Biography of a "Chemical Economics Handbook" Report*

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The nature of the "Chemical Economics Handbook" program is explained, and the life cycle of a typical research report is followed from topic selection through draft preparation, industry review, publication, updating, and eventual revision. The numerous information sources that are used at the various stages are discussed. A description is given of the procedures used to achieve as complete and accurate coverage as possible without disclosing proprietary information.

The goal of this paper is to trace the life cycle of a typical "Chemical Economics Handbook" report and thereby give a behind-the-scenes view of the operations involved in the preparation of these reports.

The "Chemical Economics Handbook" was the brainchild of a former Stanford Research Institute (SRI) staff member, Raymond Ewell (now Vice President for Research at the State University of New York in Buffalo). He felt that a publication that would provide basic facts and figures on the economic aspects of the chemical industry on a continuing organized basis would be welcomed by a large number of people in the chemical industry. He put his ideas into practice and their value is illustrated by the fact that the Handbook is still flourishing today—nearly twenty-one years after the first issue was published by SRI in 1950. Today the Handbook program is supported by over 250 corporations and other organizations throughout the Western world. The Handbook set presently consists of fourteen loose-leaf volumes, and the complete program provides monthly installments of the Handbook, bimonthly issues of an updating service called the *Manual of Current Indicators* and an inquiry and consulting service.

In the beginning, all of the information in the Handbook was presented in data-sheet format. These data sheets are brief summations which generally consist of a graph, a table of the data used in the graph, some footnotes explaining the basis for the data and any qualifications or supplementary information considered pertinent, and the sources used for the data.

Some subjects were just too complicated to be given satisfactory treatment in the data-sheet format. Therefore, in 1964, the first of the so-called reports was published in the Handbook. These reports give detailed coverage of the most important aspects of a particular chemical or product group. Although the data sheets are still very important—there are presently over 600 of them in the Handbook—the reports have become the single most important feature of the present Handbook program.

The preparation and revision of these reports is the major responsibility of the eight senior researchers on the Handbook staff. These researchers—known as section managers—are chemists and chemical engineers (most of whom have had experience in the chemical industry). They have specialized knowledge in the fields for which they are responsible—for example, fertilizers, petrochemicals, plastics, and elastomers—and their expertise is the backbone of the complete Handbook program. A measure of their productivity in the past seven years (and that of the staff of research assistants who aid them) is the fact that the Handbook presently contains 131 reports on subjects ranging from ABS resins to xylenes.

A typical Handbook report contains the following sections: Status, Outlook, Manufacturing Processes, Producing Companies, Grades, Salient Statistics, Consumption, Price, International, and Bibliography.

In the following paragraphs, some examples taken from two recent reports—those on glycerin and titanium dioxide pigments—are used to illustrate the content of these sections.

In the Status section we attempt to pull together the most important aspects of the subject as it stands today. We frequently present a table listing the latest available data on such items as production, consumption, imports, and exports and follow this with a brief discussion of the items listed in the table.

In the Outlook section, those factors that we believe will be major influences on the future of the chemical are discussed. These may include future availability of raw materials, new manufacturing processes, pollution problems, competitive products, imports, and a variety of other subjects. In some cases, we may include an estimate of the future growth of the major end uses such as that shown in Figure 1.

The Manufacturing Processes section is intended to give the reader an understanding of the main reactions involved and the typical yields. This is illustrated in Figure 2 by the discussion of one of the many routes to glycerin.

In the Producing Companies section, information is given on plant locations, processes used, capacities, and planned expansions for each of the known producers.

The section on Grades may range from a simple listing of the major grades available to a full two-page table such as that in the titanium dioxide pigments report which includes the brand equivalents by trade name for each producer, together with the mineral type, principal end uses, titanium dioxide content, and principal characteristics.

In the Salient Statistics section we pull together the historical data on total production, imports, exports, and apparent consumption, in the form of graphs and tables for ease in making comparisons and spotting trends.

The Consumption section is normally the largest section in the report. Generally, it includes a breakdown of consumption by major market areas for a period of years, fol-

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	Thousands of Short Tons		Average Annual Growth Rates—1970-1975 (Percent)
Production		760-800	3.5
Chloride process	410-420		7.5
Sulfate process	350-380		0
Consumption		825-875	3.5
Paint, varnish, and lacquer	410-425		2.5
Paper	200-210		5.5
Plastics	90-95		11
Printing inks	25-26		7
Ceramics	20-24		5
Other	80-95		0.5
Exports		15	0
Imports		75-85	6

Source: CEH estimates based on communication with industry.

Figure 1. Estimated status of titanium dioxide pigments in 1975

This process includes the following three steps:

a. $CH_2{=}CHCH_3 + O_2 \longrightarrow CH_2{=}CHCHO + H_2O$

propylene — acrolein

mol wt: 42.1 — 56.1

By-product acetaldehyde is produced in this reaction.

b. $CH_2{=}CHCHO + CH_3CH_2\underset{\displaystyle OH}{\underset{|}{C}}HCH_3 \longrightarrow CH_2{=}CHCH_2OH + CH_3CH_2COCH_3$

acrolein — secondary butyl alcohol — allyl alcohol — methyl ethyl ketone

mol wt: 56.1 — 74.1 — 58.1 — 72.1

c. $CH_2{=}CHCH_2OH + H_2O_2 \longrightarrow CH_2\underset{\displaystyle OH}{\underset{|}{C}}H\underset{\displaystyle OH}{\underset{|}{C}}H_2$

allyl alcohol — hydrogen peroxide — glycerin

mol wt: 58.1 — 34.0 — 92.1

Raw material requirements per pound of glycerin are estimated at 0.90 pound of propylene, corresponding to 51% of the theoretical yield (CEH estimate).

The acrolein – allyl alcohol route is used in the United States by Shell Chemical Company.

Figure 3. Estimated consumption of titanium dioxide pigments by type and market—1970 (thousands of short tons)

	SULFATE PROCESS	CHLORIDE PROCESS	TOTAL
Paint, varnish, and lacquer	140	230	370
Paper	145	10	155
Plastics	30	25	55
Floor coverings			25
Rubber			23
Printing inks			18
Ceramics			17
Coated fabrics	110	25	
and textiles			10
Roofing granules			7
Other			20
Exports			15
Totals	425	290	715

Source: CEH estimates based on communication with industry.

Figure 2. Acrolein-allyl alcohol route to glycerin

COMPANY AND PLANT LOCATION	CAPACITY Thousands of Short Tons per Year: SULFATE PROCESS	CHLORIDE PROCESS	REMARKS
NORTH AMERICA			
Canada			
Canadian Titanium Pigments Limited (100% owned by National Lead Company)			Trade names are TITANOX and KRONOS. Titanium slag for the sulfate process plant is supplied by Quebec Iron and Titanium Corporation.
Varennes, Quebec	30	11	
Tioxide of Canada Limited (100% owned by British Titan Products Company Ltd. [United Kingdom])			Trade name is TIOXIDE. Expansion to 37 thousand short tons per year by the end of 1970 was expected. Quebec Iron and Titanium Corporation supplies the raw material, titanium slag.
Tracy, Quebec	30		
Mexico			
Pigmentos y Productos Quimicos S.A. de C.V. (49% owned by Du Pont and 51% by Banco de Comercio S.A.)			An expansion of 10 thousand short tons per year is planned for 1971.
Tampico, Tamaulipas	20		

Figure 4. Foreign producers of titanium dioxide pigments

lowed by a more detailed breakdown for the most recent year (see Figure 3). A discussion of the major use areas then describes the advantages and disadvantages of the product in the particular application, the competitive picture, the areas of fastest growth, and the prospects for the future. We put our main research effort into this section since we feel that it is of primary importance to our readers.

In the Price section, a history of list prices is presented, together with any information available on current prices for large quantities purchased under long-term contracts.

The International section summarizes data on U.S. exports, U.S. imports and tariff rates, world production, and information on producing companies outside the United States (Figure 4).

The reports are concluded with a Bibliography of those articles which are thought to provide the best background information on the subject.

When we turn to the life cycle of a typical Handbook report, we find at the outset that most of these reports are descendants of Handbook data sheets (for example, the data sheet on the production of titanium dioxide first appeared in the Handbook in 1951). Many of the reports came into existence in the 1964-1967 period after a 1964 survey of the Handbook participants to determine their preference for report topics. For example, the participants indicated that titanium dioxide was of considerable interest to them when their votes ranked it fifth out of a list of thirty-nine suggested inorganic chemicals.

Once the topic selection has been made, the report author reviews the articles available in our clipping file to get the "big picture" as it is being presented in the open literature. At present, this clipping file is based on the monitoring of 106 magazines and newspapers devoted to the chemical and related industries. The articles of interest to us in these publications are clipped and filed under the individual subjects according to a master file index. At the present time, some 38 four-drawer filing cabinets are devoted to this clipping file, and it is growing all the time.

Armed with the information from this literature review, the author may then talk to a few industry people in order to fill in any major gaps in the picture, to get their opinions on any conflicting information or on the relative importance of various manufacturing processes or end uses, and to get their thoughts on any additional aspects that should be covered in the report.

At this point, we insert a notification in our bimonthly *Chemical Economics Newsletter* to inform all Handbook participants that we are starting work on the report.

The author then turns to the preparation of the report

draft by drawing on all of the sources of information available to us. These include not only the clipping file but the Chemical Information Services library, the main SRI library, and industry sources.

In the Chemical Information Services library we have a wide variety of books, encyclopedias, directories, annual reports, news releases, and product bulletins on the chemical and allied industries, as well as numerous government and trade association publications. Included in this collection is our own "Directory of Chemical Producers—U.S.A.," which provides a listing of all of the U.S. producers of commercial chemicals, their plant locations, and their products.

The main SRI library has among its 37,000 books, some 12,300 on economics and 9,200 on math and science. Over half of its 1,500 periodical subscriptions are in the fields of economics or physical sciences.

Contacts with industry sources at this point may range from a few phone calls to selected industry experts all the way to a formal confidential survey of all companies producing the particular chemical. In the case of the titanium dioxide pigments report, not only were market researchers and product managers contacted but industry people in research and development, technical service, commercial development, planning, manufacturing, purchasing, and traffic were consulted, as well as importers, exporters, economists, geologists, land developers, and trade association personnel.

Once the report draft is prepared, it is edited to check for consistency with other Handbook reports and to double check that no information given on a confidential basis has been included. After the editing, copies are made for mailing to industry reviewers. These reviewers generally include market researchers and product managers of the major producing and consuming companies. They may also include a number of others selected because their companies have an interest in some aspect of the subject. Also included in the reviewers are those Handbook participants who have noted in our Newsletter that the report is being prepared and who have asked for a copy of the report draft.

We actively solicit contributions by all of these reviewers in the form of comments, corrections, and proposed additions and deletions, in order to improve the quality of the final report. In some cases, the report author may even visit several of the reviewers to discuss their thoughts in greater detail. In all cases, before using any information that might possibly be proprietary, we check back with the reviewers to get permission for its use. In addition, all correspondence with industry reviewers is kept in a confidential file where it is available only to Handbook staff members.

Using the additional information gathered from these reviews, the author prepares a revised version of the report—a process which generally requires additional literature searching and industry contacts. After editing, the final report is ready for publication.

The author's work is not over at this point, however. He must prepare appropriate entries for the Handbook Index (which presently contains 71 pages of entries). He also must decide which statistics in his report are satisfactory for inclusion in the bimonthly *Manual of Current Indicators*. This Manual is an updating service which provides the latest available annual data in the same format as that used in the Handbook report and also supplies monthly or quarterly data when these are available. The author also prepares an abstract of his report for inclusion in our *Chemical Economics Newsletter*. (The Newsletter is sent free of charge to anyone who is interested in our activities, whether they are associated with participating organizations or not.)

All industry reviewers receive a copy of the final published report, and we solicit their further comments at that time. Occasionally these comments will uncover a major new aspect of the subject or a significant error or omission. In these cases, we issue revised pages in a subsequent Handbook installment and inform the participants of the reason for the revision.

Complete revisions of the Handbook reports are presently being done on an average of every three years although this period varies quite widely. We are attempting to build up our staff as our budget permits and to improve our efficiency in order to shorter this time span.

The situation during the interval between revisions of a report is far from dormant, however, since we have several mechanisms for providing additional information to Handbook participants. Whenever completely new data (such as a more detailed breakdown of statistics) become available, these are added to the listing in the *Manual of Current Indicators*. Any information on the subject which is obtained by staff members in the course of correspondence with industry sources is added to the worksheet file and, of course, new material is constantly being added to the clipping file.

All of these sources are used to provide information to the program participants through our inquiry and consulting service. If they have specific questions about some aspect of a Handbook report, we ask them to contact us, and we will provide a bibliography of references that we feel are pertinent to their inquiry. Finally, if program participants wish to discuss a chemical or group of chemicals in more general terms or are interested in the subject of a report that is in the process of being prepared, then we invite them to phone the author or visit our offices to consult with him.