FINAL REPORT

on

EPA SCIENTIFIC AND TECHNICAL INFORMATION NETWORK CONCEPT AND IMPLEMENTATION PLAN

To

U.S. ENVIRONMENTAL PROTECTION AGENCY

FEBRUARY 1974

Contract No. 68-01-1854

BATTELLE
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

April 25, 1974

OFFICE OF
RESEARCH AND DEVELOPMENT

SUBJECT: Final Report on Information Network Study

FROM: Luther E. Garrett Luther E. Garrett
Data & Information Research Division
Office of Monitoring Systems

TO: See Below

The attached final report is the result of the Battelle Columbus Laboratories study announced in Dr. Greenfield's June 28, 1973 memorandum to you.

I would like to emphasize that the recommendations made in the report have not yet been acted upon by the Agency.

If there are any questions or comments, please contact me. My telephone number is (202) 426-2355.

Addressees:

Assistant Administrators
Office Directors
Deputy Assistant Administrators
Regional Administrators
NERC Directors

Attachment

MAY 1 1974

February 1974

EPA SCIENTIFIC AND TECHNICAL INFORMATION NETWORK CONCEPT AND IMPLEMENTATION PLAN

by

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ABSTRACT

This report presents the results of an analysis of EPA scientific and technical information activities and makes recommendations concerning the concept of, and an implementation plan for, an environmental scientific and technical information network. The investigators determined that the free, unorganized network currently in operation fails to fully meet Agency, Congressional, other governmental, and non-governmental needs.

Given the autonomy of EPA organizations, their geographical dispersion, their variety of subject interests, their diversity of functional needs, the disparity between information user practices, the general image of heterogeneity displayed by EPA, and the many information resources outside EPA control, it is not likely that improvement in EPA's information practices or position can easily be effected by a high degree of centralization or a dedicated approach to a strong line organization with its accompanying authority and responsibility. A workable structure appears to be the establishment of a staff office (recognized as a line item in the appropriations budget) entitled the Office of Technical Information Coordination (OTIC), at the Administrator level, whose mission would be to plan, coordinate, and encourage improved accessibility, handling, and usage of environmental information and data within a coordinated network.

The Office would be an active group-oriented undertaking with a low level of staffing which would, over a 43 to 48 month period:

Establish a scientific and technical information coordination function

Establish an environmental project information coordination function

Establish the present functions of the Library Systems Branch, except for operation of the Headquarters Library, as a library systems coordination function

Establish a group communications function

Establish an advisory services in the information sciences function

Establish an information research function in cooperation with other appropriate offices of EPA

Establish an EPA Information Committee and an Interagency Advisory Council.

An alternative plan is provided in the event EPA elects to devote fewer resources to its scientific and technical information activities than would be required to achieve the above goals of OTIC. Under the alternative plan, EPA would create the position of Information Science Advisor to the Administrator.

The implementation plan is designed with sufficient flexibility to permit EPA to build from Information Science Advisor to OTIC (from the alternative plan to the recommended plan) as desired.

This report was submitted in fulfillment of Contract No. 68-01-1854 by Battelle, Columbus Laboratories, under the sponsorship of the Environmental Protection Agency. Work was completed as of November 30, 1973.

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MANAGEMENT SUMMARY*

> The conduct of research on the adverse effects of pollution and on methods and equipment for controlling it, *the gathering of information on pollution, and the use of this information in strengthening environmental protection programs and recommending policy changes.* (Italics added.)

The quotation above is a partial statement of EPA's mission and purpose as initially defined by the President in his message relative to Reorganization Plans 3 and 4 of 1970. However, an agency-wide plan for coordination, control, and future direction of its scientific and technical information activities does not presently exist.

Two years after the organization of EPA, some 1700 participants at the 1972 National Environmental Information Symposium still expressed as their most common concern the need for improved awareness of, and access to, environmental information. This concern was echoed by EPA personnel who were interviewed in the course of this study.

The demand for rapid access to sound information/data is becoming increasingly more critical not only in support of research and development but also in support of the enforcement and regulatory functions of the agency. It does not appear that EPA has fulfilled the President's

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*Appendix J contains a Management Briefing Report which is a condensed version of the complete Final Report but more informative than this highly condensed Management Summary.

mandate under Reorganization Plan Number 3. In order to do so, EPA should undertake the required planning and make available the adequate resources to improve EPA's scientific and technical information activities and to present EPA as the U.S. focal point for environmental information.

Given the autonomy of EPA organizations, their geographical dispersion, their variety of subject interests, their diversity of functional needs, the disparity between information user practices, the general image of heterogeneity displayed by EPA and the many information resources outside EPA control, it is not likely that improvement in EPA's information practices or position can easily be effected by a high degree of centralization or a dedicated approach to a strong line organization with its accompanying authority and responsibility. A workable structure appears to be the establishment of a staff office (recognized as a line item in the appropriations budget) entitled the Office of Technical Information Coordination (OTIC), at the Administrator level, whose mission would be to plan, coordinate, and encourage improved accessibility, handling, and usage of environmental information and data within a coordinated network.

The Office would be an active group-oriented undertaking which would be structured and implemented over a time period of approximately four years and which would:

> Establish a scientific and technical information coordination function to provide a current knowledge of sources of scientific and technical information.
>
> Establish an environmental project information coordination function to provide a current knowledge of sources of information on on-going projects.
>
> Incorporate the present functions (excluding the operation of the Headquarters Library) of the Library Systems Branch to provide for library systems coordination.

Establish a group communications function to provide a forum furnishing the atmosphere for discussion of common problems and to serve as EPA's public spokesman for environmental information in a non-conflicting relationship with the Office of Public Affairs.

Provide advisory services through its designation as the initial source for resolution of EPA's problems in information science in order to minimize the duplication of effort and inconsistency of approach possible if different individuals or contractors act without coordination.

Establish an information research function to conduct, or more often cause to be conducted, intramural and extramural research studies of information/data handling techniques and transfer processes to assure that attention is drawn to improvements which can be made by existing organizations.

Establish an EPA Information Committee and an Interagency Advisory Council to assist the Director of OTIC in the execution of his planning responsibilities.

An alternative plan is provided should EPA elect to devote fewer resources to its information activities than would be required to achieve the above goals of OTIC. The alternative retains the objectives of the first recommendation but scales back the level of effort to approach each of the operations on a priority selection basis with reduced performance. Under the alternative plan, EPA would create the position of Information Science Advisor to the Administrator. The Advisor would:

Keep the Administrator informed of, and suggest line action to be taken with respect to all EPA present, contemplated, or needed information science activities.

Establish a referral capability for environmental project information systems and for scientific and technical information systems.

> Create a presence about which the resources of EPA could be marshalled for execution of its information responsibilities.

A detailed implementation plan is provided which permits EPA to establish either the recommended OTIC or the alternative of an Information Science Advisor to the Administrator. Sufficient flexibility is included in the plan to permit EPA to evaluate progress and benefits at each step. Should EPA elect to initiate the alternative plan first (e.g. establish the Office of the Information Science Advisor), the functions of OTIC may be implemented and added as desired.

INTRODUCTION

> The conduct of research on the adverse effects of pollution and on methods and equipment for controlling it, *the gathering of information on pollution, and the use of this information in strengthening environmental protection programs and recommending policy changes.* (A portion of EPA's mission and purpose as initially defined by the President in his message relative to Reorganization Plans 3 and 4 of 1970. Italics added.)

BACKGROUND

Those concerned with environmental matters have shown considerable perceptiveness and consistency over the years in analyzing their information problems and determining their needs. Unfortunately, while some sporadic success has been realized in meeting goals, there has been little coordinated major effort toward providing environmentalists with what they say they want. What they say they want is "improved awareness of, and access to, environmental information." This is reported to be the most common concern expressed by some 1700 participants at the National Environmental Information Symposium held in September 1972 at Cincinnati, Ohio.(1)*

While there are certainly areas in which vital environmental data and information are lacking, the current situation appears to be that

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*The same theme was noted during the course of interviews with EPA personnel as discussed in a later section of this report.

expressed at the Symposium by William D. Ruckelshaus, then Administrator, U. S. Environmental Protection Agency:

> We may indeed, as one scientist has suggested, already have a substantial part of the scientific information we need to ensure the protection and preservation of our common environment. Yet we don't have timely access to it because retrieval systems are uncoordinated or non-existent. There is as great a need to organize and manage information as there is to make new discoveries.
>
> After some digging I found out a few weeks ago that environmental information is generated by some 75 different sources in the Federal Government alone. More than a dozen Federal agencies play some role in collecting and disseminating this information. Within EPA we have identified a number of separate information systems.(2)

Mr. Ruckelshaus really understated the proliferation of environmental information, since he referred only to the Federal Government. A demonstration study conducted by the United Nations Environment Programme to examine the feasibility of developing an International Referral Service for sources of environmental information identified over 700 sources world wide in a three week period.(3) The study was initiated as a result of one of the recommendations adopted by the United Nations Conference on the Human Environment, held in June 1972 in Stockholm.

The quantity of environmental information will continue to proliferate as new legislation, with specific information requirements, is enacted. The President's 1973 Environmental Program proposes a number of items of legislation containing specific information-related sections.(4) For example, in S. 888, H. R. 5087, the Toxic Substances Control Act of 1973, Section 19 states that:

> The Council on Environmental Quality in consultation with the Administrator, the Secretary of Health, Education, and Welfare, the Secretary of Commerce, and the heads of other appropriate departments or agencies, shall coordinate a study of the feasibility of establishing (1) a standard classification system for chemical

> compounds and related substances, and (2) a standard means for storing and for obtaining rapid access to information respecting such materials.

Similarly, in S. 924, H. R. 4862, the Land Use Policy and Planning Assistance Act of 1973, Section 101 (c) states that:

> The Congress finds that adequate data and information on land use and systematic methods of collection, classification, and utilization thereof are either lacking or not readily available to public and private land use decisionmakers; and that a national land use policy must place a high priority on the procurement and dissemination of useful land use data.

There is proposed legislation, as well, aimed at solution of the environmental information problem. Prominent among these is the Dingell Bill, H. R. 56. This bill, establishing a national environmental data system, was vetoed by President Nixon on October 21, 1972. As cleared, major provisions of H. R. 56 would have:

> - Established a national environmental data system with a central facility to serve as a clearinghouse for new and existing information on environmental matters
> - Directed that information should be gathered from federal, state, and local governments, private institutions--including educational institutions--and foreign sources; specified that information would be made available without charge to Congress and federal, state and local governments and upon payment of reasonable fees to private persons or groups
> - Authorized appropriations of $1-million in fiscal 1974, $2-million in fiscal 1975 and $3-million in fiscal 1976 for collection and dissemination of data.(5)

The President's veto message stated in part:

I am withholding my approval from H. R. 56.

My objections to this bill are centered upon two of its titles which would establish a National Environmental Data System and create environmental centers in each State. While both of these titles sound desirable in theory, they would in reality lead to the duplication of information or would produce results unrelated to real needs and wasteful of talent, resources, and the taxpayers' money.

In the form now before me, Title I of this legislation calls for the establishment of an independent, centralized environmental data system for the acquisition, storage and dissemination of information relating to the environment. Data for the system would come from governmental, international, and private sources. A Director, who would be under the guidance of the Council on Environmental Quality, would determine what data would actually be placed in the system and who would have access to the data.

I believe there are serious drawbacks to such a data system which would outweigh potential benefits. The collection of data and statistics on the supposition that some day they may be useful is in itself a highly dubious exercise. Data, taken out of the context of the questions they were specifically designed to answer, can even contribute to confusion or be misleading.

With this in mind, I believe the centralized collection of environmental data should be related to specific policies and programs. H. R. 56 fails to provide such a relationship and the question of whether this basic deficiency can be overcome, and a useful centralized system designed, is now under study by the Administration. In the meantime, the Environmental Protection Agency and other agencies have consistently worked to strengthen the acquisition and exchange of such data and this effort will continue.(5)

Despite the President's pocket veto, in early March 1973, a bill H. R. 36 (which is reportedly almost identical with H. R. 56) was

pending in the Merchant Marine and Fisheries Committee--the committee that reported H. R. 56 in the 92nd Congress.[6]

The pressures are not national alone, however. At the U. N. Conference on the Human Environment held in Stockholm in June 1972, the Declaration on the Human Environment included the following principle:

> Scientific research and development in the context of environmental problems, both national and multinational, must be promoted in all countries, especially the developing countries. In this connection, the free flow of up-to-date scientific information and experience must be supported and assisted, to facilitate the solution of environmental problems; environmental technologies should be made available to developing countries on terms which would encourage their wide dissemination without constituting an economic burden on the developing countries.[7]

The current U. N. effort to establish an International Referral Service for sources of environmental information is responsive to this principle.

An appraisal of the activities described above could lead to the conclusion that the present impetus in environmental information is largely directed toward specifying what is to be accomplished discretely rather than towards defining, developing, and implementing some coordinated mechanism for its accomplishment. This statement should not be construed so harshly, however, as to infer that no progress has been made. Many excellent information resources have been established, but unfortunately they have remained largely insular and parochial and have not returned to the environmental community the full potential of their benefits.

To a significant extent, EPA has operated in the mode just described. Some explanation for this operating mode may be revealed through a brief history of the information activities of EPA and its predecessor organizations.

BRIEF HISTORY OF EPA INFORMATION ACTIVITIES

This review of EPA information activities was extended over only the past five years, starting with the formation of the Consumer Protection and Environmental Health Service (CPEHS). At the time of CPEHS inception, the Federal Water Quality Administration of the Department of the Interior was administering those functions required by the Federal Water Pollution Control Act. In addition, Agriculture, Interior, and Health, Education, and Welfare were responsible for various aspects of the effects of insecticides, herbicides, fungicides and rodenticides. Further, the Atomic Energy Commission and the Federal Radiation Council were concerned with radiation effects.

CPEHS was established on July 1, 1968 by order of the Secretary of Health, Education, and Welfare, and consisted of three Administrations: the Environmental Control Administration (ECA), the National Air Pollution Control Administration (NAPCA), and the Food and Drug Administration (FDA). In August of that year, the Division of Management Systems initiated a survey of scientific and technical information systems within CPEHS that culminated in a November 1968 report commonly referred to as the "Hause Report".[8] Since FDA is not now a component of EPA, findings of the Hause Report with respect to FDA need not be recounted here. With respect to NAPCA, the point was made that because of the unity of interests within NAPCA it was possible to establish an Air Pollution Technical Information Center (APTIC) to service the entire administration. ECA, however, because of its broad diversification of interests, had no apparent common denominator to form a focus for a single specialized center. As a consequence, a number of separate and distinct information resources were established to meet the various needs within that Administration. Such differences, however, did not preclude the need for non-categorical information basic to several CPEHS programs nor did they preclude the possibility of effectively using common methods,

the Executive Office Building, Washington, D. C. Each administration, in addition to the oral briefing, compiled descriptive material on various information activities within its respective administration.[10] One statement in the review made by the then ECA appears to epitomize the information problem that continues to plague EPA today:

> Although we are organizationally peer to these two (FDA, NAPCA), informationally we are not their equal. Our sister groups came into CPEHS as already established organizations. Incidentally, each brought with it a developed, operating technical information element, including staffs, technical information systems of varying sophistication, standard and unique literature collections, and well defined programs. On the other hand, ECA, a newly formed agency, composed of an amalgam of groups from various sources, originated without any centralized technical information capability. The substantive components which were joined to form ECA have technical information support of differing qualities, finesse, sophistication, and development. Yet, it must be reiterated--there is no formal centralized technical information structure within ECA.

The COSATI effort was simply a review. It did not produce any specific recommendations. Shortly thereafter, however, in June 1969, a contract was awarded to examine research and development program planning needs and to develop a management assistance system for CPEHS. The study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. On the basis of the study, an Environmental Health Information Network (EHIN) was structured, incorporating the existing information and data sources, and also new resources such as the Information Resource Identification System (IRIS), and the Project Information Retrieval System (PIRS).[11]

In structuring the proposed EHIN, it was recognized that other agencies of the Federal Government had also established information and data bases that related to CPEHS responsibilities. Mechanisms for interfacing and utilizing those resources were suggested. Further, it was recognized that an operational EHIN structured as a result of that study might not be immediately achievable. Rather, EHIN represented a concept which CPEHS should build toward as it was able in order to assist in constantly strengthening its role in protecting man's environment. The conclusions and recommendations of that study are contained in Appendix A.

Although the two preceding paragraphs refer to CPEHS, there were two significant organizational changes effected during, and shortly after, the study that bear upon subsequent implementation of the study recommendations. The first change occurred about midway in the study when the Food and Drug Administration was separated from CPEHS to report directly to the Assistant Secretary for Health. Announcement of the change and the formation of the Environmental Health Service (EHS) to replace CPEHS was made in December 1969 and the separation took place in February 1970. The second change took place in December 1970 when the Environmental Protection Agency (EPA) was established in the executive branch as an independent agency pursuant to Reorganization Plan 3 of 1970.[12] Under the plan, EPA assumed responsibility for specified functions formerly executed by components of Interior, the Environmental Health Service, Council on Environmental Quality, Atomic Energy Commission, Federal Radiation Council, Agriculture, Water Pollution Control Board, and the Air Quality Advisory Board, among others.

The principal impact of the change from CPEHS to EHS was that its most advanced effort in technical information planning and operations, the Science Information Facility (SIF) of FDA, was lost to CPEHS, and that the future of the central computer facility and its services became uncertain.

The impact of the establishment of EPA was much more extensive with respect to information. This impact is well described in a document prepared for the National Environmental Information Symposium (NEIS):

> Current information resources (i.e., information sources, services, and systems), were inherited from a multitude and variety of organizations, including Federal agencies, private industry, and universities. For example, over 50 separate information facilities--libraries and information centers--were passed on to EPA when it was formed in December 1970. Supporting these information facilities were an extremely wide range of data handling equipment, computer programming languages, and computer software packages. In short, no single comprehensive, linked and coordinated information network existed. And, yet the need has been clear: to insure the optimal interaction of computers, information systems, information centers, and libraries in support of a well designed, responsive environmental information network.(13)

These successive organizational restructurings, coupled with subsequent changes internal to EPA, seriously hampered agency information planning and implementation. The effect of this organizational flux was compounded by the establishment of discrete, uncoordinated, information resources by various agency components to assist them in meeting their urgent commitments.

It is believed that two other elements also should be mentioned at this point. One of the elements is already in existence while the other is only in the discussion stage. The element in existence consists of a number of Centers of Competence. EPA's Assistant Administrator for Research and Development funds some of the Centers in accordance with an inter-agency agreement with the Department of Interior's Office of Water Resources Research on behalf of

the Water Resources Scientific Information Center (WRSIC).* As currently constituted within EPA, these Centers serve primarily to select, abstract, and index the literature within their respective areas of expertise. They generally do not analyze, evaluate, or compress technical information and data into such forms as state-of-the-art reports, technical compilations, data and design handbooks, or provide direct answers to technical inquiries. The output of the Centers is primarily disseminated through WRSIC and the Selected Water Resources Abstracts.

The second element, which is currently under discussion, is the Smithsonian Science Information Exchange (SSIE) and the possibility of its providing EPA with information support activities to enhance EPA's research management efforts.(14) The SSIE has been the subject of two recent studies--one by the General Accounting Office(15) and one by Research Planning and Management Services for the 70s.(16) The GAO report concluded that if the RPM-70 study showed that the Exchange was needed and it was decided to continue it, agencies should consider using the Exchange to the maximum in meeting the needs of the Government for information on active research projects.

The RPM-70 study made many recommendations. One was that the existing organizational arrangement comprised of a central exchange and specialized information centers be continued. A second was that the Exchange take the initiative to negotiate agreements, or new agreements, where necessary with other agencies of the Government to establish the working relationships necessary to implement the overall system operation for the newly defined system. A third recommendation was that an Executive Order be issued to establish

*There are several additional EPA contractors who serve a similar role in other environmental areas and with respect to pollution literature not primarily announced through WRSIC and who provide inputs to EPA information bases such as APTIC, NOISE, and SWIRS.

that it is the policy of the Government that, in the planning and conduct of their research programs, the executive departments and agencies shall use the system established for exchanging research information among them.

The above brief history of EPA information activities has been essentially an overview with little attention paid to specific information activities. Such activities are extensive as evidenced by the listing of almost 300 administrative and environmental support systems in the Environmental Information Systems Directory (EISD).[17] In addition, the Directory does not reflect many extramural and intramural information activities which are concealed within research and development activities (for example, not all of the Centers of Competence are identified in the Directory).* Discontinuance of some efforts and implementation of new efforts, changes of scope, and re-assignment of personnel or priorities all affect the reliability of this Directory as they have its predecessors. Although the June 1973 edition of the Directory has been used to delineate some aspects of the present EPA scientific and technical information network, changes have already occurred which interject some deviations from the various tabulations contained in this report.

Although the National Science Foundation reported estimated scientific and technical information expenditures by EPA in 1973 as $3,738,000 with $2,155,000 being allocated to intramural programs and $1,583,000 being allocated to extramural programs, the true expenditure may well approach an order of magnitude greater because of concealed activities.[18] For example, the cost of STORET alone is of the order of $6 million which causes the NSF figure to be questioned.

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*"Concealed" means those practices, both formal and informal, followed by scientists to assure that they have the necessary information and data to accomplish their assigned tasks. Such activities appear as costs within their individual R&D budgets rather than as budgeted information activities.

The staff of EPA are not only generators of information; they are also users of information. As recognized by Ruckelshaus, in the statement quoted in the introduction of this report, the problem faced by individual staff members is how to retrieve from the vast storehouse of human knowledge those facts, data, and procedures that are required at the time they are required. The cost of their individual efforts to obtain information cannot be estimated.*

The brief history of the several studies and the development of EPA's information facilities presented in the preceding pages amply illustrates earlier concerns for EPA's information and data systems. Unfortunately, these efforts have been largely ignored or only partially implemented due to organizational changes (e.g., CPEHS to EHS to EPA) and to deferral to other priorities.

During 1972 and early 1973, personnel assigned to the Office of Research and Monitoring's Research Information Division (since reorganized), aware of the proliferation of information efforts within EPA and concerned with the lack of coordination of those efforts, undertook a detailed review of previous EPA information studies. It was their conclusion that the network approach presented in the 1970 EHS report offered the most appropriate solution for EPA. However, the EHS report did not reflect current EPA policies, organizational structure, and congressional and private pressures. Further, the number of information and data resources had increased and become more complex. Because of those factors, the current study was undertaken.

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*It is reasonable to assume that U. S. problems are not significantly different from those of the Soviet Union, where figures have been published estimating that if Soviet scientists could reduce by one-half the time they lose in searching for and processing information, this would be comparable to adding 100,000 scientists to the existing scientific work force.(19)

SUMMARY OF THE RESEARCH APPROACH TO DETERMINATION OF EPA'S INFORMATION FUTURE

The research team made two major decisions which underlie the development of the research approach used in this study:

> That the team should avoid, insofar as possible, duplication of earlier work and capitalize on the results of earlier studies to the greatest extent feasible;
>
> That the principles of the earlier Battelle recommendations[11] for the establishment of an environmental information and data network were still valid but needed updating to reflect current EPA policies and organizational structure.*

The recognition by the research team of the recommendations of the earlier Battelle study, accomplished during 1970 under the sponsorship of CPEHS, is based upon the same premise of building upon prior work. However, it was considered that a fresh appraisal of the network concept would be warranted for the current study.

Based upon the above decisions, the investigation by the joint team consisting of members of EPA's Data and Information Research Division and personnel from Battelle's Columbus Laboratories focused upon three major sources of information and data.

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*See Appendix F for a tutorial on The Concept of Information Networks

Acquisition of EPA reports on projects related to study or review of EPA's technical information activities

Interviews with a small number of selected EPA and contractor personnel representing a reasonably complete cross-section of EPA information users, producers, processors, and disseminators.*

A minimal literature search effort to determine non-EPA sources of environmental information.

Analysis of the input from the three components was expected to result in the development of a network concept for EPA's scientific and technical information and the design of an implementation plan.

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*While details of the methodology are to be found in Appendix B, it is useful to point out here that due to the complex nature of the EPA organization and the scattering of the many information and data efforts throughout the organization, many more interviews were conducted than were originally anticipated. Several teams, consisting of a Battelle investigator and his EPA counterpart, visited all NERC's and virtually all Regions and Laboratories to assure as complete an investigation as possible.

THE FINDINGS

GENERAL

The present EPA scientific and technical information network generally is a free unorganized network.* Such a network permits individual systems to develop whenever and wherever they are needed. To the extent that interaction or cooperation between the diverse systems is required, the operators of each of the individual systems must establish and maintain such channels of interaction as they see fit.

Some portions of the existing network, such as the library system, are tending to operate in a more coordinated fashion. Other portions of the network are tending to deteriorate as unilateral decisions are made to discontinue some systems or to alter their mode of operation. While operational changes in themselves are not necessarily undesirable, the free, unorganized network is not always fully responsive to EPA's agency-wide needs because of the parochial orientation of the network nodes.

Some of the various individual systems were developed to assist each of the Offices in meeting its assigned responsibilities. Table 1 condenses and paraphrases those responsibilities as assigned by reference in Order 1110.18A, dated March 29, 1973. Other systems were designed within one organizational entity to be responsive to the needs of another organizational entity. It appears more appropriate, however, to review the systems in relationship to the Offices which

*See Appendix F for a tutorial on The Concept of Information Networks

TABLE 1. EPA ORGANIZATIONAL RESPONSIBILITIES*

ASSISTANT ADMINISTRATOR FOR PLANNING AND MANAGEMENT

Plans overall program activities; manages the Agency's resources; develops and conducts a comprehensive audit program; develops and conducts administrative programs and systems; and represents the Administrator in dealings with other federal agencies.

ASSISTANT ADMINISTRATOR FOR ENFORCEMENT AND GENERAL COUNSEL

Is responsible for enforcing environmental quality standards, including the gathering and preparation of evidential data and the conducting of enforcement proceedings.

ASSISTANT ADMINISTRATOR FOR AIR AND WATER PROGRAMS

Develops standards defining major types of air and water pollutants and levels of acceptability, and provides pollution control information to users and potential polluters.

ASSISTANT ADMINISTRATOR FOR HAZARDOUS MATERIALS CONTROL

Is responsible for the pesticides, solid waste management, noise, and radiation programs of the Agency.

ASSISTANT ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT

Provides supervision of the activities of Agency laboratories engaged in national or basic research, and technical policy direction of laboratories engaged in operations related to the Agency Regional Administrators.

REGIONAL OFFICES

Ten regional offices, which develop and implement an approved regional program for comprehensive and integrated environmental protection activities, represent the Agency's commitment to the development of strong local programs for pollution abatement.

OFFICE OF FEDERAL ACTIVITIES

Develops national policy for dealing with environmental problems arising from Federal facilities and federally authorized or supported activities.

OFFICE OF CIVIL RIGHTS AND URBAN AFFAIRS

Serves as the principal adviser to the Administrator with respect to equal opportunity and civil rights programs and policies, minority economic development, and the impact of agency programs upon urban core areas.

OFFICE OF LEGISLATION

Serves as the principal adviser to the Administrator with respect to legislative and congressional affairs.

OFFICE OF INTERNATIONAL ACTIVITIES

Develops policies and procedures for the direction of the Agency's international programs and activities, subject to U. S. foreign policy, and assures that adequate program, scientific, and legal inputs are provided.

OFFICE OF PUBLIC AFFAIRS

Provides public information services and support to Agency programs and operations, and develops and administers a cohesive information program for the Agency, including publications, audiovisual materials, and exhibits.

*Some titles may differ from those in existing orders undergoing revision.

support them financially. Based upon selection of pertinent systems from the Environmental Information Systems Directory, it appears that all 5 Offices of the Assistant Administrators, 9 out of 10 Regions, and 2 Offices have responsibility for, and are supporters of, information and data activities in one or more areas of application, but there is no uniform policy for administering those activities.*

Aside from organizational location, the various systems are not readily categorizable, however, and decisions made with respect to assigning many of the systems in the subsequent analysis are sometimes debatable. To facilitate consistency, guidelines, criteria, and several definitions were established, as presented in the following paragraphs.

Scope of the study was restricted to scientific and technical information systems. But it was found that some administrative and management information systems had either scientific and technical content or could be used with a scientific purpose. For example, the Personnel Management System (PMS) in Region VI, Denver, which provides a list of personnel according to 56 descriptive information displays, one of which is education, is not included; the Categorical Information Summary System (CISS) in Region X, Seattle, which provides program managers with a list of organizations and persons for consultation and information in their particular area of interest is included. The Assistant Administrator for Research and Development's Program Planning system is included since it identifies research needs, defines specific research objectives, and develops detailed plans to achieve those objectives. The Contracts Information System

*127 systems were selected. Tables 3 and 4 show their dispersion by organizations responsible for their operation. Appendix C is an alphabetical cross-reference to the Environmental System Identification Number as established for the Directory.

is not included since it is a tracking system providing only status and financial information. Some scientific and technical systems were not considered pertinent because of their narrow parochial scope; e.g., the Whole Body Counting System at the NERC-Las Vegas.

Some of the systems are considered data oriented while others are considered information oriented. The distinction between the two is as follows:*

> DATA--symbolic representation of information (e.g., letters, numerals, or other characters in a document) or the record of signals received from a sensing device.
>
> INFORMATION--the meaning assigned to data, or a description of data. Knowledge concerning some particular fact, subject, or event in any communicable form; for purposes of documentation, it has three basic criteria: existence, availability, and semantic content.

It is important that this distinction be made because of its relationship to possible networking considerations.

For purposes of this report the various environmental information systems were placed into the category of data-oriented or information-oriented based upon an analysis of their content rather than their titles. Within the data-oriented category, a further distinction was made between (1) activities which merely process and store raw data for future retrieval by others and (2) activities which manipulate the data to produce various summary and formatted outputs. An example of the former is the National Estuarine Inventory (NEI) which is scheduled to become a static management data base on current coastal zones as of 1965 and to be used to identify information needs

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*See P. 24 for amplification of these definitions.

for EPA special studies. An example of the latter is Characteristics of Water Supply Systems (CWSSI) which prepares statistical analysis reports from water quality data derived from samples of various community water supplies.

The last of the criteria is related to the current status of the systems. During the period of this study, both organizational and systems changes were effected. Although the June 1973 edition of the Environmental Information Systems Directory was used to delineate some aspects of the present EPA scientific and technical information network, changes have already occurred which interject some deviations from the various tabulations contained in this report.

ALL ORGANIZATIONAL UNITS

Out of the total of 284 environmental information systems listed in the Environmental Information Systems Directory, the research team selected 127, about 45 percent, as being pertinent to this particular study. Table 2 is a tabulation of those systems by subject category and controlling organization. Quantity alone is not the only criterion for importance, but from Table 2 it appears that information/data systems related to air and water comprise over half the total and they are principally controlled by the Assistant Administrator for Research and Development and the Assistant Administrator for Air and Water Programs.

In order to structure tables to illustrate some of the relationships between EPA organizational units, subject areas, and information systems, it was necessary to prepare a few definitions as follows:

Information Oriented

Activities that are text oriented. May be documents or merely textual descriptions of projects, activities, organizations, treatment plants. Will include that numeric material that is not intended to be arithmatically manipulated. Where there is a mixture of information and

TABLE 2. EPA INFORMATION SYSTEMS TABULATED BY SUBJECT CATEGORY AND CONTROLLING ORGANIZATION*

Environment/ Pollutant / Organization	Air	Water	Pesticides	Noise	Radiation	Solid Waste	General	Total	Percent
Office of Federal Activities							2	2	1.6
Office of International Activities							1	1	0.8
Assistant Administrator for Planning and Management	1						4	5	3.9
Assistant Administrator for Enforcement and General Counsel		1	2					3	2.4
Assistant Administrator for Hazardous Materials Control			8	1	5	1		15	11.7
Assistant Administrator for Research and Development	4	8	4		9		6	31	24.5
Assistant Administrator for Air & Water Programs	14	24						38	29.9
Regional Administrators		17	7			3	5	32	25.2
Total	19	50	21	1	14	4	18	127	
Percent	15.0	39.3	16.6	0.8	11.0	3.1	14.2		100.0

*Source: Environmental Information Systems Directory, June 1973[17].

data (i.e., text and numbers) the activity is placed in this category if the data are subordinate and not intended to be manipulated.

Data Oriented (Numeric Capable of Arithmetic Manipulation)

Raw--those activities collecting measurement data which could be manipulated, but are not manipulated by this specific activity.

Manipulated--performs statistical or other computations upon the data.

Management

Activities which are used primarily for planning, grant tracking or fund allocation decisions regardless of where the activity resides within the organization. Generally, if description included use of system for decision making purpose (other than at the research project level, i.e., whether or not results were conclusive, etc.) then the activity was included here. Also, if it was used to track the progress of a construction grant or other such activity it was included here.

General

Only if the activity contained material cutting across all subject areas of concern to EPA was it included in this category. Excluded were all information/data collections dealing with one specific area of concern such as pesticides or air quality. Also excluded were any tracking systems that, while general, could be used as a management tool primarily.

Specialized

All activities dealing with one or more areas of interest to EPA, but not cutting across the entire scope of EPA. Actually, most activities in this category turned out to be much narrower than this definition and dealt primarily with one subject of one area.

Includes only those activities in which it was indicated that the researcher used them as an intermediate step in the conduct of his research project. This did not include the systems he might use to search for relevant literature while planning or conducting a study, but did include systems that could be used to reduce his specific data prior to further analysis.

A decision to place a given system into a cell of a matrix was highly subjective and principally based upon the text of the Directory entry, supplemented by the personal knowledge of the system assigner. Other individuals could well have elected different distributions of systems. The study team strove for consistency of decision within the definitions given and considers the matrices to be reasonably accurate under the recognized conditions.

Table 3 is a numerical distribution by orientation and controlling organization. This table indicates a higher percentage of data oriented systems with about two-thirds of the systems being of the manipulated data type.

Table 4 is an expanded version of Table 3, listing system titles, identification numbers, and other related EPA systems.*

Table 5 is a matrix intended to show the numerical distribution of the various systems in terms of their purpose and their information/data orientation. Table 6 is a matrix showing the same distribution as Table 5, but with system titles replacing the numbers.

*Appendix C has an alphabetical cross-reference to the Environmental System Identification Number as established for the Environmental Information Systems Directory.

TABLE 3. NUMERICAL DISTRIBUTION OF SYSTEMS BY ORIENTATION AND CONTROLLING ORGANIZATION

Orientation / Organization	Date Oriented		Information Oriented	Total	Percent
	Raw	Manipulated			
Office of Federal Activities			2	2	1.6
Office of International Activities			1	1	0.8
Asst. Administrator for Planning and Management			5	5	3.9
Asst. Administrator for Enforcement and General Counsel	2		1	3	2.4
Asst. Administrator for Hazardous Materials Control	2	8	5	15	11.7
Asst. Administrator for Research and Development	6	14	11	31	24.5
Asst. Administrator for Air and Water Programs	5	19	14	38	29.9
Regions	7	6	19	32	25.2
TOTAL	22	47	58	127	
PERCENT	17.3	37.0	45.7		100.0

TABLE 4. DISTRIBUTION OF SYSTEMS BY SYSTEM TITLE AND CONTROLLING ORGANIZATION*

Office	Unit	System Title	Orientation+	Data Type**	EISD Category	Environmental Systems Identification Number	Related Systems
Office of Federal Activities		Environmental Impact Statement System	I		207	10009	
		Federal Facilities System	I		207	10013	206ES10132/10142 207ES10261
Office of International Activities		International Environmental Reports System	I		None	None	104ES10017
Assistant Administrator for Planning and Management		Environmental Information Retrieval On-Line (ENVIRON)	I		107	10045	
		Environmental Information Systems Inventory	I		104	10032	
		EPA Economic Dislocation Early Warning System	I		106	10264	
		EPA Library System	I		104	10017	104ES10042/10093/10310/10270 206ES10094 Intl Env Repts Sys.
		EPA Technical Publications System	I		201	10016	
Assistant Administrator for Enforcement and General Counsel		Pesticide Import File	D	R	203	10232	203ES10274/10294
		Pesticides Registration System	D	R	203	10028	203ES10039
		Refuse Act Permit Program System (RAPP)	I		207	10030	207ES10255
Assistant Administrator for Hazardous Materials Control	Office of Noise Control Programs	Noise Information Service (NOISE)	I		202	10026	
	Deputy Assistant Administrator for Pesticides Programs	Episode Reporting and Accident Investigation System	I		203	10082	203ES10219/10273/10293
		National Soils Monitoring System	D	M	203	10222	
		Pesticide Air Monitoring Data System	D	M	203	10207	
		Pesticide Community Studies Data System	D	M	203	10209	
		Pesticide Human Monitoring Data System	D	M	203	10208	
		Pesticide Test Result	D	R	203	10320	203ES10249/10272/10295
		Pesticides Analysis Retrieval and Control System (PARCS)	I		203	10083	
		Registration Records	I		203	10039	203ES10028
	Deputy Assistant Administrator for Radiation Programs	Human Bone Network	D	M	204	10087	
		Institutional Total Diet Sampling Network (ITDSN)	D	M	204	10085	
		National Environmental Radiation Data System (NERADS)	D	M	204	10084	
		Pasteurized Milk Network	D	R	204	10088	
		Tritium Network	D	M	204	10086	
	Deputy Assistant Administrator for Solid Waste Management Programs	Solid Waste Information Retrieval System (SWIRS)	I		205	10095	205ES10250/10251/10296

*Derived from Environmental Information Systems Directory, June 1973

+I = Information, D = Data.

**R = Raw; M = Manipulated.

TABLE 4. (Continued)

Office	Unit	System Title	Orientation+	Data Type**	EISD Category	Environmental Systems Identification Number	Related Systems
Assistant Administrator for Research and Development	Office of Program Management	Assistant Administrator for Research and Development Program Planning System	I		106	10243	
		Bibliography File	I		206	10094	104ES10093/10310/10017/10270
		Final Reports File (FINR)	I		104	10093	
		Project Information Retrieval System (PIRS)	I		104	10089	104ES10017/10310/10270 206ES10094
	Deputy Assistant Administrator for Monitoring Systems	Program Review and Evaluation System (PRES)	I		207	10048	
	NERC-Research Triangle Park (Air)	Community Health Environmental Surveillance System (CHESS)	I		201	10186	
		Fuel Additive Registration System (FARS)	I		201	10319	
		Users Network for Applied Modeling of Air Pollution (UNAMAP)	D	R	201	10185	
	(Pesticides)	Electroencephalographic Patterns of Monkeys	D	M	203	10316	
		Toxicology Data System	D	M	203	10317	
	(Radiation)	Feline Colony Information (The Cat System)	D	M	204	10190	
	NERC-Las Vegas (Radiation)	Air Data Management	D	R	204	10197	
		Eskimo Surveillance	D	M	204	10205	
		Indoor Radon Indepth Air Sampling Dosimetry Data Base	D	M	204	10200	
		Milk Director Information System	D	R	204	10198	
		Nevada Test Site Off-Site Human Surveillance System	D	M	204	10312	
		Surveillance Data Management	D	M	204	10203	
		Technical Reports System	I		104	10310	104ES10093/10017/10270 206ES10094
		Uranium Mill Tailing Survey Data Base	D	M	204	10201	
	NERC-Corvallis (Water)	Automated National Sensor Work Platform for Environmental Research (ANSWER)	D	R	206	10211	
		Data Aquisition for Aquatic Ecosystem Simulator	D	R	206	10220	
		Environmental Data Evaluation System (EDES)	D	M	206	10218	
		Mass Spectral Identification	D	M	206	10221	
		Sample Handling and Verification System (SHAVES)	D	M	206	10214	
		Solar Radiation Data Acquisition	D	M	206	10319	

TABLE 4. (Continued)

Office	Unit	System Title	Orientation+	Data Type**	EISD Category	Environmental Systems Identification Number	Related Systems
Assistant Administrator for Research and Development (Continued)	(Pesticides)	Data Acquisition and Processing for Agricultural Runoff Research	D	R	203	10219	203ES10222
		Toxicity Data File	D	R	203	10318	
	(General)	Automatic Indexing by Keyword (KWOC)	I		104	10183	
Assistant Administrator for Air and Water Programs	Deputy Assistant Administrator for Water Program Operations	Characteristics of Water-Supply Systems (CWSSI)	D	M	206	10080	
		Interstate Carrier Water Supply Inventory (ICWS)	D	M	206	10079	
		Sewage Treatment Plant Operation and Maintenance Data Retrieval (STPOM)	I		206	10077	
		Spill Information Retrieval System (OHM-SIRS)	I		206	10074	
		Technical Assistance Data System (OHM-TADS)	I		206	10075	
		Technology Transfer Data Storage and Retrieval System	I		206	10070	
		Water Inventory System	D	M	206	10066	
	Deputy Assistant Administrator for Water Planning and Standards	Accomplishment Planning and Reporting System	D	M	206	10044	
		Aerial Measurement of U.S. Coastal Zone	D	M	206	10068	
		Automap Subsystem (AUTOMAP)	D	R	206	10034.02	
		Beach Closure Inventory	I		206	10069	
		City Master File (STORET)	I		206	10034.04	
		Construction Grant Need Cost System (STORET)	D	M	206	10034.06	
		Fish Kill File (STORET)	I		206	10034.05	
		Generalized Cataloging and Inquiry System (GCIS)	I		206	10065	
		General Point Source File (GPSF)	D	M	206	10067	
		Industrial Waste Literature File (IWES)	I		206	10081	
		Map Inventory and Status Subsystem (MISS)	I		206	10034.03	
		Municipal Waste Needs Facilities Inventory (STORET)	D	M	206	10034.07	
		National Estuarine Inventory (NEI)	D	R	206	10076	
		National-Regional Water-Land Resources Assessment (1975)	D	M	206	10078	
		Storage and Retrieval of Water Quality Data (STORET)	D	M	206	10034	
		Water Quality File Subsytem (STORET)	D	R	206	10034.01	
		Water Quality Standards	I		206	10241	

TABLE 4 (Continued)

Office	Unit	System Title	Orientation+	Data Type**	EISD Category	Environmental Systems Identification Number	Related Systems
Assistant Administrator for Air and Water Programs (Continued)	Deputy Assistant Administrator for Air Quality Planning and Standards	Air Pollution Technical Information Center (APTIC)	I		201	10060	
		Air Quality Data Handling System (AQDHS)	D	M	201	10057	
		Air Quality Implementation Planning Program (IPP)	D	M	201	10058	
		Comprehensive Data Handling System (CDHS)	D	M	201	10046	
		Federal Power Commission Tape (FPC)	D	M	201	10059	
		Industry Study	I		201	10239	
		National Emissions Data System (NEDS)	D	R	201	10056	
		NEDS Variable Data Subsystem (YDSS)	D	M	201	10052	
		Storage and Retrieval of Aerometric Data (SAROAD)	D	M	201	10055	
	Deputy Assistant Administrator for Mobile Source Air Pollution Control	All Major In-House and Contracted Project Data	D	M	201	10063	
		Data Base of MSPCP Laboratory Test Results	D	M	201	10054	
		Library Files	I		104	10042	104ES10017
		Manufacturer versus EPA Vehicle *Testing Results*	D	M	201	10064	
		Primary Test Data	D	R	201	10240	
Regions	(Pesticides)	Pesticide Accidents File	I		203	10273	203ES10082/10293
		Pesticide Collection Report File	D	R	203	10272	203ES10249/10295/10320
		Pesticide Episode File	I		203	10293	203ES10082/10273
		Pesticide Import File	D	R	203	10274	203ES10232/10294
		Pesticide Sampling Information System	D	R	203	10249	203ES10272/10295/10320
		Pesticide Sampling Information System	D	M	203	10295	203ES10249/10272/10320
		Pesticides Import File	D	R	203	10294	203ES10232/10274
	(Solid Waste)	Leachate	I		205	10251	205ES10095/10296/10250
		Solid Waste Disposal Sites Inventory	I		205	10296	205ES10095/10251/10250
		Status of Recycling System	I		205	10250	205ES10095/10251/10296
	(Water)	Annapolis Field Office Water Laboratory Analysis System	D	M	206	10260	
		Basin Planning System	I		206	10104	
		County Population and Density	D	M	206	10126	
		Decimal Input Edit (DIPEDIT)	D	M	206	10115	
		Dissolved Gas Information System (DIGIS) (DIGIS)	D	R	206	10159	
		EPA Engineering Summary	D	M	206	10265	
		Federal Facilities Inventory System	I		206	10132	206ES10142 207ES10013/10261

TABLE 4 (Continued)

Office	Unit	System Title	Orientation*	Data Type**	EISD Category	Environmental Systems Identification Number	Related Systems
Regions (Continued)		Major Point Source and Effluent Loads-South Platte River	D	R	206	10141	
		Master System	I		207	10098	
		Microfilm-Microfiche System	I		107	10302	
		Municipal Information System	I		206	10297	
		Power Plant Program Management Information System	I		207	10119	
		Refuse Act Permit Program (Local)	D	M	207	10255	207ES10030
		Regional Map Collection Index	I		104	10101	
		Storet Station Location System	I		206	10277	
		Water Supplies Used on Interstate Carrier System	I		206	10275	
		Wheeling Water Laboratory Analysis System	D	R	206	10259	
	(General)	Categorical Information Summary System	I		207	10298	
		Environmental Residual Information System	I		207	10105	
		Federal Facilities File	I		207	10261	206ES10132/10142 207ES10013
		Federal Facilities Storage and Retrieval System	I		206	10142	206ES10132 207ES10013/10261
		Publications and Report System	I		104	10270	104ES10017/10093/10270 205ES10094

TABLE 5. NUMERICAL DISTRIBUTION OF SYSTEMS BY PURPOSE AND ORIENTATION

Purpose \ Orientation	Information Oriented	Data Oriented		Total	Percent
		Manipulated	Raw		
Management	14	10		24	18.9
General	5			5	3.9
Specialized	39	31	19	89	70.1
Tool		6	3	9	7.1
TOTAL	58	47	22	127	
PERCENT	45.7	37.0	17.3		100.0

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TABLE 6. DISTRIBUTION OF SYSTEMS BY PURPOSE AND ORIENTATION INCLUDING SYSTEM TITLES*

PURPOSE \ CLASSIFICATION	INFORMATION ORIENTED	
MANAGEMENT	Assistant Administrator for Research and Development Program Planning System Basin Planning System Categorical Information Summary System Environmental Impact Statement System Environmental Information Systems Inventory Environmental Residual Information System EPA Economic Dislocation Early Warning System	Federal Facilities Storage and Retrieval System Federal Facilities System (FEDFAC) Management Reporting System (MRS) Master System Municipal Information System Pesticide Episode File Water Supplies Used on Interstate Carrier System
GENERAL	Environmental Information Retrieval On-Line (ENVIRON) EPA Library System EPA Technical Publications System International Environmental Reports System Publications and Report System	
SPECIALIZE	Air Pollution Technical Information Center System (APTIC) Analytical Methodology Information Center (AMIC) Automatic Indexing by Keyword (KWOC) Beach Closure Inventory Bibliography File City Master File (STORET) Community Health Environmental Surveillance System (CHESS) Episode Reporting and Accident Investigation System Federal Facilities File Federal Facilities Inventory System Final Reports File (FINR) Fish Kill File (STORET) Fuel Additive Registration System (FARS) Generalized Cataloging and Inquiry System (CCIS) Industrial Waste Literature File (IWES) Industry Study Leachate Library Files Map Inventory and Status Sub-System (MISS) Microfilm – Microfiche System Noise Information Service (NOISE)	Pesticide Accidents File Pesticides Analysis Retrieval and Control System (PARCS) Power Plant Program Management Information System Program Review and Evaluation System (PRES) Project Information Retrieval System (PIRS) Refuse Act Permits Program System (RAPP) Regional Map Collection Index Registration Records Sewage Treatment Plant Operation and Maintenance Data Retrieval Solid Waste Disposal Sites Inventory Solid Waste Information Retrieval System (SWIRS) Spill Information Retrieval System (OHM-SIRS) Status of Recycling System STORET Station Location System Technical Assistance Data System (OHM-TADS) Technical Reports System Technology Transfer Data Storage and Retrieval System Water Quality Standards
RESEARCH TOOL		

*Based upon entries in the June 1973 edition of the Environmental Information Systems Directory[17] and does not reflect all changes which may have occurred since the Directory was prepared.

TABLE 6. (Continued)

DATA ORIENTED	
MANIPULATED	RAW
Accomplishment Planning and Reporting System Aerial Measurements of U.S Coastal Zone Comprehensive Data Handling System (CDHS) Construction Grant Need Cost System (STORET) EPA Engineering Summary Municipal Waste Needs Facilities Inventory (STORET) National – Regional Water – Land Resources Assessment Pesticide Sampling Information System Refuse Act Permit Program (Local) Storage and Retrieval of Water Quality Data (STORET)	
Air Quality Data Handling System (AQDHS) Air Quality Implementation Planning Program (IPP) All Major In-House and Contracted Project Data Annapolis Field Office Water Laboratory Analysis System Characteristics of Water Supply Systems (CWSSI) County Population and Density Data Acquisition System (TAME) Data Base of MSPCP Laboratory Test Results Decimal Input Edit (DIPEDIT) Eskimo Surveillance Federal Power Commission Tape (FPC) General Point Source File (GPSF) Human Bone Network (HBN) Indoor Radon Indepth Air Sampling Dosimetry Data Base Institutional Total Diet Sampling Network (ITDSN) Interstate Carrier Water Supply Inventory (ICWS) Manufacturer vs EPA Vehicle Testing Results National Environmental Radiation Data System (NERADS) National Soils Monitoring System NEDS Variable Data Subsystem (VDSS) Nevada Test Site – Off-Site Human Surveillance System Pesticide Air Monitoring Data System Pesticide Community Studies Data System Pesticide Human Monitoring Data System Solar Radiation Data Acquisition Storage and Retrieval of Aerometric Data (SAROAD) Surveillance Data Management Tritium Network Uranium Mill Tailing Survey Data Base Users Network for Applied Modeling of Air Pollution (UNAMAP) Water Inventory System	Air Data Management Automap Subsystem (automap) Automated National Sensor Work Platform for Environmental Research (ANSWER) Dissolved Gas Information System (DIGIS) Major Point Source and Effluent Loads – South Platte River Milk Directory Information System National Emissions Data System (NEDS) National Estuarine Inventory (NEI) Pasteurized Milk Network (PMN) Pesticide Collection Report File Pesticide Import File Pesticide Sampling Information System Pesticide Test Result Pesticides Import File Pesticides Registration System Primary Test Data Water Quality File Sub-System (STORET) Wheeling Water Laboratory Analysis System
Electroencephalographic Patterns of Monkeys Environmental Data Evaluation System (EDES) Feline Colony Information (The Cat System) Mass Spectral Identification Sample Handling & Verification System (SHAVES) Toxicology Data System	Data Acquisition and Processing for Agricultural Runoff Research Data Acquisition for Aquatic Ecosystem Simulator Toxicity Data File

SELECTED SYSTEMS

Some additional information was obtained about a few of the systems from personal interviews and other sources. Except for the Regional Offices, these systems will usually be discussed without reference to their organizational location.

Environmental Information Systems Inventory

This system is the base for the semi-annual publication of the Environmental Information Systems Directory and the unpublished Reference Index of Environmental Information Systems Hardware and Software. Maintenance of the Directory and Index is dependent upon voluntary completion and submission to the Management Information and Data Systems Division of an Information Systems Resume' Form whenever a system changes or a new system is developed. There is no obvious mechanism with which to police compliance with the requirement for form submittal.

EPA Library System

The EPA library at Headquarters serves as the focal point for the library network.[20, 21, 22, 23] The EPA library system consists of approximately 30 libraries located in the Headquarters, ten Regional Offices, and the four National Environmental Research Centers (NERC) including their satellite libraries. Some of the libraries were initiated in some other organizational form almost 25 years ago; some are of 1973 origin. The Headquarters Library was activated in 1972 with the former Federal Water Quality Administration Library as its nucleus.

There is a great disparity, even at comparable organizational levels, among resources and capabilities of the various libraries. Funding is erratic and may consist of only one man year of effort in one Region, while it may be four man years in another Region. In some instances, the library functions are performed by personnel who have

not had a formal education in library science. In a substantial majority of the libraries, the librarians do not have adequate resources, or technical subject knowledge to undertake direct interrogation of available computerized data bases.

The Library Systems Branch has only a functional operational relationship with the other libraries. It has neither any administrative responsibility, nor any authority. Despite this handicap, the Chief, Library Systems Branch is developing the libraries into a coordinated network.

At the present stage of its development, the library network activity falls into two principal categories: 1) basic library inventory systems and 2) literature retrieval systems. In the first instance, the Headquarters Library provides a centralized source of literature holdings in the form of journals, books, and microform material. Each library in the system submits data on its holdings to EPA Headquarters where a computerized data base is maintained and a print-out of holdings is produced for all libraries.

In the area of literature retrieval, in addition to local library resources and the inventory print-out, there is a central technical focal point in the library system at the NERC Cincinnati which has access to about 30 computerized data bases containing over eight million document citations. Both on-line and batch searches are available as well as selective dissemination of information. A few of the libraries have recently acquired terminals so they can interrogate selected data bases (frequently used and judged of value) without going through the NERC interface.

One other item of interest is that the Air Pollution Technical Information Center (APTIC) has provided each of the libraries at NERC and Regional Office levels with a microfiche file of APTIC holdings. An APTIC search provides microfiche accession numbers for library retrieval.

Pesticides Registration System

This system is a raw data system which produces listings of chemical ingredients of a pesticide formula and the approved practices for pesticide uses. It is understood that tapes from this system will become a component of the Pesticides Analysis Retrieval and Control System (PARCS). Input into this system is received from the Registration Record System which is under the jurisdiction of the Assistant Administrator for Hazardous Materials Control.

Pesticides Analysis Retrieval and Control System (PARCS)

PARCS has recently been developed. It assimilates most of the existing information/data bases on pesticides with the objective of providing a centralized information resource to coordinate nationwide enforcement or analysis. In those cases where systems remain organizationally external to the Office of Hazardous Materials Control, selected output tapes from those sources will provide input to PARCS.

Noise Information Service (NOISE)

A thesaurus is under development. This thesaurus is expected to be incorporated into the system and available on-line to aid the user in formulating his search strategy. With NOISE becoming a viable system, its relationship with the Transportation Noise Research Information Service at the Department of Transportation should be carefully considered.

National Environmental Radiation Data System (NERADS)

NERADS is intended to be the data management system for all radiation monitoring and will also include a modeling capability for the calculation of population dosage. The nucleus of NERADS will be composed of the Pasteurized Milk Network (PMN), the Human Bone Network (HBN), the Tritium Network, and the Institutional Total Diet Sampling Network (ITDSN). Each of those networks monitors radiation levels in the particular subject area indicated in the system title.

International Environmental Reports System

This system contains summaries of foreign government environmental reports received by EPA through document exchange programs with foreign countries. Computer generated reports are intended to alert the agency to major environmental developments around the world. The system produces reports by category (legal, planning and management, scientific and technical, and socio-economic), by country, and by subject (air, water, pesticides, radiation, solid waste, noise, and general).

This system currently places minimum emphasis upon scientific and technical information to avoid duplicating efforts being conducted elsewhere. The initial annotated bibliography produced contains reports of legislative and regulatory aspects of environmental quality. There also will be 24 issues (2500 copies each) of an abstract bulletin containing 500-600 abstracts per issue. The system is treated as a component of EPA's in-house library systems.

Principle 20 of the Declaration on the Human Environment stressed the need for free flow of up-to-date scientific information to the developing nations. Although little current effort in this respect is being expended by the Office of International Activities, a staff member is serving on the U. S. interagency committee formed to assist in the development of the U. N. International Referral Service for sources of environmental information.

Project Information Retrieval System (PIRS)

PIRS contains information on active and completed research, development, and demonstration projects funded by EPA and is part of the ENVIRON system. It is understood that consideration is being given to performing PIRS functions through the Program Planning System. The effect of such a decision on the negotiations initiated with the Smithsonian Science Information Exchange is not known at this time.

Storage and Retrieval of Water Quality Data (STORET)

Data systems are predominant within EPA. The major system, with its many associated bases, is STORET, which has terminals in 37 states and processes 1000 requests per day at an annual cost of about $6 million. Yet user attitudes toward STORET are highly polarized with respect to its true value to the water programs community. In 1972, the Office of Audit made an evaluation of STORET in which it was pointed out that evaluation and control of EPA's data bases was not, but should be, centralized. (For some of the other on-line systems an appraisal is being made to determine whether the cost of on-line storage is justified by data base usage.)

Air Pollution Technical Information Center (APTIC)

The current status of APTIC is being reviewed and some operational changes are likely to be effected, but APTIC is expected to continue to operate at some lower level of effort with perhaps greater orientation towards application programs. APTIC also will convert to a UNIVAC 1110 and will become more terminal oriented and searchable, for example, from the regional offices. This will make the regional libraries' store of APTIC microfiche more rapidly accessible.

Regional Offices

Thirty-two information/data activities controlled by the regions were selected as pertinent to this study. Their distribution among the regions by subject category is shown in Table 7.

Over half of the systems are water related and three-quarters of the systems are water or pesticides related.

TABLE 7. INFORMATION SYSTEMS REPORTING TO REGIONAL ADMINISTRATORS TABULATED BY REGION AND SUBJECT CATEGORY

Region / Subject	I	II	III	IV	V	VI	VII	VIII	IX	X	Total	Percent
Pesticides	1						3			3	7	21.8
Solid Waste	2									1	3	9.4
Water	1	3	2	1	1	2	3	1		3	17	53.2
General		1	1				1	1		1	5	15.6
TOTAL	4	4	3	1	1	2	7	2	0	8	32	
PERCENT	12.5	12.5	9.4	3.1	3.1	6.3	21.3	6.3	0.0	25.0		100.0

CENTERS OF COMPETENCE

The Water Resources Scientific Information Center (WRSIC) conceived the idea of Centers of Competence as a means of obtaining high quality abstracts and associated indexes and, more importantly, acquisitions with high relevancy to the various subject areas of interest to the water resources community. By using organizations having high technical competence to provide input to WRSIC, a quality information base could be built which would truly meet the needs of its users.

The number of Centers has fluctuated as new Centers encompassing new subject areas were initiated, while others no longer of interest or the victims of financial cutbacks were disbanded.

At the present time 14 Centers are understood to be viable. Table 8 lists the Centers of Competence as identified in the September 15, 1973 issue of Selected Water Resources Abstracts. The list contains 18 Centers because of the time lag in recognizing and reporting Center changes.

EPA's Role in Centers of Competence

On September 8, 1971, EPA entered into an inter-agency agreement between the Assistant Administrator for Research and Development and Interior's Office of Water Resources Research for processing all water related reports resulting from the EPA inhouse or sponsored activities into the WRSIC system, and for cooperatively establishing certain literature centers of competence which would be mutually advantageous and cover the field of water pollution. This agreement superseded an agreement of November 19, 1969, which predated the organization of EPA. On August 2, 1973 a letter from Stanley M. Greenfield, EPA Assistant Administrator for Research and Development, to Warren A. Hall, Acting Director of the Office of Water Resources Research, continued the terms of the agreement pending receipt of the

TABLE 8. CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE*

Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.

Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.

Eastern United States water law at the College of Law of the University of Florida.

Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.

Water resources economics at the Water Resources Center of the University of Wisconsin.

Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.

Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.

Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Water well construction technology at the National Water Well Association.

Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.

Public water supply treatment technology at the American Water Works Association.

SUPPORTED BY THE ENVIRONMENTAL PROTECTION AGENCY
IN COOPERATION WITH WRSIC

Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.

Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.

Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.

Coastal pollution at the Oceanic Research Institute.

Water treatment plant waste pollution control at American Water Works Association.

Effects on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.

*As listed in the September 15, 1973, issue of Selected Water Resources Abstracts.

recommendations forthcoming from this study.[24] A copy of the September 8, 1971 agreement is shown in Appendix D.

As a result of the interagency agreement, a number of Centers of Competence in the areas prescribed by the agreement were established. The Centers' numbers and natures have fluctuated, and at the present time only three of the EPA supported Centers shown in Table 8 are understood to be active.*

Under the agreement, abstracts prepared by the Centers are provided to WRSIC in return for 300 copies of Selected Water Resources Abstracts and 100 computer searches of the WRSIC data base. Of the 15,599 abstracts announced in Selected Water Resources Abstracts during the one-year period starting October 1, 1972, EPA supported Centers provided 4127 abstracts and EPA provided 187 abstracts of its reports. The combined EPA contribution was about 27.6 percent of the total.

A disturbing fact is that while it is possible to monitor the initiation process for a Center of Competence by following its path through the steps of Needs, Environmental Research Objective Statements (EROS), and the Research Objective Achievement Plans (ROAP), it is not possible to monitor positively the demise or change in a system.+

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*The three Centers are: 1) thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University; 2) agricultural livestock waste at the School of Environmental Science of East Central State College; and 3) methods for chemical and biological identification and measurement of pollutants at the Methods Development and Quality Assurance Laboratory (MDQARL, formerly AQCL) of EPA. The Environmental Information Systems Directory lists only the last center by including the Analytical Methodology Information Center operated for MDQARL by the Columbus Laboratories of Battelle Memorial Institute.

+During the course of the investigative interviews, the question was raised by one of the NERC's, "How long do we continue our funding of this Center of Competence? We could better use these funds for research. Shouldn't Headquarters fund this activity?" The activity referred to represents an important aspect of water pollution.

Under such conditions, EPA's Data and Information Research Division (EPA's coordinator for the agreement) may only learn about a termination when WRSIC fails to receive the input and consequently inquires of the Division. Since input cycles vary greatly from Center to Center, WRSIC may encounter long delays before being fully alerted to the true situation.

If funding for a system is discontinued by a given EPA program area manager and the manager fails to properly report system termination, the disestablishment of the system may go unnoticed for a long period of time. Continuity of operation, trained staff, and credibility are lost as a result. This situation is not unique for the Centers of Competence. It exists in a parallel fashion for other EPA information components.

INTERNATIONAL REFERRAL SERVICE

In June 1972, the United Nations convened the Conference on the Human Environment at Stockholm. One of the matters on the agenda was discussion of the educational, informational, social, and cultural aspects of environmental problems. Some of the recommendations for international action in dealing with the exchange of information were as follows:[25]

> It was recognized that there are many initiatives to promote the networking of existing information systems so as to increase their usefulness and to avoid the unnecessary duplication of effort. Because of these initiatives, access to sources of information was identified as the most important problem to be tackled as a beginning and proposals were developed for a modest International Referral Service for sources of environmental information. Such a service would enable the maximum benefit to be gained from the exchange of information about local, national and international research, application, and legislative and management experiences in environmental matters.

The Referral Service would cover the five substantive subjects of the Conference agenda: planning and management of human settlements for environmental quality; environmental aspects of natural resources management; identification and control of pollutants and nuisances of broad international significance; educational, informational, social and cultural aspects of environmental issues; development and environment; and, on the other hand, should catalogue all relevant governmental and international sources of

- data
- technological and scientific information
- social and economic information
- legislative, administrative and policy information
- public information

The Referral Service would collect, with the assistance and advice of Governments and of the bodies of the United Nations system, the entries which will form its working catalogue of information sources. Each entry to the catalogue would contain the name, address, cable and telephone number of the information source, together with details of controlling body, function, subject coverage, services and availability. These attributes would be sufficiently categorized, indexed and annotated to ensure efficient retrieval.

. . .

The survey by the Conference secretariat of the relevant information gathering and disseminating systems of United Nations bodies and of some of their clients has shown that an initial catalogue of sources of information could be easily assembled with the assistance and advice of governments. Consultations with the International Computing Centre have shown that the right kind of modern computing facilities for the Referral Service are present in Geneva and that an appropriate terminal is housed in the Palais des Nations.

The setting up of the International Referral Service which was proposed in recommendation 101 of the Action Plan was approved at the Stockholm meeting.

In June 1973, a demonstration of the International Referral Service (based upon a pilot data store of 700 information sources) was made before the Governing Council of the United Nations Environment Programme.(3) EPA was represented on the working group and had provided the project with extensive source information. The trip report of the EPA representative contains the following sentences:

> In the final analysis, one of the major benefits of such a service would be the domestic requirements for participation in such an international service. Clearly before any country would participate in the IRS, it would have to have a proper knowledge of its own environmental resources. Gaining such a knowledge would be an exercise that would probably benefit every country in the world today.

At the June meeting referred to, the U. N. authorized an expenditure of $200,000 for development of an operational model of the IRS. At the time of this writing, no substantial progress has been made.

INFORMATION RESOURCES OUTSIDE EPA

A review of 30 directories identified as containing pertinent material led to selection of 10 as being most productive. The ten are identified in Appendix I by an asterisk before each directory entry number.

Table 9 is a matrix showing the distribution relationships between the controlling organizations and the type of pollution or environment information resource selected from the directories. While the Federal Government is often thought to be the main source of environmental information, Table 9 indicates that information resources are

TABLE 9. DISTRIBUTION OF NON-EPA INFORMATION RESOURCES*

Subject / Organization	Miscellaneous Environmental Health Toxicology	Multiple	Air	Water	Pesticide	Noise	Radiation	Solid Waste	Total	Percent
Federal	16	100	19	60	21	16	27	9	268	22.8
State and Territories	3	90	17	127	54	–	31	15	337	28.7
Universities	16	71	14	123	18	5	19	1	267	22.8
Academies Libraries Societies Associations Information Centers Councils Companies Not-For-Profit	12	110	19	51	18	12	13	11	246	20.9
Abstracting and Indexing Services	11	24	6	11	1	3	1	–	57	4.8
TOTAL	58	395	75	372	112	36	91	36	1175	100

*This table was constructed from entries found in 30 directories, and it was not practical to eliminate all errors due to duplications and out-of-date listings.

about equally distributed into four classes. Although the Table does not consider aspects such as quality, quantity, size, cost, or accessibility, the distribution suggests that use of a network might make a large and viable information base available to EPA staff members to augment existing internal resources. Many of the 127 systems selected from the Environmental Information Systems Directory were of such a nature to make it unlikely they would appear in other directories. If this assumption is correct, EPA information resources represent far less than half of the Federal resources and less than 10 percent of all resources.

The research appears to bring out two important points. The first is that the network concept seems to merit consideration for dealing with large numbers of widely distributed information resources, e.g., 372 for water. The second is that the value of a printed directory is highly transient because the directory becomes outdated so quickly. If EPA elects to maintain a directory of its own or outside information resources, it should develop a methodology to keep directory entries current, whether in print or non-print form.

RESULTS OF PERSONAL INTERVIEWS

During the study, personal interviews with 131 individuals were completed. Of those internal to EPA, 4 were within staff functions and 121 within line functions. The staff interviews were 1 in the Office of Federal Activities, and 3 in the Office of International Activities. The line interviews were as follows:

Assistant Administrators

Planning and Management	2
Enforcement and General Counsel	2
Hazardous Materials Control	12
Research and Development	62
Air and Water Programs	6
Total	84

The interviews under R&D can be further broken down as follows:

Headquarters	11
NERC's	29
Laboratories	22
Total	62

Thirty-seven interviews were held in seven of the ten regions.* The remaining six interviews were held with EPA contractors or former contractors.

A list of interviewees is contained in Appendix E. The interviewees represent a very diverse range of interests compatible with the interviewees' assigned responsibilities and positions within the hierarchy of EPA. Persons interviewed were managers, researchers, administrators, enforcement people, surveillance people, and information/data people, among others. In order to deal with this diversity, the views of the interviewees have been aggregated and categorized into the following subject areas:

- Information transfer
- Users
- Data bases
- ADP requirements
- Standards

The categories are not mutually exclusive; they are highly interdependent, but continued repetition in other categories of findings initially reported in one category was not considered warranted. This approach, therefore, requires some thought transference by the reader. In some instances, statements related to the results of the interviews could be interpreted as analysis of the findings, but they are included so that continuity of thought is not interrupted.

Information Transfer

There were many comments and conclusions concerning the process of information transfer within EPA--most interviewees had something to

*Atlanta, Chicago, and Kansas City were not included.

say about this. While the process is highly complex and there are many successful functions of information transfer within EPA, the overall process is not well understood within the organization. EPA is heterogeneous in terms of its information users. This is true not only between levels but within levels of administration within the Agency. Some groups operate autonomously with little recognized need for outside information, others rely heavily on interaction with outside sources. While this could be expected where functions were highly different, it is caused as much by individual differences among staff members approaching the identical task.

Many individuals who are clearly highly proficient in their own fields are constantly having to work within the constraints of limited knowledge concerning information transfer. This is reflected in their inclination to function without using all available information sources and tools and their lack of inclination to influence potential information sources in the directions appropriate to their needs.

In many cases two groups with highly similar interests have very low interaction. Formal attempts at promoting communication within EPA have not been too successful. While there exists a structure of contact points within EPA to perform liaison with other government agencies, there is no viable structure to promote inter-group communication within the agency. The Computer Sciences Corporation (CSC) study resulted in a directory of information and data resources that generally has not been effectively used[17]. Its dissemination currently has been spotty and even where it is available it is not used extensively as a reference tool.

It appears that, in effect, knowledge and use of the conventional or traditional relevant information resources, both external and internal, is not fully exploited within EPA. This potentially results in under-utilization of resources available for application to EPA's problems.

The diversity in EPA demands for information can be categorized into horizontal interests and vertical interests as shown in Table 10. Horizontal interests can be generalized as applying principally to nonmanagement personnel who are usually involved in day-to-day operations. Vertical interests can be generalized as applying principally to management personnel who are usually involved in the functions of planning, organizing, and controlling at various periods forward in time.

The process of information transfer differs depending upon whether horizontal or vertical interests are to be served. Individuals with horizontal interests are more likely to utilize the conventional types of information services (e.g., document storage and retrieval systems, announcement services, and bibliographies) than are individuals with vertical interests. But they also depend very heavily upon direct interaction with a peer group to the extent permitted by organizational barriers. Individuals with vertical interests use the conventional services to a much lesser extent, although they do find such items as directories and reports useful when transferring information upward in the hierarchy. Such individuals more frequently require specialized information research capabilities such as advisory services or information analysis centers to provide rapid analytical responses to their information needs.

Identified formal components of EPA's existing or planned information efforts were essentially passive. Broadly speaking, the term "passive" denotes an information system, principally archival, that is normally activated only by requests from outside the system and that provides non-analytical responses to the requests received. Within EPA several documentation-type systems deal with subject matter impinging upon areas of interest to the various Offices. The majority appeared to provide primarily bibliographic and abstract services. Many automated data bases were active in the sense that

TABLE 10. EPA RESEARCH, SCIENTIFIC AND TECHNICAL INFORMATION INTERESTS*

("Demands" for Information)

Horizontal Interests	Vertical Interests
1. Details of new techniques and findings in same or similar scientific and technical disciplines.	1. Overall statistical summaries and overall condensations and application of R&D results
2. Detailed progress and results related to supplementary, supporting, or competing systems	2. Evaluation of impact of significant R&D and application results
3. Detailed results of applications, especially where more than one subagency is involved or potentially affected	3. Warning limits and danger signals
4. Technological details and available equipment developments having possible general application	4. Notice and evaluation of significant new approaches
5. Details of technical specifications relating to R&D requirements and priorities	5. Predictions and forecasts of technology, with implications
	6. Risk assessment
	7. Key specialist identification, and other means for fast answers to questions from mandatory sources

Emphasis of Demand

As level of demand goes upward, emphasis tends to be more on:

Recommendations rather than R&D results.
Breakthroughs rather than "plodding" developments.
Full-scale applications rather than small or lab-type applications.
Impact evaluation rather than technical development as such.
Predictive and planning rather than retrospective or ongoing.
Self-initiated, automatic information useful for "offensive" purposes, rather than requested or "defensive" information.

*Derived from "A Study of the Technical Information Requirements of the Department of Transportation", Battelle's Columbus Laboratories, October 15, 1972.

they initiated the publication of compilations from their holdings, but they were not reactive to the specific needs of their potential users.

If current known practices were to continue, EPA would operate essentially in a "pull" rather than a "push" mode. The "push" mode implies that the information service takes an active approach to user needs, providing much of what is needed before it is requested. In contrast, the "pull" mode, the traditional library approach, requires the user to take the initiative in acquiring information. In other organizations with both widespread indifference to the concept of an information system and frequent belief by individuals in their own ultimate ability to achieve their information goals despite frustrations, it has been advantageous to foster those courses of action that make the information system posture more dynamic, responsive, and interactive, and hence, a more integral part of the management, research, and operations processes.

The dichotomy of information interests described earlier is not unique to EPA. Unfortunately, such dichotomy has sometimes retarded the development or operation of basic information services that adequately provide valuable support to the researcher or engineer at the detailed working level, but which have little or no direct utility for those people who allocate the research resources and who need information support in special forms. In such situations emphasis must be placed upon providing special information support to the decision makers, and upon the need for the basic information services as the foundation that makes the special support possible and viable.

Users

There has been a proliferation of computerized information systems in recent years that has been received with mixed enthusiasm. Specific comments regarding particular data bases are included in the next

section; comments pertaining to general user characteristics are included here.

There was evidence of lack of sophistication regarding computerized information systems among many potential users in the EPA interviews. This was typified by the expressed desire to merely "hit a button" and retrieve all necessary information and data. Those users actually experienced with EPA systems realized that effective retrieval required considerable interaction and that no system could satisfy real needs by just "hitting a button".

If users are to be truly considered in automated on-line systems there must be a high degree of browsability in the file structure. Without this important characteristic there is little need for the scientist to have a direct hands-on capability. A concomitant requirement for such a system is a highly user-oriented language geared toward the researcher and not the information scientist. The system must become simpler and not more sophisticated until the user is ready for such sophistication.

The previous statements apply to user-oriented on-line systems. What may be a more pressing need is the development of improved information services for those users not familiar with or interested in computerized systems--and with little time or motivation to become expert in their use. Placing the emphasis on these users and their requirements does not preclude the use of advanced computerized information systems, but does introduce the need for an information interface person to assist the end user in filling his information needs. The majority of users encountered during the field survey would be better served by such an interface.

The NERC-Cincinnati is the most active component in EPA in providing an information interface, but it is a less than perfect, although valuable, mechanism. First, of the some 30 data bases accessed, only

AMIC, SWIRS, APTIC, and ENVIRON (including its 6 component bases) out of EPA's many information/data systems are queried. Of course, systems like STORET can be, and are frequently, accessed directly and the need for an interface is minimal. Second, the NERC-Cincinnati is principally utilized by other libraries through the library network although Region I also uses the NERC to expand its information base on leaching. This library sequencing has the effect of imposing two layers of transfer between the inquirer and the information/data base. Since the two interfaces are not likely to be subject knowledgeable, this process is not highly conducive to relevant information retrieval. Finally, as more users take advantage of the NERC service and no staff adjustments are effected, throughput begins to be degraded and response time approaches the limit of user tolerance.

Mention was made earlier of the horizontal and vertical information interests existing within EPA. These interests can be characterized in other fashions which tend to demonstrate that user needs differ widely. One characterization is by subject: water, air, pesticides, radiation, noise, solid waste. Presumably, many EPA personnel can circumscribe their information needs to a single subject area. But other activities such as the environmental impact statements and the international environmental reports are agency-wide with respect to information requirements. Thus, an administrative decision, for example, that air data and water data for a given location be processed into two distinct information systems, although perhaps justified for many reasons, makes the information acquisition effort more difficult for some components of EPA. A second means of characterization is the function which the user serves. Typical of this characterization is the distinction between the information needs of the researcher and those of operations oriented personnel in regulatory areas such as permits and enforcement. Regional representatives are highly oriented toward data gathering and retrieval

to support their enforcement responsibilities. They are only limitedly oriented toward the problem of retrieval of scientific and technical data to support research roles that are of concern to them. For information in the scientific area they rely most heavily upon personal contacts, supplemented by the technology transfer program and by research reports. The potential role conflict within EPA is somewhat exemplified by the current controversy over the adoption of automobile engine exhaust-cleaning catalysts. According to The New York Times, the research arm of EPA held that the devices would create a bigger medical risk through the creation of sulfates and sulfuric acid mists than would exist if the carbon monoxide, hydrocarbons, and oxides of nitrogen remained uncontrolled.[26] This view met with strong opposition from EPA regulatory officials who doubted that there was a problem.

Tables 2, 3, 4, 5, and 6 show the distribution of the various information/data oriented systems presently within EPA and presumably established to be responsive to user needs as described earlier.

Data Bases

The variety of information and data requirements throughout the agency suggests the need for a hierarchical organization of files. As an example, the Regional Offices need and have more complete information on their own activities (e.g., federal facility compliance) but portions of their information are required in headquarters' systems to provide a comprehensive (though less complete) overview. The reverse of this concept implies that data bases developed at headquarters do not satisfy requirements of the regions and laboratories. A notable exception to this and an example of a data base which should be maintained at the Agency level is a system for ongoing projects. Another example of a file to be maintained at the Agency level is a reference or directory to what files and resources are available.

This file should not be considered the final solution to the referral problem, however, since many who could use available resources may never use the referral file. The referral file might prevent several small but useful files from being overlooked. (As an example, there is a file of EPA ADP terms maintained in Corvallis that could be useful to the entire Agency.)

Data files developed at the operational level have an implicit shortcoming with respect to widespread utility. Most data users seem to trust only their own data. The widespread availability of other scientists' data files can still be useful with respect to the techniques of data manipulation, if not to the data stored. There was indication from many of the interviewees that this was a perceived utility of a system like STORET. Add to this the trend toward enforcement within the Agency and the utility of historically oriented data bases of the centralized type becomes even more questionable. The interviewing, in fact, indicated a high degree of polarization concerning such centralized files with most individuals opposed to such centralization for reasons discussed in the section on ADP requirements.

There is variation in the management of information/data bases in the sense of their control in some cases by ADP personnel who are "subject transparent" and in other cases by subject specialists who provide intellectual input.

With the above points in mind, important decisions must be reached with respect to determination of the organizational location of an information/data activity and its relationship with ADP functions from a management standpoint.

ADP Requirements

Just as was the case with information/data requirements in EPA headquarters as opposed to laboratory and regional organizations, the ADP

requirements of these various groups differ,[27, 28]. There are two opposing forces at work here. First, decentralization of computer facilities causes a problem of duplication of activities. Second, centralization limits the capabilities for ADP activities within the other groups. In addition, with relation to information and data resources, a centralized coordination of the development and growth of ADP activities appears to be highly desirable.

The uncoordinated growth of central ADP activities is seen by other EPA groups as consuming resources that could be used by their own activities. As the development of a national information resource within EPA proceeds, there will be an increase in regional and laboratory ADP requirements. This will require an aggressive coordination program between headquarters and the various concerned groups*.

One area where consolidation of resources was considered useful was that of systems programming staff. Many groups would prefer to tap a pool of programming talent rather than support a full-time staff member for this purpose.

Information Standards

There was an expressed concern for better information standards in two areas:

(1) The quality of technical reports within the Agency was seen to vary widely by scientists at the operational level. Guidelines for quality as well as content and format were considered desirable.

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*Paragraph 5 (covering the Management Information and Data Systems Division) of EPA Order 1110.16A as approved by the Assistant Administrator for Planning and Management on August 2, 1973 appears to establish this control and coordination function.

(2) Standards for documentation of computer programs were considered necessary at the Agency level to promote effective exchange of programs across various groups within the Agency.

The problem of thesaurus standardization was not investigated to any great depth, but it appears that the vocabulary-control conclusions and recommendations made for EHS in 1970 should be reviewed thoroughly before a decision to standardize is reached. Those conclusions and recommendations modified to reflect the EPA organization rather than EHS follow:

> Multiple, small, special-purpose information systems exist now and will probably persist within the administration of EPA in the future. This is even more probable with the changing structure of EPA activities at the administrator, assistant administrator, and office levels.
>
> System sophistication varies considerably among information activities within EPA, as does staff training in information-handling techniques.
>
> Current vocabulary-control techniques are not consistent, nor do they conform to what are now considered accepted thesaurus-building rules.
>
> Vocabulary-control techniques currently employed by EPA activities appear to serve the needs of the immediate group served by the system.
>
> On the basis of the above conclusions, the EPA information facilities should consider the following recommendations:
>
> (1) Allow a maximum of flexibility in structuring a thesaurus to each system currently in use or under development. Growth of new special-purpose information systems should not be stifled by creating a unified vocabulary at this stage of development. This is especially true for an organization as flexible as EPA.
>
> (2) Enforce accepted thesaurus-building rules across the board at the EPA level. This will initiate establishment of a compatibility of the various thesauri in terms of cross-reference techniques

> and similar devices. Efforts should also be made to instruct the various information activities on the general differences and applications for thesauri as opposed to alphabetical or hierarchical lists of clue words. This type of groundwork is essential if effective interchange of information between the various information systems is to occur.

Although a number of EPA information systems make use of microforms, the question of possible standardization did not arise during the interviews. However, this is a current concern and is a likely candidate for early investigation.

ANALYSIS OF THE FINDINGS

GENERAL

The findings just recounted appear to confirm the statements about the EPA information status made by Ruckelshaus at the National Environmental Information Symposium in September 1972. There are a large number of heterogeneous information/data activities dispersed irregularly throughout EPA today very much as activities were at the formation of EPA in December 1970. Many of these activities are not guided by national or agency environmental goals except to the extent that while satisfying the needs of their immediate funder, they also contribute to the achievement of national goals.* Such systems are very vulnerable to parochial initiation and termination.

THE PRESENT EPA INFORMATION NETWORK

The research team selected 127 information systems listed in the Environmental Information Systems Directory as being pertinent to the scope of this study. These systems generally function at present within a free unorganized network,+ but represent only a small fraction of the total sources of environmental information.

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*Some, however, were initiated to meet legislative requirements (e.g. water supplies used on Interstate Carriers System, under Subpart J of the Interstate Quarantine Regulations, Department of Health, Education, and Welfare, Public Health Service, Federal Register Rules and Regulations, Title 42, Public Health, Chapter 1, Part 72, Interstate Quarantine, Subpart J, Drinking Water Standards, pp. 2154-2155, March 6, 1962).

+See Figure 5, Appendix F.

The IRS demonstration project identified over 700 sources in only a three week period. Battelle's brief survey of the literature, with little emphasis upon foreign sources, disclosed about 1,200 sources.* The members of differing "invisible colleges" were largely undisclosed, but the use of the process at various levels was frequently reported.+

Although the total number of 127 different information systems within EPA seems rather large, and unmanageable, there are several factors that must be considered. First, there is some effort underway in the pesticides and radiation areas to consolidate some data bases into single multiple base systems. Second, many of the systems listed independently are actually in the STORET fold. Third, an examination of the distribution of the systems by subject category and controlling organization reveals that no single organization has a very large number of systems.

For example, Table 2 shows that there are 49 systems dealing with water. Table 7 shows that the 17 regional systems are distributed over 9 regions, with the maximum number in any region being 3. Of the eight systems controlled by the Assistant Administrator for Research and Development, six are concentrated at the NERC-Corvallis as shown in Table 4. Of the 24 systems controlled by the Assistant

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*This survey served to emphasize the transient value of directories of information resources.

+Derek J. de Solla Price, Avalon Professor of the History of Science, Yale University, pioneered in the scientific analysis of the modern growth and organization of scientific manpower and literature. He coined the phrase "invisible college" for the nucleus of prestigious researchers in a subfield of science who keep each other informed about new results and new activities. They keep track of one another's work through visits, seminars, and small invitational conferences, supplemented by informal exchange of written material long before it reaches archival publication. In contrast, technologists keep abreast of their field by close association with coworkers in their own organization; they are limited in forming invisible colleges by the imposition of organizational barriers.

Administrator for Air and Water Programs, 7 are under the Deputy Assistant Administrator for Water Program Operations and 17 under the Deputy Assistant Administrator for Water Planning and Standards as shown in Table 4. Of the latter 17, 8 are in STORET.

It appears that, within EPA, overlap and duplication between systems are not likely to occur within any given controlling organization. The scope of this study did not include a detailed investigation of duplication but a few possible instances were noted. It must be remembered that duplication, per se, is not necessarily undesirable. One situation where duplication may exist is in the agricultural livestock waste center of competence which processes its abstracts through WRSIC and publishes an annual bibliography, while one of the subject fields covered by SWIRS is also animal manures.(29) Another possible area of duplication relates to the Pesticide Import File under the Assistant Administrator for Enforcement and General Counsel with pesticide import files also maintained by Region VII, Kansas City, and Region X, Seattle. The area of announcement of EPA reports also seems to be covered by quite a few systems. Within EPA, the following systems deal with some aspect of report announcement: EPA Library System, Bibliography File, Final Reports File, Technical Reports System, and the information centers such as AMIC, APTIC, NOISE, and SWIRS. Outside EPA are AEC, NTIS, and WRSIC. Perhaps, some changes could be effected in that structure.

Still another possibility (but interagency related) is the mass spectral identification being undertaken at BCL under the sponsorship of the Southeast Environmental Research Laboratory. A similar capability is available through NIH.

From Tables 5 and 6 it appears that EPA's information systems are operations rather than management oriented and are largely specialized in nature to meet immediate environment or pollutant related problems.

Further, while some of the systems placed in the management category do serve that function, many of the systems do not really directly serve the higher management level and those who allocate the research resources. The low information profile exhibited to management merits close consideration as a prime suspect for management's apparent current reluctance to accord its information requirements higher agency-level attention and treatment.

EPA Order 1110.16, dated March 12, 1971, prescribed the Data Systems Officer, Data Systems Branch, Data and Support Systems Division, Deputy Assistant Administrator for Administration, Assistant Administrator for Planning and Management as responsible for:

> 3. Plans, coordinates, and carries out a program for exploitation of scientific and technical applications of computers, the informational sciences, and mathematical and statistical approaches to the needs of the Agency.
>
> 4. Works closely with technical and scientific staff of the Agency in developing and improving *automated applications* for environmental monitoring systems, network establishment and enlargement, and the entire area of gathering, storing, and disseminating fundamental information on the Nation's environment. (Italics Added.)

Under EPA Order 1110.16A, dated February 8, 1973, the Data and Support Systems Division was reorganized resulting in Data Systems Branch functions being incorporated into the Management Information and Data Systems Division. However, the revision to paragraph 5 (covering the Management Information and Data Systems Division) of EPA Order 1110.16A as approved by the Assistant Administrator for Planning and Management on August 2, 1973 largely omits any reference to the former functions of the Data Systems Branch. Only two sentences in

the revision seem to be applicable:

- Provides the Agency focal point for coordination and integration of information systems across functional, geographic, media, and technical lines;

- Provides technical advice and assistance to managers, technicians, and program officials throughout the Agency on the development of new and improvement of existing information and automatic data processing systems.

This lack of stress on the information sciences and particularly in their application to scientific and technical information suggests that the organizational role for guidance of the Agency's scientific and technical information programs has not been well defined at this point.

The mandate of EPA Order 1110.16A is open to other interpretation, but the research team believes that the role of the Management Information and Data Systems Division (MIDSD) must be confined to ADP support, however innovative, and not expanded to include all of information science, nor should MIDSD be permitted to take the lead in determining EPA's strategic or tactical decisions relative to information management and operations. While, in many instances, ADP and information science are inextricably linked, ADP practices are only a subset of information science as are, for example, the less sophisticated but intellectually demanding functions of abstracting and indexing. Further, EPA has 38 manual systems (30 percent of the total considered) which may be useful and valuable contributors to the overall information achievements of the Agency and which must be given full consideration when developing effective information transfer.

Many of the EPA applications operate on various types of computers. Some systems are on the IBM 370/165 at NIH, some on the IBM 370/155 at Optimum Systems Inc., some on the CDC 6400 at Battelle-Columbus Laboratories and some are to convert to the UNIVAC 1110 at RTP, to mention a few. Some groups are creating their own ADP operations and applications with insufficient attention to existing capabilities, the requirements of others, or the need for interfacing with other groups.

During the course of the 131 personal interviews conducted, the interviewees mentioned about 40 sources of information outside EPA that they used. Since the International Referral Service demonstration project identified 700 sources and the literature search for this study identified about 1,200 sources, it appears that EPA personnel are not using all available information sources and that the existing EPA network, when interrogated, largely is confined to Agency resources. Of course, the NERC-Cincinnati expands the search boundaries through its access to about 30 separate information services, but some of those were mentioned by the interviewees so the total remains small in proportion to the total apparent available resources.

NETWORK OR MONOLITH OR STATUS QUO

At the present time, the scientific and technical information network of EPA is primarily a free, uncoordinated network consisting of some 127 internal systems (as selected by the study team) and some 40 external systems identified through interviews with EPA personnel. Certainly maintaining this network in its present form is an alternative EPA must consider. Other alternatives are to alter the present network into a monolithic structure or into a coordinated network.

The National Environmental Information Symposium advanced many reasons for changing national habits with respect to organizing, processing, and disseminating environmental information.

It called for a national program to coordinate efforts to handle and disseminate environmental information. A portion of the President's message relative to EPA's mission and purpose under Reorganization Plan 3 of 1970 stated:

> ...the gathering of information on pollution, and the use of this information in strengthening environmental protection programs and recommending policy changes.

EPA must decide whether it wishes to fulfill a national role of leadership in environmental information. There are some indications that EPA will lose that role by default, the most notable and recent being its having representation but not the chair for the U. S. interagency committee formed to assist in the development of the U.N. International Referral Service for sources of environmental information. Whether or not EPA wants to become the national environmental information authority, there appears to be enough clamor for change from both within and without EPA to warrant adjustment of EPA's information management practices.

The National Science Foundation reported that EPA expects to spend $3.7 million on scientific and technical information in 1973.[18] Since STORET alone accounts for $6 million, it is apparent that the specified sum is understated. It was estimated earlier that true information costs within EPA, if measurable, might be an order of magnitude greater than reported. Such a sizeable expenditure warrants a positive Agency-wide management approach to replace the somewhat laissez faire policy existing at present.

The current information/data environment within EPA, while encompassing a multitude of valuable products and services, is recognized to have problems due to its pluralistic nature. In 1969,

the Committee on Scientific and Technical Communication (SATCOM) described a need in the information/data field which is equally applicable to EPA "for guidance of its evolution, for increasing recognition and acceptance of responsibility by all the organizations involved (Governmental, scientific, technical, and not for profit), for more effective coordination and for broader understanding of problems and opportunities."(30)

But problems in themselves do not dictate that the solution stems from a monolithic information/data structure. Many of the EPA organizational units are attempting to improve their own operations and services as well as participating in cooperative efforts within the environmental information community. To substantially tamper with significant elements of the existing overall pluralistic system with its heterogeneity of subjects and interests does not appear to be warranted. Support for this view as applied to EPA is well expressed in the following excerpt from the SATCOM final report as applied to all aspects of scientific and technical communication.(31)

> Today in the United States, scientific and technical communication exhibits the characteristic heterogeneity of a system that evolved by fits and starts through adaptations to locally perceived needs and opportunities. No master plan prepared by experts guided its evolution, nor are our information services staffed by an organized body of such experts. Instead, decisions have been made, and are still being made, at numerous points and with a considerable degree of autonomy, often by leaders of scientific and technical societies who function as volunteers in the management of information programs.
>
> Though the performance of this heterogeneous aggregate of activities has been criticized on many counts, there is no evidence of critically inefficient operation or catastrophic failure. Nevertheless, with the necessary and continued expansion of information services, scientific and technical communication presents increasingly diverse problems, and our ability to maintain

> high-quality services under such unstructured coordination and leadership is frequently questioned. As long as it continues to function reasonably well, the present dispersed system of decision making is a source of great strength. Moreover, deeply rooted principles and traditions of this country's scientific and technical community argue against placing scientific and technical communication under centralized management. Therefore, rather than urging immediate and radical change at the present time, we see the implementation of recommendations directed toward more effective coordination, planning, and decentralized management as the best means of coping with the growing and increasingly varied demands for scientific and technical information.
>
> As a prime objective, we urge that the initiative of individuals, institutions, and organizations continue to be accorded substantial scope in the development and operation of those scientific-and-technical-communication services that they consider to be in their best interest. Such information activities should be designed and operated as individual and somewhat independent parts of a comprehensive network, and, as a matter of policy or principle, no attempt should be made to centralize them either physically or managerially. The conversion at this time to a monolithic system, comprehensively planned, developed, and operated, for recording, structuring, and distributing scientific and technical information would be exceedingly costly and would not ensure improved performance.

The suggestion that information activities should be designed as individual and somewhat independent parts of a comprehensive network does not preclude certain of these activities forming a coordinated network which, in turn, becomes a node in another coordinated network.* An example of such an action is the formation of the EPA library system network. The recommendation also should not preclude consolidation of

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*See Figure 5, Appendix F

related activities wherever advantages can be demonstrated. Examples of these are the recently developed Pesticides Analysis Retrieval and Control System (PARCS) which has assimilated some seven existing pesticides information/data bases, and the National Environmental Radiation Data System (NERADS) whose nucleus will be formed from four existing data activities.

Monolithic highly centralized data files meant to serve a large volume of users frequently are viewed skeptically in the field and gain support only if the users are brought into the planning cycle. There are functions of the network, however, which are best executed in a monolithic form. Examples of such monolithic activities are report control and project information systems.

THE PUBLIC SPOKESMAN

EPA is designed to serve as the public's advocate for a livable environment.[12] Its recognition in this role with respect to information is doubtful. With the variety of vested interests and conflicting goals faced by the environmental community, EPA has not seized the initiative to emerge as the leading voice to represent the information resource for all sectors. The International Referral Service effort is an example of EPA's apparent low profile. While EPA is represented on the interagency committee formed to assist in the development of the Service, it is not providing the leadership for the committee. Further, it appears that intra-agency communication was not successful in appraising all concerned parties about the existence of the committee so that their expertise could be gainfully employed.

INFORMATION INTEGRITY

There is a lack of formal planning and coordination processes with which to specify, on an EPA-wide basis, the conditions or criteria

for the establishment or abolishment of information resources or the policies for their operation consistent with the goals of a national environmental information authority.

In practice, the interests, knowledge of information science, knowledge of the environmental information needs both within and without EPA, authority, and responsibility of funders of EPA information activities is extremely variable. This results in uneven application of information systems concepts, processes, applications, and operations by the Offices within EPA. A most prominent example of this lack of coordination is the somewhat ephemeral treatment of Centers of Competence which are initiated or abandoned on the basis of essentially unilateral decisions. Recognizing the "power of the purse strings" and the de facto elements of autonomy that will continue to exist within EPA Offices and Regions, a more powerful central mechanism than now exists is needed to mold the national environmental information directions for EPA.

The number of information systems inside and outside EPA will increase as legislated requirements, international efforts, and pressures from outside EPA continue to grow. Thus, more individuals inside EPA will be faced with information-science-related problems.

Although the technology of information/data handling and analysis is rapidly expanding, the developments and research projects do not represent a unified approach to solving many of the more critical problems. This is due, in part, to the variety of organizations currently conducting information/data research. It is also due to lack of any one organization possessing an adequate overview of current research efforts, existing systems and techniques, and needs of users. Such an organization would, ideally, have the means to develop, or cause to be developed, new techniques when the need is recognized as crucial to the entire environmental community.

Undoubtedly many of the problems could be solved by the individual, or if one has been retained, the contractor assisting in the information system design or operation. Such practice, however, is likely to result in duplication of effort and inconsistency of approach.

USER NEEDS STUDIES

Any information or data system exists, not for the benefit of information scientists, but for the benefit of intended users of the system. Although some elements of EPA's information activities have attempted to study the needs of their users or to obtain evaluation of their responses to user requests, no continuing effort has been made to measure changing use habits and information/data requirements. The evolving patterns of information/data sources and handling techniques may well change the way individuals use such resources. As a new generation enters professional life in EPA, a better understanding and use of the capabilities of the computer is introduced into the work cycle. Furthermore, EPA librarians believe that their more frequent users are the newer, younger, staff members who possess neither the experience, the knowledge, nor the personal information resources of their senior colleagues.

There seems to be little choice but to recognize the study of user needs as a continuing requirement. It should, perhaps, be viewed as a monitoring function rather than as a series of studies with definite termination dates. In addition, attention must be given to non-users so that action can be taken to develop greater system usage.

NETWORK CONCEPT PLAN

THE PLAN

Given the autonomy of EPA organizations, their geographical dispersion, their variety of subject interests, their diversity of functional needs, the disparity between information user practices, the general image of heterogeneity displayed by EPA, and the many information resources outside EPA control, it does not appear that improvement in EPA's information practices or position could easily be effected by a high degree of centralization or a dedicated approach to a strong line organization with its accompanying authority and responsibility.

The solution would really appear to lie with the creation of an active, group-oriented undertaking (recognized as a line item in the appropriations budget) which provides--in addition to a forum furnishing the atmosphere for discussion of common problems--an organization to coordinate and conduct research, user studies, and pilot demonstrations of a planning and coordinating nature, and to provide a current referral service for environmental information. In addition, the organization would actively promote information standards agreed upon by participating groups, would mount an educational thrust in areas of information science of pertinence and practical value for EPA, and would serve as EPA's public spokesman for environmental information in a non-conflicting relationship with the Office of Public Affairs. Although organizational structure and

location will be covered later, for the purposes of the immediate discussion the proposed controlling group is termed the Office of Technical Information Coordination (OTIC).

SCOPE

OTIC would be dedicated to consideration of the national environmental information/data resources. However, it also would be the logical body to represent the United States in any larger organization formed to consider the international aspects of environmental information/data.

The considerations of OTIC should be oriented toward any or all levels of audience including management, supervision, the professional working level, and the technical support level.

OPERATIONS

The operations are the specific tasks to be performed by the organization. The operations of OTIC are limited to the support, development, and coordination type aimed at providing group benefits. The operations to be performed typically would be the following:

Hold Meetings

This operation comprises all of the aspects of conducting effective group communications among the various segments of the environmental information and data community. Meetings would be planned so as to bring together representatives of diverse groups in the community for discussion, and hopefully resolution, of common problems. The goal of the meeting would be to reach agreement on questions of concern to the community as a whole so as to emerge with a common voice to promote adoption of solutions that represent the interests of the

- Encouraging the adoption of policies that will promote the long-term development of the national environmental information/data resource; and, conversely, discouraging the adoption of policies that will inhibit the long-term development of the national environmental information/data resource

- Encouraging recognition of the value (and the cost) of information/data products and services.

Promote Information Standards

The organization would bring together representatives of interested groups for the purpose of formulating information/data handling standards. The broad base of the participating groups would provide an opportunity to achieve the maximum possible consensus before the standards are adopted throughout the environmental information/data community.

Conduct Information Research

OTIC would conduct, or more often cause to be conducted, intramural and extramural research studies of information/data handling techniques and transfer processes to assure that attention is drawn to improvements which can be made by existing organizations serving environmentalists. The studies would be advisory in nature, and would be conducted by the OTIC staff, by the Data and Information Research Division, by committees or panels of qualified individuals, or by contractors and grantees.

Monitor Information Research

OTIC would stand as a central focus in the environmental information community and would review all EPA requests for funding to provide scientific and technical information services and would comment appropriately on those applications so as to place them in context with the needs of the environmental community.

Analyze User Needs

A continuing study of the environmental community would be conducted to sense its changing needs. Mechanisms for detection of new or revised needs would be developed and appropriate research programs would be undertaken when needed.

Perform Pilot Demonstrations

While OTIC would not be a major operating resource in terms of information services, it would perform or authorize limited pilot demonstrations to show feasibility of methods and products developed through the research program and the user analysis.

Referral

OTIC would establish relationships with collections or repositories of documents and data (including on-going projects) to facilitate accessibility of information resources to individuals and institutions. In addition, OTIC would maintain registers of, and serve as a referral service to, the specialized knowledge of members of the environmental community. Increasing the recognition of this referral capability would be an important responsibility of the education/orientation program.

Orientation Program

A program should be established to inform the environmental community, particularly EPA personnel, about the purposes of OTIC.

ORGANIZATION OF THE OFFICE OF TECHNICAL INFORMATION COORDINATION (OTIC)

General

It was stated earlier that it did not appear that improvement in EPA's information practices could easily be effected by a high degree of centralization or a dedicated approach to a strong line operation with its accompanying authority and responsibility. This view led to the conception of OTIC as an active, group-oriented undertaking for planning, coordinating, and encouraging improved handling of environmental information and data. Given such conditions, in order for OTIC to be effective, it becomes necessary to enhance its organizational image and its consequent acceptance within the

environmental community. Hopefully, the required stature can be achieved through three courses of action: 1) designate OTIC as a staff office at the EPA Administrator level; 2) let it be known by the Administrator that he considers the functions of OTIC to be of great importance to the success of the EPA mission and that he will impute line authority to OTIC efforts; and 3) performance of its functions by OTIC in a logical fashion which demonstrates that its actions benefit those that it affects.

Organization Structure

Figure 1 shows the proposed organizational structure for OTIC. The functions which each of the organizational units would perform already have been described in some detail and all need not be repeated here, but a few warrant further attention. The structure shown represents what is presently envisioned as the ultimate goal. The structure should be implemented on an incremental basis depending upon priority of need and resources available.

Director of OTIC--

The Director of OTIC will have a strong coordinating role on the international level, the national level, and within EPA. Many of his functions and responsibilities have been described in the preceding section on OPERATIONS of OTIC. Some currently anticipated additional responsibilities of the Director which should be highlighted are as follows:

- Information Science Advisor for the Administrator
- Chair the EPA Information Committee
- Chair the Interagency Advisory Council
- Representative to the United Nations (Environmental) Information Referral Service

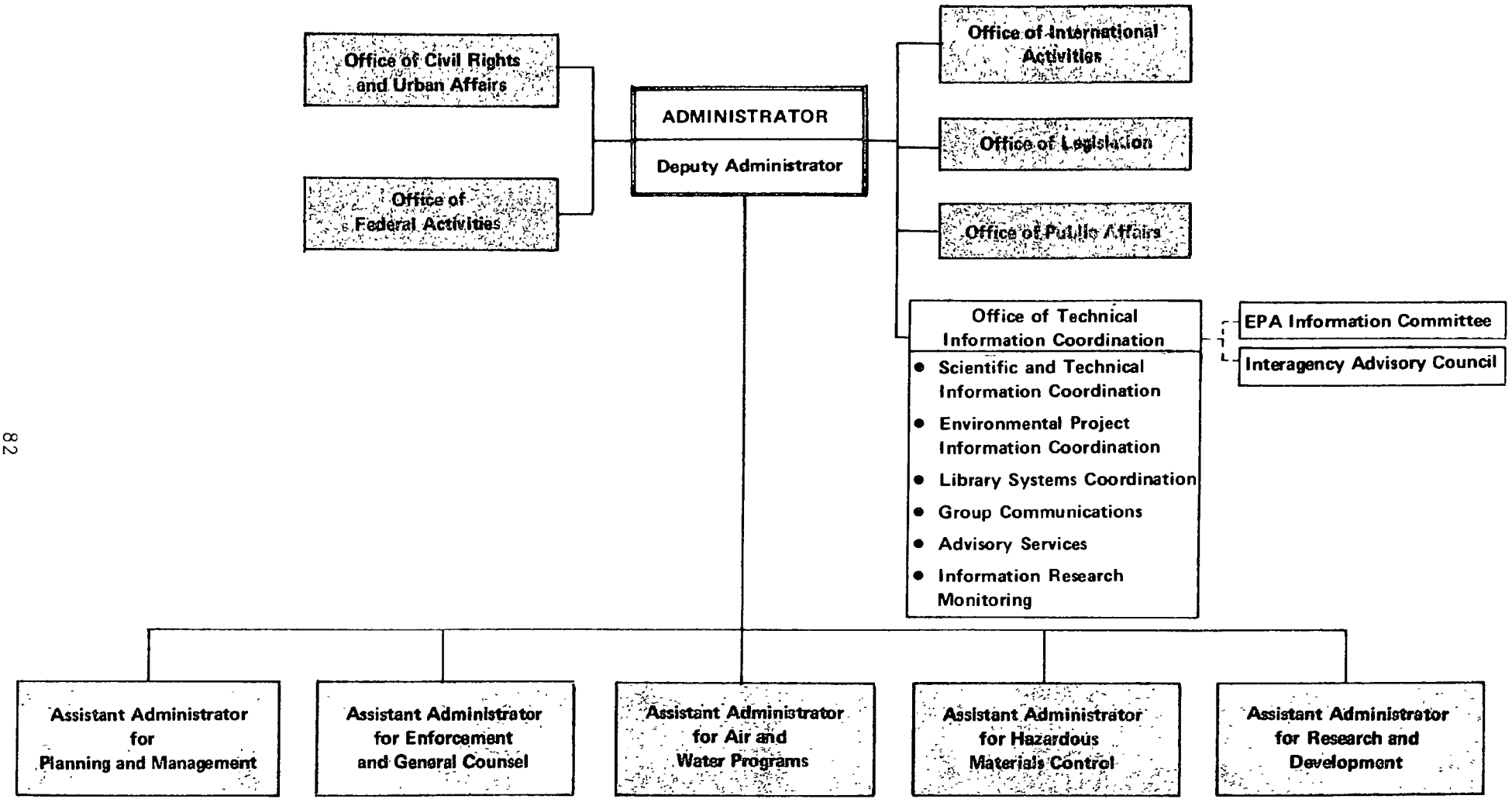


FIGURE 1. PROPOSED ADMINISTRATIVE ASSIGNMENT OF THE OFFICE OF TECHNICAL INFORMATION COORDINATION (OTIC) WITHIN EPA

EPA Information Committee--

It is suggested that a pro tem committee consist of members representing EPA components with adjustments to be made by the Committee and the Director of OTIC as planning progresses. The Committee should be limited to about 10 individuals selected by the Director of OTIC as the most valuable contributors in plotting the course of the new enterprise.

The functions of the Committee members would be to represent the various activities within their respective areas, and to advise the Director of OTIC, particularly with respect to planning. While the Committee would deal with the spectrum of EPA information activities, its main mission would be that of maintaining the vitality of the network. One urgently needed role the Committee should play, relating directly to the problems encountered with Centers of Competence, is that of reviewing establishment, consolidation, or disestablishment intentions for activities within the network.

Interagency Advisory Council--

It is suggested that the Council be composed of representatives of information activities in other Federal agencies, but consideration should be given to incorporating two representatives from state or local governments, as well.

The Council's function would be primarily to serve as a forum in which to keep current about each agency's plans and accomplishments with respect to environmental information and to discuss those actions possible to improve the network relationships.

Planning Function--

This would not be a separately staffed function within OTIC. It would be the responsibility of the Director to assimilate the advice of the Committee and Council, to review EPA program objectives and resources, and to develop a plan which would maximize Agency

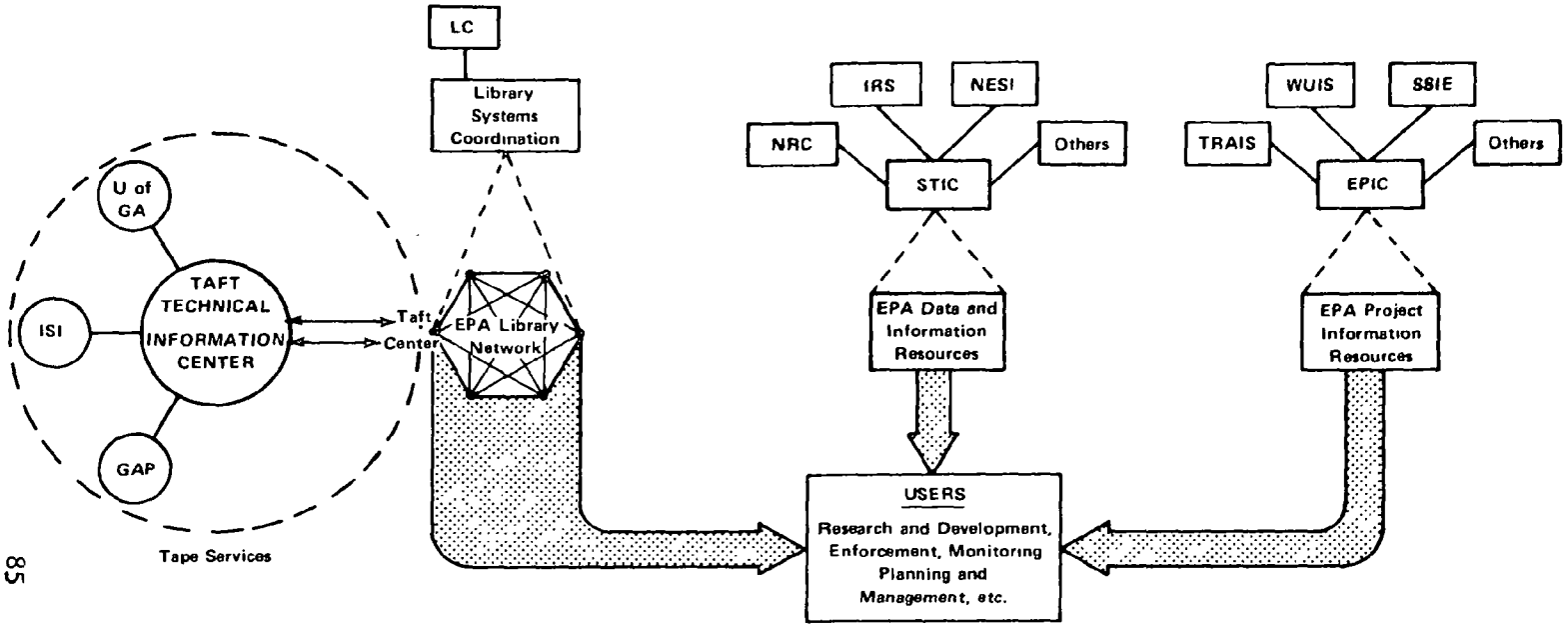
benefits. The environmental organizational structure has been a rapidly changing one and the Director must be alert to maintaining a current plan suitably responsive to any altered framework of implementation.

Scientific and Technical Information Coordination (STIC)--

STIC not only serves to maintain an inventory of resources dealing with scientific and technical information (including monitoring, surveillance, and intelligence information) and to provide both switching and referral services (emphasis upon the latter), but also serves as the focal point from which the Director of OTIC can initiate those actions designed to facilitate the development of a workable coordinated network for EPA. STIC is an information resource identification system within OTIC and is not a technical information network itself. Identification of scientific and technical information activities provides the foundation upon which the Director of OTIC, with the assistance of his Committee and Council can apply his remaining coordination responsibilities, such as advisory services, to foster improved networking. Figure 2 shows one concept of networking OTIC coordination functions. Typically, STIC would include resource information on such items as the Environmental Information Systems Inventory, the National Referral Center, and the International Referral Service. From these resources the various components or nodes of the potential coordinated network could be identified and action taken as needed.

Environmental Project Information Coordination (EPIC)--

This is similar to STIC in function, but deals with information related to on-going projects. Typical inclusions would be the Project Information Retrieval System (PIRS), the Smithsonian Science Information Exchange (SSIE), and the Work Unit Identification System of the Department of Defense. EPIC would be utilized in a manner similar to that for STIC.



EPIC	Environmental Project Information Coordination	NRC	National Referral Center
GAP	Group Associates Program	SSIE	Smithsonian Science Information Exchange
IRS	International Referral Service	STIC	Scientific and Technical Information Coordination
ISI	Institute for Scientific Information	TRAIS	Transportation Research Activities Information
LC	Library of Congress	U of G	University of Georgia
NESI	National Environmental Systems Inventory	WUIS	Work Unit Identification System

FIGURE 2. CONCEPT OF NETWORKING OTIC COORDINATION FUNCTIONS

Library Systems Coordination

The present Library Systems Branch, under the Deputy Assistant Administrator for Administration:

> Develops a technical reference library system designed to serve the mission of the Agency;
>
> Provides expert services in library science as applied to the scientific, technological, and regulatory subject matter areas represented in the Agency;
>
> Establishes and maintains consultative relationships with professional groups and libraries within and outside the Government for the purpose of locating and exchanging information of mutual interest;
>
> Immediately supervises operations and staff of the headquarters library; and
>
> Provides policy guidelines and technical supervision to all libraries in the Agency headquarters and field.

These functions are an important adjunct to the Office of Technical Information Coordination and should be incorporated into OTIC. An exception is the operation of the Headquarters Library since no apparent benefit would result from a transfer of organizational responsibility for that or any other of the libraries located within EPA.

Other Operations

The functions of the remaining organizational units have been discussed earlier. It is extremely important that the implementation plan recognize their early need and that they be made available at a low level of effort pending later full-scale development. Thus, there should be at least an embryonic capability for group communications, advisory services, and information research as soon as possible after OTIC start-up.

AN ALTERNATIVE PLAN

Should EPA elect to devote fewer resources to its information activities than would be required to achieve the ultimate goal of the preceding plan, an alternative plan could retain the objectives but scale back the level of effort to approach each of the operations on a priority selection basis with reduced performance.

Under the alternative plan, EPA would create the position of Information Science Advisor to the Administrator. The Information Science Advisor would have three primary responsibilities: 1) to keep the Administrator informed of, and suggest line action to be taken with respect to all EPA present, contemplated, or needed information science related activities; 2) to establish a referral capability for environmental project information systems and scientific and technical (including monitoring) information systems; and 3) to create a presence around which the resources of EPA could be marshalled at the desired level for execution of its scientific and technical information responsibilities.

IMPLEMENTATION PLAN

Figure 3 illustrates an implementation plan which distributes accomplishment of the program over a period varying between 43 and 48 months. This time frame is only a guideline and may be compressed or extended as EPA chooses. Further, due to the many similarities in roles between the Director of OTIC (the recommended program) and the Information Science Advisor (the alternative program), it has been possible to incorporate considerable flexibility into the implementation plan.

For example, the alternative program parallels the proposed program for the first 16 to 21 months. A decision step is incorporated into each major phase in the program to determine whether the program should be terminated, remain unchanged, or be incremented through the implementation of additional functions. Thus, EPA can implement the program at a pace and manner to best accomodate the Agency's needs. Full implementation of OTIC is envisioned as a five step process.

Step 1

Step 1 provides a two to seven month period in which EPA management can review the study recommendations and decide whether to accept them, subject them to some revision prior to acceptance, or reject them and terminate any further network effort, and, if implementation is elected, to prepare the necessary EPA orders, develop objectives, priorities, and resource requirements for approval by the EPA Administrator and the Office of Management and Budget, and to obtain an administrative decision.

Step 2

Step 2 provides 14 months for start up and incremental operation. The procedural steps differ slightly depending upon whether the budget decision in Step 1 has led to the selection of Alternative 1 or Alternative 2.

Alternative 1--

The initial two month period would be used to select the Director of the Office of Technical Information Coordination, establish the EPA Information Committee and the Interagency Advisory Council, initiate an Office planning function, and transfer the functions of the Library Systems Branch, excluding operation of the Headquarters Library.

Alternative 2--

The initial two month period would be devoted to obtaining approval for, and selecting, an Information Science Advisor to the Administrator.

Alternatives 1 and 2--

An additional 12 months is allowed to establish the functions of Scientific and Technical Coordination (STIC) and Environmental Project Information Coordination (EPIC). STIC is expected to be operational within nine months. EPCI would lag STIC but would be expected to be operational within 12 months.

The embryonic functions of group communications, advisory services, and information research should be initiated as early in Step 2 as possible but no later than the operation of STIC and EPIC. These functions are to be executed at a low level of activity, but the sphere of influence must be established.

Step 3

At the conclusion of Step 2, progress of the office should be reviewed with respect to changed EPA requirements and resources and a decision reached whether the effort should continue as it was, continue in some revised mode, or terminate. In Alternative 1, the decision to continue leads to a need for a decision as to which option to implement next. The implementation plan is based upon sequential implementation of the options in the recommended order, but provision is made for bypassing one in favor of another. The first implementation option recommended is that of group communications.

Step 4

Step 4 repeats the processes of Step 3, but, this time, adopts incremental introduction of advisory services. The services consist of consultation, education, and information standards and are expected to be available at the end of three, six, and nine month periods respectively.

Step 5

Step 5 also repeats the processes of Step 3, but establishes an information research function. The four components are user needs, products and services, information research monitoring, and pilot demonstrations. Time cycles for those activities are two, four, six, and nine months respectively.

Staffing Level

If full implementation of Alternative 1 is effected, the professional staffing for OTIC is estimated as follows:

Total Number of Professional Staff	Total Months from Implementation Plan Beginning	Ending
1	3-8	4-9
4	5-10	16-21
5	17-22	25-30
6	26-31	34-39
7	35-40	43-48

This staffing level would provide OTIC with a small, closely knit, but highly diversified professional staff capable of managing the many functions assigned to the Office. A small number of support personnel, secretarial and clerical, would be required in addition.

In executing the functions of OTIC, it is expected that the Director will resort to extramural programs to supplement EPA intramural capabilities.

Personnel Attributes

Brief job descriptions were prepared as indicators of the caliber of personnel visualized as necessary to carry out successfully the mission of OTIC.

Director of OTIC--

This individual should be a leader in the area of information and data management with extensive experience, preferably including a strong background and range of accomplishments in an environmental or associated discipline. He should hold a doctorate degree or have equivalent experience to establish him as exceptionally qualified technically as well as managerially.

A working relationship with Government, industry, academic, and not-for-profit sectors is also required. Experience in information/data matters should be such that this individual would already be a member of, or readily be accepted in, the "invisible college" of environmental information/data policy-makers and practitioners.

The Director of OTIC would be responsible for initiating start-up and guiding the operation of the new organization including hiring major staff personnel, coordinating system design and implementation, and directing the overall operation as it grows to full scale. He would be responsible for continuing operation once full-scale status was achieved.

Manager of Scientific and Technical Information Coordination

The manager should have extensive and authoritative knowledge of information storage and retrieval systems and possess a high degree of ability in development and operation of automated information systems. He should have 10 to 15 years of experience in information systems and related areas and preferably possess at least a bachelor's degree in one of the environmental sciences.

Manager of Environmental Project Information Coordination (EPIC)

The qualifications of the manager of EPIC are essentially the same as for the manager of STIC, with the exception of the bachelor's degree in one of the environmental sciences.

Manager of Library Systems Coordination

This position could best be filled by the incumbent Chief, Library Systems Branch, or equivalent, when the functions of the Branch are transferred to OTIC.

Manager of Group Communications--

The manager of group communications should have a demonstrated ability to communicate with leaders in the various environmental disciplines and in information science on matters pertaining to technical information and data. He should have an established reputation and suitable academic background to gain cooperation in directing the forum and public spokesman operations.

Manager of Advisory Services--

The manager of advisory services should have demonstrated technical and managerial ability in the areas of information research and operations and the transfer of knowledge in the information community. His background should include a bachelor's degree and 10 to 15 years' experience in information/data transfer. He should have a working acquaintance with the organizations (Government, foundations, industry, etc.) with pertinent information activities and be conversant with the needs and desires of the environmental community in information matters.

Manager of Information Research Monitoring--

The manager of information research monitoring should have experience in development of information products and services and should be capable of providing necessary support to the long-range goals of OTIC. He should have a graduate-level degree in information science or equivalent experience and be capable of planning and monitoring necessary internal research programs such as user studies and pilot demonstrations.

Information Science Advisor--

This individual should be a leader in the area of information and data management with extensive experience, preferably including a strong background and range of accomplishments in an environmental or associated discipline. He should hold a doctorate degree or have equivalent experience to establish him as exceptionally qualified technically as well as managerially.

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APPENDIX A

CONCLUSIONS AND RECOMMENDATIONS FROM THE 1970 EHS REPORT

MANAGEMENT SUMMARY
(1970 EHS STUDY)

Summary. The Battelle study entitled "Technical, Intelligence, and Project Information System for Environmental Health Service" is a multifaceted and intensive investigation of the problems facing the EHS in protecting man's environment from threats created by man. This study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This section of the report concerns itself with Information Network Analysis. The first step was to investigate the existing EHS information resources, including the monitoring and surveillance activities. A survey was conducted of the documentation systems and libraries in order to determine their operational characteristics as related to an information network.

The results of this survey, including a limited number of external information resources, are contained in a separate volume entitled "Directory of Information Sources for the Environmental Health Service".

Additional data were obtained through limited personal and telephone interviews at all levels of EHS and its Administrations and through study of EHS documentation.

On the basis of the study, the establishment of an Environmental Health Information Network (EHIN) has been structured, incorporating the existing information and data sources, and also new resources such as the Information Resource Identification System (IRIS) and the Project Information Retrieval System (PIRS).

In structuring the proposed EHIN, it is recognized that other agencies of the Federal Government have established information and data bases that relate to EHS responsibilities. Mechanisms for interfacing and utilizing these resources are suggested. Further, it is recognized

that an operational EHIN, structured as a result of this study, may not be immediately achievable. Rather, EHIN represents a concept which EHS should build toward as it is able in order to assist in constantly strengthening its role in protecting man's environment.

Specific conclusions and recommendations are detailed in the following section of this Management Summary. The reader is urged to study the more detailed discussions in the body of the report.

Conclusions and Recommendations. The following recommendations are made for the establishment of an Environmental Health Information Network (EHIN):

(a) The network should be a coordinated network consisting of a Project Information Retrieval System (PIRS), a Monitoring, Surveillance, and Intelligence Information System (MSIIS), and a Scientific and Technical Information System (STIS), supplemented by an Information Resources Identification System (IRIS).

(1) PIRS should be a centralized system, operating within EHS. The early establishment of PIRS is urged.

(2) IRIS should be a relatively small operation, maintaining an inventory of information resources and providing switching and referral services both for the use of the entire staff and for referral of other agencies desiring information to the proper portion of the EHIN network. Implementation of IRIS should begin as soon as practicable.

(3) MSIIS and STIS should each remain a federation of centers in a coordinated network structure. Each center or activity should report to the highest authority consistent with its mission, scope, and user audience.

(b) Within the EHS headquarters element, a Director of EHIN should be appointed to represent and to coordinate the interests of the network, not only at the EHS level, but also in interagency and other Federal activities.

(c) The Director of EHIN should be assisted by an Advisory Council composed of the coordinating managers of PIRS,

MSIIS, and STIS plus five representatives from the operating levels. The Advisory Council would assure the vitality of the network, determine network requirements for equipment, and recommend establishment, consolidation, or disestablishment of activities within the network.

(d) Very little analytical response (e.g., state-of-the-art reports, technical compilations, data or design handbooks, and direct answers to technical inquiry) can be expected from the present information resources, both within EHS and outside EHS. EHS should establish Centers of Technical Competence (Information Analysis Centers) for various high-priority threat areas in order to provide the needed analytical capability.

(e) Necessary information resources and capabilities for effective analysis and evaluation of threats are so great in magnitude and variety that they cannot be concentrated within any single agency. To cope effectively with the complexities of today's environmental problems, a wide variety of information resources should be utilized.

(f) There is a lack of accurate, documented information relative to the identification of sensitive population groups, to the determination of the number of people currently and potentially affected by a stressor, and to the nature and severity of the effect. This represents an information gap which should be filled on a selective basis.

(g) Accepted thesaurus building rules should be enforced in all EHS information activities in order to establish some compatibility of the various thesauri in terms of cross-reference techniques and similar devices. Growth of special-purpose information systems however should not be stifled by the creation of a unified vocabulary.

(h) Whenever practicable, without harm to the direct mission of a given information resource, common information science procedures and practices should be instituted.

(i) The "Directory of Information Sources for the Environmental Health Service" (prepared during

this study) should be revised periodically by IRIS to provide a desktop reference device for operating-level personnel.

(j) Various facilities probably can justify, and should have, a stand-alone computer capability in addition to access to the central computer facility, primarily for data-processing and research purposes. However, with regard to information systems, every effort should be made to strive for compatibility of operations.

(k) The computer facility provided for EHS administrative operations, including information storage and retrieval operations, should equal or exceed the capability of the equipment currently employed by the central computer facility, if that facility cannot be made available to EHS.

(l) The Director of EHIN and his Advisory Council should investigate the extent to which information resources dealing with program assistance, training, and demonstration and testing should be established and incorporated into the network.

APPENDIX B

PHASE I WORK PLAN

THE RESEARCH APPROACH TO DETERMINATION OF EPA'S INFORMATION FUTURE

INTRODUCTION

The Battelle team, in consultation with its EPA counterpart, made two major decisions which underlie the development of the research approach used in this study:

- That the team should avoid, insofar as possible, duplication of earlier work and capitalize on the results of earlier studies to the greatest extent feasible.
- That the principles of the earlier Battelle recommendations[11] for the establishment of an environmental information and data network were still valid but needed updating to reflect current EPA policies and organizational structure.*

The history of EPA's several earlier studies and the courses of development of EPA's information facilities amply illustrate earlier concerns for EPA's information and data systems. Unfortunately, these efforts have been largely ignored or only partially implemented due to organizational changes (e.g., CPEHS to EHS to EPA) and to deferral to other priorities. These earlier studies were reviewed and many of their recommendations (and the premises upon which they are based) were found to be as valid today as they were at the time of their conception.

The recognition by the research team of the recommendations of the earlier Battelle study, accomplished during 1970 under the initial

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*See Appendix F for a tutorial on The Concept of Information Networks

sponsorship of CPEHS, is based upon the same premise of building upon prior work. However, it was considered that a fresh appraisal of the network concept would be warranted for the current study.

Based upon the above decisions, the investigation by the research team focused upon three major sources of information and data:

- Acquisition of reports on projects related to study or review of EPA's technical-information-oriented activities.
- Informal interviews with a small number of selected EPA and contractor personnel representing a reasonably complete cross-section of EPA information users, producers, processors, and disseminators.
- A literature search to determine non-EPA sources of environmental information.

EPA REPORTS

The Data and Information Research Division (DIRD), Deputy Assistant Administrator for Monitoring Systems, Assistant Administrator for Research and Development, assumed responsibility for identifying and obtaining those reports pertinent to this project. An example is the report on the Agency's ADP needs prepared by the General Electric Company. In actuality, DIRD extended its responsibility to include any releasable EPA documentation which would contribute to determination of EPA's scientific and technical information future.

PERSONAL INTERVIEWS

Personal interviews with 131 individuals were completed. Persons interviewed were managers, researchers, administrators, enforcement people, surveillance people, information/data people, and service people among others. Organizationally, they represented EPA, other Federal agencies, and private contractors.

Interviewee selection was not based upon any statistical sampling plan. The initial list was jointly developed by DIRD and BCL personnel to be fairly representative of a cross section of EPA through the inclusion of personnel whose views were considered as important contributions to the information store on which decisions would be based. The initial list was expanded as interviewees suggested other individuals. For example, the initial list identified regional R&D representatives, who, in turn, set up interview schedules with various regional personnel. A list of those interviewed is contained in Appendix E.

Three interview teams were formed, each including both DIRD and BCL personnel, as follows:

Team	Type of Organization Visited
1	National Environmental Research Centers
2	Regional Offices, Laboratories, Contractors (Midwest and West)
3	Regional Offices, Laboratories, Contractors (East and Southeast)

To prepare the way for the interviews, the Assistant Administrator for Research and Development sent a memorandum to the other Assistant Administrators, the Office Directors, the Deputy Assistant Administrators, the Regional Administrators, and the NERC Directors announcing the existence and purpose of the joint EPA/BCL study and requesting cooperation in the effort to develop the network concept. A copy of the memorandum is contained in Appendix H. All interview scheduling was completed by telephone.

INFORMATION RESOURCES OUTSIDE EPA

A low level of effort survey was made of non-EPA information and data resources. Emphasis of this survey was directed toward those

information resources within the United States which might complement or augment EPA supported resources.

The Battelle Main Library and the Environmental Information Center were searched to identify directories of sources of information and data of interest to the EPA network.

Directories that were identified as containing pertinent material were screened to select sources of environmental information on air, water, pesticides, radiation, noise, and solid waste. Many of the 30 directories screened were out of date and no attempt was made to verify the current status and scope of coverage of the listed organizations.

Most organizations were listed in more than one directory. No attempt was made to resolve conflicting information from the various sources. Furthermore, changing resource titles and changing organizational support identification induced duplicate inclusion of some resources on the Battelle listing. A list of the directories screened is contained in Appendix I.

In order to analyze these sources a card index was developed and divided into the following major categories:

Federal
State and Territories
Universities
Academies, Libraries, Societies, Associations, Information Centers, Councils, Companies, Not-For-Profit
Abstracting and Indexing Services

Index entries consisted of the name of the source, reference number, page number and type of pollutant or environment, i.e., air, water. Selected descriptions were photocopied and added to the appropriate index entries. A matrix was then prepared to show the distribution relationship between the controlling organizations and the type of pollution or environment information resource.

FUTURE EFFORT

Analysis of the input from the three components was expected to result in the development of a network concept for EPA's scientific and technical information and the design of an implementation plan. The plan would conclude Phase I of a four phase effort. In the remaining phases, it was anticipated that the plan would be implemented and kept current with changing EPA information requirements, and a missionary effort to foster awareness and use of the EPA information network would be instituted.

APPENDIX C

ALPHABETICAL CROSS-INDEX OF INFORMATION SYSTEMS TO ENVIRONMENTAL INFORMATION SYSTEMS DIRECTORY, SUBJECT CATEGORY, AND ENVIRONMENTAL SYSTEM IDENTIFICATION NUMBER

SELECTED ADMINISTRATIVE AND ENVIRONMENTAL
MISSION SUPPORT SYSTEMS AS INDEXED IN THE
ENVIRONMENTAL INFORMATION SYSTEMS DIRECTORY (EISD)*

System Title	EISD Category	Environmental System Identification Number
Accomplishment Planning and Reporting System	206	ES-10044
Aerial Measurements of U.S. Coastal Zone	206	ES-10068
Air Data Management	204	ES-10197
Air Pollution Technical Information Center System (APTIC)	201	ES-10060
Air Quality Data Handling System (AQDHS)	201	ES-10057
Air Quality Implementation Planning Program (IPP)	201	ES-10058
All Major In-House and Contracted Project Data	201	ES-10063
Analytical Methodology Information Center (AMIC)	104	ES-10092
Annapolis Field Office Water Laboratory Analysis System	206	ES-10260
Assistant Administrator for Research and Development Program Planning System	106	ES-10243
Automap Subsystem (Automap)	206	ES-10034.02

*Some titles may differ slightly from those in the Directory.

System Title	EISD Category	Environmental System Identification Number
Automated National Sensor Work Platform for Environmental Research (ANSWER)	206	ES-10211
Automatic Indexing by Keyword (KWOC)	104	ES-10183
Basin Planning System	206	ES-10104
Beach Closure Inventory	206	ES-10069
Bibliography File	206	ES-10094
Categorical Information Summary System	207	ES-10298
Characteristics of Water Supply Systems (CWSSI)	206	ES-10080
City Master File (STORET)	206	ES-10034.04
Community Health Environmental Surveillance System (CHESS)	201	ES-10186
Comprehensive Data Handling System (CDHS)	201	ES-10046
Construction Grant Need Cost System (STORET)	206	ES-10034.06
County Population and Density	206	ES-10126
Data Acquisition and Processing for Agricultural Runoff Research	203	ES-10219
Data Acquisition for Aquatic Ecosystem Simulator	206	ES-10220
Data Acquisition System (TAME)	201	ES-10176
Data Base of MSPCP Laboratory Test Results	201	ES-10054
Decimal Input Edit (DIPEDIT)	206	ES-10115
Dissolved Gas Information System (DIGIS)	206	ES-10159
Electroencephalographic Patterns of Monkeys	203	ES-10316

System Title	EISD Category	Environmental System Identification Number
Environmental Data Evaluation System (EDES)	206	ES-10218
Environmental Impact Statement System	207	ES-10009
Environmental Information Retrieval On-Line (ENVIRON)	107	ES-10045
Environmental Information Systems Inventory	104	ES-10032
Environmental Residual Information System	207	ES-10105
EPA Economic Dislocation Early Warning System	106	ES-10264
EPA Engineering Summary	206	ES-10265
EPA Library System	104	ES-10017
EPA Technical Publications	201	ES-10016
Episode Reporting and Accident Investigation System	203	ES-10082
Eskimo Surveillance	204	ES-10205
Federal Facilities File	207	ES-10261
Federal Facilities Inventory System	206	ES-10132
Federal Facilities Storage and Retrieval System	206	ES-10142
Federal Facilities System (FEDFAC)	207	ES- 0013
Federal Power Commission (FPC)	201	ES-10059
Feline Colony Information (The Cat System)	204	ES-10190
Final Reports File (FINR)	104	ES-10093
Fish Kill File (STORET)	206	ES-10034.05
Fuel Additive Registration System (FARS)	201	ES-10309

System Title	EISD Category	Environmental System Identification Number
Generalized Cataloging and Inquiry System (GCIS)	206	ES-10065
General Point Source File (GPSF)	206	ES-10067
Human Bone Network (HBN)	204	ES-10087
Indoor Radon Indepth Air Sampling Dosimetry Data Base	204	ES-10020
Industrial Waste Literature File (IWES)	206	ES-10081
Industry Study	201	ES-10239
Institutional Total Diet Sampling Network (ITDSN)	204	ES-10085
International Environmental Reports System	None	ES-None
Interstate Carrier Water Supply Inventory (ICWS)	206	ES-10079
Leachate	205	ES-10251
Library Files	104	ES-10042
Major Point Source and Effluent Loads-South Platte River	206	ES-10141
Management Reporting System (MRS)	106	ES-10305
Manufacturer vs EPA Vehicle Testing Results	201	ES-10064
Map Inventory and Status Sub-System (MISS)	206	ES-10034.03
Mass Spectral Identification	206	ES-10021
Master System	207	ES-10098
Microfilm-Microfiche System	107	ES-10302
Milk Directory Information System	204	ES-10198
Municipal Information System	206	ES-10297

System Title	EISD Category	Environmental System Identification Number
Municipal Waste Needs Facilities Inventory (STORET)	206	ES-10034.07
National Emissions Data System (NEDS)	201	ES-10056
National Environmental Radiation Data System (NERADS)	204	ES-10084
National Estuarine Inventory (NEI)	206	ES-10076
National - Regional Water - Land Resources Assessment	206	ES-10078
National Soils Monitoring System	203	ES-10222
NEDS Variable Data Sub-System (VDSS)	201	ES-10052
Nevada Test Site - Off-Site Human Surveillance System	204	ES-10312
Noise Information Service (NOISE)	202	ES-10026
Pasteurized Milk Network (PMN)	204	ES-10088
Pesticide Accidents File	203	ES-10273
Pesticide Air Monitoring Data System	203	ES-10207
Pesticide Collection Report File	203	ES-10272
Pesticide Community Studies Data System	203	ES-10209
Pesticide Episode File	203	ES-10293
Pesticide Human Monitoring Data System	203	ES-10208
Pesticide Import File	203	ES-10274
Pesticide Import File	203	ES-10232
Pesticide Sampling Information System	203	ES-10249

System Title	EISD Category	Environmental System Identification Number
Pesticide Sampling Information System	203	ES-10295
Pesticide Test Result	203	ES-10320
Pesticides Analysis Retrieval and Control System (PARCS)	203	ES-10083
Pesticides Import File	203	ES-10294
Pesticides Registration System	203	ES-10028
Power Plant Program Management Information System	207	ES-10119
Primary Test Data	201	ES-10240
Program Review and Evaluation System (PRES)	207	ES-10048
Project Information Retrieval System (PIRS)	104	ES-10089
Publications and Report System	104	ES-10270
Refuse Act Permit Program	207	ES-10255
Refuse Act Permits Program System (RAPP)	207	ES-10030
Regional Map Collection Index	104	ES-10101
Registration Records	203	ES-10039
Sample Handling & Verification System (SHAVES)	206	ES-10214
Sewage Treatment Plant Operation and Maintenance Data Retrieval	206	ES-10077
Solar Radiation Data Acquisition	206	ES-10319
Solid Waste Disposal Sites Inventory	205	ES-10296
Solid Waste Information Retrieval System (SWIRS)	205	ES-10095
Spill Information Retrieval System (OHM-SIRS)	206	ES-10074
Status of Recycling System	205	ES-10250

System Title	EISD Category	Environmental System Identification Number
Storage and Retrieval of Aerometric Data (SAROAD)	201	ES-10055
Storage and Retrieval of Water Quality Data (STORET)	206	ES-10034
STORET Station Location System	206	ES-10277
Surveillance Data Management	204	ES-10203
Technical Assistance Data System (OHM-TADS)	206	ES-10075
Technical Reports System	104	ES-10310
Technology Transfer Data Storage and Retrieval System	206	ES-10070
Toxicity Data File	203	ES-10318
Toxicology Data System	203	ES-10217
Tritium Network	204	ES-10086
Uranium Mill Tailing Survey	204	ES-10201
User Network for Applied Modeling of Air Pollution (UNAMAP)	201	ES-10185
Water Inventory System	206	ES-10066
Water Quality File Sub-System (STORET)	206	ES-10034.01
Water Quality Standards	206	ES-10241
Water Supplies Used on Interstate Carrier System	206	ES-10275
Wheeling Water Laboratory Analysis System	206	ES-10259

APPENDIX D

INTERAGENCY AGREEMENT

WHEREAS, the Secretary of the Interior established a Water Resources Scientific Information Center (hereinafter referred to as WRSIC) as a component of the Office of Water Resources Research, and the Federal Council for Science and Technology has designated WRSIC as the Federal-wide Water Resources Scientific Information Center;

WHEREAS, the objectives of WRSIC are to: serve as a focal point for water resources scientific information activities; initiate efforts to coordinate and supplement existing scientific information services; provide for such water resources scientific and technical information services as can be best accomplished on a nationwide level in cooperation with participating agencies; and insure the prompt flow of scientific and technical information from both participating agency systems and WRSIC to interested agencies and individuals;

WHEREAS, the activities of various water-resources organizations result in the generation of and the need for scientific and technical information which should be compatible with that generated by others within the United States water-resource community to enable more effective interchange and management;

NOW, THEREFORE, the parties hereto agree as follows:

1. The objective of this memorandum is to specify the relationship between the WRSIC and the Environmental Protection Agency (hereafter referred to as EPA) for processing all water related reports resulting from the EPA inhouse or sponsored activities into the WRSIC system, and for cooperatively establishing certain literature centers of competence which will be mutually advantageous and cover the field of water pollution.

2. To achieve the foregoing objective, the EPA agrees (within such limits as may be imposed by appropriated funding levels and agency priority) to:

   a. Provide two copies, plus a completed WRSIC input-transaction form, of all releasable technical reports or documents which deal with basic and applied research, development, or planning, as they may relate to water resources.

   b. Provide bibliographical citations, abstracts, and sets of index terms used in the WRSIC input-transaction form, which shall be compatible with those used by WRSIC.

   c. Establish and/or provide funding support for literature centers of competence which will acquire, abstract, and index literature from mutually agreed upon sources in the prescribed WRSIC format. To accomplish this, such centers of competence will:

(1) Furnish a copy of each document processed as above to the WRSIC.

(2) Provide the prescribed input to the WRSIC in the following subject areas and in such additional areas as shall be mutually agreed upon by an exchange of correspondence:

(a) Eutrophication
(b) Textile waste pollution
(c) Thermal pollution
(d) Wastewater treatment
(e) Coastal pollution
(f) Water quality requirements
(g) Pollution identification
(h) Oil spillage
(i) Irrigation return flow
(j) Water treatment waste pollution

3. To achieve the foregoing objective, WRSIC agrees in return to:

a. Monitor the output of the aforementioned literature centers of competence for quality and quantity.

b. Evaluate periodically the performance of the centers and report to the EPA.

c. Incorporate the output received from these centers into the WRSIC system.

d. Cooperate with the EPA in developing specialized system output products for the field of water pollution from the WRSIC information base as mutual needs and capabilities arise. As a specialized system output service, WRSIC will provide up to one hundred (100) computer searches of its information base per year for EPA project and grantee users.

e. Provide three hundred (300) copies of Selected Water Resources Abstracts, and a mutually agreed upon number of WRSIC produced publications and other services, as they may be developed.

4. This agreement may be terminated by either party upon sixty (60) days written notice.

5. This Memorandum of Agreement supersedes the agreement dated November 19, 1969.

4-7-1971	/s/ S. M. G.
Date	
Date	Director, Office of Water Resources Research, Department of the Interior

APPENDIX E

LIST OF INTERVIEWEES

EPA NETWORK INTERVIEWS THROUGH AUGUST 16, 1973

Name	Title	Location
Anderson, Joseph	Deputy Director	Analytical Quality Control Laboratory, Cincinnati
Andrews, Richard D.	Chemical Engineer Enforcement-Wastewater Permits	Region VIII, Denver
Bach, David	Program Assistant Office of Noise Control Programs	EPA Hqs., Washington
Bartlett, Robert	Federal Agency Liaison Staff Office of Federal Activities	EPA Hqs., Washington
Beierl, H. Gregory	Supervisory Chemist Technical Services Division	Region VIII, Denver
Bishop, William D.	Chief, Manpower Development and Training Branch	Region IX, San Francisco
Bloch, Wayne	Deputy Director, Data & Information Research Div.	EPA Hqs., Washington
Budde, William L.	Group Leader, Organic Instrumentation	Analytical Quality Control Laboratory, Cincinnati
Bunce, Ronald	Chief, ADP Support Branch	Region III, Philadelphia
Burleson, Ned K.	Sanitary Engineer Enforcement	Region VI, Dallas
Byram, Kenneth B.	Computer Specialist Laboratory Support Group	NERC, Corvallis
Caras, Gus J.	Chief, ADP and Statistical Section, Technical Info. Specifications	Pesticides Toxicology Research Station, Chamblee
Carson, Kathleen	Foreign Affairs Officer Office of International Activities	EPA Hqs., Washington
Childs, Norman E.	Tech. Publ. Clearance Officer Program Coordination Staff	NERC, RTP
Circiello, Jean M.	Librarian	Region IX, San Francisco
Cochran, Joseph A.	Civil Engineer, Field Operations Office of Research Programs	NERC-Las Vegas

Name	Title	Location
Cohen, Edward H.	Asst. R&D Regional Representative	Region III, Philadelphia
Conger, Charles S.	Chief, Info. Access & User Assistance Branch, Water and Planning Standards	EPA Hqs., Washington
Connolly, John A.	Tech. Info. Officer, SWIRS	EPA Hqs., Washington
Cook, Richard	Librarian	Primate & Pesticide Effects Laboratory, Perrine
Courson, Robert G.	R&D Regional Representative	Region X, Seattle
Crawford, Vera (Dee)	Librarian	Region VI, Dallas
Cummins, Rodney L.	Chief, Environmental & Monitoring Section	Region IX, San Francisco
Cuny, Philip A.	Computer Systems Analyst Field Operations Division	EPA Hqs., Washington
Donaldson, William T.	Chief, National Water Contamination Characterization Research Program	Southeast Environmental Research Laboratory, Athens
Dovel, John A.	Chief, Publications Branch Office of Research & Development	EPA Hqs., Washington
Duffer, William R.	Research Aquatic Biologist, Water Quality Control Program	Robt. S. Kerr Env. Research Laboratory, Ada
Duttweiler, David W.	Director	Southeast Environmental Research Laboratory, Athens
Dyer, John	Sanitary Engineer Technology Transfer	EPA Hqs., Washington
Feigner, Kenneth D.	Chief, Data Systems Branch	Region X, Seattle
Field, Joseph W.	R&D Regional Representative	Region VI, Dallas
Finklea, John F.	Director	NERC-RTP
Fisher, Farley	Chemist, Office of Toxic Substances	EPA Hqs., Washington
Fitch, Russell W.	R&D Regional Representative	Region VIII, Denver
Fitzgerald, Daniel T.	Actg. Chief, Info Systems and Analysis Branch	Region III, Philadelphia

Name	Title	Location
Forrest, James A.	Computer Specialist	Region IX, San Francisco
Friedman, Morton H.	Technical Info. Officer	NERC-Cincinnati
Fry, Elgin	Chief, Systems Services Info. Branch, Technical Services Div.	EPA Hqs., Washington
Fuller, Irving	Deputy Dir., Div. of Multilateral Organizations, Office of International Activities	EPA Hqs., Washington
Gakstatter, Jack H.	Aquatic Biologist Nat'l Eutrophication Survey Program	Pacific Northwest Env. Research Lab., Corvallis
Galegar, William C.	Director	Robt. S. Kerr Env. Research Lab., Ada
Gigliotti, Gilbert M.	Technical Information	NERC-Cincinnati
Gildea, Bernard	Chemist	Region II, New York
Gimble, Alexander F.	Pesticides	Region VI, Dallas
Gitto, Louis F.	Chief, Systems Analysis Branch	Region I, Boston
Glass, Norman	Acting Director	Nat'l Ecological Res. Lab., Corvallis
Hall, Marguerite	Computer Specialist Management Information and Data Systems	EPA Hqs., Washington
Halpin, Peter	Chief, Air Pollution Technical Information Center	NERC-RTP
Hannesschlager, Robert E.	Civil Engineer Surveillance & Analysis	Region VI, Dallas
Hass, Jeffrey W.	Sanitary Engineer	Region III, Philadelphia
Hazelett, Samuel	Program Information Branch	EPA Hqs., Washington
Hegre, Carman Stanford	Actg. Branch Chf., Toxicology	Nat'l Marine Water Quality Lab., Narragansett
Hendricks, Donald R.	Office of Research Programs	NERC-Las Vegas

Name	Title	Location
Hersey, David F.	President	Smithsonian Science Information Exchange, Inc., Washington, D.C.
Hess, Richard	Chief, Operations Branch Water Program Operations	EPA Hqs., Washington
Hooper, Mark	Physical Scientist	Region X, Seattle
Horton, Thomas R.	Staff Engineer Office of Res. Programs	NERC-Las Vegas
Ireson, Robert G.	Sanitary Engineer Surveillance Branch	Region IX, San Francisco
Janensch, Paul	General Manager	Pollution Abstracts, San Diego
Jarvis, Arthur N.	Instructor Office of Quality Assurance	NERC-Las Vegas
Jaworski, Norbert A.	Director	Pacific Northwest Env., Research Lab., Corvallis
Jensen, Ray	Director	WRSIC, Washington
Johnson, Dion	Information Technologist Program Information Branch	EPA Hqs., Washington
Jones, Thomas C.	Air & Water Planning Branch	Region IX, San Francisco
Kapinos, Paul	Sanitary Engineer Monitoring & Data Support Div.	EPA Hqs., Washington
Kari, Earl N.	Deputy Director	NERC-Corvallis
Keeley, Jack W.	Sanitary Engineer Groundwater Treatment	Robt. S. Kerr Env. Research Lab., Ada
Kimbrough, Renate D.	Actg. Chief, Bioeffects Laboratory	Pesticides Toxicology Research Station, Chamblee
Krawczyk, Daniel F.	Chemist Consolidated Lab. Services	Pacific Northwest Env. Research Lab., Corvallis
Lacy, William J.	Chief, Applied Science & Technology	EPA Hqs., Washington

Name	Title	Location
Lattimer, John	Librarian	Region VIII, Denver
Law, James P.	Project Officer, Irrigation Return Flow Quality Center of Competence	Robt. S. Kerr Env. Research Lab., Ada
Levy, Burton	Director of Administration	NERC-RTP
Levy, Steven J.	Sanitary Engineer Resource Recovery	EPA Hqs., Washington
Lewis, Claudia	Tech. Info. Specialist	Pesticides Technology Research Station, Chamblee
McBride, John R.	Deputy Director	NERC-Las Vegas
McCammon, Helen	Region I R&D Representative	Region I, Boston
McCauley, Betty M.	Librarian	NERC-Corvallis
McGuire, John M.	Research Chemist	Southeast Environmental Research Lab., Athens
McMillion, Leslie G.	Hydrologist, Office of Research Programs	NERC-Las Vegas
Michel, Robert L.	General Engineer Water Program Operations	EPA Hqs., Washington
Morgan, George G.	Monitoring Systems R&D Div.	NERC-Las Vegas
Neligan, Robert E.	Offc. of Air Planning Quality and Standards	NERC-RTP
Nime, Edward J.	Supv., Computer Systems	NERC-Cincinnati
O'Connor, Michael	Off. of Research Programs	
Oneal, Gary L.	Physical Science Administrator Surveillance & Analysis Div.	Region X, Seattle
Osborn, John	Sanitary Engineer Technology Transfer	Region X, Seattle
Ozolins, Guntis	Director of Quality Assurance, Office of R&D	EPA Hqs., Washington

Name	Title	Location
Payne, Robert	Physical Science Administrator Data & Info. Research Div.	EPA Hqs., Washington
Perman, Robert	Executive Officer Office of Program Management Operations	EPA Hqs., Washington
Peters, Charles W.	Physical Scientist Offc. of Radiation Programs	EPA Hqs., Washington
Peterson, Harold T.	Health Physicist Surveillance Branch, ORP	EPA Hqs., Washington
Phelps, Donald K.	Chief, Ecological Research Br.	Nat'l Marine Water Quality Lab., Narragansett
Pintler, Herbert E.	Aquatic Biologist	Region IX, San Francisco
Power, Charles F.	Supv., Aquatic Research	NERC-Corvallis
Ramsey, Ralph	Animal Wastes Center of Competence	East Central State College, Ada
Renner, Fred H.	Technical Information Officer	NERC-RTP
Resnik, Anthony V.	Sanitary Engineer Surveillance Branch	Region IX, San Francisco
Rosenstein, Larry	Sanitary Engineer	Primate & Pesticides Effects Lab., Perrine
Sanders, Walter M.	Chief, Nat'l Pollution Fate Research Program	Southeast Environmental Research Lab., Athens
Santolucito, John A.	Supervisory Pharmacologist	Primate & Pesticides Effects Lab., Perrine
Schneider, Eric	Director	Nat'l Marine Water Quality Lab., Narrangansett
Schuck, Edward A.	Chemist, Transport Processes Branch	EPA Hqs., Washington
Seba, Douglas B.	Technical Liaison Officer	Nat'l Field Investigation Center, Denver

Name	Title	Location
Shew, D. Craig	Research Chemist Ecological Processes & Effects Division	Robt. S. Kerr Env. Research Lab., Ada
Shobe, Randall	Supervisor, Budget & Mgmt. Office of Program Mgmt.	EPA Hqs., Washington
Skogerboe, Gaylord	Irrigation Return Flow Quality Center of Competence	Colorado State University, Fort Collins
Smiecinski, Ralph	Chief, Offc. of Quality Assurance	NERC-Las Vegas
Smith, Allan E.	Chief, Planning & Management Monitoring Operations Div.	NERC-Las Vegas
Smith, Ethan T.	Physical Science Administrator	Region II, New York
Snelling, Robert	Chief, Data Acquisition	NERC-Las Vegas
Stenburg, Mike	Chief, Surveillance Branch	Region IX, San Francisco
Taras, Mike	Water Treatment Plant Wastewater Pollution Control Center of Competence	American Water Works Association, New York
Tarran, Jack	Program Management Officer Offc. of International Activities	EPA Hqs., Washington
Tenney, Vern	R&D Regional Representative	Region IX, San Francisco
Thomas, Sarah	Library Director Library Systems Branch	EPA Hqs., Washington
Thompson, John F.	Chemist	Primate & Pesticides Effects Lab., Perrine
Thompson, Loren	Chemist Offc. of Quality Assurance	NERC-Las Vegas
Tilstra, John R.	Chemist Surveillance & Analysis Div.	Region VIII, Denver
Vincent, James R.	Physical Science Administrator	Nat'l Field Investigation Center, Denver
Weddle, Bruce R.	Technical Assistance Coordinator, OSWMP	EPA Hqs., Washington

Name	Title	Location
Weiner, Lawrence	Systems Analyst Program Information Branch	EPA Hqs., Washington
Weir, Arvella J.	Librarian	Region X, Seattle
White, David R.	Computer Systems Tech. & Admin. Data Support Br.	Region VI, Dallas
White, John J.	Physical Science Administrator	Region IX, San Francisco
Whittaker, Earl L.	Chemist, Offc. of Quality Assurance	NERC-Las Vegas
Wickman, Doreen T.	Librarian	NERC-Las Vegas
Williams, Thomas F.	Dir., Tech. Info. Staff	EPA Hqs., Washington
Willmann, James C.	Sanitary Engineer Office of Oil	Region X, Seattle
Wruble, Donald T.	Chief, Monitoring Operations Division	NERC-Las Vegas
Ziegler, Lee	Physicist Offc. of Quality Assurance	NERC-Las Vegas

APPENDIX F

THE CONCEPT OF INFORMATION NETWORKS

THE CONCEPT OF INFORMATION NETWORKS

In recent years increased national recognition has been given to the concept of information networks, which Becker and Olson[32] define as follows:

> "In an information network, more than two participants are engaged in a common pattern of information exchange through communications for some functional purpose".

In some instances, the functional purposes of information exchange may be quite general. For example, for years libraries have operated a very loosely constructed information network for the exchange of books and journals (interlibrary loans) and for the centralized storage of older and infrequently used materials (archival storage). In modern-day context, however, the functional purposes of information exchange are becoming more and more specialized.

There are several types of networks currently evolving in the United States and elsewhere and a problem of definition exists regarding the types and functions of various networks. Figure 4 presents three basic types of networks: 1) data communication networks, 2) computer networks, and 3) information networks. Information networks have existed long before computer or data communication networks were developed. In the broadest sense, an information network can be a banding together of various types of information resources (e.g. libraries, information systems, referral centers) into some type of communication cooperative.

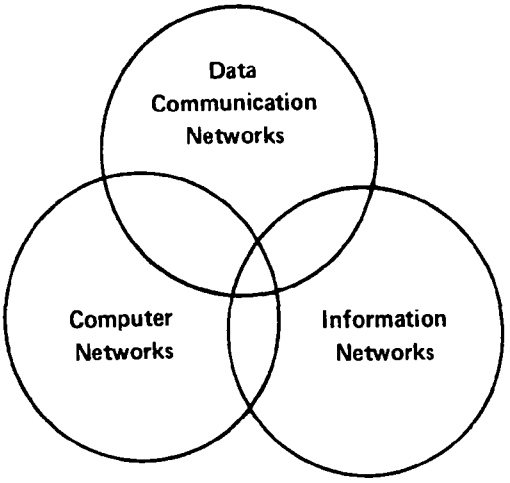


FIGURE 4. NETWORK TYPES AND RELATIONSHIPS

The computer networks have more recently evolved and are typified by the ARPANET network in which many computers are linked together via a data communications network. An example of a data communications network not necessarily geared toward computer communication is the Western Union system. An example of a computer network that does not rely on an external data communications network is the ILLIAC IV system designed at the University of Illinois in which many computers are linked together at one site to form a single computing facility.

Much of the confusion arises over a network consisting of a single computer serving many users via a communication network. Referring to Figure 4 this would be viewed as an information network (sharing of resources) overlapping a data communication network, but it is not a network of computers. This brief description is meant to help distinguish between various types of networks and point out how one type of network may make use of another type of network in accomplishing its functions. Looking specifically at information networks, historically they are usually identified by: 1) class of equipment, 2) form of data, or 3) function, as indicated in Table 11.

TABLE 11. IDENTIFICATION OF INFORMATION NETWORKS

Class of Equipment	Form of Data	Function
Telephone	Audio	Financial
Teletype	Digital	Library
Facsimile	Graphic	Biomedical
Radio		Educational
Television		Agricultural
Computer		Management

Source: Adapted from J. Becker and W. C. Olson, "Information Networks", Annual Rev. Inform. Sci. Technol., Vol. 3, 289-327 (1968).

It is easy to conceive an information network configuration based upon various combinations of the identifying elements shown in the table.

A less restrictive view of the network concept is provided by consideration not of the elements but of the characteristics for an information network, as presented by Swank[33] and shown in Table 12.

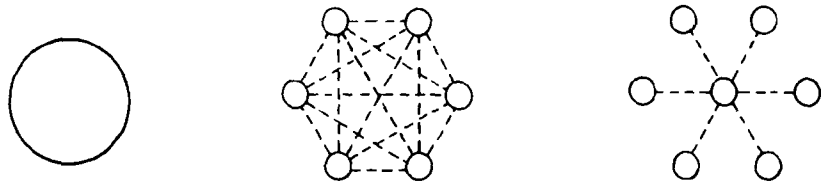
Network Organizations

Recognition of the possible organizational relationships is also significant in understanding the network concept. The top part of Figure 5 shows three types of network organizations[34]. The simplest of these is the monolith. The monolith is a highly centralized information system that draws together into one system those functions that might otherwise be performed by a number of individual systems. For its designated sphere of cognizance, the monolith acquires all of the required information, processes it into a unified store, receives and responds to all inquiries, and provides all the needed products and services for the entire user population.

TABLE 12. CHARACTERISTICS OF INFORMATION NETWORKS

Characteristics	Prescription
Information resources	Collections of documents or data in whatever medium (the data bases; the input)
Readers or users	Usually remote from the main information resources
Intellectual access systems	Schemes for the intellectual organization of documents or data as directories for use by readers or users
Physical access systems	Methods for the delivery of resources to readers or users – the output
Formal organization	Combinations of cooperating or contracting formations, representing different data bases and/or groups of users
Bidirectional communications	Network links, preferably through high-speed, long-distance electrical transmission with switching capabilities and computer hook-ups

Source: Adapted from R. C. Swank "Interlibrary Cooperation, Interlibrary Communications, and Information Networks – Explanation and Definition", Proceedings of the Conference on Interlibrary Communications and Information Networks, p. 18-26, American Library Association, 1971.

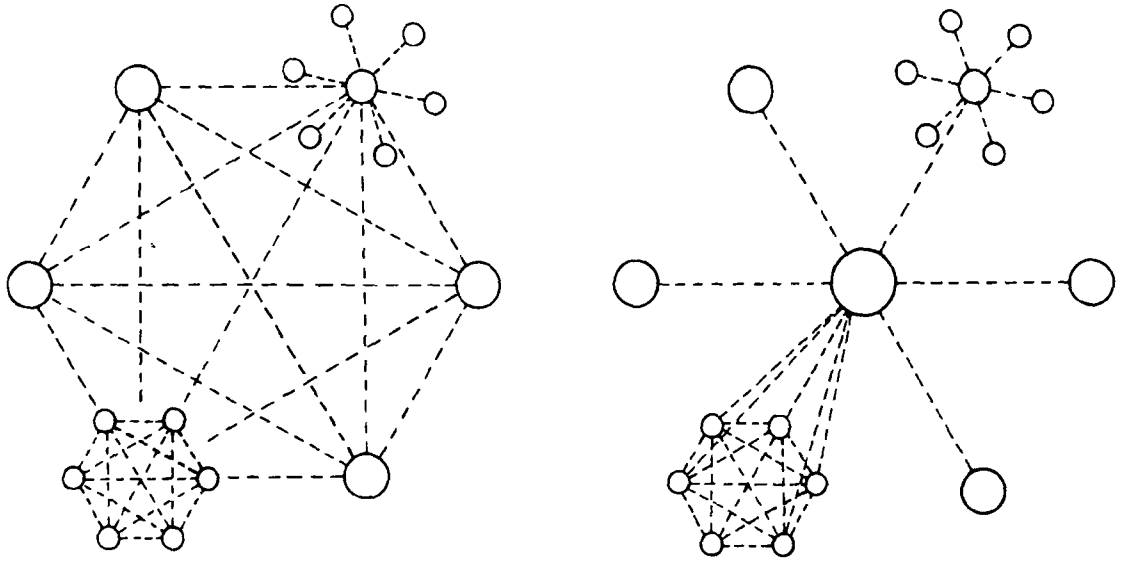


a. Monolith

b. Free – Unorganized

c. Coordinated

Basic Networks



d. Free – Unorganized

e. Coordinated

Agglomerated Networks

FIGURE 5. NETWORK ORGANIZATIONS

The second type--the free-unorganized network--permits individual systems to develop whenever and wherever they are needed. To the extent that interaction or cooperation between the diverse systems is required to service an inquiry properly or to provide other products and services, the operators of each of the individual systems must establish and maintain such channels of interaction as they see fit.

The third type--the coordinated network--also permits individual systems to develop wherever needed. Here, however, a central coordinating organization is superimposed on the population of individual systems such that the lines of interaction are markedly simplified. For example, suppose an inquiry is directed to one of the systems in the network, but a comprehensive response to the inquiry requires inputs from a number of the other systems. In the coordinated network, the centralized coordinating body would assume the task of acquiring and coordinating multiple inputs and making them available to the system that must answer the inquiry.

This characteristic of the coordinated network provides the basis for understanding the concepts of "referral" and "switching". In a referral network, the inquiry addressed to any individual system is referred to other systems that can contribute the answer. This requires the inquirer to establish direct contact with these other systems in order to obtain their inputs to the answer, consolidates these inputs, and presents to the inquirer a comprehensive, coordinated response to his inquiry. In both the referral network and the switching network it is the centralized coordinating body that provides the intersystem cooperation required.

The three basic organizational models shown in Figure 5 can be applied to information situations at almost any level of generality or specificity.

APPENDIX G

LIST OF ACRONYMS

As an illustration, they might be applied at the level of handling information for a corporation. The corporation could consider building a monolithic structure, "the corporate information system". What is more likely to happen, however, is that the corporation would allow each department (manufacturing, finance, personnel, marketing, etc.) to devise and construct its own information-handling facilities as it sees fit. If the latter is the case, the corporate information system may become either a free-unorganized network or a coordinated network (involving a centralized corporate information referral or switching group).

The same organizational models can be applied at a national level. The Soviet Union, for example, has chosen to implement the monolithic VINITI, the centralized Soviet national system for handling scientific and technical information. The national "system" of information handling in the United States, however, comprises a free-unorganized network in which individual systems of various types, sizes, and subject areas have been permitted to grow and interact on an almost totally uncontrolled basis. The influence applied so far by the United States Government has been in the direction of achieving a coordinated national network of information systems rather than a monolithic structure.

In addition to the three basic organizational models that might be applied to any level of generality or specificity for an overall information-handling entity, it is important to realize that any single satellite system of such an entity (when the entity is either a free-unorganized model or a coordinated model) could itself be organized according to any one of the three models. Thus, these three organizational models can form a variety of agglomerated networks (bottom of Figure 5) to represent the total complex of organization relationships in all types of information-system networks, from the very simple to the very complex.

ACRONYMS

ADP	-	Automatic Data Processing
AEC	-	Atomic Energy Commission
AMIC	-	Analytical Methodology Information Center
ANSWER	-	Automated National Sensor Work Platform for Environmental Research
APTIC	-	Air Pollution Technical Information Center
AQCL	-	Analytical Quality Control Laboratory
AQCR	-	Air Quality Control Region
AQDHS	-	Air Quality Data Handling System
AQDM	-	Air Quality Display Model
BCL	-	Battelle Columbus Laboratories
BIOSIS	-	Biosciences Information Services
CAMP	-	Continuous Air Monitoring Program
CDHS	-	Comprehensive Data Handling System
CDM	-	Climatological Dispersion Model
CDS	-	Compliance Data System
CFSS	-	Combined File Search System
CHAMP	-	Continuous Health Air Monitoring Program
CHESS	-	Community Health Environmental Surveillance System
CIS	-	Contracts Information System
CISS	-	Categorical Information Summary System
CMIS	-	Comprehensive Management Information System
COSATI	-	Committee on Scientific and Technical Information
CPEHS	-	Consumer Protection and Environmental Health Service
CSC	-	Computer Sciences Corporation
CSS	-	Community Studies System
CWSSI	-	Characteristics of Water Supply Systems
DCIM	-	Direct Cost of Implementation Model
DHEW	-	Department of Health, Education and Welfare
DIGIS	-	Dissolved Gas Information System
DIPEDIT	-	Decimal Input Edit
DIPS	-	Departmental Integrated Personnel Services
DIRD	-	Data and Information Research Division
DTI	-	Document-Based Technical Information
ECA	-	Environmental Control Administration

EDES - Environmental Data Evaluation System
EHIN - Environmental Health Information Network
EHS - Environmental Health Service
EISD - Environmental Information Systems Directory
EMS - Enforcement Management System
ENVIRON - Environmental Information Retrieval On-Line
EPA - Environmental Protection Agency
EPIC - Environmental Project Information Coordination
EQM - Energy Quality Model
EROS - Environmental Research Objective Statement
FARS - Fuel Additive Registration System
FDA - Food and Drug Administration
FEDFAC - Federal Facilities System
FINR - Final Reports File
FPC - Federal Power Commission Tape
FTS - Federal Telecommunications System
FWPCA - Federal Water Pollution Control Act
FWQA - Federal Water Quality Administration
GAO - General Accounting Office
GAP - Group Associates Program
GCIS - Generalized Cataloging and Inquiry System
GFDF - General Facilities Discharge File
GPSF - General Point Source File
GSA - General Services Administration
HAPEMS - Hazardous Air Pollutant Enforcement Management System
HBN - Human Bone Network
HEW - Health, Education and Welfare
HMS - Human Monitoring System
ICWS - Interstate Carrier Water Supply Inventory
IMIS - Integrated Management Information System
IPP - Air Quality Implementation Planning Program
IRIS - Information Resource Identification System
IRS - Information Reporting System
IRS - International Referral Service
IRSIS - Ionizing Radiation Source Inventory System
ISI - Institute for Scientific Information
ITDSN - Institutional Total Diet Sampling Network
IWES - Industrial Waste Literature File
KWOC - Automatic Indexing by Keyword
KWOC - Keyword Out of Context
LSC - Library Systems Coordination
MCDF - Master Code Descriptor Files
MDQARL - Methods Development and Quality Assurance Research Laboratory
MICS - Management Information and Control System
MIDSD - Management Information and Data Systems Division
MISS - Map Inventory and Status Subsystem

MIT - Milestone Interval Table
MSPCP - Mobile Sources Pollution Control Program
MRS - Management Reporting System
NADB - National Air Data Branch
NADB - National Ambient Data Bank
NADIS - National Aerometric Data Information System
NAPCA - National Air Pollution Control Administration
NASA - National Aeronautics and Space Administration
NASN - National Aerometric Surveillance Network
NEDB - National Emissions Data Bank
NEDS - National Emissions Data System
NEI - National Estuarine Inventory
NEIS - National Environmental Information Symposium
NERADS - National Environmental Radiation Data System
NERC - National Environmental Research Center
NESI - National Environmental Systems Inventory
NICS - National Institute for Community Development
NIH - National Institutes of Health
NOISE - Noise Information Service
NRC - National Referral Center
NSIS - National Sources Inventory Section
NTIS - National Technical Information Service
NTS - Nevada Test Site
OHM-SIRS - Office of Hazardous Materials--Spill Information Retrieval System
OHM-TADS - Office of Hazardous Materials--Technical Assistance Data System
OMB - Office of Management and Budget
OSI - Optimum Systems Inc.
OTIC - Office of Technical Information Coordination
PAMS - Pesticides Air Monitoring System
PARCS - Pesticides Analysis Retrieval and Control System
PCS - Petitions Control System
PHS - Public Health Service
PMN - Pasteurized Milk Network
PMS - Personnel Management System
PPBS - Programming, Planning and Budgeting System
PIRS - Project Information Retrieval System
PRES - Program Review and Evaluation System
PRS - Product and Registrant System
RAN - Radiation Alert Network
RAPP - Refuse Act Permit Program
RAPS - Regional Air Pollution Study
RECON - Remote Console
REMS - Regional Economic Model System
RMI - River Mile Index
ROAP - Research Objective Achievement Plans
RPG - Report Program Generator

RPIO	-	Responsible Planning and Implementation Officer
RTP	-	Research Triangle Park
SAROAD	-	Storage and Retrieval of Aerometric Data
SAS	-	Statistical Analysis System
SATCOM	-	Committee on Scientific and Technical Communication
SCC	-	Source Classification Code
SEAS	-	Strategic Environment Assessment System
SHAVES	-	Sample Handling and Verification System
SIF	-	Science Information Facility
SIP	-	State Implementation Plans
SMF	-	System Management Facility
SPSS	-	Statistical Package for the Social Sciences
SSIE	-	Smithsonian Science Information Exchange
SSPCP	-	Stationary Source Pollution Control Program
STIMS	-	Scientific Technical Information Modular System
STIC	-	Scientific and Technical Information Coordination
STORET	-	Storage and Retrieval of Water Quality Data
STPOM	-	Sewage Treatment Plant Operation and Maintenance Data Retrieval
SWIRS	-	Solid Waste Information Retrieval System
TADS	-	Technical Assistance Data System
TAME	-	Data Acquisition System
TIMPS	-	Technical Information and Management Planning System
TNRIS	-	Transportation Noise Research Information Service
TRAIS	-	Transportation Research Activities Information System
TSN	-	Tritium Surveillance Network
UNAMAP	-	Users Network for Applied Modeling of Air Pollution
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey
UTM	-	Universal Transverse Mercator
VDSS	-	NEDS Variable Data Subsystem
WRSIC	-	Water Resources Scientific Information Center
WUIS	-	Work Unit Identification System

APPENDIX H

INFORMATION NETWORK STUDY MEMORANDUM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 28 1973

SUBJECT: Information Network Study

FROM: Assistant Administrator for Research and Development

TO: See Distribution

In the period since its inception, EPA has developed or augmented many valuable scientific and technical information resources vital to the accomplishment of its goals. In order to utilize these important resources to their fullest potential, we are undertaking a scientific and technical information network concept study, the goal of which is continued resource evolution in a systematic manner.

On June 1, 1973, we initiated a six-month contract with the Columbus Laboratories of Battelle Memorial Institute. The purpose is to devise a development plan for the creation of a scientific and technical information network from EPA's resources as well as from information resources of other agencies that relate to the EPA mission.

In the next few months, Battelle personnel and personnel from our Data and Information Research Division, Office of the Assistant Administrator for Research and Development, will be visiting some of you to obtain information required to build the foundation from which to develop the network concept and plan.

If you have any questions regarding the purpose or goals of this study, additional details are available from Luther Garrett, (202) 755-0638.

I consider the results of this project very important to the future effectiveness of EPA's scientific and technical information activities and would appreciate your full cooperation with the research team if it should seek your assistance.

Stanley M. Greenfield

Distribution

Assistant Administrators
Office Directors
Deputy Assistant Administrators
Regional Administrators
NERC Directors

APPENDIX I

LIST OF DIRECTORIES SCREENED FOR NON-EPA INFORMATION RESOURCES

LIST OF DIRECTORIES

1. Encyclopedia of Information Systems and Services, 1st Edition. Ann Arbor, Edward Brothers, 1971. 1109 p.

*2. A Directory of Information Resources in the United States: Physical Science, Engineering. Washington, D.C., Library of Congress, 1971. 803 p.

*3. A Directory of Information Resources in the United States: Biological Science. Washington, D.C., Library of Congress, 1972, 577 p.

4. Encyclopedia of Associations--Volume I, National Organizations of the U.S., 7th Edition. Detroit, Gale Research Co., 1972.

5. Directory of Water Pollution Research Laboratories. Organization for Economic Cooperation & Development, 1966. 519 p.

6. Directory of Information Resources in Agriculture-Biology Washington, D.C., National Agriculture Library, 1971. 523 p.

7. United States Government Organization Manual, 1972/73. Washington, D.C., Government Printing Office, 1972. 710 p.

8. Available Data Banks for Library & Information Sources. Tempe, Arizona, LARC Association, 1973.

9. Caroll, Kenneth. Survey of Scientific-Technical Tape Services. National Technical Information Service, Washington, D.C. Publication Number PB 196 154. September 1970. 64 p.

*10. Combs, Z., et. al. Directory of Environmental Information Sources. Oak Ridge National Laboratory, Oak Ridge, Tennessee. Publication Number ORNL-EIS-71-5. October 1971. 57 p.

11. Battelle EHS Study, Volume IV: Directory of EHS Information Facilities with Selected Supplementary Resources. Battelle Memorial Institute, Columbus, Ohio.

12. Analysis of Information Requirements of the Noise Abatement Community. Final Report. Informatics, Inc., Washington, D.C. May 24, 1972.

13. U. S. Organization Chart Service, P. O. Box 15175, San Diego, California

*14. Government Air Pollution Agencies, 1972-1973 Directory. Air Pollution Control Association, Pittsburgh, Pennsylvania, 1972.

*15. Your Government and the Environment. An Annual Reference. Matthew J. Kerbec, Editor. Output Systems Corporation, Virginia, 1971.

*16. Directory of Government Agencies Safeguarding Consumer and Environment, 4th Edition. Alexandria, Virginia, Serina Press, 1971.

17. Ulrich's International Periodicals Directory, 14th Edition, 1971-72. New York, R. R. Bowker Co., 1972.

*18. Research Centers Directory, 4th Edition. Detroit, Gale Research Co., 1972. 1033 p.

19. Consultants and Consulting Organizations Directory, 2nd Edition. Detroit, Gale Research Co., 1973. 835 p.

20. Directory of Special Libraries & Information Centers, 2nd Edition. Detroit, Gale Research Co., 1968. 1048 p.

21. Journal of Water Pollution Control Facilities. Water Pollution Control Agencies. March 1973. p. 142-151.

*22. The Federal Environmental Monitoring Directory. Council on Environmental Quality. May 1973.

23. Scientific, Technical & Related Societies of the U.S., 9th Edition. Washington, D.C., National Academy of Sciences, 1971. 213 p.

24. International Scientific Organizations: A Guide to Their Library, Documentation & Information Indexes. Washington, D.C., Library of Congress, 1962. 794 p.

25. International Scientific Organizations. Organization for European Cooperation & Development, 1965.

26. Specialized Science Information Services in the United States. Washington, D.C., National Science Foundation, 1961.

27. Agriculture-Environmental & Consumer Protection Appropriations for 1974, Part 5: Environmental Protection. (Hearings before a Subcommittee of the Committee on Appropriations. House of Representatives. 93rd Congress, 1st Session.)

28. Agriculture-Environmental & Consumer Protection Appropriations for 1974, Part 8: Miscellaneous. (Hearings before a Subcommittee of the Committee on Appropriations. House of Representatives, 93rd Congress, 1st Session.)

*29. Environmental Information Sources: Engineering and Industrial Applications. A Selected Annotated Bibliography. Carole Schildhauer, Compiler. New York, Special Libraries Association, 1972. 45 p.

*30. Bonn, George S., ed. Information Resources In the Environmental Sciences. University of Illinois, Graduate School of Library Science. (Papers presented at the 18th Allerton Park Institute. November 12-15, 1972.) 1973. 238 p.

*Most productive sources

APPENDIX J

MANAGEMENT BRIEFING REPORT

INTRODUCTION

This is a condensed version of a February 1974 report entitled EPA Scientific and Technical Information Network Concept and Implementation Plan prepared under EPA Contract No. 68-01-1854. A more highly condensed version is contained in the blue pages labeled Management Summary which are attached at the end of this document.

REASON FOR THIS RESEARCH PROJECT

In September 1972, William D. Ruckelshaus, then Administrator, U. S. Environmental Protection Agency stated:

> We may indeed, as one scientist has suggested, already have a substantial part of the scientific information we need to ensure the protection and preservation of our common environment. Yet we don't have timely access to it because retrieval systems are uncoordinated or non-existent. There is as great a need to organize and manage information as there is to make new discoveries.

Furthermore, despite its large expenditures for scientific and technical information, EPA does not appear to have fulfilled the President's mandate under Reorganization Plan 3 of 1970 to gather information on pollution, to use the information to strengthen environmental protection programs, and to recommend policy changes. Rationale for that statement stems from the 1972 National Environmental Information Symposium (NEIS) where the consensus of some 1700 participants was that their most common concern was the need for improved awareness of, and access to, environmental information.

Since EPA's Environmental Information Systems Directory listed almost 300 administrative and environmental mission support information activities, and there were many additional information resources outside EPA, personnel of the Data and Information Research Division (DIRD) sought a solution to controlling the proliferation of information resources and to the findings of the NEIS. Because their

interest was centered upon EPA, they undertook a detailed review of previous information studies of EPA and its predecessor services.

It was their conclusion that the information network approach presented in a 1970 study of the scientific and technical information requirements of the Environmental Health Service (EHS) offered the most appropriate solution for EPA. However, the 1970 EHS report did not reflect current EPA policies, organizational structure, and Congressional and private pressures. Further, the number of information and data resources had increased and become more complex. Because of those factors, this current study was undertaken.

RECOMMENDATIONS

As a result of this study, the following recommendations were made to EPA:

1. The EPA should establish an Office of Technical Information Coordination (OTIC) which would report at the Administrator level.

2. The mission of OTIC would be to plan, coordinate, and encourage improved accessibility, handling, and usage of environmental information and data within a developing coordinated network.

3. OTIC should appear as a line-item in the EPA budget.

4. OTIC would be an active group-oriented undertaking which would be structured and implemented over a time period of approximately four years and would:

   - Establish a scientific and technical information coordination function to provide a current knowledge of sources of scientific and technical information.

   - Establish an environmental project information coordination function to provide a current knowledge of sources of information on on-going projects.

   - Incorporate the present functions (excluding the operation of the Headquarters Library) of the Library Systems Branch to provide for library systems coordination.

- Establish a group communications function to provide a forum furnishing the atmosphere for discussion of common problems and to serve as EPA's public spokesman for environmental information in a non-conflicting relationship with the Office of Public Affairs.

- Provide advisory services through its designation as the initial source for resolution of EPA's problems in information science in order to minimize the duplication of effort and inconsistency of approach possible if different individuals or contractors act without coordination.

- Establish an information research function to conduct, or more often cause to be conducted, intramural and extramural research studies of information/data handling techniques and transfer processes to assure that attention is drawn to improvements which can be made by existing organizations.

- Establish an EPA Information Committee and an Interagency Advisory Council to assist the Director of OTIC in the execution of his planning responsibilities.

An alternative plan is provided should EPA elect to devote fewer resources to its information activities than would be required to achieve the above goals of OTIC. The alternative retains the objectives of the first recommendation but scales back the level of effort to approach each of the operations on a priority selection basis with reduced performance. Under the alternative plan, EPA would create the position of Information Science Advisor to the Administrator. The Advisor would:

> Keep the Administrator informed of, and suggest line action to be taken with respect to all EPA present, contemplated, or needed information science activities.
>
> Establish a referral capability for environmental project information systems and for scientific and technical information systems.

Create a presence about which the resources of EPA could be marshalled for execution of its information responsibilities.

A detailed implementation plan is provided which permits EPA to establish either the recommended OTIC or the alternative of an Information Science Advisor to the Administrator. Sufficient flexibility is included in the plan to permit EPA to evaluate progress and benefits at each step. Should EPA elect to initiate the alternative plan first (e.g. establish the Office of the Information Science Advisor), the functions of OTIC may be implemented and added as desired.

NETWORK CONCEPT PLAN

THE PLAN

Given the autonomy of EPA organizations, their geographical dispersion, their variety of subject interests, their diversity of functional needs, the disparity between information user practices, the general image of heterogeneity displayed by EPA, and the many information resources outside EPA control, it is not likely that improvement in EPA's information practices or position can easily be effected either by a high degree of centralization or by a dedicated approach to a strong line organization with its accompanying authority and responsibility.

The solution would really appear to lie with the creation of an active, group-oriented undertaking (recognized as a line item in the appropriations budget) which provides--in addition to a forum furnishing the atmosphere for discussion of common problems--an organization to coordinate and conduct research, user studies, and pilot demonstrations of a planning and coordinating nature, and to provide a current referral service for environmental information. In addition, the organization would actively promote information standards agreed upon by participating groups, would mount an educational thrust in areas of information science of pertinence and practical value for EPA, and would serve as EPA's public spokesman for environmental information in a non-conflicting relationship with the Office of Public Affairs. The proposed controlling group is termed the Office of Technical Information Coordination (OTIC).

SCOPE

OTIC would be dedicated to consideration of the national environmental information/data resources. However, it also would be the logical body to represent the United States in any larger organization formed to consider the international aspects of environmental information/data.

The considerations of OTIC should be oriented toward any or all levels of audience including management, supervision, the professional working level, and the technical support level.

OPERATIONS

The operations are the specific tasks to be performed by the organization. The operations of OTIC are limited to the support, development, and coordination type aimed at providing group benefits. The operations to be performed typically would be the following:

Hold Meetings

This operation comprises all of the aspects of conducting effective group communications among the various segments of the environmental information and data community. Meetings would be planned so as to bring together representatives of diverse groups in the community for discussion, and hopefully resolution, of common problems.

Make Recommendations

Discussion and resolution of problem areas as described above will lead naturally to the formulation of recommendations of a planning nature. Specifically, the organization would be in a position to suggest needed improvements in the environmental information/data environment.

Provide EPA-Wide Information Advisory Service

OTIC should be designated as the initial source for resolution of EPA problems in information science in order to minimize the possible duplication of effort and inconsistency of approach if different individuals or contractors acted without coordination.

Public Spokesman

The organization would direct efforts toward increasing the effectiveness of the transfer of environmental information and data through a promotional and educational spokesman, supplementing the role of the Office of Public Affairs.

Promote Information Standards

The organization would bring together representatives of interested groups for the purpose of formulating information/data handling standards. The broad base of the participating groups would provide an opportunity to achieve the maximum possible consensus before the information standards are adopted throughout the environmental information/data community.

Conduct Information Research

OTIC would conduct, or more often cause to be conducted, intramural and extramural research studies of information/data handling techniques and transfer processes to assure that attention is drawn to improvements which can be made by existing organizations serving environmentalists. The studies would be advisory in nature, and would be conducted by the OTIC staff, by the Data and Information Research Division, by committees or panels of qualified individuals, or by contractors and grantees.

Monitor Information Research

OTIC would stand as a central focus in the environmental information community and would review all EPA requests for funding to provide

scientific and technical information services and would comment appropriately on those applications so as to place them in context with the needs of the environmental community.

Analyze User Needs

A continuing study of the environmental community would be conducted to sense its changing needs. Mechanisms for detection of new or revised needs would be developed and appropriate research programs would be undertaken when needed.

Perform Pilot Demonstrations

While OTIC would not be a major operating resource in terms of information services, it would perform or authorize limited pilot demonstrations to show feasibility of methods and products developed through the research program and the user analysis.

Referral

OTIC would establish relationships with collections or repositories of documents and data (including on-going projects) to facilitate accessibility of information resources to individuals and institutions.

Orientation Program

A program should be established to inform the environmental community, particularly EPA personnel, about the purposes of OTIC.

ORGANIZATION

It was stated earlier that it did not appear that improvement in EPA's information practices could easily be effected by a high degree of centralization or a dedicated approach to a strong line operation

with its accompanying authority and responsibility. This view led to the conception of the Office of Technical Information Coordination (OTIC) as an active, group-oriented undertaking for planning, coordinating, and encouraging improved handling of environmental information and data. Given such conditions, in order for OTIC to be effective, it becomes necessary to enhance its organizational image and its consequent acceptance within the environmental community. Hopefully, the required stature can be achieved through three courses of action: 1) designate OTIC as a staff office at the EPA Administrator level; 2) let it be known by the Administrator that he considers the functions of OTIC to be of great importance to the success of the EPA mission and that he will impute line authority to OTIC efforts; and 3) performance of its functions by OTIC in a fashion which demonstrates that its actions benefit those that it affects.

Figure 1 shows the proposed organizational structure for OTIC. The functions which each of the organizational units would perform already have been described in some detail and all need not be repeated here, but a few warrant further attention. The structure shown represents what is presently envisioned as the ultimate goal. The structure should be implemented on an incremental basis depending upon priority of need and resources available.

Director of OTIC--

The Director of OTIC will have a strong coordinating role on the international level, the national level, and within EPA. Many of his functions and responsibilities have been described in the preceding section on OPERATIONS of OTIC. Some currently anticipated additional

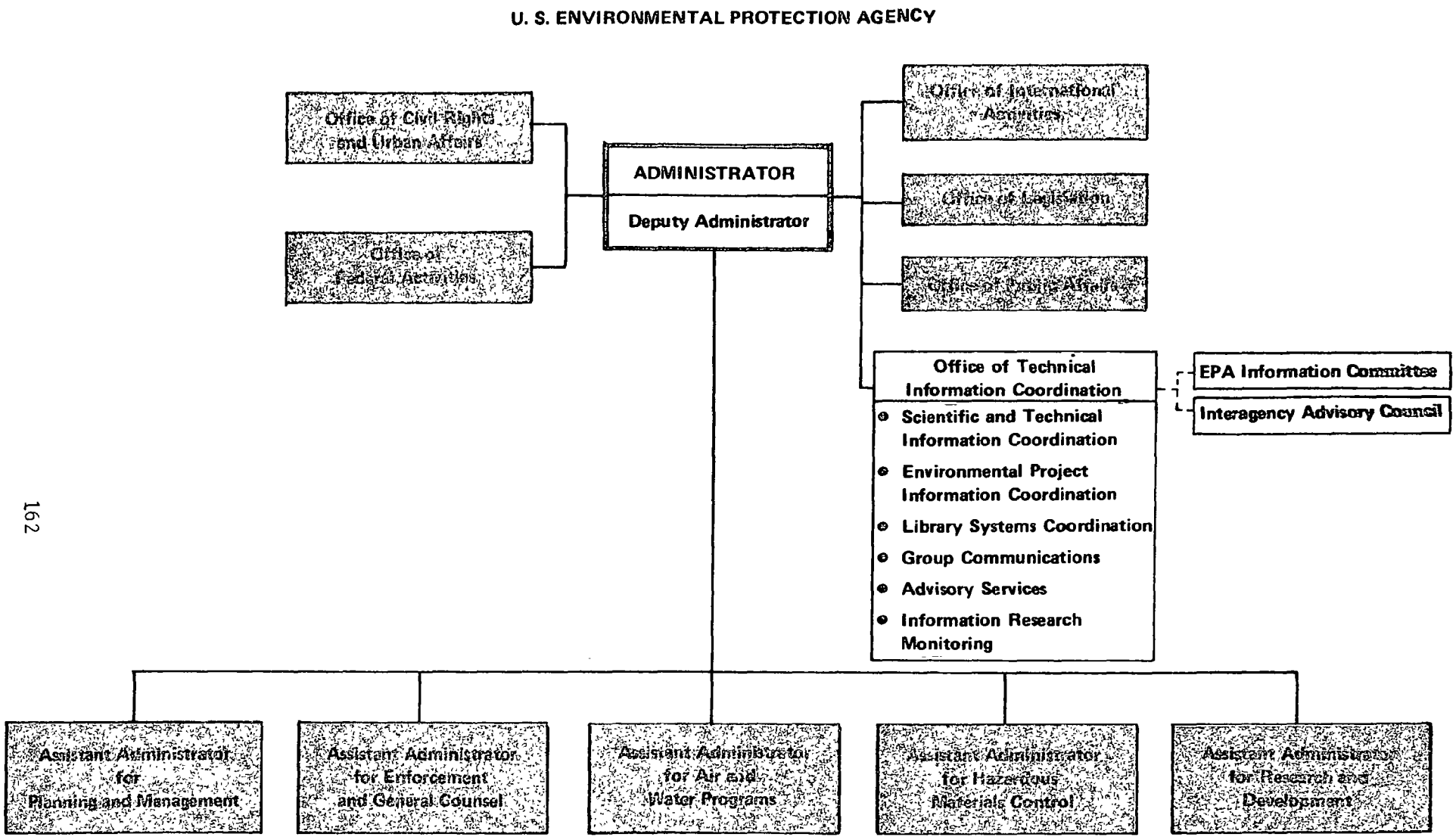


FIGURE 1. PROPOSED ADMINISTRATIVE ASSIGNMENT OF THE OFFICE OF TECHNICAL INFORMATION COORDINATION (OTIC) WITHIN EPA

responsibilities of the Director which should be highlighted are as follows:

- Information Science Advisor for the Administrator
- Chair the EPA Information Committee
- Chair the Interagency Advisory Council
- Representative to the United Nations (Environmental) Information Referral Service

EPA Information Committee

The functions of the Committee members would be to represent the various activities within their respective areas, and to advise the Director of OTIC, particularly with respect to planning. While the Committee would deal with the spectrum of EPA information activities, its main mission would be that of maintaining the vitality of the network.

Interagency Advisory Council

It is suggested that the Council be composed of representatives of information activities in other Federal agencies, but consideration should be given to incorporating two representatives from state or local governments, as well.

The Council's function would be primarily to serve as a forum in which to keep current about each agency's plans and accomplishments with respect to environmental information and to discuss those actions possible to improve the network relationships.

Planning Function

This would not be a separately staffed function within OTIC. It would be the responsibility of the Director to assimilate the advice of the Committee and Council, to review EPA program objectives and resources, and to develop a plan which would maximize Agency benefits. The environmental organizational structure has been a rapidly changing one and the Director must be alert to maintaining a current plan suitably responsive to any altered framework of implementation.

Scientific and Technical Information Coordination (STIC)--

STIC not only serves to maintain an inventory of resources dealing with scientific and technical information (including monitoring, surveillance, and intelligence information) and to provide both switching and referral services (emphasis upon the latter), but also serves as the focal point from which the Director of OTIC can initiate those actions designed to facilitate the development of a workable coordinated network for EPA. STIC is an information resource identification system within OTIC and is not a technical information network itself. Identification of scientific and technical information activities provides the foundation upon which the Director of OTIC, with the assistance of his Committee and Council can apply his remaining coordination responsibilities, such as advisory services, to foster improved networking. Figure 2 shows one concept of networking OTIC coordination functions.

Typically, STIC would include resource information on such items as the Environmental Information Systems Inventory, the National Referral Center, and the International Referral Service. From these resources the various components or nodes of the potential coordinated network could be identified and action taken as needed.

Environmental Project Information Coordination (EPIC)--

This is similar to STIC in function, but deals with information related to on-going projects. Typical inclusions would be the Project Information Retrieval System (PIRS), the Smithsonian Science Information Exchange (SSIE), and the Work Unit Identification System (WUIS) of the Department of Defense. EPIC would be utilized in a manner similar to that for STIC.

Library Systems Coordination

The functions of the present Library Systems Branch are an important adjunct to the Office of Technical Information Coordination and should be incorporated into OTIC. An exception is the operation of the Headquarters Library since no apparent benefit would result from a transfer of organizational responsibility for that or any other of the libraries located within EPA.

Other Operations

The functions of the remaining organizational units have been discussed earlier. It is extremely important that the implementation plan recognize their early need and that they be made available at a low level of effort pending later full-scale development. Thus, there should be at least an embryonic capability for group communications, advisory services, and information research as soon as possible after OTIC start-up.

AN ALTERNATIVE PLAN

Should EPA elect to devote fewer resources to its information activities than would be required to achieve the ultimate goal of the preceding plan, an alternative plan could retain the objectives but scale back the level of effort to approach each of the operations on a priority selection basis with reduced performance.

Under the alternative plan, EPA would create the position of Information Science Advisor to the Administrator. The Information Science Advisor would have three primary responsibilities: 1) to keep the Administrator informed of, and suggest line action to be taken with respect to all EPA present, contemplated, or needed information science related activities; 2) to establish a referral capability for environmental project information systems and for scientific and technical

(including monitoring) information systems; and 3) to create a presence around which the resources of EPA could be marshalled at the desired level for execution of its scientific and technical information responsibilities.

IMPLEMENTATION PLAN

Figure 3 illustrates an implementation plan which distributes accomplishment of the program over a period varying between 43 and 48 months. This time frame is only a guideline and may be compressed or extended as EPA chooses. The alternative program parallels the proposed program for the first 16-21 months and is structured to permit conversion to the OTIC concept if so desired. A decision step is incorporated into each major phase in the program to determine whether the program should be terminated, remain unchanged, or be incremented through the implementation of additional functions. Full implementation is envisioned as a five step process.

Staffing

If full implementation of Alternative 1 is effected, the professional staffing for OTIC is estimated as follows:

Total Number of Professional Staff	Total Months From Implementation	
	Beginning	Ending
1	3-8	4-9
4	5-10	16-21
5	17-22	25-30
6	26-31	34-39
7	35-40	43-48

This would provide OTIC with a small closely knit, but highly diversified professional staff capable of manning the many functions assigned to the Office. A minimal number of support personnel, secretarial and clerical, would be required.

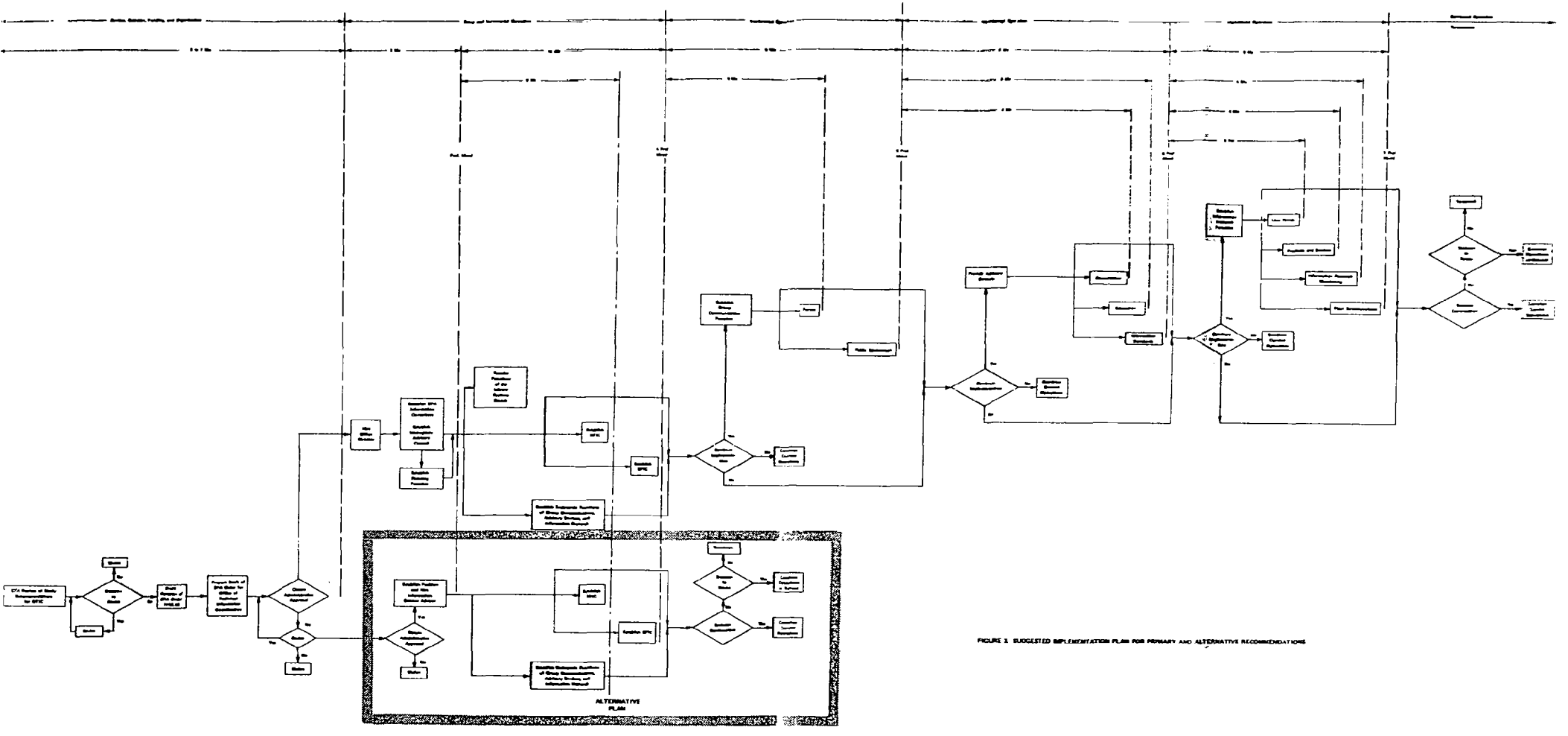


FIGURE 3. SUGGESTED IMPLEMENTATION PLAN FOR PRIMARY AND ALTERNATIVE RECOMMENDATIONS

MANAGEMENT SUMMARY*

> The conduct of research on the adverse effects of pollution and on methods and equipment for controlling it, *the gathering of information on pollution, and the use of this information in strengthening environmental protection programs and recommending policy changes.* (Italics added.)

The quotation above is a partial statement of EPA's mission and purpose as initially defined by the President in his message relative to Reorganization Plans 3 and 4 of 1970. However, an agency-wide plan for coordination, control, and future direction of its scientific and technical information activities does not presently exist.

Two years after the organization of EPA, some 1700 participants at the 1972 National Environmental Information Symposium still expressed as their most common concern the need for improved awareness of, and access to, environmental information. This concern was echoed by EPA personnel who were interviewed in the course of this study.

The demand for rapid access to sound information/data is becoming increasingly more critical not only in support of research and development but also in support of the enforcement and regulatory functions of the agency. It does not appear that EPA has fulfilled the President's

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*Appendix J contains a Management Briefing Report which is a condensed version of the complete Final Report but more informative than this highly condensed Management Summary.

mandate under Reorganization Plan Number 3. In order to do so, EPA should undertake the required planning and make available the adequate resources to improve EPA's scientific and technical information activities and to present EPA as the U.S. focal point for environmental information.

Given the autonomy of EPA organizations, their geographical dispersion, their variety of subject interests, their diversity of functional needs, the disparity between information user practices, the general image of heterogeneity displayed by EPA and the many information resources outside EPA control, it is not likely that improvement in EPA's information practices or position can easily be effected by a high degree of centralization or a dedicated approach to a strong line organization with its accompanying authority and responsibility. A workable structure appears to be the establishment of a staff office (recognized as a line item in the appropriations budget) entitled the Office of Technical Information Coordination (OTIC), at the Administrator level, whose mission would be to plan, coordinate, and encourage improved accessibility, handling, and usage of environmental information and data within a coordinated network.

The Office would be an active group-oriented undertaking which would be structured and implemented over a time period of approximately four years and which would:

> Establish a scientific and technical information coordination function to provide a current knowledge of sources of scientific and technical information.
>
> Establish an environmental project information coordination function to provide a current knowledge of sources of information on on-going projects.
>
> Incorporate the present functions (excluding the operation of the Headquarters Library) of the Library Systems Branch to provide for library systems coordination.

Establish a group communications function to provide a forum furnishing the atmosphere for discussion of common problems and to serve as EPA's public spokesman for environmental information in a non-conflicting relationship with the Office of Public Affairs.

Provide advisory services through its designation as the initial source for resolution of EPA's problems in information science in order to minimize the duplication of effort and inconsistency of approach possible if different individuals or contractors act without coordination.

Establish an information research function to conduct, or more often cause to be conducted, intramural and extramural research studies of information/data handling techniques and transfer processes to assure that attention is drawn to improvements which can be made by existing organizations.

Establish an EPA Information Committee and an Interagency Advisory Council to assist the Director of OTIC in the execution of his planning responsibilities.

An alternative plan is provided should EPA elect to devote fewer resources to its information activities than would be required to achieve the above goals of OTIC. The alternative retains the objectives of the first recommendation but scales back the level of effort to approach each of the operations on a priority selection basis with reduced performance. Under the alternative plan, EPA would create the position of Information Science Advisor to the Administrator. The Advisor would:

Keep the Administrator informed of, and suggest line action to be taken with respect to all EPA present, contemplated, or needed information science activities.

Establish a referral capability for environmental project information systems and for scientific and technical information systems

Create a presence about which the resources of EPA could be marshalled for execution of its information responsibilities.

A detailed implementation plan is provided which permits EPA to establish either the recommended OTIC or the alternative of an Information Science Advisor to the Administrator. Sufficient flexibility is included in the plan to permit EPA to evaluate progress and benefits at each step. Should EPA elect to initiate the alternative plan first (e.g. establish the Office of the Information Science Advisor), the functions of OTIC may be implemented and added as desired.