Table I. Divisions of the *Health Aspects of Pesticides* Abstract Bulletin

1. General	4. Toxicology and Pharmacology
2. Monitoring	5. Safety
3. Epidemiology and Treatment	6. Analysis

The abstracts in the bulletin will be of the informative type as far as possible, and abstracts of foreign publications will also be included. The abstracts will be grouped into six categories as shown in Table I. The abstracts in the bulletin will follow closely the format and rules established by *Chemical Abstracts*. There will be annual author and subject indexes for the convenience of the user.

Other services to be performed under this contract include expansion of the thesaurus which was developed under the previous contract and a computerized system by which it will be possible to retrieve information automatically. It is anticipated that the mechanized retrieval will not be very useful until several thousand abstracts accumulate making manual searching time-consuming and ineffective. The primary purpose of the abstract bulletin for the immediate future is, of course, current awareness rather than retrospective searching.

FUTURE PLANS FOR PESTICIDES INFORMATION SYSTEM

The current collection of about 17,000 references on the toxicology of pesticides will be strengthened by the references that will result from the publication of the abstract bulletin. Reference cards for the papers in the abstract bulletin will be prepared and added to the central collection in Atlanta as well as to the satellite collections in the various laboratories of the Pesticides Program. In the future, abstract cards will be produced from the magnetic tapes used in the production of the abstract bulletin, and it will be possible to expand their distribution to selected laboratories which are involved in the toxicology of pesticides. The cards will continue to be coded according to the system used in the Pesticides Program, and those laboratories receiving copies of the cards will also receive detailed instructions on the system of classification. In addition, the new cards will carry keywords, so the laboratory receiving them will have a choice of the classification system they use. The advantage of the system used by the Pesticides Program is economy. Classification is assigned by an experienced person and printed directly on the card, which may be filed by a clerk. The use of keywords for indexing—for example, by use of a peek-a-boo system—would offer the advantage of flexibility and somewhat greater depth of indexing; however, its maintenance in each laboratory using it would require considerable time of professionally trained personnel. As the information system is developed over the years, a sizable collection of references will be stored on the computer tapes. Eventually, in several years' time, it will be possible to search these tapes for specific references to particular subjects. It is hoped that this retrospective searching of the files can be made available as a service to those working on the toxicology of pesticides.

This information system is designed to provide a broad informational background for all persons working in the field of the health aspects of pesticides. In the abstract bulletin there is no attempt to go beyond the area of pesticides. Naturally, professional chemists working in this field will require references concerned with other aspects of chemistry, but it is hoped that the abstract bulletin will be a start on which they can build their own specific information systems.

One of the roles of the Pesticides Program is to provide assistance to state and local health departments in building and strengthening their own competence in the problems related to pesticides and public health. It is believed that the abstract bulletin, *Health Aspects of Pesticides*, and the related services of the information system will be of great assistance to these departments of health.

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An Occupational Health Information Service*

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Scientific Reference Service (SRS) of the Occupational Health Program provides an information resource serving the Program research and field personnel, state and other federal agencies, industry, labor, physicians, attorneys, and the general public. Inquiries on any aspect of occupational health are accepted by letter or telephone. An information storage and retrieval system is operational but still developing, utilizing a special thesaurus and index searching by the optical coincidence technique. Approximately 1500 inquiries per year are being handled at present.

The Scientific Reference Service of the Bureau of Occupational Safety and Health is the present stage of more than 50 years of technical information services in industrial hygiene and occupational health. From the inception of an occupational health activity in the Public Health Service with the establishment of the Office of Industrial Hygiene and Sanitation in 1914, this program has been a resource for those seeking information on occupational health hazards and the toxicity of industrial materials.

For most of this period, the technical information ser-

*Presented before the Division of Chemical Literature, Symposium on Toxicological Information Centers, 156th Meeting, ACS, Atlantic City, N. J., September 9, 1968. The mention of trade names does not constitute endorsement by the Department of Health, Education and Welfare.

vices were not on a formally organized basis. The information was disseminated through publication of reports of field studies and research investigations and by correspondence with members of the scientific staff. Inquiries received were passed to the appropriate section where a staff member formulated a suitable reply on the basis of experience and information at hand or readily obtainable. The important thing is that the inquiries were answered conscientiously and the service of providing information was rendered, however informally. Aside from a growing reference library, information services, including a storage and retrieval system, have developed as an organizational unit only within the past decade.

The toxicology of materials has in the past and presently continues to play a rather dominant role in occupational health hazards. The physical agents, such as heat, noise, radiation, and vibration, and the psychological stresses encountered in various occupations are receiving increasing attention with the sophistication of modern occupational health practice. This same sophistication and modern technology have combined also to increase the number of toxic materials and the need for more and better information on the toxicologic properties of these materials.

In consideration of the magnitude of this need for information, it follows that a significantly large portion of the resources of the occupational health program is devoted to research into the toxicologic properties of industrial materials and the mechanisms of the toxic actions. An equally significant activity is the field studies of the epidemiology of occupational exposures and disease. In these studies the actual exposures of, and effects on, humans of such materials in the industrial environment are determined and correlated with the laboratory observations. From such activities in the past 54 years, the occupational health program has generated approximately 2900 publications, the majority of which are totally or in part concerned with the toxicity of materials.

In 1958 the first step was taken in the development of a specifically identified technical information service. Based on the belief that a wealth of unpublished information on occupational health problems and solutions exists within the experience and records of industrial firms, a unit was established as the Technical Information Exchange. Emphasis was placed on the exchange aspect. The unit was to serve as a repository for such information, freely contributed, and to provide the information on request with the objective of ultimate protection of workers from occupational health hazards.

When so indicated, the source and identifying features of information were to be treated as "commercially discreet." Sensitive or secret information was not sought for the Information Exchange because of the difficulty and complexity of a public agency giving firm and binding assurances of confidentiality. More recently, new legislation has further compounded the difficulties of keeping confidential records.

The "exchange" on a volunteer basis did not work. It proved to be almost a one-way street. Requests for information increased in number, but volunteered contributions to the files were few and far between. It became very clear that without the staff and a mechanism for seeking out—even digging out—the information, there would be very little input. This was not because the information was inaccessable or withheld but because of inertia, shortage of manpower, and other problems of supplying the information. Accordingly, the "exchange" was dropped and the activity became the Technical Information Section, recently renamed the Scientific Reference Service.

The Scientific Reference Service now provides information across the broad field of occupational health in any of its aspects. This service is directed mainly to meeting the information needs of professional personnel and others having responsibilities for decisions and actions in occupational health. However, the service is available, within reasonable limits, to anyone having a question on any aspect of occupational health or closely related thereto. A typical week brings inquiries from our own research and field staffs, state agencies, other federal agencies, industry, labor, physicians, attorneys, and the general public. A high percentage of these involve toxicology of materials.

Most inquiries are received by letter although inquiries are accepted also by telephone. Reply is usually made by letter in either case, except for emergency situations or questions that can be answered without search and retrieval procedures. Inquiries from all sources now total about 1500 per year.

An attempt is made to assess the actual interest and need of the inquirer so that the reply may be truly responsive to the intended question. The interpretation of the question is not always apparent or simple. This is more apt to be true of questions received from the general public because of less familiarity with the subject material and the technical terminology.

A letter of reply is prepared for each inquiry and is tailored specifically to the interest and need conveyed by the inquiry. The replies are prepared and reviewed by occupational health specialists who incorporate professional evaluation, judgment, and opinion as appropriate and helpful. While the small staff of the Scientific Reference Service answers many of the inquiries, a considerable number of them are referred to persons on our scientific and technical staff having special experience and expertise pertinent to the question. On the staff are numbered physicians, toxicologists, chemists of assorted specialties, physiologists, psychologists, physicists, engineers (also assorted), nurses, statisticians, and other industrial hygiene specialists. In this approach, we believe that we achieve a degree of sophistication in our services that is not common to most information services.

The replies are made as factual and specific as the available information can provide. Reprints, pamphlets, bibliographies, and such other materials are utilized when possible and appropriate. Some form letters or statements are used for frequently asked questions. Such materials are updated whenever the need becomes apparent.

We try to tap and to utilize any source which will provide the information we need. In our reference room we receive 202 periodicals and we have approximately 3800 bound volumes of journals and 3000 reference texts. In addition, we have the extensive program files and reports of field studies, research, technical assistance, and correspondence on occupational health for a large number of years. Then we make use of telephone and correspondence to seek out needed information from industrial firms,

research laboratories, other information services, or any likely and reliable source. The professional community in the field of occupational health is still small enough that a great deal of communication is possible on a personal contact basis.

The full-time staff of the Scientific Reference Service consists of three persons (one industrial hygienist, one physical science aid, and one clerical) with part-time assistance from two others (one professional and one clerical). The considerable assistance from the research and field staff has been previously mentioned and constitutes an important resource for the information services.

An information storage and retrieval system has been developed and is now partially operational. A specialized thesaurus for occupational health has been developed consistent with the descriptor term concept used by DDC (the Defense Documentation Center and formerly ASTIA). This selection was made on the basis of the breadth of the subject fields to be covered, including many professional disciplines and industrial technology. Although the dictionary of terms is open-ended, we presently try to limit it to less that 2000 descriptors, exclusive of chemical names. The chemical names are handled in a special, compatible system with provision for index searching under the synonyms.

The optical coincidence technique is used for index searches. We use Termatrex equipment with a manually-operated drill and visual readout. With this system, a coordinate search on almost any desired number of descriptors can be made in less than a minute. If the number of pertinent documents or entries is large, the visual readout may increase the time somewhat. This readout gives only the document numbers of pertinent items which must then be obtained from the files or other locations.

Because each descriptor requires a term card we chose, after some study, to limit the dictionary to 2000 terms. This number of cards can be handled conveniently in the system and equipment used and the number of descriptors provides for more than sufficient specificity in most searches.

The potentially enormous number of chemicals and industrial materials (including trade name products) which may eventually be entered into the index system dictated the use of a separate but compatible arrangement for these terms. At this time, we have approximately 2500 separate substances indexed with all available synonyms for each.

Each substance is assigned a five-digit code number selected on a random number basis. The same number is used for all synonyms of that substance. The alphabetic index of chemicals must be consulted to find the code number, when making a search, but the number is specific to that substance for whatever the synonym used.

The chemical deck of term cards consists of 50 cards, 10 cards in each of five colors. This provides a card for each integer in each decimal place of any five-digit number. As an optimistic mnemonic, we use the word GROWS indicating the colors for the cards of each decimal place—green, red, orange, white, and sand. Thus selection of the respective five cards for a given code number and superimposing them on the readout stand identifies all documents in the system pertaining to that substance. Cards of the descriptor terms may be superimposed on the chemical code cards to coordinate the search on such other parameters as are desired.

The superimposition of chemical code term cards for two or more substances gives the possibility of false drops due to the permutations of the two groups of cards forming code numbers of still other substances. The assigning of five-digit numbers from a table of random numbers was designed to reduce this problem because only a fraction of the 100,000 possibilities actually would be in use. In usage this has not been as great a problem as it appeared in planning. Rather, the problem has been with a few articles each listing information on several hundred substances. These particular articles tend to readout from almost any combination of chemical code term cards. These articles are sufficiently few that the problem is not serious.

As with most evaluative systems for information storage and retrieval, there is a "bottleneck" at the input to the system. The documents to be included must be reviewed and selected by persons knowledgeable in the field, then they must be abstracted, indexed, and entered into the system individually. These procedures are costly in requirements of both staff and time. Some information centers are making real progress in computerization or mechanization of such procedures, but this is usually at appreciable loss in the evaluative aspects or shifting of these to the other end of the line.

For each document entered into our system, a descriptive abstract is made at the time the document is indexed. The descriptive abstract tells what type and subject areas of information are in the document and does not attempt to give data or details of the information. Use of data from an abstract taken out of context of the complete document may be misleading and even dangerous when the health or life of persons may be involved.

The descriptive abstract is also the real output of the storage and retrieval system. These abstracts identified by any search provide the basis for deciding which documents are worth pursuing in the original full text. Our abstracts are typed on file cards which also contain the document identification number, title, authors, citation, index terms, and location. Two files of these cards are maintained: one as a working file from which abstracts are taken for review or copying, and the other as a master file for protection from loss of the working copies.

This system provides the abstract and, as deemed necessary, the full text of documents to our staff for responses to requests for information. From these and other available resources, the replies are formulated.

The system is compatible with computer procedures and could be converted whenever necessary or desirable. At the present time, the Termatrex equipment we are using is adequate and in some respects preferable for our needs. Even allowing for moderate growth, it should continue to be so for possibly four to five years. By that time the bulk of material will become very cumbersome to handle by the present equipment. The time required by an index search will be multiplied by five to 10 times. A mechanization of the present optical coincidence system is possible. The hardware and electronics are available. The cost and advantages of this will need to be weighed against those of the computer.

To this time, computerization of the search and retrieval procedures has not been advantageous to our activity.

The number of entries in our system is not yet great enough to take full advantage of the speed of search provided by a computer. Under our present circumstances, computerization would slow down our search abilities because of the time lag in getting our questions into the computer in competition with other priority uses.

I am confident that the need for scientific and technical information services is going to continue to increase. The growth of such services will be a necessity to progress. The utilization of the best facilities that mechanization and electronics can provide will be required to meet the need. A great deal more can be done than is being done with systems presently practical, but the costs in dollars and in personnel are high.

Through the shared-time approach, computerization of relatively small activities can be brought within reasonable limits even now. Today, it would be possible to establish specialized information activities, such as ours in occupational health, with remote control consoles at various locations providing shared-time access to a centralized computer combining the memory banks of a number of systems. Perhaps the toxicology resource now growing at the National Library of Medicine may move in this direction. Today it is a possibility; time and progress will make it an actuality.

"Meanwhile back at the ranch," the Scientific Reference Service will continue to provide an information service within the limits of our resources and be prepared to grow and advance as we are able. Our services are without charge and we expect to continue this policy. Access to our information is open to all on reasonable requests and within legal limits of confidentiality of certain information. Our objective is that all possible information on occupational health—including toxicology—be brought to bear on the problems of providing a healthful and safe working environment to every occupation.

The Committee on Toxicology and the Advisory Center on Toxicology of the National Research Council*

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The origin and development of the Committee on Toxicology and the Advisory Center on Toxicology are reviewed briefly. The discussion is centered on how the Committee and the Center assist their sponsoring federal agencies. The interactions and mutual responsibilities of these three units are described. Information is also given on the literature holdings and indexing of the Center.

The Center is a part of the Division of Chemistry and Chemical Technology of the National Research Council which is the functional unit carrying out the detailed activities of the National Academies of Sciences and Engineering. The present chairman of the Chemistry Division is Dr. Theodore L. Cairns, Director of Basic Sciences, E. I. duPont de Nemours and Co., and the executive secretary is Dr. Martin A. Paul. Policy guidance for the Center comes from this Division with the advice of the Committee on Toxicology. Two other Divisions of the National Research Council are also consulted on policy matters, and they are Biology and Agriculture and Medical Sciences.

The Advisory Center on Toxicology was proposed in 1953 by Adm. C. J. Brown and was officially organized in 1956. It began operating in January, 1957, when Dr. Harry W. Hays took office as its first director, a position which he filled until July, 1966.

The Committee on Toxicology was organized in 1947 by Dr. W. Albert Noyes, Jr., who at that time was Chairman of the Division of Chemistry and Chemical Technology. The first members were Dr. H. H. Schrenk (chairman), Dr. L. T. Fairhall, Dr. D. O. Hamblin, Dr. D. D. Irish, Dr. J. H. Sterner, Major Gen. Alden H. Waitt, Dr. W. P. Yant, and Dr. H. C. Hodge. In 1949, Dr. A. J. Lehman and Col. John Wood were also appointed. The present members of the Committee, who are listed in Table I, comprise a balanced group of scientific specialties and come from diverse backgrounds of government, industry, and universities.

The Committee on Toxicology meets at least once a year with representatives of the sponsors for formal and informal discussion. It meets at other times as often as required by the problems presented, usually three to four times a year. Members are appointed for a definite term of office by the Chairman of the Division of Chemistry and Chemical Technology. They are chosen for their recognized professional ability, judgment, and integrity. They bring to the Committee's deliberations a technical competence and objectivity permitting a dignified and unbiased perusal of the problems presented. They serve with-

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