Table II. Searchable Data Elements of the JOIS-I Data Base

data elements	directly searchable	indirectly searchable
keyword	X	X
title and/or abstract word (CACon, TOXLINE)	X	
classification code or CAS section number or MeSH tree number	X	X
author's (investigator's) name	X	X
author's affiliation or location of work		X
name of research institution	X	
code indicating the type of research institution	X	X
citation number		X
publication type		X
JICST journal code or CODEN or ISSN		X
type of document (e.g., review, patent)		X
year of publication or ending date of investigation		X
country of publication or country of patent application or location of institution		X
language		X
entry date		X
type of budget		X

in Japanese language are preferable particularly when the output of abstract texts becomes available on-line, because users will be required to read the abstract texts on the display of the terminal quickly and to proceed to the next step, judging whether the given citation is relevant or not. Therefore, JICST is required to give efforts to meet various kinds of the Japanese users' needs relating the JICST data bases. The JICST thesaurus is updated every year and better quality of indexing will be expected. New data elements, such as affiliations of authors and other data, are to be added to the data base in the near future.

At present, almost all the data in the JICST data bases are given in the Japanese language; therefore, it is rather difficult for non-Japanese people to utilize the data bases. To solve this problem and make the information produced in Japan available for overseas as well, bilingual processing is being

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化学構造の図を処理するための相互作用型計算機グラフィックスシステム (a○)
EN
An interactive computer graphics system for processing chemical structure diagrams. BLAKE J E, FARMER N A, HAINES R C
:A294A J Chem Inf Comput Sci (USA) 17 (4)
(223-228) ('77) 1
CASの出版物に使用できる品質の化学構造の図を作り得る表題グラフィックスシステムを開発した。IBM370/168ホスト計算機に連結したデジタルエキップメントコーポレーション(DEC)PDP-15グラフィックスシステムに基づき，利用者は端末からライトペンによりメニューから原子または環を選択し，結合を指示すると，構造図の優先位置が計算される。入力された構造は蓄積され，テキストと共に出版物用にAutologic APS-4で写真製版される。このシステムは2年以上CA出版物の作成に使用されている。基本的環系と構造図との二つの参照ファイルが作られている ;
写図8参12
グラフィックスシステム，分子構造，CAS，図形処理，化学構造検索

Figure 5. Output sample of JOIS-K.

considered as a future plan. The JICST data bases adopt the distribution format which conforms to ISO 2709 to make it internationally exchangeable. The descriptions of bibliographic data elements such as journal abbreviations, ISSN, country code, and language code also conform to respective ISO standards. The description of author names is also standardized in accordance with the recommendations in the UNISIST Reference Manual.

JOIS-II, the revised system of JOIS-I, is now being developed. It will have following features: (1) to extend the coverage of data bases to the maximum 99; (2) to make authority files (JICST vocabulary file, MeSH file, CHEMLINE file, etc.) searchable; (3) to offer services to locate the source journals using the source documents master file; (4) to increase the directly searchable data elements, such as journal codes, names of organizations, and segments of chemical substance names; (5) to make the output of abstract texts available and to provide more output format options; (6) to increase the number of commands to three times as many as JOIS-I; (7) to store search questions for later uses; (8) to make the output in kanji characters available through dial-up connection of terminals; (9) to provide the JICST on-line service news and to receive users' comments; and (10) to make the output of system messages in English available.

Adapting the Gmelin Handbook to Modern Information Requirements†

WALTER LIPPERT
The Gmelin Institute, 6 Frankfurt/Main, West Germany

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The current 8th Edition of the "Gmelin Handbook of Inorganic Chemistry" comprises 380 volumes, devoted to a systematic description of the entire knowledge of all chemical elements and compounds. Continuation of the Handbook in its historic form is no longer feasible; to preserve the Handbook's timeliness a number of editorial changes have taken place. Supplement volumes devoted to fields of chemistry where important developments are occurring, expanded use of English, and a Formula Index to allow quick user access and to prepare for computer-storage and -retrieval ensure that the Gmelin Handbook will continue to hold its place as an indispensible source of critically evaluated, basic information.

What should a chemist do when information is needed on a specific chemical element or a given inorganic compound, such as its occurrence in nature—its geochemistry or cosmochemistry—or whether a given compound really exists at all, and, if it does, what are its structural properties? Many possibilities are available for answering these questions. One

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of these possibilities, and one of the very best, is the "Gmelin Handbook of Inorganic Chemistry".

Most chemists are aware of "Gmelin". While some chemists, as well as a considerable number of physicists, accept as fact that "Gmelin" is an outstanding and high-quality, well-organized information source for the field of inorganic chemistry,[1] many regard it as one which has become somewhat dusty with age, is still written in German, and is rather difficult to use.

The Gmelin Handbook is dedicated to keeping pace with advances in science, and to report on the new discoveries. The dust was jarred loose many years ago, and "Gmelin" today is really an up-to-date and modern handbook.

The current status of completion is shown in Figure 1. Using the periodic table as a base, symbols are shown indicating which elements and compounds have been described in the Handbook. As you can see, there are no longer any gaps, except for Fr and At, the latter of which is being covered at present in connection with a new treatment of the halogens. Thus, all of the elements and their compounds and alloys have now been covered within the framework of the Eighth Edition; i.e., the Gmelin Handbook is now complete from A to Z. As of the end of 1978, 381 volumes containing 118 000 text pages were available—a truly monumental work.

However, although completion may be admirable in itself, the question, "Just how current are the Gmelin volumes?", remains. I cannot begin to tell you the specific literature closing dates or publication cut-off dates for each of the existing volumes; I would rather refer you to the Complete Catalog and Alphabetical Reference Chart. By examining these publications, you will learn that the Gmelin Handbook is surprisingly up to date. This degree of being current is achieved because the literature evaluation for each of the Gmelin volumes is brought as close to the publication date as possible. For example, in Gmelin volumes which will appear in mid-1979, the literature for the year 1977 is completely and exhaustively reviewed, and certain important publications appearing in 1978 are also evaluated. The volumes which we are discussing here are part of the Eighth Edition, begun in 1922.[2,3] The First Edition appeared in 1817, when Leopold Gmelin published his three-volume "Handbook of Theoretical Chemistry". The totality of chemical knowledge of that time—inorganic as well as organic—was contained in these three volumes. Beginning with the Fifth Edition, organic chemistry was separated from the inorganic area, and was covered by Beilstein's "Handbook of Organic Chemistry"; this was started about 1852. It is worth mentioning that the volumes of the Fourth Edition, which appeared between 1843 and 1866, were translated into English immediately after publication by the Cavendish Society, a very early example of international cooperation in chemistry.

Work on the Seventh Edition was begun in 1905 by a group of university professors. It soon became apparent, however, that the ever-increasing quantity of literature could no longer be managed by a small group of chemists on a part-time basis. Under the initiative of Alfred Stock, a permanent, full-time staff of professional scientists was assembled in 1922, under the guidance and supervision of the German Chemical Society, to begin working on the Eighth Edition. The total literature of inorganic chemistry and its related fields was to be reviewed again in this edition, starting from the original publications themselves, and this information was to be summarized from the point of view of modern science. The Eighth Edition has now been brought up to date by means of supplement volumes.

The first volume of the Eighth Edition describes the element zinc and its compounds; it covers the total literature from the middle of the 18th century up to the end of 1923. This volume, which contains 329 pages, and the zinc Supplement Volume, which reviews the literature from 1924 up to the end of 1949, contains 1025 pages. Evaluating the literature of these 25 years produced a volume three times as large as was required for evaluating some 200 years of literature—a clear example of the growth of scientific knowledge and the corresponding growth in the literature. Another example is provided by the volumes devoted to sodium. The Main Volume had a literature closing date of 1927 and contains 1000 pages. This should be compared to the seven Supplement Volumes with literature closing dates ranging from 1960 to 1970 and containing a total of some 3000 pages. There is also an Index Volume, containing 167 pages, covering all of these volumes. A very instructive, final example of the expansion of scientific knowledge and the associated growth in the literature is provided by the chemistry of boron. The Main Volume appeared in 1926 and contained 142 pages. The boron Supplement Volume had a literature closing date of 1949 and contained 253 pages. Since 1974, 17 volumes on boron chemistry, containing some 4369 pages, have appeared in the New Supplement Series; many chapters in these volumes are in the English language, and were prepared by English and American authors.

These examples, many more of which could be cited, show the rapid growth in understanding and knowledge in the field of chemistry as well as the fruitful efforts of the Gmelin Institute to make the Handbook topical and to keep it up to date. When I came to the Gmelin Institute more than 20 years ago, it was believed possible to complete the Eighth Edition within a few more years. A Ninth Edition would then have been started. The enormous growth in the literature has made it necessary to abandon this plan. It is simply impossible today to prepare a "handbook" treatment in a new edition covering all of the chemical elements and their inorganic compounds. In view of the very painstaking, detailed, and critical review of the literature (characteristic of the Handbook), there would be such a large gap between the literature closing date and the time of publication that volumes of an entirely new Handbook edition could not possibly be maintained current. An up-to-date treatment is being achieved now by publication of Supplement Volumes to those volumes of the Eighth Edition which have already appeared. The Eighth Edition thus provides a foundation upon which the further and continuing documentation of inorganic chemistry can be erected.

In order to report even more promptly the newest developments in inorganic chemistry while maintaining scientific interrelationships, a New Supplement Series to the Eighth Edition was recently initiated. The first volume in this series appeared in 1970 and covered inert gas compounds. It includes compounds of the inert gases with one or more elements, for example, the oxides, fluorides, and metal complexes, as well as their inclusion compounds. It seemed more sensible to collect the inert gas compounds into a single volume, and not to distribute them among the several corresponding Gmelin volumes according to the normal Gmelin Classification System.

According to this arrangement scheme, the inert gas compounds would have had to be separated into many individual volumes: those compounds with fluorine would appear in the fluorine volume and the oxides would be in the oxygen volume, while compounds with fluorine and metals would be assigned to the corresponding metal volume. This did not seem to be too sensible, and it was decided to collect the inert gas compounds in a single volume, specifically into the first volume of the New Supplement Series. Doing this also emphasizes the underlying concept of the New Supplement Series: namely, to review new topical developments in the field of inorganic chemistry while maintaining their chemical interrelationships.

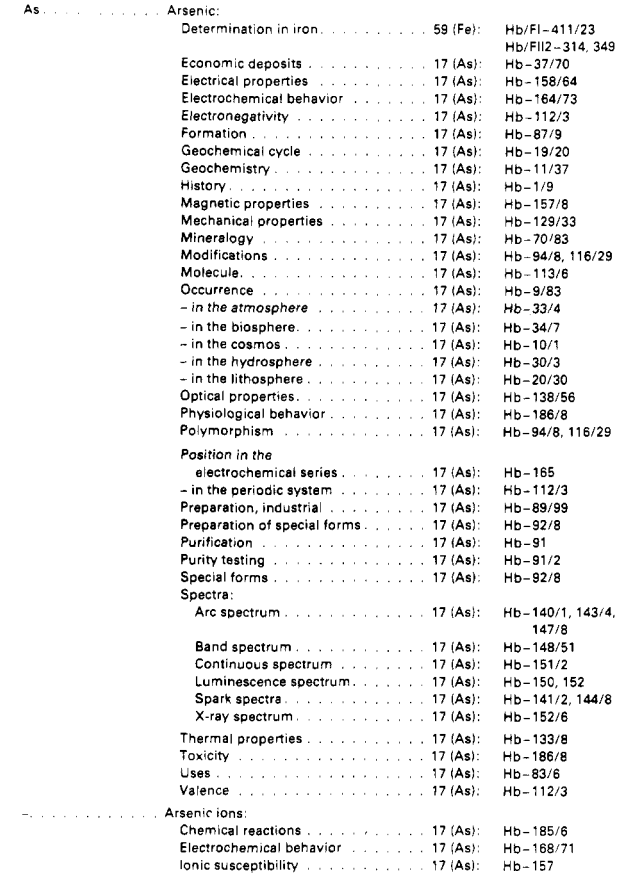
Within the framework of the New Supplement Series, there are also volumes dealing with boron compounds, transuranium elements, perfluorohalogenoorgano compounds, and organometallic compounds. The volume "Water Desalting" deserves special mention here, not only because of the importance of recovering drinking water from the oceans, but also because of two additional features which also characterize the entire New Supplement Series. These involve introducing the English language into the body of the Gmelin text, and the collaboration of off-site and foreign colleagues.

It was the practice for many decades for the Gmelin Handbook to be prepared by a permanent and full-time staff of scientists stationed at the Gmelin Institute. The Institute building in Frankfurt also houses the Beilstein Institute. Thus, two of the large Handbooks—Gmelin's Handbook of Inorganic Chemistry and Beilstein's Handbook of Organic Chemistry—are prepared under a single roof. About 120 permanent professional workers are employed at the Gmelin Institute. Despite this large number, it became impossible to maintain the Handbook fully up to date for all of the chemical elements and inorganic compounds. In effect, some dust began to settle on the Handbook. However, as I mentioned earlier, this dust has long since been brushed away, particularly by the starting of the New Supplement Series. Off-site technical specialists were recruited, both in Germany and in foreign countries, with whose help it was possible to work on topical research areas so that the Handbook treatment of important subjects could be brought up to date in a relatively short time. The transuranium elements represent one such subject area: present knowledge of these elements and their compounds are reviewed in nine volumes. All of the volumes were prepared by renowned specialists on transuranium elements in the U.S.A., England, France, and Germany. Each contribution is in the native language of its author; thus, the volume is published in German, French, and English. The name of each author is printed in the Handbook, along with the specific chapters for which the author was responsible. The volume on the manufacture of steel was prepared by Professor Trenkler, the discover of the LD process. Since he was responsible for the complete volume, his name appears on the front of the cover.

The organometallic compounds represent another important branch of chemistry whose coverage was begun in the New Supplement Series. My earlier comments in connection with the growth of the literature are particularly applicable to the field of the organometallic compounds. Thus, the organochromium and organovanadium compounds were covered together in a single volume of the New Supplement Series which appeared as the second volume of the Series, following the inert gas compounds. The compounds of zirconium and hafnium cover one volume, which was prepared entirely in the English language. Two volumes of the Handbook have already been devoted to the organocobalt compounds. The growth of literature on iron compounds has been much more drastic. Eight volumes are expected for the ferrocenes alone, of which four have now been published. More than 10 volumes are planned for the mono- and polynuclear compounds. Consequently, about 20 volumes of Gmelin will be required to cover the organoiron compounds. As we discussed the conceptual arrangement of the organotin compounds with Professor Schumann, who undertook their review early in the 1970s, we believed that these compounds could have been covered in three volumes. More than five volumes have already been published. Four volumes are devoted to the mononuclear tin tetraorganyls and organotin hydrides, corresponding to sections 1.1 and 1.2 of the arrangement outline. The fifth volume starts with a description of the mononuclear organotin halides, i.e., with section 1.3. Three volumes are projected for this section. You will surely understand my reluctance to risk a prognosis as to the size of the entire series; this can easily become a lifetime project for Professor Schumann.

The collaboration of off-site technical specialists has made it possible to include very current research results in Gmelin, and has allowed the Gmelin headquarters staff to concentrate on other equally important areas. This collaboration has also involved introducing the English language into the body of the Gmelin text. This was initiated in the volumes dealing with the transuranium elements. The practice of providing English headings in the margins of the text, as well as an English table of contents, was begun many years ago. In view of the Reprint Program (which maintains the totality of the Eighth Edition "in print"), none of the Gmelin volumes is without these English insertions at the present time. Since the German language is losing importance, and is being replaced more and more by English, particularly in the natural sciences, and since Gmelin does enjoy broad utilization in countries outside of Germany, it has been decided to introduce the English language into the main text of the Gmelin Handbook. Such a replacement of our native tongue by a foreign language will naturally require time; it can be understood that only a few selected volumes will be printed entirely in English at the start of this program. However, it is expected that the Gmelin text will one day be printed completely in English.

The modern changes I have described (collaboration of off-site specialists, introduction of English, and reviews of very topical subjects) which were begun in the New Supplement Series have naturally had an effect on the Main Series. Since the conception of the New Supplement proved to be so successful, and since it should be made clear that the volumes of the Main Series, the Supplement Volumes, and the New Supplement Series are all parts of a single Gmelin Handbook, the New Supplement Series was incorporated into the Main Work at the start of 1978. With the collaboration of off-site specialists working in the English language, this Main Work and its supplements will present the totality of knowledge applicable to the field of inorganic chemistry including the organometallic compounds. This will be done in the manner characteristic of "Gmelin": namely, all of the reported facts for each individual compound will be completely collected and critically evaluated so as to present the current state-of-knowledge. The extent to which this reporting is being maintained current and up to date has already been discussed.



As . . . . . Arsenic:
- Determination in iron . . . . . 59 (Fe): Hb/Fl-411/23, Hb/Fll2-314, 349
- Economic deposits . . . . . 17 (As): Hb-37/70
- Electrical properties . . . . . 17 (As): Hb-158/64
- Electrochemical behavior . . . . . 17 (As): Hb-164/73
- Electronegativity . . . . . 17 (As): Hb-112/3
- Formation . . . . . 17 (As): Hb-87/9
- Geochemical cycle . . . . . 17 (As): Hb-19/20
- Geochemistry . . . . . 17 (As): Hb-11/37
- History . . . . . 17 (As): Hb-1/9
- Magnetic properties . . . . . 17 (As): Hb-157/8
- Mechanical properties . . . . . 17 (As): Hb-129/33
- Mineralogy . . . . . 17 (As): Hb-70/83
- Modifications . . . . . 17 (As): Hb-94/8, 116/29
- Molecule . . . . . 17 (As): Hb-113/6
- Occurrence . . . . . 17 (As): Hb-9/83
- *- in the atmosphere* . . . . . 17 (As): *Hb-33/4*
- - in the biosphere . . . . . 17 (As): Hb-34/7
- - in the cosmos . . . . . 17 (As): Hb-10/1
- - in the hydrosphere . . . . . 17 (As): Hb-30/3
- - in the lithosphere . . . . . 17 (As): Hb-20/30
- Optical properties . . . . . 17 (As): Hb-138/56
- Physiological behavior . . . . . 17 (As): Hb-186/8
- Polymorphism . . . . . 17 (As): Hb-94/8, 116/29
- *Position in the electrochemical series* . . . . . 17 (As): Hb-165
- - in the periodic system . . . . . 17 (As): Hb-112/3
- Preparation, industrial . . . . . 17 (As): Hb-89/99
- Preparation of special forms . . . . . 17 (As): Hb-92/8
- Purification . . . . . 17 (As): Hb-91
- Purity testing . . . . . 17 (As): Hb-91/2
- Special forms . . . . . 17 (As): Hb-92/8
- Spectra:
  - Arc spectrum . . . . . 17 (As): Hb-140/1, 143/4, 147/8
  - Band spectrum . . . . . 17 (As): Hb-148/51
  - Continuous spectrum . . . . . 17 (As): Hb-151/2
  - Luminescence spectrum . . . . . 17 (As): Hb-150, 152
  - Spark spectra . . . . . 17 (As): Hb-141/2, 144/8
  - X-ray spectrum . . . . . 17 (As): Hb-152/6
- Thermal properties . . . . . 17 (As): Hb-133/8
- Toxicity . . . . . 17 (As): Hb-186/8
- Uses . . . . . 17 (As): Hb-83/6
- Valence . . . . . 17 (As): Hb-112/3

- . . . . . Arsenic ions:
  - Chemical reactions . . . . . 17 (As): Hb-185/6
  - Electrochemical behavior . . . . . 17 (As): Hb-168/71
  - Ionic susceptibility . . . . . 17 (As): Hb-157

Figure 2.

Another new feature introduced at the beginning of 1978 further facilitates the use of Gmelin; this deals with the library-shelf arrangement of the individual volumes. Shelving arrangements had heretofore generally followed the System Numbers, although there was a difference in arrangement between the volumes of the Main Series (and its Supplement Volumes) and those of the New Supplement Series. Looking for a specific volume thus required some knowledge of the classification system underlying the Handbook arrangement (the so-called "System of the Last Position"). Now, it will be necessary to watch for only two items: the symbol of the chemical element and the alphabet. The shelf arrangement of the individual Gmelin volumes will then follow an alphabetic sequence, based on the element's chemical symbol.

Volumes of the New Supplement Series will thus be shelved adjacent to the corresponding volumes of the Main Series. The advantage of this new feature will be that all volumes which deal with a particular chemical element will be collectively shelved under the corresponding symbol of that element, without regard to whether the volumes are in the Main Series, the Supplement Volumes, or in the New Supplement Series. The internal structural arrangement in each volume of the Handbook is undisturbed by this modification, and the Gmelin Classification System applies as heretofore.

In order further to facilitate user access, the preparation of a complete Gmelin Index has been started. The Formula Index is arranged alphabetically by element symbol and compiled in the English language. As a consequence of the introduction of English into the body of the Gmelin text, it was decided to prepare the Formula Index (begun in 1975) entirely in English. Figure 2 shows some subject entries listed for the element arsenic. Thus, this is not purely a Formula Index: listings of subject entries are also provided wherever it seems necessary or purposeful. Generally, this occurs for those chemical elements whose description in the Handbook covers a large number of pages. For compounds, in place of subject headings, the normal chemical formulas appear; these are familiar to all chemists.

At present ten volumes of this Formula Index have been published, covering the chemical elements from actinium to iodine together with their compounds. About two more volumes will be needed to reach zirconium and its compounds so as to be able to list all of the elements from A to Z which had been covered in Gmelin up to 1974.

I have covered specific steps taken by the Institute on the way to modernization and in achieving topical coverage. I should also like to report another further stride in this direction; it concerns the mechanics of publishing the Index. For the first time in the history of the Gmelin Handbook, this was not done using molten type but rather by photooptical composition. It has thus become possible to store the entire Index text on magnetic tape, so that it can be readily extended at a later date to include subsequently published Handbook volumes. A capability has also been provided for preparing special indexes dealing with restricted groups of subject entries.

During the past few years we have begun to publish other Gmelin volumes, in addition to the Index, using photooptical methods of composition. We must bear in mind the fact that the age of Gutenberg's lead type is drawing to an end, and new technologies open other possibilities for modernization and better utilization. Gmelin's Handbook is without any doubt the archival collection for the field of inorganic chemistry; it presents the totality of chemical knowledge from the middle of the 18th century up to modern times in a summarized and critically evaluated form. However, an archival collection must also be used. In view of its structure, the Handbook not only can give the researcher information, but can also suggest ideas for his research activities. If we compare the information stored in Gmelin with an inaccessible treasure, we need an "Open Sesame!" command in order to be able to get at this wealth of technical knowledge. The Index we have been discussing provides one means for a more facile access to this treasure. This will become ever easier by the continual updating of this Index, and by its gradual broadening to permit additional subject matter inquiries to be made. Such an Index could then be formulated as an electronic information storage system, and the new technologies can provide the basis for this development.

The possibility of searching by subject opens a new route to the knowledge treasure contained in Gmelin. The primary arrangement of compounds in the Handbook follows the Gmelin Classification System, which I mentioned earlier. For each substance listed, subject entries then follow in a specific sequence, which was developed and published by the Gmelin Institute over 20 years ago, with a view toward developing the mechanical documentation of inorganic chemistry. These plans had been deferred in favor of making the Handbook more up to date; they are again under serious study but admittedly for a somewhat different purpose. What is involved now is to make the Handbook truly an information tool which is constantly maintained correct and current, and is readily accessible by appropriate techniques.

These efforts continually force the Gmelin Institute into new considerations, especially in regard to the selection of subject content. Since the newest literature is being included in the Handbook, the editorial staff is always being confronted with the latest research results, and questions continually arise as to whether a particular research finding should be included in the Handbook. This is especially true of subjects in physics. Obviously, physics is covered in the Gmelin Handbook and descriptions of physical properties occupy considerable space, especially in connection with the chemical elements. For example, such entries as structural data, thermodynamic

functions, thermal and electrical conductivity data, magnetic susceptibility, optical constants, and magnetooptical effects are generally included. Data on molecular structure have become very important; the rapidly developing field of spectroscopic methods has become of especial interest in this connection. However, the complete review and reporting of the many papers dealing with these subjects can rupture the framework of a Handbook of Inorganic Chemistry. The Gmelin Institute uses guidance provided here by its professional staff in order to achieve a practicable way for describing the properties of the substances—in the characteristic and complete Gmelin form—without becoming mired in details and in speculative discussions. The professional staff also counsels the Institute as to selecting the chemical elements and compounds to describe in the Handbook.

As publishers of the Handbook, the Gmelin Institute is in contact with organizations which are active in the fields of documentation and information. Close contact with the Beilstein Institute follows directly because of proximity. A relationship with Landolt–Börnstein is also maintained; arrangements are being established to prepare a common Index. The "Fach-Informations-Zentrum Chemie" (Technical Information Center for Chemistry) is also located at the Carl-Bosch Haus; the major organizations in Germany active in documentation and information are affiliated with this Center, which is organizationally responsive to the "Internationale Dokumentationsgesellschaft der Chemie" (International Documentation Society for Chemistry)—created by the large chemical companies. The West German Federal Government through the Ministry for Research and Technology is also a partner of the Center. The Technical Information Center for Chemistry is in very close contact with Chemical Abstracts Service, and the Gmelin Institute uses the magnetic tapes of *Chemical Abstracts Condensates*. This is another example of international collaboration.

I opened with the question: "What should a chemist do when he wishes information on a chemical or physical subject?", and I stated that many possibilities existed to answer such questions. One of the possibilities for information exchange is that of personal correspondence. This form of direct communication is surely not the worst; it is in widespread use and often is successfully practiced—otherwise there would be no more conferences or congresses. Following personal correspondence comes information exchange in the form of publications. This covers the entire spectrum of publications ranging from conference proceedings, laboratory reports, preliminary releases, articles, progress reports, review studies, monographs, and abstracts up to the multivolume Handbooks. Among these latter publications, the Gmelin Handbook of Inorganic Chemistry occupies a very special place.

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Health and Safety Information for Regulatory Purposes — An Industrial Point of View

JAMES W. CONDER

Health and Environmental Sciences, The Dow Chemical Company, 2030 Dow Center, Midland, Michigan 48640

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This article describes how one company (The Dow Chemical Company) is managing the issue of increasing demands by regulatory agencies for health and environmental information. Described are: an interdisciplinary organization linked by a resource and communication network; methods of evaluating information requests and establishing priorities for response; and problems in communicating with the regulators. The need for a responsive technical dialogue between government and industry is stressed.

Much of the data used by the government in developing health and safety regulations originates in industry. Increasing demands by government agencies for toxicity studies, exposure data, process and emissions information, environmental effects, and related information impose burdens on individual companies far beyond the mechanics of data generation, compilation, and retrieval. Such demands raise the additional consideration of direct costs, allocation of technical resources to "nonproductive" efforts, and protection of proprietary information. There also exist possibilities of misuse or misinterpretation of the data by government agencies, or, conversely, failure to use relevant information in regulatory decision making.

Regulatory agencies seem to have an insatiable appetite for data. The front end of the regulatory process is structured for information collection, storage, selection — and occasional usage. Since much of the government's data originates in industry (although frequently transmitted via contractors), effective and reliable communications between government and industry are vital.

Only ten years ago, the transmission of technical data to federal regulatory agencies was fairly simple. It was conducted through established channels for registering agricultural products, food additives, and pharmaceuticals, or through peer relationships between industry and government scientists.

However, with the increased regulatory activities of such agencies as the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA), the data demands on industry have increased significantly. Transmitting technical data for regulatory purposes now requires a major level of company effort and internal consistency if it is to be managed properly. The current complexity, number, and frequency of federal agency information demands on a technically based company can require a major allocation of that company's available resources.

Consistency in this article is provided by the following definitions: "information" is considered synonymous with "communication" and implies the evaluation and utilization of data; "regulatory purpose" relates to the development of health and environmental standards by OSHA, by the Na-

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