementation

Exhibit E-1, on the following page, summarizes each of these six phases. These phases, together with the control points between phases, give management the opportunity to answer the three fundamental questions: (1) Is the system in question likely to produce high savings in relation to

Exhibit E-1
U.S. Environmental Protection Agency
Coordinated ADP Planning -- A
Managed and Controlled Process



risk? (2) Does the system look attractive enough to warrant the costs involved in the succeeding phases of development? and (3) Is the system likely to meet the program needs for which it will be designed?

The balance of this appendix describes the procedures which EPA should follow in each of the six phases of systems development.

1. <u>THE FIRST PHASE OF SYSTEMS DEVELOPMENT IS THE IDENTIFICATION OF NEW SYSTEM NEEDS</u>.

In a field of rapidly-developing technology, such as ADP, it is necessary to organize the identification and development of new system requirements. To assure a proper flow of new thinking on computer systems, EPA should use the following procedures in identifying ADP needs.

(1) <u>Organize an internal network for gathering new system needs</u>.

A senior manager within each Agency office should be designated to be responsible for stimulating and organizing the formulation of new system requirements. These requirements should be transmitted to the head of MIDSD.

(2) Analyze major legislative requirements and environmental strategies.

Just as with other management tools, computer systems produce the best results when they are part of the Agency's overall strategy. Analysis of EPA's major legislative requirements and environmental strategy is the most productive source of new systems ideas. Such analysis tends toward the selection of new systems which will not only meet Agency requirements themselves, but which may consolidate the functions already provided by older, less efficient systems.

2. THE SECOND PHASE OF SYSTEMS DEVELOPMENT IS THE SCREENING OF POTENTIAL AUTOMATED APPLICATIONS.

Once new systems requirements have been identified and formulated, they must be screened to determine which requirements are of primary interest consistent with overall Agency priorities. EPA should screen new ADP systems by taking the following steps.

(1) Develop criteria for the screening process.

The criteria for the screening process, as well as for the evaluations made in subsequent phases of systems development, should include:

- Potential savings in the system per se, which are determined by estimating, on an "order of magnitude" basis:
  - Present displaceable costs
  - One-time systems and programming development costs
  - ADP operating costs
  - Resultant savings
- Potential savings in the program area which the system is designed to service
- Information or service improvement to users
- Potential technical risk, such as EPA's capability to implement the system
- Potential financial risk:
  - Probably investment in one-time costs
  - Probably months or years of payback

(2) Interview key EPA personnel and gain their informed judgments, on the basis of the criteria established, of the identified new automated systems.

Because selected key personnel are well informed about their specific functions, they can express helpful judgments on proposed systems in relation to the screening criteria.

(3) Rank all new systems in terms of priority of interest and prepare recommendations for senior management on the next steps to be taken on each system.

All new systems should be ranked in terms of priority of their interest to EPA based on the screening criteria. Recommendations such as the following should then be prepared for senior management regarding the next steps to be taken on each system.

- Proceed to a preliminary development and evaluation project.
- Proceed immediately to a detailed development and evaluation project when it is reasonably obvious that there is a paramount need for the system and when, for this reason, preliminary development and evaluation are not necessary.
- Put the system "into inventory" for future development and evaluation as part of EPA's coordinated ADP plan.
- Eliminate the system from further consideration.

In preparing recommendations on systems that require development and evaluation projects, preliminary cost estimates should be prepared for carrying out the projects.

(4) Meet with senior management and obtain decisions as to the actions to be taken on each system.

This step is recommended so that management can:

- Select systems in relation to cost and risk by making the decisions on (1) which systems warrant preliminary development and evaluation, (2) which warrant detailed development and evaluation, and (3) which should be put "into inventory" for future development, and which should be dropped.
- Control the costs of systems development by approving, in advance, the expenditures involved in development projects.

(5) Document and file senior management recommendations and decisions with respect to all new systems and revisions to existing systems.

Documentation and filing assure that:

- EPA will not lose track of any system that has once been considered.
- The work that already has been done on a system will not have to be repeated.
- There is a record of management decisions and the reasons for making them.
- There is a record of estimated costs to be incurred on recommended systems development and evaluation projects, which can be used as guidelines for project cost control.

(6) Develop an inventory of systems which have current low priority but may have high priority in the future.

These are systems which are "rejects" in terms of current priority. These systems, however, may have high priority in the future because of:

- Changes in ADP technology
- Changes in the legislative requirements
- Changes in program strategies
- Changes in Agency workload. The Agency may not have the people available to work on low-priority systems because they are occupied with high-priority systems. When the workload changes, technical people would become available to work on additional systems.

3. THE THIRD PHASE OF SYSTEMS DEVELOPMENT IS PRELIMINARY DEVELOPMENT AND EVALUATION.

The concept of preliminary development and evaluation is that enough, but only enough, work will be done: (1) to determine whether the system involved seems to make sense from a cost standpoint, and (2) to determine its priority with respect to other systems under consideration. In doing this preliminary work, it should always be kept in mind that, before a system is operational, more detailed and accurate work will be done in the subsequent detailed development and evaluation phase.

To carry out preliminary development and evaluation of computer systems, EPA should use the following procedures.

(1) Develop preliminary specifications for each service.

The specifications should be prepared in terms of how the system functions would be processed on computer equipment. The specifications should be in sufficient detail to permit estimation of preliminary costs.

(2) Develop preliminary estimates of operating costs.

The cost estimates should be reasonably accurate projections of the operating costs to be incurred.

(3) Develop preliminary estimates of one-time costs.

The one-time costs include ADP systems analysis and programming development, and other implementation costs, such as documentation, parallel operation and data conversion.

(4) Evaluate each service in terms of the criteria previously established.

These criteria, as established for the system screening process and described above, are:

- Potential savings in the system per se
- Potential savings in the program which the system serves
- Information or service improvement to users
- Risks, both technical and financial

(5) Prepare documented recommendations for senior management on each system as to whether it warrants detailed development and evaluation.

The documentation for each system should cover:

- Preliminary specifications (e.g., scope, input, output, processing, controls)
- Preliminary estimates of operating costs
- Preliminary estimates of one-time ADP development and implementation costs
- Evaluations in terms of the established criteria
- Recommendation as to whether the system warrants detailed development and evaluation

(6) Meet with senior management and obtain decisions on each system as to whether the system warrants development and implementation.

This step is recommended so that management can:

- Select systems in relation to cost and risk by making the decisions as to whether systems warrant detailed development and evaluation
- Control development costs by determining whether the costs incurred in preliminary development and evaluation projects correspond to the costs originally estimated for the project

(7) Develop an inventory of systems which have been put through preliminary development and evaluation, but which do not warrant immediate detailed development and evaluation.

These are the systems which are "rejects" in terms of current priority. These systems, however, may develop high priority in the future because of changes in ADP technology, in legislative requirements, in program strategies, or in the workload of the automated services program.

4. THE FOURTH PHASE OF SYSTEMS DEVELOPMENT IS COORDINATED PLANNING FOR ADP APPLICATIONS OF CURRENT PRIORITY.

After completion of the preliminary development and evaluation phase of systems development, EPA normally will have a number of high-priority applications which warrant detailed development and evaluation. However, there will be a number of additional, lesser priority internal applications that warrant attention also. Thus, there are conflicting demands for the time of qualified ADP personnel. Additionally, equipment requirements to carry out a program embracing ADP applications may exceed current capacity. Finally, there are questions as to how the implementation of the coordinated ADP plan should be organized.

Under the foregoing circumstances, coordinated planning becomes a necessity. EPA should carry out its coordinated planning by taking the following steps.

(1) Review any additional ADP applications that may be planned.

The additional ADP applications should be reviewed in terms of potential cost savings, improvements in service, and other benefits.

(2) Develop, for planning purposes, a schedule of additional computer applications.

In setting the schedule, the following factors should be considered:

- Relative value to EPA of new ADP services
- Equipment requirements
- Manpower requirements for designing and programming systems

(3) <u>Project the cash outlay and payback involved in the development of each application and all applications in combination over the period covered by the coordinated plan</u>.

The projection of cash outlay and payback should be a pro-forma statement of:

- Estimated savings from ADP systems
- Estimated one-time ADP development and implementation costs

(4) <u>Make recommendations and obtain management decisions on the coordinated program</u>.

The coordinated program is intended to be management's master process for the conduct of the ADP program. Management should make decisions on the following:

- The coordinated plan as proposed
- Budget and staffing requirements for carrying out the program

(5) Revise the coordinated program when new conditions warrant.

It is not intended that the coordinated program be "cast in bronze" and become inflexible because of an unwarranted desire not to upset plans. It is anticipated that revisions in planning will become necessary because systems once thought to have low priority develop a higher priority because of changed conditions.

5. THE FIFTH PHASE OF SYSTEMS DEVELOPMENT IS DETAILED DEVELOPMENT.

Detailed development and evaluation require essentially the same steps as preliminary development and evaluation, but in greater detail so that management has a firm basis upon which to make final decisions to implement new systems.

(1) Develop detailed ADP specifications.

Detailed ADP specifications should be prepared in terms of:

- The operations which the data processing facility must perform

- The operations which the program users will be asked to perform

(2) Develop detailed cost estimates.

Detailed cost estimates should be made in terms of:

- Cost of the operations which the data processing facility will perform
- Cost of the operations which the program users will perform

(3) Develop detailed one-time cost estimates.

Estimates should be prepared for one-time ADP implementation costs.

(4) For the purpose of making a final decision to implement the system, reappraise the value of the system in terms of the criteria previously established.

As mentioned earlier, the criteria are:

- Potential savings in the system per se
- Potential savings in the program which the system supports
- Information or service improvement to users
- Risk, both technical and financial

(5) Prepare documented recommendations for senior management on whether to implement the system.

The documentation should include:

- Detailed ADP specifications
- Detailed estimates of operating costs
- Detailed estimates of one-time ADP implementation costs
- Evaluation in terms of the established criteria
- Recommendation as to whether the system should continue to be implemented

(6) Obtain management's final decision on whether to implement the system.

It should be noted that this is the third opportunity management has had to take a look at the proposed system (first, during screening; second, after preliminary development; and third, after detailed development).

This step is required so that management can control both the selection of systems in relation to cost and risk and the costs involved in the next phase of systems development, which is implementation.

6. THE SIXTH PHASE OF SYSTEMS DEVELOPMENT IS IMPLEMENTATION.

After detailed development and evaluation have been completed and management has made a decision to implement the system, the final phase of systems development is implementation. EPA should carry out implementation by taking the following steps.

(1) Develop a detailed ADP systems design for the coordinated automation program.

The detailed system design includes:

- Flow of work
- Input preparation
- Computer runs
- Output forms
- Scheduling and conversion planning
- Controls and audit trails

(2) Write, test, and debug the computer programs.

(3) Plan the conversion of records and/or files where applicable.

(4) Test the system through a pilot operation.

(5) Train personnel to use the system.

(6) Make recommendations and obtain management decisions on full-scale installation of the system.

(7) Begin full-scale use of the system.