tion will be provided on any preprints, reprints, proceedings, abstract publication, etc. expected to issue from the meeting (Figure 1). The timeliness of this information will enable the scientist and engineer to correspond with the author of a paper while he is still working in the same area. It will make possible much more meaningful correspondence than could possibly take place a year or more later when the same paper appears in a journal. Furthermore, it will serve as a means of preserving those papers that might otherwise have been lost through nonpublication in a journal. It will make the papers presented at a meeting available in the same context within which they were originally presented, instead of viewing them scattered through a multitude of different journals over a span of several years. Perhaps of equal importance to the information specialist, indexes to *Current Programs* will provide a large measure of bibliographic control over meeting papers. Detailed subject indexes (Figure 2), author indexes, and indexes to the meetings covered by *Current Programs* are being published every three months under the title *Quarterly Index to Current Programs.* At the end of the year, these will be cumulated into a single hard-bound volume, the *Annual Index to Current Programs.*

CONCLUSIONS

Current Programs is much more than a publication listing meeting papers. It is a tool of real importance to the working scientist and engineer; it is a means of moving the scientific and technical community away from its complete reliance on journal publication for evidence of accomplishment, so that the whole area of meetings, with its inherent richness and flexibility, can be more completely and rapidly utilized.

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Environmental Chemistry—An Examination of Available Literature

JANET FRIEDLANDER
Lake Erie Study Collection, Sears Library, Case Western Reserve University, Cleveland, Ohio 44106

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Literature sources for environmental chemistry are detailed, such as data services, abstract and index services, periodicals, books, handbooks, and bibliographies.

Interest in the field of environmental quality has increased many fold in the last several years. Problems of water and air pollution and related problems have generated a growing number of academic courses, publications, and background literature relative to the pollution problem. Research in the environmental area is being done in many institutions: governmental, industrial, and academic. Each of these diversified groups makes demands for environmental literature and information in areas of their expertise or specialization.

Environmental literature is particularly difficult to cope with. This difficulty stems from the nature of the field itself. There are three factors here. One, environmental science is a new field. Its boundaries are not yet clearly defined. It was not until December, 1970, that the United States Environmental Protection Agency was established, to centralize in one agency the major Federal pollution control programs, formerly scattered in different departments. Ohio's Environmental Protection Agency is more recent still.

Scattering is the problem with the literature, also. There are no comprehensive bibliographies of books, periodicals, or reports. There are numerous partial bibliographies which must be located one by one. The need for coordination and cooperation in literature identification and exchange was one of the concerns of the United Nation's First Conference on the Human Environment, held in Stockholm last June, and one of the concerns of the United States Environmental Protection Agency's First National Environmental Information symposium, held in

Cincinnati last September. The "first" in the titles of both conferences also points up the recency of concern in this area.

A second factor, which makes it difficult to cope with environmental literature, is that the field is broadly interdisciplinary. My present position includes working with a project group which is studying phosphate pollution control in Lake Erie. This group includes biologists, chemists, geologists, toxicologists, systems analysts, engineers of all kinds, economists, political scientists, mathematicians, logicians, and a philosopher, who, I assume, will either gather all the strings together at the end, or ease the process of such diverse disciplines communicating with each other as the work progresses.

To back up the information requests of such a diverse group requires the availability of the major information sources in each subject area. The nature of the environmental science field is broad, and cuts across traditional disciplines, requiring a reorganization of the fields of information. This reorganization is just beginning.

The third factor which makes environmental literature difficult to cope with, is the rapid growth of the field. The rapid growth of the field results from the rapid growth of interest in the area by the public and by the Government. A survey of entries in the *Congressional Record* for a several-month period in 1969 showed the environment to be second only to Viet Nam in number of occurrences.[1] Public interest burgeoned in the sixties. A standard periodical directory caught up with this stream of interest by using, for the first time in the 1967–68 edition,[2] the combined heading "Air and Water Pollution," under which were listed 13 periodicals. The 1971–72 edition[3] listed 120 periodicals under the heading "Environmental Science." *Chemical Abstracts,* in its 5th Decennial Index covering the years 1947–56, listed, under the subject heading "Environment," three entires.[4] The 8th Collective Index, covering 1967–71, listed over 300 entires under that heading.[5]

The growing public interest and outcry helped focus Government attention on the environmental area. With Government attention comes Government funding, which is a tremendous aid to growth. The United States Environmental Protection Agency, which was only established in December 1970, now funds, or partially funds, 4000 projects. I am sure some were taken over from earlier agencies, but I assume this represents a growth in the number of studies in the environmental area. This tremendous growth has resulted in a lag between the literature which is being produced and used in the environmental sciences and the sources which would organize, coordinate, and make it possible to locate information sources in this area.

Having decided that the literature of environmental chemistry is difficult to cope with, it now becomes necessary to figure out ways to cope in spite of these difficulties.

Chemistry is one of the most important disciplines in the environmental sciences. To quote a recent American Chemical Society publication, "Chemical awareness and the flow of chemical know-how are essential to any long-term rational approach to understanding and controlling our environment ... a strong vein of chemistry runs throughout environmental science and technology ... environmental problems do provide at the very least a fit intellectual match for the talents of those chemical scientists and engineers who wish to work at the worthy mission of making a cleaner world."[6]

LITERATURE SOURCES

I will now outline literature sources in environmental chemistry and discuss how they might be used as an individual begins, works on, and completes a project. I will mention only those sources which cover the entire environmental subject area although there are many which cover parts, such as water or air only.

Data Services. In the initial planning stage, we need to know what work has been done before and what is being done currently. A good way to find out is to have a search of the literature and current research done for you. Four relevant sources are:

1. The *Environment Reporter*[7] Research Service. The *Environment Reporter* is a looseleaf current awareness service published by the Bureau of National Affairs in Washington. An order to them for a custom computer search on a particular subject will result in a listing of research in progress which the Smithsonian Science Information Exchange gathers nationally, and a list of all United States Government reports, with abstracts, on the subject requested.
2. *Environmental Science Citation Index,*[8] which is a machine-readable data base covering world-wide ecological information and which provides copies of the original documents upon request.
3. *Toxicon,*[9] a collection of computerized toxicology information assembled by the National Library of Medicine.
4. *Environ,*[10] another computerized system, provides access to records on all research-oriented projects that are funded by the United States Environmental Protection Agency, management information for long-term water quality monitoring stations, and information on hazardous materials.

Abstracts and Indexes. The data services just mentioned give a broad coverage of research and reports. To pick out individual items more specifically related to a project, we will need to use abstracts and indexes. There are four major indexes which cover environmental information generally.

1. *Pollution Abstracts,*[11] published in La Jolla, Calif., is a bi-monthly abstracting service which covers all aspects of pollution, world-wide.
2. *Environment Information Access,*[12] published by the Environment Information Center in New York, twice a month, covers international scholarly and general publications in the fields of environmental pollution and conservation.
3. Another publication of this same organization is the *Environment Index.*[13] This is a cumulative citation index to the key literature of the year, cross-referenced to abstracts published in *Access.*[12] Published annually, it includes summary data on patents, legislation, names and addresses of control officials, conference data, and year-end reviews.
4. *Environmental Patent Abstracts.*[14] In the beginning of 1970, President Nixon requested that the Patent Office set up a priority program to process inventors' applications for those patents which could aid in controlling pollution of all forms. *Environmental Patent Abstracts* covers 1200 patents issued under this program, and 1000 more environmental patents issued outside of the priority program.

Patents are a primary source of new ideas for those working in new technologies. This information does not appear in journals or trade magazines. The *Environmental Patent Abstracts* provides access to this information specifically in the environmental area.

Periodicals. After a comprehensive search has been conducted, and specific relevant material located, we will need to keep in touch with what is currently being done, through periodicals. As mentioned earlier, there are 120 periodicals listed under the subject heading "Environment" in a recent periodical directory,[3] so we need to be very selective. I think of six specifically:

1. Particularly relevant is the American Chemical Society's *Environmental Science and Technology*[15] which is concerned with current techniques, research, and activity

in the legislative and industrial areas of environmental management.

2. Another journal particularly relevant to environmental chemistry is *Chemosphere,*[16] subtitled *Chemistry, Physics and Biology as Focused on Environmental Problems,* a bimonthly journal which is photographically reproduced from typewritten communications as received, in order to speed communications. It publishes in English, French, or German to encourage international communication of programs resulting from an interdisciplinary approach to any environmental problem demanding scientific investigation.

3. The Chemical Rubber Company publishes *Critical Reviews in Environmental Control,*[17] a quarterly journal which provides a qualitative approach to scientific literature in environmental control. Each issue includes three or more critical reviews of specific environmental topics of current interest. Authors extract the most significant papers from the mass of current literature, focusing attention on the major developments.

4. The *Science of the Total Environment*[18] is a more general international journal for reporting scientific research on the environment and its relationship with man. Among other areas, emphasis is given to establishing the baselines for the chemical composition of living matter in relation to the environment.

5. Another general publication is the *Journal of Environmental Sciences,*[19] published by the Institute of Environmental Sciences. This organization grew out of the Environmental Equipment Institute which was primarily a trade association for equipment manufacturers. The science section of that organization began a separate society which later merged with the Society of Environmental Engineers, bringing together all facets of environmental engineering and sciences. The *Journal of Environmental Science*[19] is the official publication of this organization. The society also publishes the proceedings of its annual meetings which contain technical reports on the environment, and conducts a tutorial series to facilitate communication.

6. The last periodical which I think is particularly useful is the *Environment Reporter,*[7] published by the Bureau of National Affairs in Washington. The Bureau of National Affairs devotes itself to reporting and interpreting the interactions of government and business. The *Environment Reporter* is a weekly, loose-leaf, notification and reference service that gives comprehensive coverage of current legislative, administrative, and industrial developments in pollution control and environment protection.

Books. By now, in our hypothetical project, we have conducted a data search of what has been published, we have checked indexes for relevant articles, and we are keeping up with what is going on in the field with periodicals. The last area is the books you might find useful in our work.

For background information, specifically related to chemistry and chemical engineering, "Cleaning Our Environment; The Chemical Basis for Action,"[6] a report by the Subcommittee on Environmental Improvement of the Committee on Chemistry and Public Affairs of the American Chemical Society, contains an objective account of the current status of the science and technology of environmental improvement, which concludes with a series of recommendations to help accelerate the sound development and use of that science and technology.

Handbooks. There are two comprehensive handbooks in this area which contain a mass of detailed information.

One is the Chemical Rubber Company's "Handbook of Environmental Control,"[20] of which three volumes are now available which cover air pollution, solid waste, and water and wastewater. The volumes were developed to bring together pertinent information in tabular form. Each starts with definitions of pollution problems and basic data on pollutants; statistics on rates of pollutant release to the environment; effects of pollutants on man, plant, and animal life, and inanimate materials; and legal, technical, and economic aspects of control measures. The emphasis is on data rather than discussion.

Another handbook is the "Industrial Pollution Control Handbook,"[21] one of the McGraw-Hill series. This guide to solving pollution problems begins by looking at pollution as a total system, traces the evolution of industrial pollution control, the history of legislation on pollution, quality standards, and criteria, and describes the major industries where pollution is a difficult problem.

Not a handbook, but similarly useful in covering a broad area, is "Environmental Measurement and Interpretation,"[22] a comprehensive text and reference manual concerned with the selection, measurement, and interpretation of environmental conditions.

Closely related to measurement are the instruments used. "Pollution Analyzing and Monitoring Instruments"[23] contains descriptions and specifications of ready-made, on-the-line, commercial equipment for sampling, measuring, and analyzing pollutants.

There are three books specifically concerned with chemistry, although each covers only one environmental area.

The first is a British publication, "The Chemical Analysis of Industrial Water,"[24] which is a comprehensive guide to the procedures used for chemically analyzing various types of aqueous solutions associated with refining, chemical manufacture, and water cooling.

Another chemically-oriented book is "Chemical Markets in Water and Wastewater."[25] This report shows where changing concerns affect technology in pollution control, bulk water treatment, and industrial water treatment, and gives detail profiles for 66 specific chemicals or chemical groups. It explains why the market for chemicals and services connected with the treatment of municipal, private, and industrial water systems grows at a compound rate more than five times that of the economy, in general, and what steps a businessman in the chemical service area must take to tap this market.

"Important Chemical Reactions in Air Pollution Control"[26] is a third source of specifically chemical information. This is a volume of papers reporting research results from a wide range of problems dealing with chemical aspects of air pollution. It also reviews the chemistry of air pollution.

Two more books of interest to those in the chemical industry are: "Environmental Control in the Organic add Petrochemical Industries"[27] and the "Environmental Control in the Inorganic Chemical Industry."[28]

Directories. There are few directories that are environmentally oriented. One which is available and covers industries, is entitled "Pollution Control Companies."[29] It lists 1500 manufacturers or suppliers of products useful in all areas of pollution control. Included are chemical companies which deal largely in water treatment chemicals. A second section covers companies which provide consulting, design, engineering, or analyses of pollutants.

A second is the "Directory of Environmental Information Sources"[30] which lists over 3000 Government agencies, professional organizations, trade associations, and private groups dealing with ecology and conservation. It also lists publications and conference proceedings.

Bibliographies. We also need to find out about other books that might be of use. One source for further information is called "Environmental Information Sources, Engineering and Industrial Applications, A Selected, Annotated Bibliography,"[31] published by the Special Libraries Association. This covers literature sources of all kinds and includes a directory of organizations to contact for further information.

A second source of new books is contained in the American Chemical Society's journal *Analytical Chemistry,*[32]

which published, at the end of 1972, a "Laboratory Guide" which included a list of new books on the subject of the environment.

One other service, the Ecology Placement Service, may be of interest. It publishes a monthly newsletter[33] listing jobs and graduate research opportunities in the environmental area.

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Evaluation of an SDI Service Based on the *Index Chemicus Registry System*

PETER LEGGATE,* B. N. ROSSITER[a] and J. F. B. ROWLAND[b]
Experimental Information Unit, University of Oxford, 7 Keble Road, Oxford OX1 3QL, U.K.

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The *Index Chemicus Registry System* (ICRS) is the machine-readable equivalent of *Current Abstracts in Chemistry & Index Chemicus* (CAC & IC). In an earlier paper,[1] we described the development of an experimental selective-dissemination-of-information (SDI) service based on these tapes. A detailed description of the techniques of profile construction for searching a Wiswesser Line Notation (WLN) structure file is given in this earlier paper. The present paper describes the evaluation of the SDI service in terms both of quantitative measures of retrieval performance, coverage and currency, and also of user reactions to the service, as expressed in their replies to a questionnaire. Failure analysis techniques[2] were used to identify the reasons for retrieval failures and possible methods for improving retrieval performance. A fuller description of the evaluation has been published in report form.[3] More detailed discussions of the evaluation methodology, with particular reference to the nature of user relevance decisions, the methods for measuring recall, and

* To whom correspondence should be addressed.
[a] Present address: Computing Laboratory, The University, Newcastle upon Tyne, NE1 7RU, U.K.
[b] Present address: United Kingdom Chemical Information Service, The University, Nottingham, NG7 2RD, U.K.