Gmelin's Handbook of Inorganic Chemistry*

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Historical development of the Gmelin Handbook is covered from its origins in 1817 to the current eighth edition. Explanation is given of the Handbook arrangement based on "system numbers" by which any chemical compound is reduced to a characteristic serial number which has a unique and invariant location. The Gmelin Institute staff and organizational structure, as well as the working techniques used in preparing Handbook volumes for publication, are described.

The origins of "Gmelin's Handbook of Inorganic Chemistry, Eighth Edition," published by the Gmelin Institute for Inorganic Chemistry of the Max Planck Society for Advancement of Sciences in conjunction with the German Chemical Society go back to the beginning of the 19th century. Even at that time, the increasing number of publications made it necessary to initiate the collection and rearrangement of experimental research results in a systematic and classified form for ready accessibility. Leopold Gmelin, professor of chemistry at Heidelberg, had these requirements in mind when he published[1] the first edition of his Handbook in 1817 and the third edition in 1830. Inorganic as well as organic chemistry was reviewed in the Gmelin Handbook through the fourth edition. However, in the fifth edition, which began issuing in 1852, purely organic chemistry was excluded in view of its own extraordinary growth. Its treatment was subsequently continued in a separate Handbook of Organic Chemistry by Friedrich Beilstein.[4]

It became apparent during publication of the seventh edition, begun in 1905, that it would no longer be possible to use the same technique as had been employed for the sixth edition (started in 1872), namely, covering the literature using only a few collaborators on an almost part-time basis. The necessary changes in working methods and organization, introduced in 1922 by the German Chemical Society, involved the setting up of a full-time headquarters staff to work on the eighth edition. The specific assigned task of the eighth edition was, and still remains, to review again the entire state of knowledge of inorganic chemistry and related fields from the middle of the 18th century up to the present day, from the original publications themselves—without depending on previously issued editions of the Handbook—and to evaluate the research results in terms of present understanding.

The Gmelin staff was attached to the German Chemical Society from the start of work on the eighth edition up to 1945. In 1946, the Institute became a member of the Max Planck Society for Advancement of Sciences.

ASSIGNED TASK

The task of making available every bit of data as rapidly and comprehensively as possible is accomplished by technical journals, abstracting organs, and handbooks, as well as by the ever-expanding information services dealing with narrow, highly specialized, subject areas. The sheer bulk of published material makes it virtually impossible for the research worker to review the technical journals to acquire a first or general orientation to a subject; the other information sources thus have become more and more important. Although abstracting organs place material from technical journals into a specific collected and indexed arrangement, abstracts on a given subject nonetheless remain noncontiguous in time or position; the Gmelin Handbook places this material into larger aggregates, having time and subject continuity.[2] In accordance with its tradition, the Handbook is an archive of the entire literature of inorganic chemistry and adheres to the principle of archival completeness and critical evaluation in its preparation. However, archival completeness should not be understood to mean that absolutely none of the publications which have appeared during the course of centuries should be omitted—the compiler must of course eliminate meaningless or trivial papers. That there is also a difference in the treatment of inorganic chemistry proper and related fields; only a selection of the latter, which in each instance is carefully considered, can be presented. Critical evaluation becomes especially important in view of the assigned task of the Handbook to arrange reports into larger time and subject associations, as mentioned above. What is involved is a critique arrived at by selection and emphasis, having as its goal the complete presentation of the state of knowledge developed by experiment and theory; statements which are false or inadequate by present day scientific standards are treated critically in this sense.

The Gmelin Institute commits itself on behalf of science to judge in retrospect the total literature from the present state of scientific knowledge and to assemble it critically. It is the assigned task of the Gmelin Handbook to provide chemists with a tool for their work and decisions and to inform them of the results of other workers.

The need to develop manuscript text from original publications is related to this statement of purpose. In order to reduce somewhat the very expensive review of the original documents, procedural limits are established whereby the content of the reference is evaluated at the time it is first located. The reference item is, and remains, the source of information for a specific research study and must be judged somewhat differently from the entire

* Editors note: Portions of this article appeared in *Chemiker-Zeitung*, 94, No. 2, 47–53 (1970). Because of the importance of the Handbook, the reviewers felt that an English version with additional information would be of value to readers of this journal.

composite represented by the Handbook. Only the totality of the information presented for an element or a compound can reconcile the many viewpoints by which all details are to be judged.

A very important statement, which must be emphasized, results from the structure of the Handbook with regard to heterogeneity of the referenced items—namely, in contrast to other information sources, the Handbook is in a position to offer the scientific worker a comparative judgment. The logical interweaving of subjects with one another together with references to related concepts, the critical evaluation of all of the aspects dealing with a single specific substance and subject, as well as the pointing out of current not-yet-completed developments, make possible associations which only the Handbook can provide. On the one hand, the user is given the modern state of knowledge in monographic form, while he is offered the totality of archival source material, on the other hand. Numerous tables and graphs bring individual papers together, and data, which are frequently presented by the several cited authors in different units, are converted to a common basis (wherever possible).

Despite the enormous increase in chemical literature, the concept underlying the Handbook has to be retained without change. However, the degree to which the Handbook is current should also be maintained, or even increased, if possible. An important, although only first, step in this direction was represented by the lifting, several years ago, of the fixed literature termination date of 1949. The evaluation of the literature for every single volume is now brought as closely as possible to its publication date. The eighth edition is thus being completed with an open literature termination date. Another step toward increased topicality is provided by the continuing publication of supplement volumes for those elements whose descriptions were completed a rather long time ago. Other steps, finally, may be seen in plans to restructure the entire work so as to give consideration to modern concepts, to adapt the chapters to correspond to these concepts, to emphasize certain fields of knowledge, and to eliminate those which appear dispensable.

This program should also contribute to meeting the empirical ratio between the size of a published Handbook section and the literature treated in it, established historically, and should thus lead to saving some of the working time used for publishing the Handbook. With respect to the future of the Handbook as an information tool in the field of the natural sciences, see Reference 2.

SYSTEMATIC STRUCTURE

Material in the Handbook is arranged primarily in terms of substances—i.e., by the chemical elements and their compounds. Within the substances, the arrangement is in terms of the following subjects, in addition to those included in the general fields of inorganic and physical chemistry: analytical chemistry; atomic physics; ore preparation; chemical technology; iron and steel; electrochemistry; geochemistry; history of chemistry; colloidal chemistry; coordination chemistry; corrosion and passivity; crystallography; economic deposits; metallography; metallurgy; mineralogy; physical properties of elements, compounds, and alloys (crystallographic, mechanical, optical, magnetic, and electric properties); toxicity and hazards; and selected production statistics.

Substances which do not fall within the scope of "Beilstein's Handbook of Organic Chemistry," are arranged according to the so-called "Gmelin Principle of the Last Position," as illustrated in Figure 1. In this procedure, the elements are assigned serial numbers in such a way that those elements which form anions have smaller serial numbers than those which form cations. Any given compound can thus be described in terms of the serial or "system" numbers of the elements present. The Handbook volume for an element having system number n will contain all of the compounds and combinations of this element with all of the elements having system numbers between 1 and $(n - 1)$. A sought-for compound or combination of elements thus appears in the Handbook volume corresponding to the element having the highest system number.

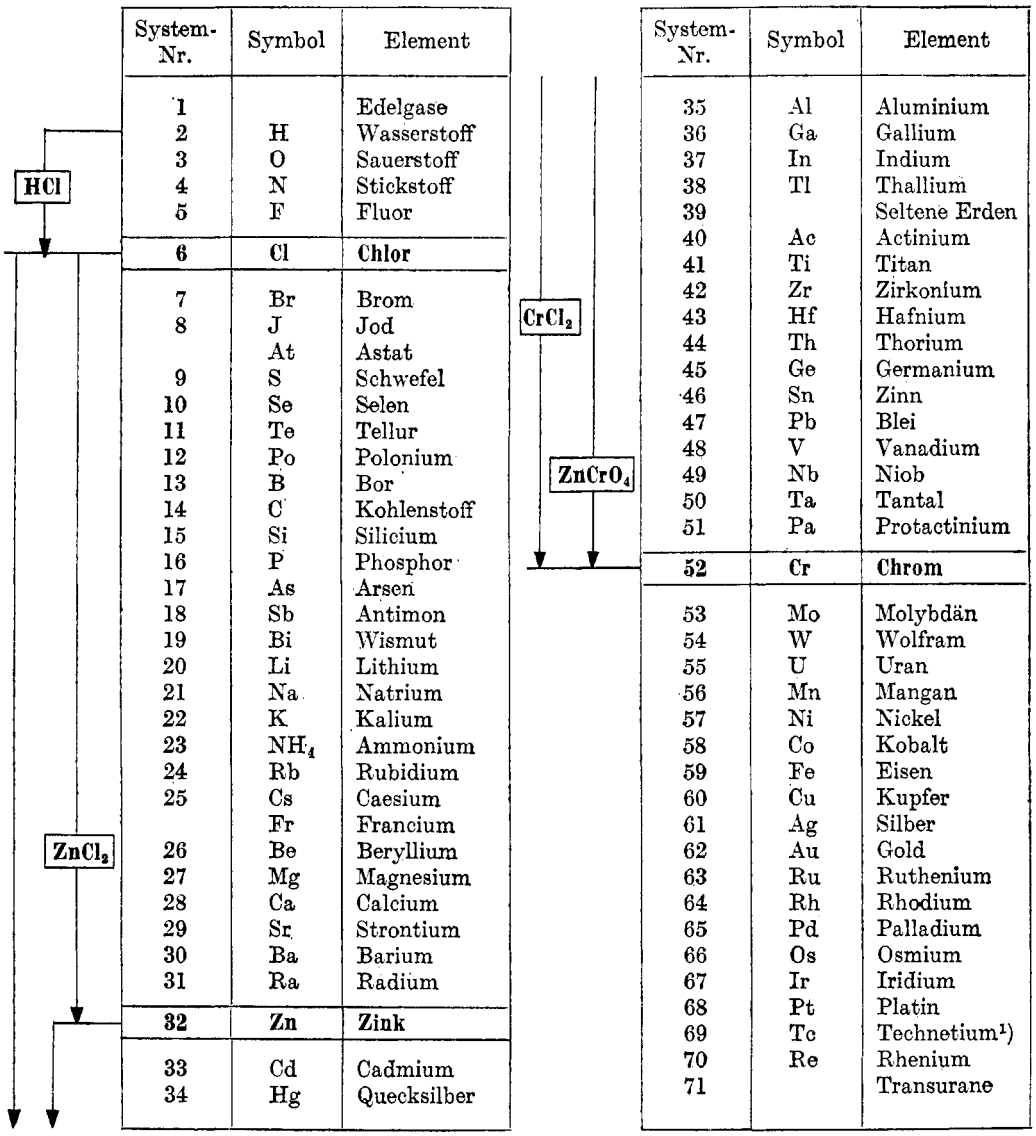
This principle provides the additional advantage that a specific and absolutely definite location can be assigned for every compound during the archival searching, recording, and collecting steps, as well as in developing the written Handbook text. In contrast to the abstracting journals, one thus can be assured that a given compound will always be indexed (or located) at the very same position regardless of the formulation suggested by the author.

Within an individual system number, the subjects generally appear in the following sequence: Historical, Occurrence, Technology and Preparation, Physical Properties, Electrochemical Behavior, Chemical Reactions, Detection and Determination.

In view of the magnitude of the literature, it is frequently not possible to treat a system number completely in a single volume. In such cases the system number is subdivided into individual parts, which are sometimes further subdivided into individual sections.

This subdivision will be illustrated using system number 57, Nickel, as an example. The treatment extends here over three parts, of which Part A covers History, Occurrence, and The Element; Part B treats Alloys and Compounds; while Part C is devoted to Coordination Compounds with Neutral and Inner-complex-forming Ligands. These parts are themselves subdivided into individual sections: Part A I covers History, Occurrence, Technology and Preparation; Part A II, Section 1 has Physical Properties, Part A II, Section 2 has Electrochemical Behavior, Chemical Reactions and Detection and Determination. Part B, Section 1 has Alloys; Part B, Section 2 has Nickel Compounds from Nickel and Inert Gases to Nickel and Polonium; Part B, Section 3 has the remaining compounds of nickel. Part C, which completes the system number, consists of two sections dealing with the coordination compounds of nickel. The entire system number for nickel thus consists of three parts with a total of eight individual sections.

At present, the eighth edition, which was started in 1924 with publication of the volume for Zinc, contains about 217 individual sections (a complete brochure is available upon request) with more than 69,000 text pages. Present estimates project the completion of this edition by approximately 1975.



System-Nr.	Symbol	Element
1		Edelgase
2	H	Wasserstoff
3	O	Sauerstoff
4	N	Stickstoff
5	F	Fluor
6	**Cl**	**Chlor**
7	Br	Brom
8	J	Jod
	At	Astat
9	S	Schwefel
10	Se	Selen
11	Te	Tellur
12	Po	Polonium
13	B	Bor
14	C	Kohlenstoff
15	Si	Silicium
16	P	Phosphor
17	As	Arsen
18	Sb	Antimon
19	Bi	Wismut
20	Li	Lithium
21	Na	Natrium
22	K	Kalium
23	NH_4	Ammonium
24	Rb	Rubidium
25	Cs	Caesium
	Fr	Francium
26	Be	Beryllium
27	Mg	Magnesium
28	Ca	Calcium
29	Sr	Strontium
30	Ba	Barium
31	Ra	Radium
32	**Zn**	**Zink**
33	Cd	Cadmium
34	Hg	Quecksilber

System-Nr.	Symbol	Element
35	Al	Aluminium
36	Ga	Gallium
37	In	Indium
38	Tl	Thallium
39		Seltene Erden
40	Ac	Actinium
41	Ti	Titan
42	Zr	Zirkonium
43	Hf	Hafnium
44	Th	Thorium
45	Ge	Germanium
46	Sn	Zinn
47	Pb	Blei
48	V	Vanadium
49	Nb	Niob
50	Ta	Tantal
51	Pa	Protactinium
52	**Cr**	**Chrom**
53	Mo	Molybdän
54	W	Wolfram
55	U	Uran
56	Mn	Mangan
57	Ni	Nickel
58	Co	Kobalt
59	Fe	Eisen
60	Cu	Kupfer
61	Ag	Silber
62	Au	Gold
63	Ru	Ruthenium
64	Rh	Rhodium
65	Pd	Palladium
66	Os	Osmium
67	Ir	Iridium
68	Pt	Platin
69	Tc	Technetium[1])
70	Re	Rhenium
71		Transurane

Dem einzelnen Element werden alle Verbindungen mit denjenigen Elementen zugeordnet, die im Gmelin-System vor diesem Element stehen. Bei dem Element Zink mit der System-Nr. 32 stehen z. B. alle Verbindungen mit den Elementen der System-Nr. 1 bis 31.

The material under each element number contains all information on the element itself as well as on all compounds with other elements which preceed this element in the Gmelin System.
For example, zinc (system number 32) as well as all zinc compounds with elements numbered from 1 to 31 are classified under number 32.

[1]) Diese System-Nr. ist im Jahre 1941 unter der Bezeichnung „Masurium" erschienen.

Figure 1. Gmelin system of elements and compounds

The term eighth edition, however, is not to be understood as implying that a completely new, and in itself closed, edition will be started directly after each of the system numbers has been treated once. This original editorial principle has already been broken by publication of supplement volumes. In the 217 sections just mentioned, there are about 20 supplement volumes. These supplements represent a step on the road to making the Handbook more topical, and are being published for those system numbers whose treatment had been already completed rather long ago. The eighth edition really represents a reference system from which further commentaries on inorganic chemistry can follow.

To the extent that the eighth edition of "Gmelin's Handbook of Inorganic Chemistry" has been completed, it provides a single inclusive source for the total field of inorganic chemistry since the very beginning of its scientific foundations. In accordance with its archival principles, almost all of the published material which has appeared in the sector of inorganic chemistry has been collected, critically evaluated, and presented in a monographic form in this Handbook. However, although the entire Handbook contains many relevant facts, it is inherent in the nature of its text arrangement that direct answers to questions of the following type are not possible:

> How many inorganic compounds exist and what are they? Which inorganic compounds are formed from a specific element? Which compounds form addition compounds or dou-

ble salts, and with which partners? Which coordination compounds are known? Which elements or compounds exist as components in what systems?

For interested readers to answer easily questions of the listed type, the vast amount of material collected in the Gmelin Handbook can only be made accessible by means of a subject index. At present many broad proposals as to the form of such an index are being developed by the Gmelin index group. In addition, so-called volume indexes are being prepared for certain of the system numbers. Thus a volume containing a formula and heading index has been prepared for the Phosphorus System Number, which consists of three parts. Also, there is a formula and German-English heading index for the Oxygen System Number, which covers all eight sections of the system number and is bound together with Section 8. An index for mercury is in Part B, Section 4. Concepts developed in preparing these volume indexes will be of great value in working up the planned general index.

PREPARING AND EDITING THE TEXT

Maximum dedication to archival standards, study of the original publications with complete evaluation of their contents, and a thoroughgoing consideration of related fields are the essential characteristics of the Handbook. Another typical feature is the rule that all characteristic data and properties for a substance are presented together with appropriate source citations. This arrangement is not found elsewhere in any of the world literature on inorganic chemistry.

To satisfy the assigned task, these stated purposes necessitate certain definite conditions which find expression in the organizational structure of the Gmelin Institute. A documentation section is assigned the task of locating all papers in the entire field. The Library is supposed to have copies of these papers in original form available or to be able to obtain them as quickly as possible. The photographic section has to prepare all kinds of reproductions in the shortest time. The technical completion section prepares the editorially completed manuscript for press and makes those corrections associated with the printing operation. A translation section provides assistance to the Handbook staff over a very broad range of technical subjects, especially in East European languages.

A full-time staff of scientific collaborators is directly engaged in writing the Handbook at the headquarters offices of the Institute. This full-time permanent staff of scientists, together with the actual location of the several service sections with all of their facilities at the Institute site, makes it possible to maintain the necessary unity in Handbook style, as well as to assure essential continuity in text preparation methods. This makes it appear that the Gmelin Handbook has a structured unity produced by a collective effort.

Some of the scientific workers have editorial functions, and several of these individuals are responsible for planning and publication of entire system numbers. Meetings of an editorial college take place regularly to coordinate working methods and to assure homogeneity of the entire work.

A development has set in, caused largely by the extraordinary increase in publications in the years since 1950 and the increasing need to maintain topicality, which has made it extremely difficult for the Handbook to continue with complete, exact, and exhaustive reporting of the literature, as described above. The possibilities for rationalizing the work involved in preparing the Handbook text itself are naturally very limited, but the following steps are suggested to ease these difficulties:

1. The number of collaborators is to be increased proportionally
2. The subject region covered is to be somewhat reduced
3. The method of reporting is to be simplified to reduce the labor involved
4. The working operations are to be made more efficient

Only a combination of measures can make the operating methods satisfy the increased requirements in such a way as to permit the Handbook to meet its previously described assigned task in a world characterized by rapid developments in modern methods of documentation and information handling.

With these aims in mind, a "rationalization and reform program" has been developed having the goal—while preserving the basic concept of the Handbook—of reducing the delay in making the literature available, therefore effecting a reduction in subject coverage. This is intended to facilitate treatment of the abundance of material available with manageable quantities of time and labor.

At the same time, the program provides for abandoning the principle of archival thoroughness and exhaustive description in favor of a more orientational treatment, in all suitable cases. It is thus planned that those volumes (system numbers) of the basic eighth edition which have not yet appeared will be similar to those which have already been published; however, the supplement volumes will be more sharply abridged than those of the main work.

To accomplish this rationalization program, proposals are being developed at the Institute for reducing the scope of individual chapters as well as for reducing the effort expended and the scale of printing. These proposals are intended essentially to reduce the size of the subject fields being reported based on technical considerations, as well as to simplify the type of reporting. No reduction is envisioned in terms of substances included, since the Handbook only covers and will continue to cover elements and *definite* inorganic compounds; inorganic substances such as glass, cement, construction materials, mixed fertilizers, or ceramic materials are not subjects for the Handbook.

As has already been mentioned, the rationalization program should contribute to a definite reduction in working time for developing the Handbook, since an appropriate ratio is being established between the magnitude of the literature appearing in subject areas encompassed by the Handbook and the magnitude of the processed literature associated therewith.

THE GMELIN INSTITUTE AND ITS ORGANIZATION

Work Flow at the Institute. A full-time staff of scientific collaborators forms the basis for the work of the Gmelin Institute. Working conditions are provided for these collaborators which permit them to devote extensive effort

to the study and evaluation of the literature and to creative writing of the manuscript, without being distracted by other technical but relatively noncreative tasks. The following may be mentioned as examples: assembling and preparing the literature, procuring publications, technical preparation of the manuscript for press, technical proof reading and assistance in translating (especially from East European languages). These activities are provided by corresponding service sections or departments.

The organization of the Institute, headed by a director, is as follows: Literature and Manuscript Preparation Section, Library, Reproduction Services, Translation Section, Handbook Department, Index Section, Completion and Correction Department, and Administrative Department.

The sequence in which these service sections and departments have been listed also reflects the work flow at the Institute.

Literature and Manuscript Preparation Section. This service group was formed from the documentation section which existed some years ago. It is charged with providing the most complete archival foundation possible for preparing the Gmelin Handbook. For this purpose, the abstracting journals of chemistry as well as the original journals are searched and evaluated by subject matter, and the material thus obtained is prepared for orderly classification in the archives. Some 2 million literature reference cards were placed in the archival files between 1950 and 1966. These so-called archive cards are subdivided and classified in terms of author, literature source, and abstracting journal, as well as by chemical element or compound and subject matter. The cards provide the scientific collaborators in the Handbook department with the essential basis for preparing the Handbook chapters.

The documentation section has been collecting all publications in inorganic chemistry and its related fields, to the extent that they are proper subjects for treatment by the Handbook. The arrangement of the literature reference cards in the archives corresponds to the structure of the Handbook and is given by the already-mentioned Gmelin Principle of the Last Position and by the Systematic Table of Contents. This arrangement makes it possible to assign an exact and single-valued, definite position in the archival collection, and to arrange the corresponding subject matter in a specified order so searches for a particular substance and subject can be performed manually extremely rapidly.

The collected archive cards are used for preparing Handbook text for a given system number and are destroyed after the volume is published. From the literature closing date for each volume, the documentation section again starts the archival collection of material, so that a continuous in-and-out flow of archive cards takes place. The inventory continually increases, however, as a consequence of the continuing increase in the number of publications. Thus, the files were increased annually about 150,000 cards during the 1962–1965 period, while only 60,000 cards were withdrawn for preparing Handbook text. These figures make clear the difficulties faced by the Handbook in its efforts to be more current.

Every change in method used for preparing Handbook text necessitates a corresponding change in method used for preparing literature cards. Such a change was created by lifting the fixed literature termination date and by the attempt to bring each individual volume as closely as possible to the current date by evaluating the literature almost up to the year of publication of the volume. Other changes have been caused by the rationalization program.

As a consequence of revising the Handbook structure and adapting it more closely to modern scientific developments, decisions were made several years ago—on theoretical and practical grounds as well as on the basis of the rationalization program—to dissolve the documentation section, to discontinue searching the literature and collecting archive cards for *all* chemical elements and their compounds *simultaneously*, and to have a special literature and manuscript preparation section work only on those elements and compounds whose descriptions were required for the Handbook volumes about to be published. This project represents a critical change; it means the end of continually maintaining a complete archival collection covering the entire literature of inorganic chemistry and its related fields.

Library and Reproduction Service. The Institute Library has the task of delivering the original papers which the scientific collaborators require for their assigned Handbook chapters, and to which they have been referred by the archival citation cards, directly to their office desks. In addition to its own collection of journals, considerable use must be made of loans from other libraries via the interlibrary loan system. By working closely with documentation and information centers in Germany and other countries, missing items and rare papers can almost always be obtained.

The reproduction service uses a variety of devices to prepare microfilm and photocopies needed for working on the Handbook.

Translation Section. In view of the increasing proportion of Russian language papers in the chemical literature, it has become necessary to have workers available for translation from this language. The ability to read English text material is a prerequisite for the scientific collaborators.

Handbook Department. As already mentioned, a full-time staff of scientific collaborators is directly assigned the task of preparing Handbook text material. In general, these people are chemists with an inorganic specialty; some physicists and mineralogists are also used.

After the system numbers on which work is intended have been established a chief editor is appointed for each volume. He has the task of taking care of a whole system number or of a specific Handbook section and of coordinating all operational work from planning to printing. He must first develop a disposition of the illustrative material (charts, figures, and tables) made available by the literature preparation section for this volume. He then must assign specific tasks to the several authors and technical editors (personnel disposition). The nature and scope of the individual chapters, the literature closing date, and the initial and concluding subjects are determined by the chief editor, with concurrence of the director and the department manager, to assure that the individual program is being properly developed within the scope of the total program.

Depending on the nature of the chapter, and the subject matter which is to be included in it, assignments to particularly qualified collaborators and technical editors are then

made, in accordance with requirements. The illustrative material is delivered at this time to the collaborator preparing the manuscript; he sorts, selects and classifies, consulting with the technical editor as necessary. The author then devotes himself to a thorough study of the original papers—for which he has received citations via the archival cards, and which the Library has supplied to him; he then completes the manuscript.

During compilation of the manuscript, the technical editor is always available to the author for advice and direction with respect to technical questions, as well as with regard to fixing the limits of the assignment, managing the assignment, and providing general guidelines for handling the theme. Advice and direction must be provided in such a way that the general goal of the Handbook—to present the current state of knowledge correctly, understandably, comprehensively, and as tersely as possible—will be attained. General introductory statements, especially for voluminous or complicated chapters, which serve to eliminate repetitions in the text as well as large accumulations of literature citations, are developed here.

After the manuscript has been completed, editorial work begins. The editorial task of the technical editor extends over the entire scientific content of the manuscript and is directed toward the previously-outlined goal of the Handbook.

When technical editing has been completed, the manuscript is reviewed by the chief editor. The latter is available to the author and technical editor during manuscript preparation with advice and counsel. He undertakes the final editorial review and is responsible during printing for coordinating all manuscripts which belong in his volume. Also, he supervises and controls all of the work involved in preparing the manuscript for press.

After the author and technical editor have finished the new manuscript pages (galley proofs) and first revisions (page proofs), these are read carefully by the chief editor for mistakes and style. In addition, English headings in the margins are checked and running heads are entered onto each page. After completion of the second revision, the chief editor grants his imprimatur.

Index Section. The working groups (which consist mainly of scientific collaborators) also are assigned the task of preparing the so-called volume indexes for the individual system numbers, as well as developing a collective subject index which would make available the entire contents of the Handbook to all interested users. Although the complete subject index is still largely in a planning stage, individual volume indexes are already being prepared.

A volume index consists of a formula index and an alphabetic index. Although the text portion of the formula index has German and English language entries, the alphabetic index consists of separate German and English sections, each complete within itself.

The following general guidelines are observed in deciding which specific entries are to be shown in the volume index:

> The formula index contains only those compounds which belong to the specific volume by virtue of the Gmelin classification system, or for some other definite reason.
>
> Principal entries in the alphabetic index can be a substance, an important concept, a factual entry, a proper name or a geographical term, a process or a name reaction.
>
> Preparation of the volume index goes through several stages. First, source cards are prepared by perusal of the Handbook pages when ready for press; these serve as the working copy and contain comments and working notes as well as the page reference. Index cards are then prepared from these, containing only the reference information in final form and serving as the index manuscript.

As working tools for preparing the index, the following continually expanding working card files are used:

> The *headings card file* contains the main and secondary headings (except for names of substances); this facilitates uniformity of headings, and will some day be expanded into a thesaurus.
>
> The *reference card file* contains all data to which references are made, as well as concepts or synonyms, for which it was decided to make no reference.
>
> The *German-English word card file* facilitates preparing the English language material.

After work on all sections of the Handbook volume is completed, and after the several individual operations mentioned above are completed, the finished index card file is sent to press, in place of a manuscript.

Completion and Correction Department. Corrections and other operations associated with printing are performed on the editorially completed manuscript by the completion and correction department, which is responsible for preparing an error-free manuscript for final approval. This specifically includes checking the typewritten manuscript for abbreviations and abbreviated journal titles, units, and formulas; checking all of the graphical presentations; and supervising and correcting all stages of printing. In addition, this Department must be familiar with the English marginal headings, as well as the Index and Table of Contents for each of the Handbook sections.

Administrative Department. This Department has the task of assuring smooth operation of the entire Institute plant, including the technical administrative problems associated with its full-time permanent staff of collaborators. Principal concerns include inventory control and care of personnel. Among these are data collected by the Personnel Section, furnishing the working offices, etc., as well as setting up and supervising the Institute's balance sheet and developing several financial items. Among the latter, business associations with Verlag Chemie are most important as they handle distribution and sale of the Handbook.

STATUS AND OUTLOOK

Based on present estimates, the portion of the Eighth Edition of the Gmelin Handbook which is still being prepared will be completed by about 1975. By that time, a collection of monographs dealing with inorganic chemistry will be available amounting to about 240 separate volumes, containing some 85,000 pages of text—this is unique in world literature. In accordance with archival standards, this Handbook will contain virtually everything published in the field of inorganic chemistry, critically evaluated and presented in monographic form, representing a single comprehensive source covering all inor-

ganic chemistry from the very origins of chemical science to the present day.

Corresponding to its character of long-term balance, the Handbook always has, and will have, definite gaps from the immediate present in its individual volumes. This is a fact which will continue to exist despite all efforts to approach the present moment.

A chemist requires another information source in addition to the Handbook for information. Considerations at the Gmelin Institute, as well as those on a broader plane relating to forming a documentation center for chemistry in Germany, have recently resulted in establishing the Arbeitsgemeinschaft Chemie Dokumentation e.V. (Council for Chemical Documentation). Undertaking to create and staff a centralized documentation agency encompassing the entire field of chemistry follows from a realization that a sufficiently powerful means must be devised to cope with all of the tasks confronting individual documentation and information facilities—tasks which threaten to overwhelm such facilities in the relatively near future. However, the idea that an individual paper could be evaluated, arranged, and indexed by a large number of documentation centers made it seem reasonable to collect these centers into a single combined agency. It has proven to be desirable that the several institutions for chemical documentation agree upon and support common interests within this over-all concept, without losing their own individuality and assigned tasks. It was thus thought that a paper should be evaluated only by a single collaborator, with the resultant material being worked up in such a way as to satisfy simultaneously the requirements of the several information transmission arrangements being considered—i.e., express information services, handbooks, and computer services. The Handbook has thus acquired an essential position in the information field.

A computer can serve as an information source spanning the period of time between the literature closing date of the Handbook and the present. Reference 2 discusses the position of the Handbook with respect to the computer. Reference is made here to the opinions of E. Pietsch[3] and F. Richter[4] according to whom "the mere arrangement of information promptly in a defined manner, such as is made possible by a computer, will not provide the final form which can serve satisfactorily the progress of science. A large number of bits of information summed up into a mosaic does not really provide a picture of the state of knowledge in a discipline. The Handbook does not merely give citations but rather provides a text, and is in fact a critically reworked text, and gives many kinds of stimuli among the topics near the subject being sought. In this respect, it far exceeds the performance of a machine."

Consequently, only a systematic Handbook can offer the scientist an opportunity for comparative evaluation and thus encourage creative initiative and effort; a computer is in a position only to provide answers to already formulated definite questions in an equally definite form. Although it is certainly important to have a computer available to aid in data compilation, the Handbook must retain its fundamental importance well into the future as a most important chemical information tool.

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Proposed Rules for Nomenclature for Compounds of Phosphorus, Sulfur, and Related Elements

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A subcommittee of the ACS Committee on Inorganic Nomenclature has been meeting for a number of years to develop a rational system of nomenclature for the compounds of phosphorus and related elements. The report of the subcommittee is presented here at the suggestion of the parent committee for general consideration and comment. The membership of the subcommittee has included: A. F. Clifford (Chairman), Roy M. Adams (ex officio), Gail H. Birum, James E. Huheey, A. F. Isbell, Fred Leighton (deceased), Fred McCollough, Patricia M. McDonnell, George W. Parshall, Rudi Raetz (deceased), and Russell J. Rowlett, Jr.

The system of nomenclature for compounds of phosphorus, sulfur, and related elements proposed in the following pages has been developed in answer to objections to systems, proposed and adopted, which have been suggested in the past. As the known chemistry of phosphorus and related elements becomes more complicated and as molecules containing atoms of more different elements including nonsubstituent carbon become known, it is increasingly necessary to have an internally consistent system of nomenclature for such compounds. Inasmuch as it seems highly inadvisable to create for these elements yet another new system which is different from that of other elements, every attempt has been made to build upon an existing accepted system—specifically the "a" system—augmenting it as necessary to meet the more complex demands of the chemistry of these elements. The choice of a system