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RTECS®

A Comprehensive Guide

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

0272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. PB94-140449
4. Title and Subtitle Registry of Toxic Effects of Chemical Substances (RTECS). Comprehensive Guide to the RTECS			5. Report Date 1993/09/00
			6.
7. Author(s) Sweet, D. V., Ed.			8. Performing Organization Rept. No. 93-130
9. Performing Organization Name and Address NIOSH, U.S. Department of Health and Human Services, Cincinnati, Ohio			10. Project/Task/Work Unit No.
			11. Contract (C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered
			14.

15. Supplementary Notes

16. Abstract (Limit: 200 words) This Guide was intended serve as a reference to the Registry of Toxic Effects of Chemical Substances (RTECS). It was prepared to assist the many users who access RTECS data through on line databases, compact disk or magnetic computer tape. Recent changes to the service were reviewed and a detailed description was offered of the various format selections. Each of the fields was defined and discussed, including the substance prime name, update, Chemical Abstracts Service Registry Number, RTECS number, molecular weight, molecular formula Wiswesser Line Notation, synonyms, compound descriptor codes, skin and eye irritation data, mutation data, reproductive effects data, tumorigenic data, acute toxicity data, other multiple dose toxicity data, cited references, reviews, standards and regulations, NIOSH standards development and surveillance data, and status. Tables included toxic effects code, reproductive effects code, routes of administration, species, master file data types, line numbers, line matrix for RTECS mutation data, line matrix for RTECS reproductive effects data, and the line matrix for RTECS lethality data.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms NIOSH-Publication, Reproductive-hazards, Chemical-structure, Mutagens, Information-retrieval-systems, Epidemiology, Cytotoxic-effects, Toxic-effects, Genotoxic-effects, Carcinogens

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages 76
	22. Security Class (This Page)	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* **OPTIONAL FORM 272(4-77)** (Formerly NTIS-35) Department of Commerce

REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS®)

COMPREHENSIVE GUIDE TO THE RTECS®

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September 1993

ACKNOWLEDGMENT

The invaluable assistance of Laura A. Delaney, Brenda J. Hamons, and Barbara C. Cromer in producing the camera-ready copy of this publication is gratefully acknowledged.

PB94-140449

DHHS(NIOSH) PUBLICATION NO. 93-130

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

PREFACE

This Comprehensive Guide, which was formerly included in each printed edition of the Registry of Toxic Effects of Chemical Substances (RTECS®), has been prepared as a service to the many users who now access RTECS® data through on-line databases, CD-ROM, or the magnetic computer tape. The many inquiries about format, content, and policies of the Registry have made it evident that the information provided herein must be readily available to the community of RTECS® users.

The last printed edition of RTECS®, the 1985-86 edition, is now out of print and there are no plans for future editions. However, the Registry is maintained and updated electronically each quarter by the National Institute for Occupational Safety and Health (NIOSH). The July 1993 update marked the twenty-second annual update prepared in compliance with the requirements of Section 20(a)(6) of the Occupational Safety and Health Act of 1970 (Public Law 91-596). The original list, then known as the Toxic Substances List, was completed on June 28, 1971 and contained approximately 4,000 substances. As of July 1993, RTECS® contained 120,962 chemical entries.

Since the first edition, the database has expanded to include primary skin and eye irritation, mutagenic effects, reproductive effects, tumorigenic effects, and acute toxicity data. A most important recent addition is other toxic effects data from multiple dose studies. From its inception, the policy of NIOSH has been to record the lowest dose or lowest exposure concentration reported to cause the tabulated effect. It has also been the policy of NIOSH not to evaluate the data, but to tabulate the values reported. The logic for this is twofold: (1) while most references are drawn from a core list of about 200 technical journals, sources of data also include abstracts, textbooks, government reports, compendia, proceedings of scientific meetings, symposia, industry reports and letters, professional society reports, reports by research institutions, personal communications, and publications from a large number of non-English language journals; (2) the resources available to the RTECS® program do not allow for the time and effort required to perform an evaluation of the vast amount of data that has been accumulated and reported. It was decided that the offering of data from a broad spectrum of sources not generally accessible was of major value to the database users.

RTECS® EDITORIAL REVIEW BOARD

The RTECS® Editorial Review Board was established to serve as a source of advice and technical review for the RTECS® data file. The Board consists of representatives from various NIOSH Divisions and from other Agencies that have a direct interest in the RTECS® programs. The Board meets periodically to resolve questions of policy and to review current and projected RTECS® operations.

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A. INTRODUCTION

RECENT CHANGES

This Comprehensive Guide to the Registry of Toxic Effects of Chemical Substances (RTECS®) describes the types of data, and their format, contained in the 1993 Edition of RTECS®. Since the last printed edition (1985-1986), there have been several additions and alterations to RTECS®. Listed below are the most notable of those changes and additions.

(1) All references cited in the file before the Toxic Effects Codes (TEC) system was introduced have now been reviewed to extract any descriptive data.

(2) A new toxicity indicator has been developed and is labeled "OTHER MULTIPLE DOSE TOXICITY DATA AND REFERENCES." Citations include the results of multiple dose toxicity studies which relate to other than mutagenic, reproductive, or tumorigenic effects. New codes have been added to the TECs to denote effects of multiple dose studies.

(3) RTECS® now includes data with the notation "LD50>__ mg/m^3" or "LC50>__ ppm" when the substance has been tested up to the noted dose or concentration without reaching the LD50 or LC50.

(4) Three new units of dose have been added: milliliters per kilogram (mL/kg); international units (iu); and kilounits (ku).

(5) The International Agency for Research on Cancer (IARC) entries have been expanded to include the risk groups which first appeared in Supplement VII to the IARC Monographs, and each new IARC monograph is added when it becomes available.

(6) The Department of Transportation (DOT) Hazardous Materials List regulations have been updated to reflect the current issue of the Code of Federal Regulations, Title 49.

(7) The Mine Safety and Health Administration (MSHA) air standards have been added, and updated to reflect the Code of Federal Regulations, Title 30.

(8) The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) have been updated to reflect the Code of Federal Regulations, Title 29.

(9) The NIOSH Recommended Exposure Levels (RELs) have been updated in accordance with DHHS (NIOSH) Publication No. 92-100, NIOSH Recommendations for Occupational Safety and Health-Compendium of Policy Documents and Statements. Current Intelligence Bulletins and Criteria Documents issued by NIOSH are listed as they are published.

(10) Data from the two NIOSH nationwide surveys of industry, the National Occupational Hazard Survey (NOHS) completed in 1974 and the National Occupational Exposure Survey (NOES) completed in 1983, have been entered into the Registry. Numerical data listed include: the total number of industries (NIS); the estimated number of individual facilities (TNF); the number of occupations (NOS); the estimated number of employees exposed (TNE); and for NOES data only, the estimated number of female employees exposed (TFE).

(11) The Environmental Protection Agency (EPA) Toxic Substances Control Act (TSCA) Chemical Inventory status lines have been updated to reflect the most recent version of the EPA TSCA Inventory; the EPA TSCA Test Submission (TSCATS) status lines are updated quarterly; and citations to the EPA Genetic-Toxicity (GENE-TOX) program and the IRIS database have been added.

(12) Data from the National Toxicology Program (NTP) Annual Report on Carcinogens have been updated to reflect the substances reported in the most recent edition. The data from NTP Technical Reports and Toxicity Studies are added as they become available. The NTP Chemtrack data are updated quarterly.

(13) Toxicological Profiles from the Agency for Toxic Substances and Disease Registry (ATSDR) are listed with their NTIS publication numbers.

(14) Analytical methods from NIOSH and OSHA are included in the appropriate substance records.

(15) Beginning in the January 1993 update, the RTECS® file includes Occupational Exposure Limits (OELs) from several nations. They appear under the heading "International OELs." These will be updated and data from other countries will be added as they are received.

RTECS® DATA SELECTION, EVALUATION, AND USE

The toxicity information appearing in the Registry is derived from reports of the toxic effects of chemical substances. The absence of a substance from the Registry does not imply that the substance is non-toxic. A substance may not appear for a variety of reasons. Four reasons include: (1) the test results could not be cited because the protocol of the study did not meet the RTECS® selection criteria, (2) the substance has not yet been tested, (3) the substance has been tested but the RTECS® literature search has not yet uncovered the data, or (4) the data are not publicly available.

RTECS® consists of tabulations of the lowest dose reported to have caused the listed toxic effect in the designated species by the designated route of administration. The Registry includes substances which have been selected primarily for the toxic effect produced by single doses. However, when the toxic effect has been described by the author as mutagenic, tumorigenic, or as a reproductive toxicant, the toxic dose data are reported for both single and multiple dose studies. A newly established toxicity field, "Other Multiple Dose Toxicity Data and References", includes any other effects from multiple dose studies and in time will become a significant part of the Registry.

For human data, any reported adverse effect is included.

The report of the lowest total dose administered to produce the toxic effect is given preference, although some editorial license is taken so that additional references might be cited. No restrictions are placed on the amount of a substance producing death in an experimental animal nor on the time period over which the dose was given. The inclusion of data with the notation "LD50>__ mg/kg" or "LC50>__ ppm" is intended to indicate that the substance cited has been tested up to the indicated level without reaching that level of toxicity.

The Detailed File Description of RTECS® provides details of the format and content of the various toxicity data lines. Studies reporting primary irritation to the skin and eyes are described in paragraph 10; paragraph 11 describes the mutagenic test systems and the organisms and cell types used in mutagenic testing; elements of the reproductive effects toxicity lines are described in paragraph 12; reports of positive or equivocal tumorigenic effects included in the Registry are described in paragraph 13. (Other tumorigenic data may be found on the International Agency for Research on Cancer [IARC] review lines [described in paragraph 17b] and the NTP carcinogenesis bioassay status lines [paragraph 20c].) Paragraph 14 describes acute toxicity data, including the system of Toxic Effects Codes (TEC). The most recently developed toxicity field, other multiple dose data, is described in paragraph 15.

Toxicity data reported in the literature are transformed into Registry format using the criteria presented in the Detailed File Description. The quality of the data on which the report is based have not been evaluated. In most cases no attempt is made to resolve any questions about the data. One of the responsibilities of the RTECS® Editorial Review Board is to review a limited number of citations to resolve any ambiguities. Citations may be suggested for Board consideration by the data abstractors, the editor, or the Registry readership. The Board will

review citations for resolution of ambiguities, but will not judge the relative merits of several publications which present contradictory data on the same substance. The Registry strives to represent accurately the literature as it exists, leaving to others the problem of resolving contradictory data.

It is not the purpose of the Registry to quantitate a hazard through the use of the toxic concentration or dose data that are presented with each substance. UNDER NO CIRCUMSTANCES CAN THE TOXIC DOSE VALUES PRESENTED WITH THESE CHEMICAL SUBSTANCES BE CONSIDERED DEFINITIVE VALUES FOR DESCRIBING SAFE VERSUS TOXIC DOSES FOR HUMAN EXPOSURE.

GENERAL COMMENTS

The Editor requests and will appreciate assistance from representatives of the industrial, academic, and governmental communities in supplying data for this Registry. Such assistance may be offered in the form of reprints of scientific publications, technical data sheets, sales or promotional material, other publicly available reference material, and data presented on unpublished studies. All materials received will be considered to be in the public domain and as such may be made available to any person or organization. Data cited and published in the Registry will be selected according to the criteria presented herein. Information on errors in the file is also solicited, as are general comments or recommendations. All correspondence should be addressed to:

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B. DETAILED FILE DESCRIPTION

SELECTION

Substances Included--For the purpose of this publication, the phrase "all known toxic substances" is interpreted by the Editor to mean all mined, manufactured, processed, synthesized, and naturally occurring inorganic and organic compounds. The list of substances includes drugs, food additives, preservatives, ores, pesticides, dyes, detergents, lubricants, soaps, plastics, extracts from plant and animal sources, plants and animals which are toxic by contact or consumption, and industrial intermediates and waste products from production processes. Some of the information in the file thus refers to materials whose composition is not perfectly known. The chemical substances included in this list are assumed to exhibit the reported toxic effect in their pure state unless otherwise noted. However, even in the case of a supposedly "pure" substance, there is usually some degree of uncertainty as to its exact composition and the impurities which may be present. This possibility must be considered in attempting to interpret the data presented since the toxic effects observed could in some cases be caused by a contaminant.

Substances Excluded--Excluded from the Registry are trade name products representing compounded or formulated proprietary mixtures available as commercial products. These exclusions are necessary because of difficulties in assessing the contribution of each component of a mixture to that substance's toxicity and because a product's formulation is often changed by varying the components, their concentration, or the purity of the ingredients. Commercial product trade names are included, however, when they represent a single active chemical entity or a well-defined mixture of relatively constant composition. Radioactive substances are included but the effect reported is the chemically produced effect rather than the radiation effect.

FORMAT

All substance prime names and synonyms in the file are listed in alphabetical order, ignoring special characters such as numerals, Greek letters, and prefixes indicating substituent locations, and stereochemical or other structural features. These components are taken into account for secondary ordering in ascending alphabetical and numerical order.

In the computer tape, each substance prime name is identified by a nine-position sequence number (two letters and seven numerals) which varies directly with the alphabetic sequence of the name, so that toluene, for example, has a higher number than benzene. Each synonym is cross-referenced to its appropriate prime name sequence number. The sequence number is simply an identifier assigned alphabetically and numerically to each substance in the Registry. It is not intentionally related to the compound's toxicity or structure, although compounds with alphabetically similar names and, in some cases therefore, similar structures are grouped together.

For each prime name sequence number the following data are provided when available: the substance prime name and synonyms; a description of the substance (where necessary); date when the RTECS® data record was last updated; CAS number; RTECS® number; molecular formula; molecular weight; Wiswesser Line Notation (WLN); compound descriptor code; primary irritation; mutagenic, reproductive, and tumorigenic effects data; acute toxicity data; other multiple dose toxicity data; ACGIH Threshold Limit Values, IARC monograph reviews, and toxicological reviews; existing Federal standards; NIOSH Criteria Documents, Current Intelligence Bulletins, recommended exposure levels, surveillance data, and analytical methods; the NTP Carcinogenesis Testing Program; and the EPA TSCA Inventory, GENETOX, TSCATS Database, Section 8(a) preliminary assessment, and Section 8(e) status programs. Each data line and citation is referenced by CODEN to the source from which the information was extracted. A list of CODEN abbreviations and their respective titles is provided in the CODEN Master File and on the microfiche found in the pocket inside the back cover of this volume. Each field in the RTECS® data record is discussed in detail below and tabulated in Section C.

1. Substance Prime Name (Data Type A). The prime name of each substance in the Registry is derived from the nomenclature used by the American Chemical Society's Chemical Abstracts Service (CAS) in the Collective Index of Chemical Abstracts. The names are given in the inverted form. The complete RTECS® data record for each substance follows that substance's prime name.

Some entries, however, appear under the chemical or descriptive names used in the reference from which the toxic data were obtained. This is particularly true for those substances of questionable composition, such as plant or animal extracts. These prime names are accompanied by a brief description or definition ("DEF") (Data Type C) listing the source of the substance, a general statement of constituents, or other pertinent information, and the CODEN citation of the reference that contained the definition.

2. Update (Data Type E). This field specifies when the data record of a substance was last changed. The format is YYMM, e.g., 8105 = May 1981. All 33,929 substances in the file as of January 1979 were initialized with a date of 7901. When data on a new substance are first input to the file, the update field is assigned the month of entry. When the data record is subsequently revised, the date is changed to reflect the month the change was made. Any revision, for example, deletion of an invalid synonym, addition of new toxicity data, change in the NTP status, or correction of a molecular formula, will cause the substance's update field to change.

3. Chemical Abstracts Service (CAS) Registry Number (Data Type D). The CAS Number is a numeric designation assigned by the American Chemical Society's Chemical Abstracts Service that uniquely identifies a specific chemical compound, regardless of the name or naming system used.

Because CAS, on occasion, assigns new numbers to selected chemicals without withdrawing the previously assigned numbers, confusion sometimes arises. This situation occurs when a substance is better described or more accurately identified. The RTECS® policy of listing only the current CAS number for a substance and dropping the earlier number when it updates the file may result in the loss of previously accepted CAS numbers by users of the database. Therefore, RTECS® will henceforth list the most recent CAS number available for a chemical

and, to preserve continuity and prevent confusion, will include a second CAS number line which will list "OTHER" previous CAS numbers. Up to ten (10) such previous CAS numbers will be listed for a substance.

4. RTECS® Number (Data Type G). The RTECS® Number is a unique 9-position alphanumeric designation assigned to each prime chemical name. This is the same number by which substances listed in the Registry have long been identified, although the file is no longer sorted by these numbers. A special data type, the "G" line, has been created for this identifier. New RTECS® numbers will be assigned to each prime chemical substance as it is entered into the file. They are not to be confused with the sequence numbers by which the file is sorted.

5. Molecular Weight (MW) (Data Type H). The molecular weight is calculated from the molecular formula using standard elemental molecular weights (carbon = 12.01).

6. Molecular Formula (MF) (Data Type F). The molecular formula designating the elemental composition of the substance is structured according to the Hill System (see Journal of the American Chemical Society, 22(8):478-494, 1900) in which carbon and hydrogen (if present) are listed first, followed by the other elemental symbols in alphabetical order. The formulas for compounds that do not contain carbon are ordered strictly alphabetically by element symbol. Compounds such as salts or those containing waters of hydration have molecular formulas incorporating the CAS dot-disconnect convention, in which the components are listed individually and separated by a period. The individual components of the formula are generally given in order of decreasing carbon atom count and component ratios. A lower case "x" indicates that the ratio is unknown. A lower case "n" indicates a repeating, polymer-like structure. The formula is obtained from one of the cited references or a chemical reference text, or derived from the name of the substance.

7. Wiswesser Line Notation (WLN) (Data Type J). The Wiswesser Line Notation is a line-formula chemical notation that precisely and concisely describes the structural formula of a chemical compound. This linear representation for a three-dimensional structure facilitates substructure searching for special functional groups and constituents that are part of the molecule. The WLNs allow machine retrieval by chemical characteristics.

8. Synonyms (Data Type L). Synonyms for the substance prime name are listed alphabetically according to the rule described under "FORMAT." Synonyms include other chemical names, trade names, common or generic names, foreign language names (with the language in parentheses), or codes. Some synonyms consist wholly or in part of registered trademarks. These trademarks are not identified as such in the RTECS® file because of limitations in the computer and photocomposition character sets used to produce the Registry. The Editor is aware of the problem of trademarks becoming generic trade names through common usage. While the Registry does not presently have a mechanism for noting trademarks, the lack of the appropriate registered trademark symbol does not imply that the trademarks contained herein are considered generic synonyms by NIOSH. Those trade names that are known to be obsolete, either because production and marketing of the substance has ceased or because the compound is currently manufactured under another name, are indicated with the abbreviation "(OBS)."

The reader is cautioned that some synonyms, particularly common names, may be ambiguous and refer to more than one substance. The substances may or may not be chemically similar. For example, some common names are applied in the literature to both a particular compound and various metallic salts of that compound. In addition, the Registry's list of synonyms is not exhaustive, and the file may not include an entry for every existing use of a particular common name. Therefore, when using a synonym to look up data in the Registry, care must be taken to ensure that the substance record retrieved is for the particular substance in question and not for one with an identical common name.

9. Compound Descriptor Codes (Data Type N). For each data type "N" code found in position 10, a one-letter code appears in column 14. These codes are listed below and can be used as selection keys to extract defined subfiles of the master file. A substance entry may contain multiple "N" records.

CODE	COMPOUND DESCRIPTOR
A	Agricultural Chemical
C	Tumorigen
D	Drug
H	Hormone
M	Mutagen
N	Natural Product
O	Organometallic
S	Primary Irritant
T	Reproductive Effector

This compound descriptor field was developed primarily as a search tool, and therefore was never included in the printed edition of RTECS® or the microfiche edition.

The RTECS® compound descriptor codes do not represent an evaluation of the toxicity of a substance, nor are the codes all-inclusive with respect to use (that is, there may be some substances in the RTECS® file that should be, but are not, coded as belonging to certain application classes). The codes must be interpreted only in conjunction with the other information found in each substance data record.

The RTECS® descriptor codes fall into two categories: (1) those based on the types of toxicity data found in the substance data records and (2) those based on related information found in the references from which the data were extracted. In the first category are the following descriptor codes: tumorigen, mutagen, reproductive effector, and primary irritant. As mentioned, these four classifications do not represent an evaluation of the overall toxicity of a substance by NIOSH. Rather, they indicate the type(s) of toxicity data line(s) found in the substance data record.

The descriptor code "tumorigen" is something of a misnomer. More specifically, it denotes a "substance with positive or negative tumorigen citation(s)." That is, any substance with the descriptor "tumorigen" will have one or more of the following in its RTECS® data records:

(1) One or more tumorigenic data lines (Data Type S, see Section 2, paragraph 13).

(2) One or more U.N. International Agency for Research on Cancer (IARC) review lines (Data Type V), regardless of whether the IARC review concluded that the carcinogenicity of the substance was noted as Sufficient Evidence, Limited Evidence, Inadequate Evidence, or No Evidence.

(3) One or more National Toxicology Program (NTP) carcinogenesis bioassey studies status lines (Data Type Y), regardless of whether the substance had only been selected for test or whether the NTP study showed Clear Evidence, Some Evidence, Equivocal Evidence, or No Evidence of Carcinogenicity, or that the test is still in progress.

Based on the above criteria, therefore, there may be some substances in RTECS® that have only negative IARC review or NTP status lines, but that still appear with the descriptor code "tumorigen." This is done to bring the significance of the results of the IARC reviews and the NTP studies to the user's attention. Again, this points out the need to review the complete data record before drawing any conclusion about the total toxic potential of a substance. The user must not rely simply on the descriptor code.

Any substance with the descriptor code "reproductive effector" will contain:

(1) One or more reproductive effects data lines (Data Type R) or

(2) One or more tumorigenic data lines (Data Type S) that cite either transplacental carcinogenesis (Toxic Effects Code [TEC] T65) or tumors to the reproductive system (TEC T61, T62, T63, T64, or T69). Thus, a substance reported to cause these latter two types of effects will contain both tumorigen and reproductive effector compound descriptor codes.

Finally, any substance described as a "primary irritant" will contain one or more skin or eye irritation data lines (Data Type P) in its RTECS® data record.

The remaining five descriptor codes (agricultural chemical and pesticide, drug, organometallic, hormone, and natural product) are use or application codes and are included in the file based only on information found in the references cited in RTECS®. For example, if an article that reports an oral-rat LD50 value for a substance indicates the substance is used as a drug or a pesticide, then it will be so coded in the file. However, if the article makes no such indication, descriptor codes will not be added to the data record. Therefore, the user should recognize that these use classifications are not all-inclusive; they are based solely on information in the references from which the RTECS® is compiled.

Agricultural chemicals include those used to improve crop yields, such as fertilizers and pesticides of all kinds. Drugs include both commercially available (approved) compounds as well as those that have been identified as experimental. Hormones include both those naturally found in the body and synthetic substances that act like hormones. Natural products include organic compounds that are produced by plants, animals, and microorganisms and that are not commercially synthesized.

10. Skin and Eye Irritation Data (Data Type P). Each irritation data line includes, in sequence, the tissue tested (skin or eye); the species of animal tested; the total dose and where applicable, the duration of exposure; for skin tests only, whether open or occlusive; an interpretation of the irritation response severity when noted by the author; and the reference from which the information was extracted. Only positive irritation test results are included in the Registry.

Substances that are applied topically to the skin or to the mucous membranes can elicit either (a) systemic effects of an acute or chronic nature or (b) local effects, more properly termed "primary irritation". A primary irritant is a substance that, if present in sufficient quantity for a sufficient period of time, will produce a non-allergic, inflammatory reaction of the skin or of the mucous membrane at the site of contact. Primary irritants are further limited by the editor to those substances that are not corrosive. Hence, concentrated sulfuric acid is not classified as a primary irritant.

a. Primary Skin Irritation. In experimental animals, a primary skin irritant is defined as a chemical substance that produces an irritant response on first exposure in a majority of the test subjects. However, in some instances compounds act more subtly and require either repeated contact or special environmental conditions (humidity, temperature, occlusion, etc.) to produce a response.

The most standard animal irritation test is the Draize procedure (Journal of Pharmacology and Experimental Therapeutics, 82: 377-390, 1944). This procedure has been modified and adopted as a regulatory test by the Consumer Product Safety Commission (CPSC) in 16 CFR 1500.41 (formerly 21 CFR 191.11). In this test a known amount (0.5 ml of a liquid or 0.5 gm of a solid or semisolid) of the test substance is introduced under a one square inch gauze patch. The patch is applied to the skin (clipped free of hair) of twelve albino rabbits. Six rabbits are tested with intact skin and six with abraded skin. The abrasions are minor incisions made through the stratum corneum, but are not sufficiently deep to disturb the dermis or to produce bleeding. The patch is secured in place with adhesive tape, and the entire trunk of the animal is wrapped with an impervious material, such as rubberized cloth, for a 24-hour period. The animal is immobilized during exposure. After 24 hours the patches are removed and the resulting reaction evaluated for erythema, eschar, and edema formation. The reaction is again scored at the end of 72 hours (48 hours after the initial reading), and the two readings are averaged. A substance producing any degree of positive reaction is cited in the Registry as an irritant.

As the modified Draize procedure described above has become the standard test specified by the U.S. Government, nearly all of the primary skin irritation data either strictly adhere to the test protocol or involve only simple modifications to it. When test procedures other than those described above are reported in the literature, appropriate codes are included in the irritation data line to indicate those deviations.

The most common modification is the lack of occlusion of the test patch, so that the treated area is left open to the atmosphere. In such cases the notation "open" appears in the irritation data line. Another frequent modification involves whole arm or whole body immersion in the test substance or, more commonly, in a dilute aqueous solution of the test substance. This type of test is often conducted on soap or detergent solutions. Immersion data are identified by the abbreviation "imm" in the data line.

The dose reported is based first on the lowest dose producing an irritant effect and second on the latest study published. The dose is expressed as follows:

(1) Single application by the modified Draize procedure is indicated by only a dose amount. If no exposure time is given, then the data are for the standard 72-hour test. For test times other than 72 hours, the dose data are given in mg (or in an appropriate unit)/duration of exposure, e.g., 10 mg/24H.

(2) Multiple applications involve administration of the dose in divided portions applied periodically. The total dose of test substance is expressed in mg (or appropriate unit)/duration of exposure, with the symbol "I" indicating intermittent exposure, e.g., 5 mg/6D-I.

The method of testing substances for primary skin irritation given in the Code of Federal Regulations does not include an interpretation of the response. However, some authors do include a subjective rating of the irritation observed. If such a severity rating is given, it is included in the data line as mild ("MLD"), moderate ("MOD"), or severe ("SEV"). The Draize procedure employs a rating scheme which is included here for informational purposes only. Since other researchers may not categorize irritation response in this manner.

Category (Draize)	Code	Skin Reaction
Mild	MLD	Well defined erythema and slight edema (edges of area well defined by definite raising)
Moderate	MOD	Moderate to severe erythema and moderate edema (area raised approximately 1 mm)
Severe	SEV	Severe erythema (beet redness) to slight eschar formation (injuries in depth) and severe edema (raised more than 1 mm and extending beyond area of exposure)

b. Primary Eye Irritation. In experimental animals, a primary eye irritant is defined as a chemical substance that produces an irritant response in the test subject on first exposure. Eye irritation study procedures developed by Draize have been modified and adopted as a regulatory test by CPSC in 16 CFR 1500.42. In this procedure, a known amount of the test material (0.1 ml of a liquid or 100 mg of a solid or paste) is placed in one eye of each of six albino rabbits; the other eye remains untreated, serving as a control. The eyes are not washed after instillation and are examined at 24, 48, and 72 hours for ocular reaction. After the recording of ocular reaction at 24 hours, any or all eyes may be further examined following the application of fluorescein. Any or all eyes may also be washed with a sodium chloride solution (U.S.P. or equivalent) after the 24 hour reaction has been recorded.

A test is scored positive if any of the following effects are observed: (1) ulceration (besides fine stippling); (2) opacity of the cornea (other than slight dulling of normal luster); (3) inflammation of the iris (other than a slight deepening of the rugae or circumcorneal injection of the blood vessel); (4) swelling of the conjunctiva (excluding the cornea and iris) with eversion of the eyelid; or (5) a diffuse crimson-red color with individual vessels not clearly identifiable. A substance is an eye irritant if four of six rabbits score positive. It is considered a nonirritant if none or only one of six animals exhibits irritation. If intermediate results are obtained, the test is performed again. For the purpose of RTECS®, substances producing any degree of irritation in the eye are identified in the Registry as irritants. When an author has designated a substance as either a mild, moderate, or severe eye irritant, this designation is also reported.

The dose reported is based first on the lowest dose producing an irritant effect and second on the latest study published. Single and multiple applications are indicated as described in paragraph 10a above. Test times other than 72 hours are noted in the dose. All eye irritant test exposures are assumed to be continuous, unless the reference states that the eyes were washed after instillation. In this case, the notation "rns" (rinsed) is included in the data line.

c. Species Exposed. Since Draize procedures for determining both skin and eye irritation specify rabbits as the test species, most of the animal irritation data in the Registry are for rabbits, although any of the species listed in Table II may be used. The editor endeavors to include as much human data as possible, since this information is directly applicable to occupational exposure. Much of this data comes from studies conducted on volunteers (such as the cosmetic or soap ingredients) or from persons accidentally exposed. When an accidental exposure, such as a spill, is cited, the data line includes the abbreviation "nse" (non-standard exposure). In these cases it is often very difficult to determine the precise amount of the substance to which the individual was exposed. Therefore, for accidental exposures an estimate of the concentration or strength of the substance, rather than a total dose amount is generally provided.

11. Mutation Data (Data Type Q). Mutation data include both whole animal and *in vitro* studies. Each mutation data line includes, in sequence, the mutation test system utilized, the species of the tested organism (and, where applicable, the route of administration or cell type), the exposure concentration or dose, and the reference from which the information was extracted. Only positive mutation test results are cited in the Registry.

A mutation is defined as any heritable change in genetic material. Unlike irritation, reproductive effects, tumorigenic, and acute and other multiple dose toxicity data (see paragraphs 10, 12, 13, 14, and 15 respectively), which report the results of whole animal studies, mutation data also include studies on lower organisms such as bacteria, yeasts, molds, and insects, as well as *in vitro* mammalian cell cultures. Studies of plant mutagenesis are not now included in the Registry. No attempt is made to evaluate the significance of the data or to rate the relative potency of the compound as a mutagenic risk to man.

Each element of the mutation data line is discussed below.

a. Mutation Test System. A number of test systems are used to detect genetic alterations caused by chemical substances. Those systems currently cited in the Registry are listed below. Others found in the literature have been grouped together under the general term other mutation test system (oms). Each test system is identified by the 3-letter code shown in parentheses. For additional information about mutation tests, the reader may wish to consult the Handbook of Mutagenicity Test Procedures, edited by B. J. Kilbey, M. Legator, W. Nichols, and C. Ramel (Amsterdam: Elsevier, Second Edition, 1984).

(1) Mutation in Microorganisms (mmo) - System is based on the detection of heritable genetic alterations in microorganisms exposed directly to the chemical substance.

(2) Microsomal Assay (mma) - System utilizes an *in vitro* technique which allows enzymatic activation of promutagens in the presence of an indicator organism in which induced mutation frequencies are determined.

(3) Micronucleus Test (mnt) - System utilizes the fact that chromosomes or chromosome fragments may not be incorporated into one or the other of the daughter nuclei during cell division.

(4) Specific Locus Test (slt) - System utilizes a method for detecting and measuring rates of mutation at any or all of several recessive loci.

(5) DNA Damage (dnd) - System detects the damage to DNA strands including strand breaks, crosslinks, and other abnormalities.

(6) DNA Repair (dnr) - System utilizes methods of monitoring DNA repair as a function of induced genetic damage.

(7) Unscheduled DNA Synthesis (dns) - System detects the synthesis of DNA during usually non-synthetic phases.

(8) DNA Inhibition (dni) - System detects inhibition of DNA synthesis.

(9) Gene Conversion and Mitotic Recombination (mrc) - System utilizes unequal recovery of genetic markers in the region of the exchange during genetic recombination.

(10) Cytogenetic Analysis (cyt) - System utilizes cultured cells or cell lines to assay for chromosomal aberrations following the administration of chemical substances.

(11) Sister Chromatid Exchange (sce) - System detects the interchange of DNA in cytological preparations of metaphase chromosomes between replication products at apparently homologous loci.

(12) Sex Chromosome Loss and Nondisjunction (sln) - System measures the nonseparation of homologous chromosomes at meiosis and mitosis.

(13) Dominant Lethal Test (dlt) - A dominant lethal is a genetic change in a gamete that kills the zygote produced by that gamete. In mammals, the dominant lethal test measures the reduction of litter size by examining the uterus and noting number of surviving and dead implants.

(14) Mutation in Mammalian Somatic Cells (msc) - System utilizes the induction and isolation of mutants in cultured mammalian cells by identification of the gene change.

(15) Host-Mediated Assay (hma) - System uses two separate species, generally mammalian and bacterial, to detect heritable genetic alteration caused by metabolic conversion of chemical substances administered to host mammalian species in the bacterial indicator species.

(16) Sperm Morphology (spm) - System measures the departure from normal in the appearance of sperm.

(17) Heritable Translocation Test (trn) - Test measures the transmissibility of induced translocations to subsequent generations. In mammals, the test uses sterility and reduced fertility in the progeny of the treated parent. In addition, cytological analysis of the F1 progeny or subsequent progeny of the treated parent is carried out to prove the existence of the induced translocation. In Drosophila, heritable translocations are detected genetically using easily distinguishable phenotypic markers, and these translocations can be verified with cytogenetic techniques.

(18) Oncogenic Transformation (otr) - System utilizes morphological criteria to detect cytological differences between normal and transformed tumorigenic cells.

(19) Phage Inhibition Capacity (pic) - System utilizes a lysogenic virus to detect a change in the genetic characteristics by the transformation of the virus from noninfectious to infectious.

(20) Body Fluid Assay (bfa) - System uses two separate species, usually mammalian and bacterial. Test substance is first administered to host, from whom body fluid (e.g., blood or urine) is subsequently taken. This body fluid is then tested *in vitro*, and mutations are measured in the bacterial species.

b. Those test species that are peculiar to mutation data cited in the Registry are designated by the 3-letter codes shown on the following page. Other species are listed in Table V.

CODE		SPECIES
Bacteria:	bcs	Bacillus subtilis
	esc	Escherichia coli
	hmi	Haemophilus influenzae
	klp	Klebsiella pneumoniae
	sat	Salmonella typhimurium
	srm	Serratia marcescens
Molds:	asn	Aspergillus nidulans
	nsc	Neurospora crassa
Yeasts:	smc	Saccharomyces cerevisiae
	ssp	Schizosaccharomyces pombe
Protozoa:	clr	Chylamydomonas reinhardi
	eug	Euglena gracilis
	omi	Other microorganisms
Insects:	dmg	Drosophila melanogaster
	dpo	Drosophila pseudo-obscura
	grh	Grasshopper
	slw	Silkworm
	oin	Other insect
Fish:	sal	Salmon
	ofs	Other fish

If the test organism is a cell type from a particular species (generally mammalian), the parent species is reported, followed by a colon and the cell type designation. For example, human leukocytes are coded "hmn:leu." The various cell types currently cited in the Registry are listed below.

Designation	Cell Type
ast	Ascites tumor
bmr	Bone marrow
emb	Embryo
fbr	Fibroblast
hla	HeLa cell
kdy	Kidney
leu	Leukocyte
lng	Lung
lvr	Liver
lym	Lymphocyte
mmr	Mammary gland
ovr	Ovary
spr	Sperm
tes	Testis
oth	Other cell types not listed above

In the case of host-mediated and body fluid assays, the host and indicator organisms are given as follows: host organism/indicator organism, e.g., "ham/sat" for a test in which hamsters were exposed to the test chemical and S. typhimurium was used as the indicator organism.

For *in vivo* mutagenic studies, the route of administration is specified following the species designation, e.g., "mus-orl" for oral administration to mice. See Table I for a complete list of routes cited in the Registry. The route of administration is not specified for *in vitro* data.

c. Units of Exposure. The lowest dose producing a positive effect is cited. The author's calculations are used to determine the lowest dose at which a positive effect was observed. If the author fails to state the lowest effective dose, two times the control dose will be used. Ideally, the dose should be reported in universally accepted toxicological units such as milligrams of test chemical per kilogram of test animal body weight. While this is possible when the actual intake of the chemical by an organism of known weight is reported, it is not possible in many systems using insect and bacterial species. When a dose is reported or where the amount can be converted to a dose unit, it is normally listed as milligrams per kilogram (mg/kg). However, micrograms (μg), nanograms (ng), or picograms (pg) per kilogram may also be used for convenience of presentation. Concentrations of gaseous substances in air are listed as parts per hundred (pph), million (ppm), billion (ppb), or trillion (ppt).

Test systems using microbial organisms usually report exposure data as an amount of chemical per liter (L) or amount per plate, well, or disc. The amount may be on a weight (gm, mg, μg, ng, or pg) or molar (millimole [mmol], micromole [μmol], nanomole [nmol], or picomole [pmol]) basis. These units describe the exposure concentration rather than the dose actually taken up by the test species. Insufficient data currently exist to permit the development of dose amounts from this information. In such cases, therefore, the substance concentration units used by the author are reported.

Since the exposure values reported in host-mediated assays are the doses delivered to the host organism, no attempt is made to estimate the exposure concentration to the indicator organism. The exposure values cited for host-mediated assay data are in units of milligrams (or other appropriate unit of weight) of substance administered per kilogram of host body weight or in parts of vapor or gas per million (ppm) parts of air (or other appropriate concentrations) by volume.

12. Reproductive Effects Data (Data Type R). Each reproductive effects data line includes, in sequence, the reproductive effects code, the route of exposure, the species of animal tested, the type of dose, the total dose amount administered, the time and duration of administration, and the reference from which the information was extracted. Only positive reproductive effects data for mammalian species are cited in the Registry. Because of differences in the reproductive systems among species and the systems' varying responses to chemical exposures, no attempt is made to extrapolate animal data or to evaluate the significance of a substance as a reproductive risk to humans. Each element of the reproductive effects data line is discussed below.

a. Reproductive Effects Code. For purposes of the Registry, the reproductive effects for which dose data are cited have been grouped into seven categories: paternal effects, maternal effects, effects on fertility, effects on the embryo or fetus, specific developmental abnormalities, tumorigenic effects, and effects on the newborn. Within these seven categories, 65 specific effects have been defined. The effects cited on a given data line were reported to occur in the species and at the dose level given on that line. Up to three reproductive effects are cited on a single data line. If more then three reproductive effects are reported for the same route-species-dose level-duration combination, duplicate lines will appear in this section of the file to allow complete coding of the reproductive effects.

b. Route of Exposure or Administration. See Table IV for a complete list of abbreviations and definitions of the various routes of exposure reported in the Registry. For reproductive effects data, the specific route is listed in RTECS® either when the substance was administered to only one of the parents or when the substance was administered to both parents by the same route. However, if the substance was administered to each parent by a different route, the route is indicated as "mul" (multiple).

c. Species Exposed. Reproductive effects data are cited in the Registry for mammalian species only. Species abbreviations are the same as those used for acute toxicity data and are shown in Table V. Also shown in Table V are approximate gestation periods.

d. Type of Exposure. Only two types of exposure, TDLo and TCLo, are used to describe the dose amounts reported for reproductive effects data. These two terms, which are also used to describe toxic dose data, are defined in Paragraph 14d.

e. Dose Amounts and Units. The total dose amount that was administered to the exposed parent is given. If the substance was administered to both parents, the individual amounts to each parent are added together and the total amount shown. Where necessary, appropriate conversion of dose units is made. The dose amounts listed are those for which the reported effects are statistically significant. The statistical test is that used by the author. If no statistic is reported, a Fisher's Exact Test is applied with significance at the 0.05 level, unless the author makes a strong case for significance at some other level.

Dose units are usually given as an amount administered per unit body weight or as parts of vapor or gas per million parts of air by volume. A complete description of dose units is given in paragraph 14e. There is no limitation on either the quantity or concentration of the dose or the duration of exposure reported to have caused the reproductive effect(s).

f. Time and Duration of Treatment. The time when a substance is administered to either or both parents may significantly affect the results of a reproductive study, because there are differing critical periods during the reproductive cycles of each species. Therefore, to provide some indication of when the substance was administered, which should facilitate selection of specific data for analysis by the reader, a series of up to four terms follows the dose amount. These terms indicate to which parent(s) and at what time the substance was administered. The terms take the general form:

(uD male/VD pre/w-xD preg/YD post)

where u = total number of days of administration to male prior to mating

v = total number of days of administration to female prior to mating

w = first day of administration to pregnant female during gestation

x = last day of administration to pregnant female during gestation

y = total number of days of administration to lactating mother after birth of offspring

If administration is to the male only, then only the first of the above four terms is shown following the total dose to the male, e.g., 10 mg/kg (5D male). If administration is to the female only, then only the second, third, or fourth term, or any combination thereof, is shown following the total dose to the female. For example.

10 mg/kg (3D pre)
10 mg/kg (3D pre/4-7D preg)
10 mg/kg (3D pre/4-7D preg/5D post)
10 mg/kg (3D pre/5D post)
10 mg/kg (4-7D preg)
10 mg/kg (4-7D preg/5D post)
10 mg/kg (5D post) (NOTE: This example indicates administration to the lactating mother only after birth of the offspring.)

If the administration is to both parents, then the first term and any combination of the last three terms are listed, e.g., 10 mg/kg (5D male/3D pre/4-7D preg). If administration is continuous through two or more of the above periods, the above format is abbreviated by replacing the slash (/) with a dash (-). For example, 10 mg/kg (3D pre-5D post) means a total of 10 mg/kg administered to the female for three days prior to mating, on each day during gestation, and for five days following birth. Approximate gestation period for various species are shown in Table V.

g. Multigeneration Studies. Some reproductive studies entail administration of a substance to several consecutive generations, with the reproductive effects measured in the final generation. The protocols for such studies vary widely. Therefore, because of the inherent complexity and variability of these studies, they are cited in RTECS® in a simplified format as follows. The specific route of administration is reported if it was the same for all parents of all generations; otherwise the abbreviation "mul" is used. The total dose amount shown is that administered to the F0 generation only (as described in paragraph 11e above); doses to the Fn (where n = 1, 2, 3, etc.) generations are not reported. The time and duration of treatment for multigeneration studies are not included in the data line. Instead, the dose amount is followed by multigeneration, e.g., 10 mg/kg multigeneration. The reader must consult the cited reference for complete details of the study protocol.

13. Tumorigenic Data (Data Type S). Tumorigenic dose data also appear under data type R. The format of these data types are identical to that of the acute toxicity data line, which is described in detail in paragraph 14. Briefly, each tumorigenic data line sequentially includes toxic effects code, the route of exposure, the species of animal studied, the type of dose (either TDLo or TCLo), the total dose amount administered, the duration of exposure, and the reference from which the information was extracted. Only positive or equivocal tumorigenic reports are cited in this section. For other information about tumorigenicity, the reader should also see the IARC monograph review lines (paragraph 17b), the ACGIH review lines (paragraph 17a), and the NTP status lines (paragraph 20d).

The importance attached to reports of the carcinogenic activity of substances necessitates a more detailed discussion of the criteria used to include this type of data in the Registry. Tumorigenic citations are classified according to the reported results of the study only to aid the reader in selecting appropriate references for in-depth review and evaluation. The two classifications used are V01, indicating a positive carcinogenic finding and V02, indicating a study producing benign tumors. A third classification, V03, was added to denote those studies reporting uncertain, but seemingly positive, results. The criteria for these three classifications are listed below. As explained in the Introduction, these criteria are used to abstract the data in individual reports on a consistent basis and do not represent a comprehensive evaluation of the tumorigenic potential of a substance to humans.

Because of the increasing concern with carcinogens in the occupational environment, the Registry cites multiple studies in which tumorigenic responses were reported. That is, for a given substance, a particular route-species combination may be cited more than once if the results of the multiple studies are coded V01, V02, or V03. These multiple tumorigen entries have been cited simply with a toxicity measure of TD (toxic dose) or TC (toxic concentration).

The following nine technical criteria are used by RTECS® to abstract the toxicological literature and classify studies that report positive tumorigenic responses. No attempts are made either to evaluate the various test procedures or correlate results from different experiments.

(1) A citation is coded with the TEC "V01" (carcinogenic) when review of an article reveals that all of the following criteria are satisfied:

(a) A statistically significant increase in the incidence of tumors in the test animals. The statistical test is that used by the author. If no statistic is reported, a Fisher's Exact Test is applied with significance at the 0.05 level, unless the author makes a strong case for significance at some other level.

(b) A control group of animals is used and the treated and control animals are maintained under identical conditions.

(c) The sole experimental variable between the groups is the administration or non-administration of the test substance (see 9 below).

(d) The tumors consist of autonomous populations of cells of abnormal cytology capable of invading and destroying normal tissues, or the tumors metastasize as confirmed by histopathology.

(2) A citation is coded with the TEC "V02" (neoplastic) when review of an article reveals that all of the following criteria are satisfied:

(a) A statistically significant increase in the incidence of tumors in the test animals. The statistical test is that used by the author. If no statistic is reported, a Fisher's Exact Test is applied with significance at the 0.05 level, unless the author makes a strong case for significance at some other level.

(b) A control group of animals is used, and the treated and control animals are maintained under identical conditions.

(c) The sole experimental variable between the groups is the administration or non-administration of the test substance (see 9 below).

(d) The tumors consist of cells that closely resemble the tissue of origin, that are not grossly abnormal cytologically, that may compress surrounding tissues, but that neither invade tissues nor metastasize; or

(e) The tumors produced cannot definitely be classified as either benign or malignant.

(3) A citation is coded with the TEC "V03" (equivocal tumorigenic agent) when some evidence of tumorigenic activity is presented, but one or more of the criteria listed in (1) or (2) above is lacking. Thus, a report with positive pathological findings, but with no mention of control animals, is coded V03. Reports in which the results are not interpretable are not cited in the Registry.

(4) Since an author may make statements or conclusions based on a larger context than that of the particular data reported, papers in which the author's conclusions differ substantially from the evidence presented in the paper are subject to review by the RTECS® Editorial Review Board.

(5) All doses except those for transplacental carcinogenesis are reported in RTECS® in one of the following formats.

(a) For all routes of administration other than inhalation:

Cumulative dose in mg (or other appropriate unit)/kg/duration of administration.

Whenever the dose reported in the reference is not in the above units, conversion to this format is made based on the information given in paragraph 14e. The total cumulative dose is derived from the lowest dose level that produces tumors in the test group.

(b) For inhalation experiments:

Concentrations in ppm (or mg/m^3)/total duration of exposure.

The concentration refers to the lowest concentration that produces tumors.

(6) Transplacental carcinogenic doses are reported in RTECS® in one of the following formats.

(a) For all routes of administration other than inhalation:

Cumulative dose in mg/kg/(time of administration during pregnancy).

The cumulative dose is derived from the lowest single dose that produces tumors in the offspring. The test chemical is administered to the mother.

(b) For inhalation experiments:

Concentration in ppm (or mg/m^3)/(time of exposure during pregnancy).

The concentration refers to the lowest concentration that produces tumors in the offspring. The mother is exposed to the test chemical either during pregnancy or lactation.

(7) For the purposes of RTECS®, all test chemicals are reported as pure, unless otherwise stated by the author. This does not rule out the possibility that unknown impurities may have been present.

(8) A mixture of compounds whose test results satisfy the criteria in (1), (2), or (3) above is included if the composition of the mixture can be clearly defined.

(9) For tests involving promoters or initiators, a study is included if the following conditions are satisfied (in addition to the criteria in (1), (2), or (3) above):

(a) The test chemical is applied first followed by an application of a standard promoter. A positive control group in which the test animals are subjected to the same standard promoter under identical conditions is maintained throughout the duration of the experiment. The data are not used if no mention of positive and negative control groups is made in the reference.

(b) A known carcinogen is first applied as an initiator, followed by application of the test chemical as a promoter. A positive control group in which the test animals are subjected to the same initiator under identical conditions is maintained throughout the duration of the experiment. The data are not used if no mention of positive and negative control groups is made in the reference.

14. Acute Toxicity Data (Data Type T). Each dose data line sequentially includes toxic effects; the route of exposure; the species of animal studied; the type of dose; the amount of substance per body weight or concentration per unit of air volume and, where applicable, the duration of exposure; and the reference from which the information was extracted. Each element of the acute toxicity line is discussed below.

a. Toxic effects. The effects listed in the Registry should not be viewed as an exhaustive representation of all the potential toxic effects of a compound. Beginning in October 1980, a coding system was developed to include over 400 different effects. These effects are noted in the Registry by means of an alphanumeric Toxic Effects Code (TEC). The TEC permits a detailed coding of the toxic effects reported in the literature and is included for both human and animal data.

In the computer tape, the TEC is the first entry on the toxicity data line; it appears to the left of the route of administration. Each TEC is made up of one or more code segments, each of which contains three characters. Each TEC, which may contain as many as three code segments, is preceded by a single digit (1, 2, or 3) that indicates the number of segments. For example, the entry "2J18K13" indicates 2 code segments: J18 and K13. An explanation of the individual code segments is given below.

The first position of each segment is alphabetic and describes an organ, tissue, or functional system, or other major physiological or behavioral grouping. Positions two and three are numeric damage codes that specify individual toxic effects within each system. A complete list of TECs, including all major system groupings and individual damage codes, appears in Table II. Using Table II to decode the preceding example (2J18K13), the reader finds that for the "J18" TEC segment, the "J" represents the lung as the affected organ and the "18" indicates pleural thickening. For "K13", "K" represents the gastrointestinal system and "13" means nausea or vomiting.

In selected CD-ROM and on-line versions, the codes have been expanded to their verbal equivalents as reported in Tables II and III.

In using the TEC, the reader should be aware of the following restrictions:

(1) Specific TECs included in Table II may change as more experience is gained in coding the literature. Some may be deleted, while others may be added. The TEC is not static and will be changed to reflect the information reported in the literature.

(2) TECs listed on each line describe effects reported only for the route and species specified on that line.

(3) The TECs listed in the Registry should not be viewed as an exhaustive representation of all the potential toxic effects of a compound. This caution results from two considerations. The first is that each RTECS® data line is limited to a maximum of three code segments. For studies in which more than three effects were reported, only those deemed most significant will be listed. Second, the effects are limited to those that meet the basic selection criteria for inclusion in the Registry, i.e., lowest dose for a given route-species combination. Unique effects reported in studies not cited in the Registry would therefore not be listed herein. This restriction is important because, for example, studies done to determine acute LD50 values often report little other information besides the LD50 itself.

b. Route of Exposure or Administration. Although many exposures to substances in the industrial community occur via the respiratory tract or skin, most studies in the published literature report exposures of experimental animals in which the test substances were introduced primarily through the mouth by pills, in food, in drinking water, or by intubation directly into the stomach. The abbreviations and definitions of the various routes of exposure reported in the Registry are found in Table IV.

c. Species Exposed. Since the effects of exposure of humans are of primary concern, we have indicated, when available, whether the results were observed in man, woman, child, or infant. If no such distinction was made in the reference, the abbreviation "hmn" (human) is used. However, the results of studies on rats or mice are the most frequently reported and hence provide the most useful data for comparative purposes. The species and abbreviations used in reporting toxic dose data are listed alphabetically in Table V.

d. Description of Exposure. Six abbreviations are used to describe the administered dose reported in the literature. These abbreviations indicate whether the dose caused death (LD) or other toxic non-lethal effect (TD), or whether it was administered as a lethal concentration (LC) or toxic concentration (TC) in the inhaled air. In general, the term "Lo" is used where the number of subjects studied was not a significant number from the population or the calculated percentage of subjects showing an effect was listed as 100. The doses and concentrations are defined as follows:

TDLo--Toxic Dose Low--The lowest dose of a substance introduced by any route, other than inhalation, over any given period of time and reported to produce any toxic effect in humans or to produce tumorigenic, reproductive, or multiple dose effects in animals.

TCLo--Toxic Concentration Low--the lowest concentration of a substance in air to which humans or animals have been exposed for any given period of time that has produced any toxic effect in humans or produced tumorigenic, reproductive, or multiple dose effects in animals.

LDLo--Lethal Dose Low--the lowest dose (other than LD50) of a substance introduced by any route, other than inhalation, over any given period of time in one or more divided portions and reported to have caused death in humans or animals.

LD50--Lethal Dose Fifty--a calculated dose of a substance which is expected to cause the death of 50% of an entire defined experimental animal population. It is determined from the exposure to the substance by any route other than inhalation of a significant number from that population. Other lethal dose percentages, such as LD1, LD10, LD30, and LD99, may be published in the scientific literature for the specific purposes of the author. Such data would be published in the Registry if these figures, in the absence of a calculated lethal dose (LD50), were the lowest found in the literature.

LCLo--Lethal Concentration Low--the lowest concentration of a substance in air, other than LC50, which has been reported to have caused death in humans or animals. The reported concentrations may be entered for periods of exposure which are less than 24 hours (acute) or greater than 24 hours (subacute and chronic).

LC50--Lethal Concentration Fifty--a calculated concentration of a substance in air, exposure to which for a specified length of time is expected to cause the death of 50% of an entire defined experimental animal population. It is determined from the exposure to the substance of a significant number from that population.

e. Units of Dose Measurement. As in almost all experimental toxicology, the doses given are expressed in terms of the quantity administered per unit body weight, or quantity per skin surface area, or quantity per unit volume of the respired air. In addition, the duration of time over which the dose was administered is also listed, as needed.

Dose amounts are generally expressed as milligrams (one thousandth of a gram) per kilogram (mg/kg). In some cases, because of dose size and its practical presentation in the file, grams per kilogram (gm/kg), micrograms (one millionth of a gram) per kilogram (μg/kg), or nanograms (one billionth of a gram) per kilogram (ng/kg) are used. Volume measurements of dose were converted to weight units by appropriate calculations. Densities were obtained from standard reference texts. Where densities were not readily available, doses were reported as milliliters/kilogram (ml/kg).

All body weights are converted to kilograms (kg) for uniformity. For those references in which the dose was reported to have been administered to an animal of unspecified weight or a given number of animals in a group (e.g., feeding studies) without weight data, the weights of the respective animal species are assumed to be those listed in Table V and the dose listed on a per kilogram body weight basis. Assumptions for daily food and water intake are found in Table V to allow approximating dosages for humans and experimental animals where the dose was originally reported as a concentration in food or water. The values presented are selections which are reasonable for the species and convenient for dose calculations.

Concentrations of a gaseous substance in air are generally listed as parts of vapor or gas per million parts of air by volume (ppm). However, parts per hundred (pph or per cent), parts per billion (ppb), or parts per trillion (ppt) may be used for convenience of presentation. If the substance is a solid or a liquid, the concentrations are listed preferably as milligrams per cubic meter (mg/m^3) but may, as applicable, be listed as micrograms per cubic meter ($\mu g/m^3$), nanograms per cubic meter (ng/m^3), or picograms per cubic meter (pg/m^3) of air. For those cases in which other measurements of contaminants are used, such as the number of fibers or particles, the measurement is spelled out.

f. Duration of exposure. The duration of exposure is included to give an indication of the testing period during which the animal was exposed to the total dose.

Where the duration of exposure is available, time is presented as minutes (M), hours (H), days (D), weeks (W), or years (Y). Additionally, continuous (C) indicates that the exposure was continuous over the time administered, such as ad libitum feeding studies or 24-hour, 7-day per week inhalation exposures. Intermittent (I) indicates that the dose was administered during discrete periods, such as daily, twice weekly, etc. In all cases, the total duration of exposure

appears first after the kilogram body weight and slash, followed by descriptive data; e.g., 10 mg/kg/3W-I means ten milligrams per kilogram body weight administered over a period of three weeks, intermittently in a number of separate, discrete doses. This description is intended to provide the reader with enough information for an approximation of the experimental conditions, which can be further clarified by studying the reference cited.

g. Frequency of Exposure. Frequency of exposure to the test substance varies depending on the nature of the experiment. For the purposes of the Registry, frequency of exposure is given for inhalation experiments, for human exposures (where applicable), or where reproductive, tumorigenic, or other multiple dose data are specified (see paragraphs 12, 13, and 15 respectively).

15. Other Multiple Dose Toxicity Data (Data Type U). Citations in this field include the results of multiple dose toxicity studies, of variable duration, which relate to other than mutagenic, reproductive, or tumorigenic effects. The format is similar to that found in the tumorigenic effects data field, with toxic rather than lethal doses indicated and including duration of exposure. The numerical dose data is a cumulative amount over the duration of the study. The most common study designs include thirteen week, twenty-six week, fifty-two week, and two year studies. Because the effects described in this field are nonlethal, the TECs assume an important descriptive role.

Shown below is a summary of the several categories of toxicity data entries (paragraphs 12-15), where they appear in the file, and how they are used.

			TOXIC DATA TYPE	
	EXPOSURE REGIME	ROUTE OF EXPOSURE	HUMAN	ANIMAL
LD50	Single Dose	All except inhalation	Not applicable	Acute Lethality (Data Type T) Statistically determined
LC50	Single Dose	Inhalation	Not applicable	Acute Lethality (Data Type T) Statistically determined
LDLo	Single Dose (except for Human data)	All except inhalation	Data Type T	Acute Lethality (Data Type T)
LCLo	Single Dose (except for Human data)	Inhalation	Data Type T	Acute Lethality (Data Type T)
LD	Single Dose	All except inhalation	Not applicable	Acute Lethality (Data Type T) Lethal Dose > Dose Reported
LC	Single Dose	Inhalation	Not applicable	Acute Lethality (Data Type T) Lethal Dose > Dose Reported
TDLo	Single or Multiple Dose	All except inhalation	All non-lethal (Data Types R, S, T, U)	Non-lethal (Data Types R, S, U)

TCLo	Single or Multiple Dose	Inhalation	All non-lethal (Data Types R, S, T, U)	Non-lethal (Data Types R, S, U)
TD	Single or Multiple Dose	All except inhalation	Not applicable	Tumorigenic (Data Type S)
TC	Single or Multiple Dose	Inhalation	Not applicable	Tumorigenic (Data Type S)

16. Cited References. The final entry on each irritation, mutation, reproductive effects, tumorigenic, acute toxicity, and multiple dose data line is the reference from which the information was extracted. All references cited are publicly available. No government classified documents have been used for source information. All references have been given a unique six-letter CODEN character code (derived from the American Society for Testing and Materials "CODEN for Periodical Titles", which identifies periodicals, serial publications, and individual published works). For example, "CNREA8" is the CODEN for Cancer Research, and "PCBPBS" for Pesticide Biochemistry and Physiology. For those references for which no CODEN was found, the corresponding six-letter code includes asterisks (*) in the last one or two positions following the first four or five letters of an acronym for the publication title. Following the CODEN designation (for most entries) is the number of the volume, followed by a comma; the page number of the first page of the article, followed by a comma; and a two-digit number, indicating the year of publication in this century. When the cited reference is a report, the report number is listed. Where contributors have provided information on their unpublished studies, the CODEN consists of the first three letters of the last name, the initials of the first and middle names, and a number sign (#). The date of the letter supplying the information is listed. All CODEN acronyms are listed in alphabetical order and defined in the CODEN Master File (see Section C.2.). The complete CODEN listing is also reproduced on the microfiche found in the pocket on the inside back cover of this volume.

17. Reviews (Data Type V). Three types of reviews are listed: (a) Threshold Limit Values (TLVs®), which recommend limits proposed by the American Conference of Governmental Industrial Hygienists (ACGIH); (b) International Agency for Research on Cancer (IARC) monograph reviews, which are published by the United Nations World Health Organization (WHO); and (c) general toxicology review articles.

a. Threshold Limit Value (TLV®). The TLV® is an ACGIH-recommended concentration of a substance to which most workers can be exposed without adverse effect. The TLV® may be expressed as a time-weighted average (TWA), as a short term exposure limit (STEL), or as a ceiling value (CL). The TWA is for a normal 8-hour workday or 40-hour work week. The STEL is the maximum concentration to which workers can be exposed for up to 15 minutes, provided no more than four excursions per day are permitted with at least 60 minutes between exposure periods and provided the daily TWA is not also exceeded. The CL is the concentration that should not be exceeded even instantaneously. The notation "(skin)" indicates that even though the air concentration may be below the limit value, significant additional exposure to the skin may be dangerous.

A separate TLV® review line is included for those substances that ACGIH has classified as human carcinogens (either with or without an assigned TLV®) or suspected carcinogens.

The TLVs® are taken from "Documentation of the Threshold Limit Values for Substances in Workroom Air" (sixth edition, 1990, and subsequent annual editions). Copies of the complete TLV® Documentation may be ordered from ACGIH, 6500 Glenway Avenue, Building D-5, Cincinnati, Ohio 45211, telephone (513) 661-7881.

The reader is cautioned that the TLVs® are revised periodically. A "Notice of Intended Changes" for substances for which either a TLV® is proposed for the first time or for which a change to an existing TLV® is proposed is published annually by ACGIH. Proposed changes are considered trial limits for two years, after which they are considered for inclusion as adopted TLVs®. Only substances for which TLVs® have been adopted and final documentation prepared are cited in the Registry.

In addition, some TLVs® are recommended for classes of substances rather than for individual compounds. These classes may be based on certain chemical or physical properties, such as solubility, that have not been determined for all potential members of the class. This makes it difficult to cite individual substances belonging to the class. Any questions about TLV® citations in the Registry should be directed to ACGIH. Any errors should be brought to the attention of the RTECS® Editor at the address given in the Introduction.

b. IARC Cancer Reviews. In the U.N. International Agency for Research on Cancer (IARC) monographs, information on suspected environmental carcinogens is examined, and summaries of available data with appropriate references are presented. Included in these reviews are synonyms, physical and chemical properties, uses and occurrence, and biological data relevant to the evaluation of carcinogenic risk to humans. The 52 monographs in the series contain an evaluation of approximately 1,000 substances. Single copies of the individual monographs (specify volume number) can be ordered from WHO Publications Centre USA, 49 Sheridan Avenue, Albany, New York 12210, telephone (518) 436-9686.

The entry "IARC CANCER REVIEW" indicates that some carcinogenicity data pertaining to a compound has been reviewed by the IARC committee. The Registry summarizes the committee's conclusion in three words. The first indicates whether the data pertains to humans or to animals. The next two words indicate the degree of carcinogenic risk as defined by IARC.

The evidence of carcinogenicity in experimental animals is assessed by IARC and judged to fall into one of four groups defined as follows:

(1) SUFFICIENT EVIDENCE of carcinogenicity is provided when there is an increased incidence of malignant tumors: (a) in multiple species or strains; or (b) in multiple experiments (preferably with different routes of administration or using different dose levels); or (c) to an unusual degree with regard to the incidence, site or type of tumor, or age at onset. Additional evidence may be provided by data on dose-response effects.

(2) LIMITED EVIDENCE of carcinogenicity is available when the data suggest a carcinogenic effect but are limited because: (a) the studies involve a single species, strain or experiment; (b) the experiments are restricted by inadequate dosage levels, inadequate duration of exposure to the agent, inadequate period of follow-up, poor survival, too few animals, or

inadequate reporting; or (c) the neoplasms produced often occur spontaneously and, in the past, have been difficult to classify as malignant by histological criteria alone (e.g., lung adenomas and adenocarcinomas, and liver tumors in certain strains of mice).

(3) INADEQUATE EVIDENCE is available when, because of major qualitative or quantitative limitations, the studies cannot be interpreted as showing either the presence or absence of a carcinogenic effect.

(4) NO EVIDENCE applies when several adequate studies are available which show that within the limitations of the tests used, the chemical is not carcinogenic.

It should be noted that the categories SUFFICIENT EVIDENCE and LIMITED EVIDENCE refer only to the strength of the experimental evidence that these chemicals are carcinogenic and not to the extent of their carcinogenic activity nor to the mechanism involved. The classification of any chemical may change as new information becomes available.

The evidence for carcinogenicity from studies in humans is assessed by the IARC committees and judged to fall into one of four groups defined as follows:

(1) SUFFICIENT EVIDENCE of carcinogenicity indicates that there is a causal relationship between the exposure and human cancer.

(2) LIMITED EVIDENCE of carcinogenicity indicates that a causal relationship is credible, but that alternative explanations, such as chance, bias, or confounding, could not adequately be excluded.

(3) INADEQUATE EVIDENCE, which applies to both positive and negative evidence, indicates that one of two conditions prevailed: (a) there are few pertinent data; or (b) the available studies, while showing evidence of association, do not exclude chance, bias, or confounding.

(4) NO EVIDENCE applies when several adequate studies are available which do not show evidence of carcinogenicity.

IARC has also published, as Supplement 7, a volume entitled "Overall Evaluation of Carcinogenicity: An Updating of IARC Monographs Volumes 1 to 42." In this Supplement, chemicals have been listed in the following groups:

Group 1.	The Working Group concluded that the listed agents are carcinogenic to humans.
Group 2A.	The Working Group concluded that the listed agents are probably carcinogenic to humans.
Group 2B.	The Working Group concluded that the listed agents are probably carcinogenic to humans.
Group 3.	The Working Group concluded that the listed agents are not classifiable as to their carcinogenicity to humans.
Group 4.	The Working Group concluded that the listed agent is probably not carcinogenic to humans.

For any chemical listed in RTECS® which appears in one of these groups, its group designation is noted in the Review field, immediately following the IARC monograph lines.

These cancer reviews reflect only the conclusions of the IARC committees based on the data available for the committee's evaluation. Hence, for some substances there may be disagreement between the IARC determination and the information on the tumorigenic data lines (see paragraph 13). Also, some substances previously reviewed by IARC may be reexamined as additional data become available. These substances will contain multiple IARC review lines, each of which is referenced to the applicable IARC volume.

c. Toxicology Reviews. The entry "TOXICOLOGY REVIEW" indicates that the cited review article has been located in the literature. Each review is identified by its CODEN citation. These articles discuss one or more facets of the toxicology of the substance or the general class to which the substance belongs. Most of these references do not contain specific dose values that can be cited in the Registry. However, the reviews do provide useful information about the toxicity of the substance or group of related substances. The reader is cautioned that the scope of discussion varies greatly among the reviews. Some articles may contain a complete, detailed description of the toxicity of a substance; others may address only a particular aspect of the toxicity (e.g., effect of a substance on fetal development, or body fluid and tissue levels of a substance found under conditions of poisoning); and others may only list the substance in a general discussion of the toxicity of a class of compounds.

18. Standards and Regulations (Data Type W). This section contains notations indicating the substance is regulated by an agency of the United States Government either by "DOT", "EPA", "MSHA", or "OEL." "DOT" refers to substances regulated for shipment by the Department of Transportation. "EPA" refers to substances regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). "MSHA" refers to standards promulgated under Subpart D, Section 56 of the Federal Mine Safety and Health Act of 1977. These have been codified in 30 CFR 56.0001. "OSHA" refers to standards promulgated under Section 6 of the Occupational Safety and Health Act of 1970. These have been codified in the Code of Federal Regulations, Part 29. "OEL" refers to the Occupational Exposure Limits published by several nations around the world.

All United States standards and regulations are listed in the appropriate Federal Register (FR) or Code of Federal Regulations (CFR) reference. Because of frequent changes to and litigation of Federal regulations, it is recommended that the reader contact the applicable agency for information about the current standards for a particular substance. Omission of a substance or regulatory notation from the Registry does not imply any relief from regulatory responsibility.

a. DOT (or occasionally International Maritime Organization [IMO]) regulations are noted with the entry "DOT" or "IMO" followed by (a) the hazard class and (b) the label(s) required. Except for certain export and import shipments, no person may offer or accept a hazardous material, as defined by the Code of Federal Regulations, Title 49, for transportation in commerce within the United States unless that material is properly classed, described, packaged, marked, labeled, and in the condition for shipment as specified by 49 CFR, Parts 100 to 189.

For transportation purposes, a hazardous material means a substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce and which has been so designated.

Specific definitions are given for each hazard class addressed in 49 CFR; however, DOT reserves the right to regulate materials whether or not they meet these definitions. The basic hazard classes include compressed gases, flammables, oxidizers, corrosives, explosives, radioactive materials, and poisons. Although a material may be designated by only one hazard class, additional hazards may be indicated by adding labels or by using other means directed by DOT.

It is essential, therefore, to know the hazard class of a substance and to use the proper label. Generally a material meeting the DOT definition of a poison must always be labeled as a poison, regardless of the other labelling requirements to ensure adherence to the prohibition against shipping poisons with foodstuffs.

Specific shipping names are designated for hazardous materials listed in 49 CFR. Because of the presence of many nontechnical names or the use of archaic names for some materials, it is necessary to identify the DOT shipping names. The approved DOT shipping names are included as synonyms of the prime names and are identified by the addition of "(DOT)" to the name.

Substances not specified in 49 CFR and not appearing in the Registry are not necessarily exempt from DOT regulations. The Registry contains only those substances specifically identified in 49 CFR. Generic names or general descriptive names such as "insecticide, liquid" are not included in the Registry. Determination of the correct classification for transportation of materials not specifically identified in 49 CFR is the responsibility of the shipper.

b. EPA FIFRA standards indicate pesticides that are subject to registration or reregistration under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended. The amendments were issued in four parts, representing four lists of pesticides: (A) Federal Register 54(35), page 7740, Feb 22, 1989; (B) Federal Register 54(100), page 22706, March 25, 1989; (C) Federal Register 54(140), page 30848, July 24, 1989; and (D) Federal Register 54(204), page 4388, October 24, 1989.

c. MSHA air contaminants standards are noted with the entry "air" following "MSHA STANDARD." The standards for coal mines are defined in Subpart D, Section 56.0001 of 30 CFR as follows: "The exposure to airborne contaminants shall not exceed, on the basis of a time-weighted average, the threshold limit values adopted by the American Conference of Governmental Industrial Hygienists, as set forth and explained in the 1972 edition of the publication entitled 'TLVs® Threshold Limit Values for Chemical Substances in Workroom Air' adopted and published by ACGIH for 1972, pages 1 through 54." Standards for metal and nonmetal mines were adopted in like manner from the 1973 edition of "TLVs® Threshold Limit Values for Chemical Substances in Workroom Air." For those substances where a change in TLV® was adopted in 1973, the air contaminant standards for coal mines and for metal and nonmetal mines differ. Therefore, this RTECS® record for those substances will consist of two lines: (1) MSHA Coal Mine Standard; and (2) MSHA metal and nonmetal mine standard.

d. OSHA air contaminant standards are noted with the entry "OSHA PEL" (Permissible Exposure Limit). The PEL may be further described by one or more of the following terms: "8-hour TWA" (time-weighted average); "STEL" (short term exposure limit); or "CL" (ceiling). The TWA is the employee's airborne exposure in any 8-hour work shift of a 40-hour work week which shall not be exceeded. The STEL is the employee's 15-minute time weighted average which shall not be exceeded at any time during a work day. A time period other than 15 minutes may be specified in parentheses behind the notation "STEL." The CL is the employee's exposure which shall not be exceeded at any time during the work shift. The notation "(skin)" following the PEL for a substance indicates that even though the air concentration may be below the PEL, significant additional exposure to the skin may be dangerous. The use of personal protective equipment, engineering controls, or work practices is required. (Another designation is applied to substances listed on the Z-2 table: "PK", which refers to the acceptable maximum peak concentration above the ceiling concentration.)

Some workplace exposures consist of more than one contaminant. OSHA regulations provide for the reduction of PELs based on additive or synergistic health effects.

OSHA Cancer Hazard and OSHA Suspect Cancer Agent designations may appear on a subsequent data line for selected substances regulated by OSHA as carcinogens.

The reader is cautioned that some OSHA PELs are promulgated for classes of compounds rather than for individual substances. These classes may be based on certain chemical or physical properties that have not been well defined for every member of the class. Any questions about specific OSHA PELs should be directed to OSHA, Office of Public Affairs, Room N-3647, Department of Labor, 200 Constitution Avenue, NW, Washington, D.C. 20210, telephone (202) 219-8151.

The PEL values listed are those promulgated by OSHA in 1989. The reader should note that they were voided by court order in 1992 and the currently enforceable limits are those listed in Federal Register 58, page 35338, June 30, 1993.

e. International Occupational Exposure Limits (OELs). In recent years, RTECS® has become widely used around the world. Therefore, to increase RTECS® relevance to the international scientific community (from which its data are drawn), the various OELs from many nations have been acquired and collated. At the present time, the file includes OELs from the following nations: Australia, Austria, Belgium, Czechoslovakia, Denmark, Egypt, Finland, France, Germany, Hungary, India, Japan, the Netherlands, the Peoples Republic of China, the Philippines, Poland, Russia, Sweden, Switzerland, Thailand, Turkey, and the United Kingdom. Others will be added as they become available, and current listings will be updated as changes are made.

19. NIOSH Standards Development and Surveillance Data (Data Type X). This section contains information generated by NIOSH in two areas of endeavor. The Standards Development Program produces Recommended Exposure Levels (RELs). The Surveillance Program has conducted two nationwide surveys and some of its findings are noted in the "X" data field.

a. NIOSH Recommended Exposure Level (REL). This section indicates that a NIOSH recommendation for occupational exposure has been published. The RELs may appear in any of several document forms: Criteria Documents, Current Intelligence Bulletins, Special Hazard Reviews, Occupational Hazard Assessments, and Technical Guidelines. NIOSH also periodically presents testimony before various Congressional committees and at regulatory hearings convened by OSHA and MSHA. The testimony presented always includes the current NIOSH policy concerning the particular hazard in question. A summary of NIOSH recommendations is contained in DHHS (NIOSH) Publication 92-100.

b. NIOSH Occupational Exposure Survey Data. NIOSH Survey Data (NOHS, 1974, or NOES, 1983) lines indicate that data on potential occupational exposure to the substance exist in one or both of the databases assembled as a result of national surveys of industry in the United States. The first survey, the National Occupational Hazard Survey (NOHS) was conducted from February 1972 to June 1974; the second, the National Occupational Exposure Survey (NOES) from November 1980 to May 1983. The intent of both surveys was to associate potential exposure agents (chemical, physical, and biological) with industry types, occupations, and specific surveyed facilities.

In both surveys, the sample of surveyed facilities was designed to permit projections to the national level based on survey results. It is possible, for example, to estimate the total number of people potentially exposed to a particular agent. Among other data reporting capabilities of each survey are the actual number of industries, occupations, or facilities in which an agent was observed.

There are several limitations, dictating the need for caution and some reservation, that must be observed in the interpretation and any subsequent use of the occupational exposure data presented in this field.

(1) The occupational exposure data presented for each survey were representative of the workplace at the respective times each survey was conducted. The data are becoming progressively more dated, and as a consequence, less representative of the current situation.

(2) Data in both surveys were collected using observational techniques. No environmental levels of chemical or biological contaminants or levels or degrees of physical hazards were actually measured.

(3) Neither survey covered industries in mining or agriculture. The sample universe of the NOHS did not include rural areas. The NOES did not include Federal, State, or local governments, financial, real estate, or retail trade industries.

(4) Exposure data reported for both surveys are provisional. In both cases, the majority of exposure data (approximately 70%) recorded during both surveys was by trade name product. Subsequent detailed component information for these trade name products was sought from the manufacturers and incorporated into the respective survey databases.

Basic parameters of both surveys are as follows:

	SURVEY	
PARAMETER	NOHS	NOES
Start date of field survey	February 1972	November 1980
End date for field survey	June 1974	May 1983
Estimated number of plants in the survey universe	739,244	508,697
Estimated number of employees in the survey universe	38,262,627	33,409,031
Number of plants surveyed	4,636	4,490
Number of employees surveyed	895,725	1,830,330
Number of different occupations surveyed	453	410
Number of agents seen	8000+	9000+
Number of unique trade name products	80,000	100,000

Types of data appearing on the survey data lines for each substance and the abbreviations used in the text are as follows.

HAZARD CODE (HZD) - a five-position identifier used exclusively by NIOSH for search and retrieval of data from either survey database.

NUMBER OF INDUSTRIES (NIS) - number of industries, as defined by standard 4-digit industrial classification (SIC) codes, in which the agent was observed.

TOTAL NUMBER OF FACILITIES (TNF) - estimated (nationwide) total number of facilities in which the agent is thought to be present.

NUMBER OF OCCUPATIONS (NOS) - number of occupations, as defined by the Bureau of Census Occupational codes, in which the agent was observed.

TOTAL NUMBER OF EMPLOYEES (TNE) - estimated (nationwide) total number of employees thought to be exposed to the agent.

TOTAL NUMBER OF FEMALE EMPLOYEES (TFE)* - estimated (nationwide) total number of female employees thought to be exposed to the agent.

*NOTE: These data are available for the NOES only.

Questions specific to the occupational survey data reported in the Registry should be directed to:

NIOSH
Surveillance Branch, Hazard Section
Mail Stop R-19
4676 Columbia Parkway
Cincinnati, Ohio 45226
FAX: (513) 841-4489

Detailed descriptions of the surveys and their resulting databases are available in the following NIOSH technical reports:

Survey Manual (NOHS)
DHEW (NIOSH) Publication No. 74-127 (1974)
Available from the National Technical Information Service (NTIS)
Stock No. PB 274241

Data Editing and Data Base Development (NOHS)
DHEW (NIOSH) Publication No 77-213 (1977)
Available from the National Technical Information Service (NTIS)
Stock No. PB 274819

Survey Analysis and Supplemental Tables (NOHS)
DHEW (NIOSH) Publication No. 78-114 (1977)
Available from the National Technical Information Service (NTIS)
Stock No. PB82-229881

Survey Manual (NOES)*
DHHS (NIOSH) Publication No. 88-106 (1987)

Sampling Methodology (NOES)*
DHHS (NIOSH) Publication No. 89-102 (1989)

Analysis of Management Interview Responses (NOES)*
DHHS (NIOSH) Publication No. 89-103 (1989)

* Available, while supplies last, from:
NIOSH Publications Office
4676 Columbia Parkway
Cincinnati, Ohio 45226
FAX: (513) 533-8573

20. Status (Data Type Y). This section provides information on the activities of various governmental agencies regarding the substance. Status lines are currently listed for ATSDR, EPA, NIOSH, NTP, and OSHA.

a. The Agency for Toxic Substances and Disease Registry (ATSDR) has been directed by the Superfund Amendments and Reauthorization Act of 1986 (SARA) to prepare toxicological profiles for hazardous substances which pose the most significant potential threat to human health, as determined by ATSDR and the Environmental Protection Agency (EPA). Each profile is intended to characterize the toxicological and adverse health effects information for the hazardous substance being described. The currently available profiles are noted in the Status field of the appropriate chemical records. Also noted is the NTIS Stock Number of each profile.

b. EPA status entries are included for four portions of the Toxic Substances Control Act (TSCA), Public Law 94-469: the Section 8(b) chemical inventory, Section 8(a) preliminary assessment information, Section 8(e) substantial risk information, and TSCA Test Submissions database (TSCATS). Additional status lines are for two other EPA programs, GENE-TOX and IRIS.

A TSCA inventory citation indicates that the substance appears on the Chemical Inventory prepared in 1986 by the EPA in accordance with provisions of Section 8(b) of TSCA. Substances reported in the inventory include those that are produced commercially in or imported into this country. The reader should note, however, that substances already regulated by EPA under FIFRA and by the Food and Drug Administration under the Food, Drug, and Cosmetic Act, as amended, are not included in the TSCA inventory. Similarly, alcohol, tobacco, and explosive substances are not regulated under TSCA. TSCA regulations should be consulted for an exact definition of reporting requirements. Approximately eight percent of the RTECS® chemicals are contained in the TSCA inventory.

A preliminary assessment information status line indicates that EPA has promulgated both a final and a proposed rule under Section 8(a) of TSCA, reporting and retention of information. The final rule requires chemical manufacturers and, in some cases, processors and importers to report production and exposure-related data on approximately 250 chemicals to EPA. Included in this status line is a citation to the Federal Register issue (volume 47, page 26992, June 22, 1982) in which the rule appeared. This reference should be consulted for a complete explanation of the rule. The proposed rule (Federal Register, volume 47, page 27009, June 22, 1982) covered an additional 350 chemicals for which similar reporting would be required.

A substantial risk status line indicates that EPA has received and reviewed information submitted under Section 8(e) of TSCA, which requires that persons who obtain information which reasonably supports the conclusion that a substance presents substantial risk of injury to human health or the environment must notify EPA within 15 days. These notices are reviewed by EPA and an initial valuation is prepared containing, if appropriate, follow-up questions to the submitter, referrals to other agencies, and decisions to list the chemical for a Section 8 reporting rule or to undertake a formal risk assessment. The submissions and the initial evaluations are in the Public Reading Room, 447 East Tower, Waterside Mall, 401 M Street, SW, Washington, D.C. 20460. Persons wishing to request a copy of these notices may write to the EPA Freedom

of Information Office (A-101), Washington, D.C. 20460. A duplication fee will be charged. The reader should note that many 8(e) notices represent a company's first review of a situation or datum and a judgment in compliance with the statute to submit a notice within 15 days of obtaining the information. EPA publishes its evaluations of these notices in order to make widely available this Section 8(e) information in a form understandable to the general public.

The TSCATS was developed to make unpublished test data submitted to EPA available to the public. Test is broadly defined to include case reports, episodic incidents (such as spills), and formal test study presentations. The database (except for the microfiche version) allows searching of test submissions according to specific chemical identity or type of study. Studies are indexed under three broad subject areas: health effects, environmental effects, and environmental fate. Additional controlled vocabulary index terms are assigned which describe the experimental protocol and test observations. Records identify reference information needed to locate the source document, as well as the submitting organization and reason for submission of the test data. This database is updated quarterly on magnetic tape and is made available to the public through NTIS. Microfiche copies of the unpublished documents cited in TSCATS are also available through NTIS.

GENE-TOX: A Genetic Toxicology program status line indicates that the substance has been reported in the literature for potential genetic effects during 1969-1979. The test protocol in the literature is evaluated by an EPA Expert Panel on Mutations and a positive or negative effect of the substance is evaluated and reported. To obtain additional information about this program, contact GENE-TOX Program, EPA, 401 M Street, SW, TS796, Washington, D.C. 20460, telephone (202) 260-1513.

IRIS: The Integrated Risk Information System is the EPA electronic on-line database of summary health risk assessment and regulatory information on chemical substances. The primary purpose of IRIS is to provide guidance risk values to EPA risk assessors and decision makers for use in EPA risk management decisions. EPA staff and EPA contractors are expected to use the risk information in IRIS for those chemicals in the database. The information contained in IRIS, except as specifically noted, has been reviewed and agreed upon by intra-agency review groups comprised of EPA scientists with extensive experience in risk assessment. Thus, the information in IRIS represents an expert Agency consensus.

c. NIOSH status lines are included for those substances for which an analytical method(s) has been developed by NIOSH or for substances for which NIOSH Current Intelligence Bulletins (CIBs) have been issued. The chemicals listed in the Third Edition of "NIOSH Manual of Analytical Methods (NMAM)" are also cited in the RTECS®. The sampling and measurement methods in the NMAM Third Edition are revisions and additions to those contained in the Second Edition.

d. There are two types of National Toxicology (NTP) status lines listed in the RTECS® file. The first indicates that the substance has been or is being tested by the NTP under its Carcinogenesis Testing Program. These entries were identified as National Cancer Institute (NCI) status lines in issues of the Registry prior to July 1980. However, the NCI Carcinogenesis Testing Program has been absorbed by NTP, and the status lines have been reformatted accordingly. The following different citations are used to reflect the current test status of the compound: nominated for test; selected for test; currently undergoing test; or test completed.

These citations are updated as each bioassay progresses. Selection of a chemical for bioassay does not necessarily imply that it is a carcinogen. Also a compound originally selected and even scheduled for bioassay may be withdrawn from the program anytime during testing or before testing actually begins. This initial selection is cited in the Registry but is deleted when the compound is removed from the test. It is, therefore, important that the reader monitor these status lines for changes. The bioassay itself normally takes about two and one-half years to conduct, and another year is required to prepare the final report. When this report is released, the report number and test results are listed, and, where applicable, specific tumorigenic dose lines (see paragraph 10) are generated. In June 1983, NTP adopted five categories of interpretive conclusions for use in their technical reports. The Registry citations make use of these same five categories in the NTP Status Lines. As defined by NTP, the categories (which refer to the strength of the experimental evidence) are as follows:

CLEAR EVIDENCE of Carcinogenicity is demonstrated by studies that are interpreted as showing a chemically related increased incidence of malignant neoplasms, studies that exhibit a substantially increased incidence of benign neoplasms, or studies that exhibit an increased incidence of a combination of malignant and benign neoplasms where each increases with dose.

SOME EVIDENCE of Carcinogenicity is demonstrated by studies that are interpreted as showing a chemically related increased incidence of benign neoplasms, studies that exhibit marginal increases in neoplasms of several organs/tissues, or studies that exhibit a slight increase in uncommon malignant or benign neoplasms.

EQUIVOCAL EVIDENCE of Carcinogenicity is demonstrated by studies that are interpreted as showing a chemically related marginal increase of neoplasms.

NO EVIDENCE of Carcinogenicity is demonstrated by studies that are interpreted as showing no chemically related increases in malignant or benign neoplasms.

INADEQUATE STUDY of Carcinogenicity demonstrates that because of major qualitative or quantitative limitations, the studies cannot be interpreted as valid for showing either the presence or absence of a carcinogenic effect.

Final reports for some bioassays may not be published because the data are insufficient, and this is noted in the Registry where applicable. Also, some substances may be selected by NTP for retest after the first bioassay is completed and the final report issued. These duplicate studies are noted on a separate NTP status line. Some of the early NCI testing was not done in accordance with the strict experimental protocols now used. The results of these studies were not published as NCI bioassay reports, but instead appeared in the literature as journal articles. These are noted on the NTP status lines as "studies" rather than "bioassays", and reference to the journals are given. To obtain additional information about the Carcinogenesis Testing Program or the status of a particular substance under test, or to obtain copies of the final bioassay reports, contact the Central Data Management, Mail Drop A0-01, NIEHS, P.O. Box 12233, Research Triangle Park, North Carolina 27709, telephone (919) 541-3991.

The second type of NTP status line indicates that the substance is listed in the NTP "Annual Report on Carcinogens." This cumulative list is published in accordance with Public Law 95-622, which requires that the Secretary of the Department of Health and Human Services publish an annual report containing ". . . . a list of all substances (i) which either are known to be carcinogens or which may reasonably be anticipated to be carcinogens and (ii) to which a significant number of persons residing in the United States are exposed. . . ." Included for each of the 117 chemicals in the report is a description of the substance, including a brief synopsis of the scientific evidence that led to its inclusion in the report. This is immediately followed by information about the regulatory activities of the NTP-participating federal agencies. For additional information about the report, contact the Public Information Office, National Toxicology Program, P.O. Box 12233, Research Triangle Park, North Carolina 27709, telephone (919) 541-3971. Subsequent NTP Reports on Carcinogens will be cited in future issues of the Registry.

e. OSHA Status. The OSHA status line that now appears in RTECS® is a notation that a validated analytical method(s) has been developed for the chemical by OSHA and appears in its Manual of Analytical Methods. The manual, in loose leaf form, can be ordered from the American Conference of Governmental Industrial Hygienists (ACGIH) (513-661-7881). OSHA Manual of Analytical Methods: Inorganic Methods (ID-101 to ID-210) publication number 4545; Organic Methods (#1-80) publication number 4542, Organic Methods Supplement (#55-80) publication number 4544.

C. RTECS® COMPUTER TAPE

The RTECS® Computer Tape is composed of two major sections that are described separately below:

1. RTECS® Master File. The RTECS® Master File is composed of 107-character fixed length records. Each record (line) contains a sequence number, a data type (code that defines the type of information on the line), a line number, and the actual data. (See figure 1) The file is arranged sequentially by ascending sequence number. The first three fields define the data in the fourth field and determine the sequence of each record in the file.

RTECS® MASTER FILE LAYOUT

Field No.	Field Name	Position	Description
1	Sequence Number	1-9	Alphanumeric
2	Data Type	10	Alphabetic
3	Line Number	11-13	Numeric
4	Data	14-107	Alphanumeric

Data field No. 2 contains one of the 22 codes shown in Table VI and Data Field No. 4 contains the corresponding data. All data except types "G" and "H" are variable-fielded beginning in position 14. Data type "G" is fix-fielded (with the format AANNNNNNN) in the positions 14-22. Data type "H" is fix-fielded (with the format xxxx.xx) in the positions 14-20. Only data types "A", "B", "C", "J", and "L" can have more than one data record line; i.e., data beginning on line 010 may be continued on line 011 if necessary.

The following material is a tabular description of the file layout.

The listing below specifies elements of the data lines in fields "A" through "Y" and their columnar positions in the file.

FIELD	POSITION	DATA DESCRIPTION
A - Prime chemical name (Section B, para. 1)	14-107	Name may occupy additional lines, e.g., A011, A012, etc.
B - Cross reference	14-107	Synonymous name, Sequence Number of Prime Name. May occupy multiple lines.
C - Definition (Section B, para. 1)	14-107	Identification of natural products. May occupy multiple lines
D - CAS Number (Section B, para. 3)	14-23	Registry number. Format leading zeros
E - Update field (Section B, para. 2)	14-17	Data record last changed. Format: YYMM

FIELD	POSITION	DATA DESCRIPTION
F - Molecular Formula (Section B, para. 6)	14-107	Empirical formula
G - RTECS® Number (Section B, para. 4)	14-22	Unique identifier. Format: AANNNNNNN
H - Molecular Weight (Section B, para. 5)	14-20	Format: xxxx.xx
J - Wiswesser Line Notat. (Section B, para. 7)	14-107	May occupy multiple lines.
L - Synonyms (Section B, para. 8)	14-107	May occupy multiple lines.
N - Compound Descrip. Code (Section B, para. 9)	14	Alphabetic symbol
P - Irritation Data (Section B, para. 10)	14-16	Route of Administration
	18-20	Species Tested
	22-42	Dose Data
	64-107	CODEN
Q - Mutation Data (Section B, para. 11)	14-16	Mutation Test System
	18-20	Organism
	22-50	Dose Data
or	14-16	Mutation Test System
	18-20	Indicator Organism
	22-24	Tissue Tested
	26-56	Dose Data
	64-107	CODEN
R - Reproductive Data (Section B, para. 12)	14	Number of TECs (1, 2, or 3)
	15-17, 18-20, 21-23	TECs
	24-26	Route of Administration
	28-30	Species Tested
	32-35	TDLo or TCLo
	37-60	Dose Data
	74-107	CODEN
S - Tumorigenic Data (Section B, para. 13)	14	Number of TECs (1, 2, or 3)
	15-17, 18-20, 21-23	TECs
	24-26	Route of Administration
	28-30	Species Tested
	32-35	TDLo or TCLo
	37-70	Dose Data
	74-107	CODEN
T - Acute Toxicity Data (Section B, para. 14)	14	Number off TECs (1, 2, or 3)
	15-17, 18-20, 21-23	TECs
	24-26	Route of Administration
	28-30	Species Tested
	32-35	LD50, LC50, LDLo, LCLo TDLo, or TCLo
	37-70	Dose Data
	74-107	CODEN

FIELD	POSITION	DATA DESCRIPTION
U - Other Multiple Dose Toxicity Data	14	Number of TECs (1, 2, or 3)
(Section B, para. 15)	15-17, 18-20, 21-23	TECs
	24-26	Route of Administration
	28-30	Species Tested
	32-35	TD, TDLo, TC, or TCLo
	37-60	Dose Data
	74-107	CODEN
V - Reviews	14-62	ACGIH, IARC, or TOXICOLOGY Reviews
(Section B, para. 17)	64-107	CODEN
W - Standards and Regulations	14-82	DOT, EPA, MSHA, OSHA Regs., OELs
(Section B, para. 18)	84-107	CODEN
X - NIOSH Documentation and Surveillance	14-82	REL
(Section B, para. 19)	84-107	CODEN
or	14-107	NOHS, NOES (TWO LINES FOR EACH ENTRY)
Y - Status	14-82	ATSDR, EPA, NIOSH, NTP, or OSHA Status
(Section B, para. 20)	84-107	CODEN

Table VII lists the line numbers assigned to entries in the Toxicology Review Field ("V"), Standards and Regulations Field ("W"), NIOSH Documentation Field ("X"), and the Status Field ("Y"). Table VIII details the line matrix by test system and organism tested for Mutagenic Effects Data ("Q"). Table IX shows the line matrix by route of administration and species for Reproductive Effects Data ("R"). Table X displays the line matrix for Acute Lethality Data ("T").

2. RTECS® CODEN Master File. The CODEN file, the second file of the 1993 RTECS® computer tape, is formatted as shown below. This file provides the complete bibliographic citation for each coden on the data type C, P, Q, R, S, T, U, V, W, and Y lines. See paragraph 16 of the Detailed File Description.

Field No.	Field Name	Position	Description
1	CODEN	1-6	Alphanumeric
2	Line Number	7-8	Numeric
3	Bibliographic Data	9-107	Alphanumeric

A full listing of all CODEN designations currently listed in RTECS® is found on the microfiche located in the pocket on the inside back cover of this volume.

D. RTECS® ON-LINE

The NIOSH Registry of Toxic Effects of Chemical Substances (RTECS®) is now available as a real-time interactive computer database from seven different sources: (1) the National Library of Medicine (NLM) TOXNET System, (2) the Chemical Information System (the CIS), (3) (in Canada only) the CCINFOLINE produced by the Canadian Centre for Occupational Health and Safety, (4) DIALOG, (5) Chemical Abstracts Service-Science and Technology Network (CAS-STN), and (6) the European Space Agency (ESA), and these systems permit the user to search the RTECS® file for specific data or subsets of data and to compile RTECS® subfiles tailored to their particular needs. Updates to these systems are provided on a quarterly basis.

NATIONAL LIBRARRY OF MEDICINE: MEDLARS/TOXNET SYSTEM

MEDLARS is NLM's computerized literature retrieval service, which is available through a nationwide network of more than 1300 NLM on-line centers. The MEDLARS RTECS® file is accessed like other NLM files on the TOXNET system and is available as a standard service to all NLM on-line service subscribers. The RTECS® data fields are structured in a format similar to that which they previously appeared in the printed and microfiche Registry. RTECS® records can be searched on a given route, species, toxic dose type, toxic effect, etc., and can be retrieved by entering the desired free text terms or specific toxic effects. Chemical substances can be entered by their names, RTECS® accession numbers, or Chemical Abstracts Service (CAS) registry numbers. Terms may be entered singly or combined using AND, OR, and AND NOT. One can generate subfiles of compounds with similar attributes--for example, all substances have been issued. Records can be printed on-line at the user's terminal, or off-line and mailed to the user from NLM.

For additional information on how to interrogate the MEDLARS RTECS® file, contact:

RTECS®
Toxicology Information Program
Specialized Information Services
National Library of Medicine
8600 Rockville Pike
Bethesda, Maryland 20209
Telephone: (301) 496-1131

THE CHEMICAL INFORMATION SYSTEM (THE CIS)

The Chemical Information System (The CIS) consists of a collection of chemical data bases that were initially developed by the National Institutes of Health and the Environmental Protection Agency. These databases, which now include RTECS®, are available commercially through the CIS. Twenty-three RTECS® data fields are available for searching. Range searching of toxicity data, a feature not generally available, can be performed. Using the "SANSS" component of the CIS, one can specify an actual chemical structure or substructure or its name and generate a list of all compounds in the RTECS® file which contain that feature. Data may be displayed in an abbreviated or expanded format.

For information, contact:
Chemical Information System, Inc.
810 Gleneagles Court, Suite 300
Towson, Maryland 21286
Telephone: (410) 321-8440 (in Maryland)
Toll Free: 1-800-CIS-USER
FAX: (410) 296-0712

DIALOG

In December 1989, RTECS® became available on the DIALOG network as File 336. It can now be accessed over the DIALOG-NET, TYMNET, TELENET, and INWATS telecommunications systems in the United States and abroad.

Once a user's search has been established, the output can be accessed and/or printed either in abbreviated form or fully spelled out. DIALOG offers several search enhancements, e.g., (S) proximity operator and Key Word in Context (KWIC) format. They have also prepared a detailed documentation of the layout and characteristics of the RTECS® file.

For information, contact:
Dialog Information Services, Inc.
3460 Hillview Avenue
Palo Alto, California 94304
Telephone: (415) 858-3810
Toll Free: 1-800-3-DIALOG

CHEMICAL ABSTRACTS SERVICE-SCIENCE AND TECHNOLOGY NETWORK (CAS-STN)

In October 1991, RTECS® became available on STN International. Special features of this on-line system include: Chemical structure display for all records with CAS Registry numbers, easily read tabular displays of toxicity data, RTECS® flags in the locator (LC) field of the Registry file to identify substances covered in RTECS®, easy crossover to related files such as MSDS-CCOHS, MEDLINE, and the CA File, tabular FA (Field Available) display for complete data list, and complete numeric searching capability for toxicity data.

For information, contact:
CAS-STN
2540 Olentangy River Road
Columbus, Ohio 43210
Telephone: 1-800-848-6538, extension 3661

CCINFOLine (in Canada only)

The Canadian Centre for Occupational Health and Safety (CCOHS) has included RTECS® in its CCINFOLine system.

For information, contact:
Canadian Centre for Occupational Health and Safety
250 Main Street East
Hamilton, Ontario L8N 1H6
CANADA
Telephone: 1-800-525-9083 (in Canada)

EUROPEAN SPACE AGENCY (ESA)

In mid-1992 RTECS® was mounted on the European Space Agency/Information Retrieval Service (ESA/IRS). This service provides ready access to RTECS® data throughout Europe.

For information, contact:
ESA/IRS
via Galileo Galilei
00044 Frascati
Rome, ITALY
Telephone: (39) 6 941801
FAX: (39) 6 94180361

E. RTECS® ON CD-ROM

The newest addition to the RTECS® formats is the laser-read compact disc system known as Compact Disc-Read Only Memory (CD-ROM), which is similar in principle to the new digital, audio compact discs. This system offers the convenience of a personal computer to search the database without the need for telecommunications. The complete RTECS® file (with additional selected data) is contained on a single, 3.72-inch-diameter disc, and enables the user to search the database, build subfiles, print paper copies, or download to floppy discs as desired.

A CD-ROM reader-driver, which can be used for the many new information packages now being produced in this medium, is required. Quarterly updates, including operating software, are provided by the vendors of these systems on a yearly lease program. At this time, the following four commercial versions of RTECS® on CD-ROM are being marketed.

CHEM-BANK™ by SilverPlatter

The CHEM-BANK™ compact disc marketed by SilverPlatter Information Inc., contains the complete RTECS® file along with the Hazardous Substances Data Bank (HSDB) produced by the National Library of Medicine (NLM), Oil and Hazardous Materials Technical Assistance Data System (OHMTADS) produced by the Environmental Protection Agency (EPA), and Chemical Hazard Response Information System (CHRIS) produced by United States Coast Guard. Free text searching is possible and desired subfiles can be extracted using Boolean operators. Introductory screens are provided to identify field designations and techniques for developing search strategies. It is also possible to "browse" through the file using the "INDEX" operator.

For information, contact:

SilverPlatter Information, Ltd.
10 Barley Mow Passage
Chiswick, London W4 4PH
UNITED KINGDOM
Telephone: 0800-262-096
+44 (0) 81-995-8242
FAX: +44 (0) 81-995-5159

OR

SilverPlatter Information, Inc.
100 River Ridge Drive
Norwood, Massachusetts 02062-5026
Telephone: (617) 769-2599
Toll Free: 1-800-343-0064
FAX: (617) 769-8763

CCINFODisc by CANADIAN CENTRE FOR OCCUPATIONAL HEALTH AND SAFETY

The CCINFODisc system produced by the Canadian Centre for Occupational Health and Safety (CCOHS) presents RTECS® in both English and French on their A-2 chemical information compact disc. The data are expanded and no abbreviations or codes are used. Using the "Findit" software system, the user can access RTECS® data via any of the twenty-six data fields.

For information, contact:

Canadian Centre for Occupational Health and Safety
250 Main Street East
Hamilton, Ontario L8N 1H6
CANADA
Telephone: (416) 572-2981
Toll Free: 1-800-263-8276 (Canada only)

TOMES-PLUS® BY MICROMEDEX

The TOMES PLUS® disc produced by Micromedex, Inc. was developed to provide data in the areas of toxicology, occupational medicine, and environmental science. RTECS® is part of the collection, which also includes the Hazardous Substance Data Bank (HSDB) from the National Library of Medicine, the Integrated Risk Information System (IRIS) from the Environmental Protection Agency, the Teratogen Information System (TERIS) from the University of Washington, and several others.

Using menu-driven software, RTECS® records can be accessed by chemical name or name fragments, RTECS® number, or CAS registry number. It offers a direct approach, especially aimed at easy access of individual substance records, which are displayed in a systematic outline format.

For information, contact:

Micromedex, Inc.
500 Grant Street
Denver, Colorado 80203-3527
Telephone: (303) 831-2140
Toll Free: 1-800-525-9083
FAX: (303) 887-1717

TABLE I. RTECS® ABBREVIATIONS

asn	- Aspergillus nidulans
ast	- Ascites tumor
bcs	- Bacillus subtilis
bfa	- body fluid assay
bmr	- bone marrow
brd	- bird (domestic)
bwd	- wild bird species
C	- continuous
cc	- cubic centimeter
chd	- child
ckn	- chicken
CL	- ceiling concentration
clr	- Chlamydomonas reinhardi
ctl	- cattle
cyt	- cytogenetic analysis
D	- day
dck	- duck
DEF	- definition
dlt	- dominant lethal test
dmg	- Drosophila melanogaster
dnd	- DNA damage
dni	- DNA inhibition
dnr	- DNA repair
dns	- unscheduled DNA synthesis
dom	- domestic
DOT	- Department of Transportation
dpo	- Drosophila pseudo-obscura
emb	- embryo
EPA	- Environmental Protection Agency
esc	- Escherichia coli
eug	- Euglena gracillis
eye	- administration into the eye (irritant)
fb	- fiber
fbr	- fibroblast
frg	- frog
gm	- gram
gpg	- guinea pig
grb	- gerbil
grh	- grasshopper
H	- hour
ham	- hamster
hla	- HeLa cell
hma	- host-mediated assay
hmi	- Haemophilus influenzae
hmn	- human
hor	- horse, donkey
I	- intermittent
ial	- intraaural
IARC	- International Agency for Research on Cancer
iat	- intraarterial
ice	- intracerebral
icv	- intracervical
idr	- intradermal
idu	- intraduodenal
ihl	- inhalation
imm	- immersion
imp	- implant
ims	- intramuscular
inf	- infant
ipc	- intraplacental
ipl	- intrapleural
ipr	- intraperitoneal
irn	- intrarenal
isp	- intraspinal
itr	- intratracheal
itt	- intratesticular
iu	- international unit
iut	- intrauterine
ivg	- intravaginal
ivn	- intravenous
kdy	- kidney
kg	- kilogram (one thousand grams)
klp	- Klebsiella pneumoniae
L	- liter
LC50	- lethal concentration, 50 percent kill
LCLo	- lowest published lethal concentration
LD50	- lethal dose, 50 percent kill
LDLo	- lowest published lethal dose
leu	- leukocyte
liq	- liquid
lng	- lung
lvr	- liver
lym	- lymphocyte
M	- minute
m^3	- cubic meter
mam	- mammal (species unspecified)
mg	- milligram (one thousandth of a gram; 10^{-3} gram)
mky	- monkey
mL	- milliliter
MLD	- mild irritation effect
mma	- microsomal mutagenicity assay
mmo	- mutation in microorganisms
mmol	- millimole
mmr	- mammary gland
mnt	- micronucleus test
MOD	- moderate irritation effect
mol	- mole
mppcf	- million particles per cubic foot
mrc	- gene conversion and mitotic recombination
msc	- mutation in mammalian somatic cells
MSHA	- Mine Safety and Health Administration
mul	- multiple routes
mus	- mouse
ng	- nanogram (one billionth of a gram; 10^{-9} gram)
nml	- non-mammalian species
nmol	- nanomole
NOES	- National Occupational Exposure Survey
NOHS	- National Occupational Hazard Survey
nsc	- Neurospora crassa
nse	- non-standard exposure
NTP	- National Toxicology Program
OBS	- obsolete (trade name)
ocu	- ocular
OEL	- Occupational Exposure Limit
ofs	- other fish
omi	- other microorganisms
oms	- other mutation test systems
oin	- other insects
open	- open irritation test
orl	- oral
ORM	- Other Regulated Materials (DOT)
OSHA	- Occupational Safety and Health Administration

TABLE I. RTECS® ABBREVIATIONS (Continued)

oth	- other cell types
otr	- oncogenic transformation
ovr	- ovary
par	- parenteral
PEL	- Permissible Exposure Limit (OSHA)
pg	- picogram (one trillionth of a gram; 10^{-12} gram)
pgn	- pigeon
pic	- phage inhibition capacity
pig	- pig
PK	- peak concentration
pmol	- picomole
post	- after birth
ppb	- parts per billion (v/v)
pph	- parts per hundred (v/v) (percent)
ppm	- parts per million (v/v)
ppt	- parts per trillion (v/v)
pre	- prior to copulation
preg	- pregnant
qal	- quail
rat	- rat
rbt	- rabbit
rec	- rectal
REGS	- standards and regulations
REL	- Recommended Exposure Level
rns	- rinsed with water
RTECS®	- Registry of Toxic Effects of Chemical Substances
S	- second
sal	- salmon
sat	- Salmonella typhimurium
sce	- sister chromatid exchange
SCP	- Standards Completion Program
scu	- subcutaneous
SEV	- severe irritation effect
skn	- administration onto the skin
sln	- sex chromosome loss and nondisjunction
slt	- specific locus test
slw	- silkworm
smc	- Saccharomyes cerevisiae
spm	- sperm
sql	- squirrel
srm	- Serratia marcescens
ssp	- Schizosaccharomyces pombe
STEL	- short term exposure limit
TC	- toxic concentration (other than lowest)
TDLo	- lowest published toxic dose
tes	- testis
TLV®	- Threshold Limit Value
tod	- toad
trk	- turkey
trn	- heritable translocation test
TWA	- time-weighted average
unr	- unreported
W	- week
wmn	- woman
Y	- year
%	- percent
μg	- microgram (one millionth of a gram; 10^{-6} gram)
μmol	- micromole

TABLE II. TOXIC EFFECTS CODE (TEC)

Position 1 - Organ, Tissue, or Functional System

A Brain and Coverings

B Spinal Cord

C Peripheral Nerve and Sensation

D Sense Organs and Special Senses (Nose, Eye, Ear, and Taste)

E Autonomic Nervous System

F Behavioral

G Cardiac

H Vascular

J Lung, Thorax, or Respiration

K Gastrointestinal

L Liver

M Kidney, Ureter, and Bladder

N Endocrine

P Blood

Q Musculoskeletal

R Skin and Appendages

T Reproductive

U Nutritional and Gross Metabolic

V Tumorigenic

Y Biochemical

Z Others

TABLE II. TOXIC EFFECTS CODE (TEC) (Continued)

Positions 2 and 3 - Damage Codes, two digits

Each of the major headings below correspond to one of the organs, tissues, or functional systems listed in Position 1.

A BRAIN AND COVERINGS

01 Meningeal changes
02 Changes in cerebral spinal fluid
03 Increased intracranial pressure
04 Changes in circulation (hemorrhage, thrombosis, etc.)
05 Encephalitis
06 Demyelination
10 Changes in surface EEG
11 Recordings from specific areas of CNS
30 Other degenerative changes
60 Tumors
70 Changes in brain weight

B SPINAL CORD

01 Meningeal changes
02 Changes in circulation
03 Inflammatory changes
04 Demyelination
30 Other degenerative changes
60 Tumors

C PERIPHERAL NERVE AND SENSATION

01 Associated connective tissue
02 Sensory syndrome diagnostic of central lesion
03 Sensory change involving trigeminal nerve
04 Sensory change involving peripheral nerve
05 Sensory change involving segmental distribution
06 Spastic paralysis with or without sensory change
07 Flaccid paralysis with appropriate anesthesia
08 Flaccid paralysis without anesthesia (usually neuromuscular blockage)
09 Fasciculations
10 Paresthesis
15 Recording from afferent nerve
16 Recording from peripheral motor nerve
17 Local anesthetic
18 Structural change in nerve or sheath
60 Peripheral nerve tumors

D SENSE ORGANS AND SPECIAL SENSES (NOSE, EYE, EAR, AND TASTE)

Olfaction:

01 Deviated nasal septum
02 Ulcerated nasal septum
03 Change in olfactory nerve
04 Change in sensation of smell
07 Other changes
09 Tumors

TABLE II. TOXIC EFFECTS CODE (TEC) (Continued)

Eye:

10 Optic nerve neuropathy
11 Cycloplegia
12 Changes in refraction
13 Ciliary spasm
14 Visual field changes
15 Miosis (pupilliary constriction)
16 Mydriasis (pupilliary dilation)
17 Lacrimation
18 Chromodacryorrhea
19 Increased intraocular pressure
20 Retinal changes (pigmentary depositions, retinitis, other)
21 Hemorrhage
22 Changes in circulation
23 Diplopia
24 Changes in extra-ocular muscles
25 Conjunctive irritation
26 Corneal damage
27 Iritis
28 Ptosis
29 Tumors
35 Other

Ear:

40 Change in acuity
41 Tinnitus
43 Changes in vestibular functions
44 Change in cochlear structure or function
45 Tumors

Taste:

50 Change in function

E AUTONOMIC NERVOUS SYSTEM

01 Sympathomimetic
02 Alpha adrenergic blocker
03 Beta adrenergic blocker
04 Central sympatholytic
05 Ganglion blocker
06 Ganglion facilitant
08 Other (direct) parasympathomimetic
09 Intensity beta adrenergic effects
15 Smooth muscle relaxant (mechanism undefined, spasmolytic)
16 Parasympatholytic

F BEHAVIORAL

01 General anesthetic
02 Anticonvulsant
03 Wakefulness
04 Sleep
05 Altered sleep time (including change in righting reflex)
06 Euphoria

07	Somnolence (general depressed activity)
08	Hallucinations, distorted perceptions
09	Changes in REM sleep (human)
10	Toxic psychosis
11	Tremor
12	Convulsions or effect on seizure theshold
13	Excitement
14	Anorexia (human)
15	Food intake (animal)
16	Fluid intake
17	Change in motor activity (specific assay)
18	Muscle weakness
19	Ataxia
20	Stiffness
21	Rigidity (includes catalepsy)
22	Tetany
23	Muscle contraction or spasticity
24	Coma
25	Antipsychotic
26	Antianxiety
27	Headache
29	Analgesia
30	Tolerance
31	Withdrawal
32	Abuse
33	Irritability
34	Straub Tail
40	Alteration of classical conditioning
41	Alteration if operant conditioning
42	Changes in psychophysiological tests
43	Aggression

G CARDIAC

01	Cardiomyopathy including infarction
02	Changes in coronary arteries
03	Pericarditis
04	Arrythmias (including changes in conduction)
05	Cardiomegaly
06	EKG changes not diagnostic of above
07	Pulse rate increased without fall in BP
08	Pulse rate
09	Change in force of contraction
10	Change in rate
11	Change in conduction velocity
12	Cardiac output
13	Change in resting or action potential
30	Other changes
60	Tumors
70	Changes in heart weight

H VASCULAR

01	BP elevation not characterized in autonomic section
02	BP lowering not characterized in autonomic section
03	Pulse pressure increase
04	Regional or general arteriolar constriction

05 Regional or general arteriolar or venous dilation
06 Measurement of regional blood flow
07 Change in plasma or blood volume
08 Shock
15 Acute arterial occlusion
16 Structural changes in vessels
17 Thrombosis distant from injection site
20 Contraction (isolated tissues)
21 Relaxation (isolated tissues)
30 Other changes
35 Effect on gills and gill functions
60 Tumors

J LUNGS, THORAX, OR RESPIRATION

01 Ciliary function changes
02 Structural or functional change in trachea or bronchi
03 Bronchiolar dilation
04 Bronchiolar constricxtion
05 Bronchiectasis
06 Emphysema
07 Changes in pulmonary vascular resistance
08 Consolidation
12 Fibrosis, focal (pneumoconiosis)
13 Fibrosis (interstitial)
14 Fibrosing alveolitis
15 Acute pulmonary edema
16 Chronic pulmonary edema
17 Pleural effusion
18 Pleural thickening
20 Respiratory obstruction
21 Cough
22 Dyspnea
23 Sputum
24 Cyanosis
25 Respiratory depression
26 Respiratory stimulation
27 Pulmonary emboli
30 Other changes
60 Tumors
61 Bronchiogenic carcinoma
70 Changes in Lung Weight

K GASTROINTESTINAL

01 Changes in structure or function of salivary glands
02 Changes in structure or function of exocrine pancreas
03 Changes in structure or function of esophagus
04 Alteration in gastric secretion
05 Gastritis
06 Ulceration or bleeding from stomach
07 Ulceration or bleeding from duodenum
08 Ulceration or bleeding from small intestine
09 Ulceration or bleeding from large intestine
12 Hypermotility, diarrhea
13 Nausea or vomiting
14 Decreased motility or constipation

TABLE II. TOXIC EFFECTS CODE (TEC) (Continued)

15	Malabsorption
17	Peritonitis
20	Necrotic changes
30	Other changes
31	Contraction (isolated tissue)
32	Relaxation (isolated tissue)
60	Tumors
61	Colon tumors
70	Changes in pancreatic weight

L LIVER

01	Hepatitis (hepatocellular necrosis), diffuse
02	Hepatitis (hepatocellular necrosis), zonal
03	Fatty liver degeneration
04	Hepatitis, fibrous (cirrhosis, post-necrotic scarring)
10	Jaundice (or hyperbilirubinemia) hepatocellular
11	Jaundice, cholestatic
12	Jaundice, other or unclassified
14	Liver function tests impaired
15	Change in gall bladder structure or function
30	Other changes
50	Multiple effects
60	Tumors
61	Angiosarcoma
70	Changes in liver weight

M KIDNEY, URETER, BLADDER

01	Changes in blood vessels or in circulation of kidney
02	Changes primarily in glomeruli
03	Changes in tubules (including acute renal failure, acute tubular necrosis)
04	Changes in both tubules and glomeruli
05	Interstitial nephritis
10	Urine volume increased
11	Urine volume decreased
12	Renal function tests depressed
13	Proteinuria
14	Hematuria
16	Other changes in urine composition
20	Inflammation, necrosis, or scarring of bladder
21	Structural or functional changes in ureter
29	Incontinence
30	Other changes
60	Tumors
61	Kidney tumors
70	Changes in bladder weight
71	Changes in kidney weight

N ENDOCRINE

01	Antidiuresis
02	Change in LH
02	Change in GH
04	Change in gonadotropins
05	Thyroid weight (goiter)

TABLE II. TOXIC EFFECTS CODE (TEC) (Continued)

06	Toxic goiter - hypofunction
07	Evidence of thyroid hyperfunction
08	Evidence of thyroid hypofunction
10	Hyperparathyroidism
12	Adrenal cortex hyperplasia
13	Adrenal cortex hypoplasia
15	Aldosternism
16	Androgenic
17	Estrogenic
18	Differential effect of sex or castration on observed toxicity
19	Effect on menstrual cycle
20	Gynecomastia
21	Diabetes mellitus
22	Hypoglycemia
23	Ketosis
24	Hyperglycemia
25	Diabetes insipidus (nephrogenic or CNS)
30	Other changes
60	Tumors
61	Adrenal cortex tumors
62	Thyroid tumors
70	Changes in endocrine weight (unspecified)
71	Changes in pituitary weight
72	Changes in adrenal weight
73	Changes in Spleen weight
74	Changes in thymus weight
75	Changes in thyroid weight

P BLOOD

01	Hemorrhage
02	Change in clotting factors
05	Normocytic anemia
06	Microcytosis with or without anemia
07	Macrocytosis
08	Pigmented or nucleated red blood cells
13	Granulocytopenia
14	Leukopenia
15	Agranulocytosis
16	Eosinophilia
17	Thrombocytopenia
20	Changes in cell count (unspecified)
22	Oxidant related (GPD deficient) anemia
23	Other hemolysis with or without anemia
24	Methemoglobinemia-Carboxyhemoglobin
25	Aplastic anemia
26	Changes in bone marrow not included above
27	Changes in spleen
28	Changes in serum composition (e.g., TP, bilirubin, cholesterol)
30	Other changes
60	Tumors
61	Leukemia
62	Lympnomas including Hodgkin's disease
70	Changes in other cell count (unspecified)
71	Chnages in erythrocyte (RBC) count
72	Changes in leukocyte (WBC) count
73	Changes in platelet count

Q MUSCULOSEKLETAL

See also Behavioral for muscle changes secondary to CNS or metabolic changes

01 Changes in teeth and supporting structures
02 Osteoporosis
10 Osteomalacia
15 Joints
30 Other changes
60 Tumors

R SKIN AND APPENDAGES

Skin:

After systemic exposure:
01 Dermatitis, allergic
02 Dermatitis, irritative
03 Dermatitis, other
04 Photosensitivity

After topical exposure:
10 Primary irritation
11 Corrosive
12 Dermatitis, allergic
13 Cutaneous sensitization (experimental)
14 Photosensitivity

Other:
20 Sweating
21 Hair
22 Nails
25 Breast
30 Other glands
60 Tumors

S IMMUNOLOGICAL INCLUDING ALLERGIC

01 Increase in cellular immune response
02 Decrease in cellular immune response
03 Increase in humoral immune response
04 Decrease in humoral immune respones
05 Decreased immune response
06 Increased immune response

Allergic (Multiple organ involvement)

When single organs are involved code under organ
Cholesterol jaundice - see Liver
Aplastic anemia, agranulocytoses - see Blood
Allergic dermatitis - see Skin

15 Anaphylaxix
16 Other immediate (humoral): uticaria, allergic rhinitis, serum sickness
18 Hypersensitivity delayed

20 Autoimmune
25 Uncharacterized

U NUTRITIONAL AND GROSS METABOLIC

See also Biochemical (Intermediary Metabolism)

01 Weight loss or decreased weight gain
02 Conditioned vitamin deficiency
03 Dehydration

Changes in:

05 Na
06 Cl
07 Ca
08 P
09 Fe
10 K
11 Other metals
20 Metabolic acidosis
21 Metabolic alkalosis
25 Body temperature increase
28 Body temperature decrease
30 Other changes

V TUMORIGENIC

01 Carcinogenic by RTECS® criteria
02 Neoplastic by RTECS® criteria
03 Equivocal tumorigenic agent by RTECS® criteria
05 Cells (cultured) transformed
08 Increased incidence of tumors in susceptible strains
10 Tumors at site of application
15 Tumor types after systemic administration not seen spontaneously
16 Facilitates action of known carcinogens
25 Protects against induction of experimental tumors
30 Active as anti-cancer agent

Y BIOCHEMICAL

Enzyme inhibition, induction, or change in blood or tissue levels

01 True cholinesterase
02 Other esterases
03 Phosphatases
04 Other hydrolases
05 Carbonic anhydrase
06 Xanthine oxidases
07 Hepatic microsomal mixed oxidase (dealkylation, hydroxylation, etc.)
08 Monoamine oxidase
09 Cytochrome oxidases (including oxidative phosphorylation)
10 Dehydrogenases
11 Catalases
12 Other oxidoreductases
13 Phosphokinase

TABLE II. TOXIC EFFECTS CODE (TEC) (Continued)

14 Hexokinases
15 Transaminases
16 Other transferases
17 Peptidases
18 Proteases
19 Isomerases
20 Multiple enzyme effects
21 Other enzymes
23 Reactivates cholinesterase

Effect on specific coenzyme:

25 B vitamin including folate
26 CoA
27 NAD, NADP
28 Others
29 Proportion of isoenzymes
30 Disturbed regulation

Metabolism (intermediary)

35 Xanthine, purine, or nucleotides including urate
36 Porphyrin including bile pigments
37 Lipids including transport
38 Amino acids (including renal excretion)
39 Plasma proteins not involving coagulation
40 Other proteins
41 Glycolytic
42 TCS cycle
43 Pentase shunt
44 Other carbohydrates
45 Histamines (including liberation not immunochemical in origin)
50 Effect on mitochondrial function
51 Effect on active transport
52 Effect on Na-K pump
53 Other
54 Effect on cyclic nucleotides
55 Effect on inflammation or mediation of inflammation

Neurotransmitters or modulators (putative)

60 Catecholamine levels in sympathetic nerves
61 Catecholamine levels in CNS
64 Dopamine in striatum
65 Dopamine at other sites

Z RELATED TO CHRONIC DATA

01 Death in the "U" date type field
71 Changes in ovarian weight
72 Changes in prostate weight
73 Changes in testicular weight
74 Changes in uterine weight

TABLE III. REPRODUCTIVE EFFECTS CODE

Paternal Effects:

T01 Spermatogenesis (including genetic material, sperm morphology, motility, and count)
T02 Testes, epididymis, sperm duct
T03 Prostate, seminal vessicle, Cowper's gland, accessory glands
T04 Impotence
T05 Breast development
T09 Other effects on male

Maternal Effects:

T11 Oogenesis
T12 Ovaries, fallopian tubes
T13 Uterus, cervix, vagina
T14 Menstrual cycle changes or disorders
T15 Breasts, lactation (prior to or during pregnancy)
T16 Parturition
T17 Postpartum
T19 Other effects

Effects on Fertility:

T21 Mating performance (e.g., # sperm positive females per # females mated; # copulations per # estrus cycles)
T22 Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated)
T23 Male fertility index (e.g., # males impregnating females per # males exposed to fertile nonpregnant females)
T24 Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea)
T25 Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants)
T26 Litter size (e.g., # fetuses per litter; measured before birth)
T27 Abortion
T29 Other measures of fertility

Effects on Embryo or Fetus:

T31 Extra embryonic structures (e.g., placenta, umbilical cord)
T32 Maternal-fetal exchange
T33 Cytological changes (including somatic cell genetic material)
T34 Fetotoxicity (except death, e.g., stunted fetus)
T35 Fetal death
T39 Other effects to embryo

Specific Developmental Abnormalities:

T41 Central nervous system
T42 Eye, ear
T43 Craniofacial (including nose and tongue)
T44 Skin and skin appendages
T45 Body wall
T46 Musculoskeletal system
T47 Cardiovascular (circulatory) system
T48 Blood and lymphatic system (including spleen and marrow)
T49 Respiratory system
T50 Gastrointestinal system
T51 Hepatobiliary system
T52 Endocrine system
T53 Urogenital system
T54 Immune and reticuloendothelial system

T55 Homeostasis
T59 Other developmental abnormalities

Tumorigenic Effects:

T61 Testicular tumors
T62 Prostate tumors
T63 Ovarian tumors
T64 Uterine tumors
T65 Transplacental tumorigenesis
T69 Other reproductive system tumors

Effects on Newborn:

T71 Stillbirth
T72 Live birth index (similar to T26, except measured after birth)
T73 Sex ratio
T74 Apgar score (human only)
T75 Viability index (e.g., # alive at day 4 per # born alive)
T76 Weaning or lactation index (e.g., # alive at weaning per # alive at day 4)
T77 Other neonatal measures or effects
T81 Growth statistics (e.g., reduced weight gain)
T82 Germ cell effects (in offspring)
T83 Biochemical and metabolic
T84 Drug dependence
T85 Behavioral
T86 Physical
T87 Other postnatal measures or effects
T91 Delayed effects

TABLE IV. ROUTES OF ADMINISTRATION TO, OR EXPOSURE OF, ANIMAL SPECIES TO TOXIC SUBSTANCES

Abbreviation	Route	Definition
eye	Eyes	Administration directly onto the surface of the eye; used exclusively for primary irritation data; see Ocular
ial	Intraaural	Administration into the ear
iat	Intraarterial	Administration into the artery
ice	Intracerebral	Administration into the cerebrum
icv	Intracervical	Administration into the cervix
idr	Intradermal	Administration within the dermis by hypodermic needle
idu	Intraduodenal	Administration into the duodenum
ihl	Inhalation	Inhalation in chamber, by cannulation, or though mask
imp	Implant	Placed surgically within the body location described in reference
ims	Intramuscular	Administration into the muscle by hypodermic needle
ipc	Intraplacental	Administration into the placenta
ipl	Intrapleural	Administration into the pleural cavity by hypodermic needle
ipr	Intraperitoneal	Administration into the peritoneal cavity
irn	Intrarenal	Administered into the kidney
isp	Intraspinal	Administration into the spinal canal
itr	Intratracheal	Administration into the trachea
itt	Intratesticular	Administration into the testes
iut	Intrauterine	Administration into the uterus
ivg	Intravaginal	Administration into the vagina
ivn	Intravenous	Administration directly into the vein by hypodermic needle
mul	Multiple	Administration by more than one route
ocu	Ocular	Administration directly onto the surface of the eye or into the conjunctival sac; used exclusively for systemic toxicity data; see Eyes
orl	Oral	Per os, intragastric, feeding, or introduction with drinking water
par	Parenteral	Administration into the body through the skin Reference cited is not specific concerning the route used; could be ipr, scu, ivn, ipl, ims, irn, or ice
rec	Rectal	Administration into the rectum or colon in the form of enema or suppository
scu	Subcutaneous	Administration under the skin
skn	Skin	Application directly onto the skin, either intact or abraded; used for both systemic toxicity and primary irritant effects
unr	Unreported	Dose, but not route, is specified in the reference

TABLE V. SPECIES

With Assumptions For Toxic Dose Calculation From Non-specific Data*

Abbrev.	Species	Age	Weight	Consumption Food gm/day	(Approx.) Water ml/day	1 ppm in Food Equals, in mg/kg/D	Approximate Gestation Period days
brd	Bird - domestic or laboratory bird not otherwise identified		1 kg				
bwd	Bird - wild bird species		40 gm				
cat	Cat, adult		2 kg	100	100	0.05	64 (59-68)
chd	Child	1-13 Y	20 kg				
ckn	Chicken, adult (male or female)	8 W	800 gm	140	200	0.175	
ctl	Cattle, horse		500 kg	10,000		0.02	284 (279-290)
dck	Duck, adult (domestic)	8 W	2,500 gm	250	500	0.1	
dog	Dog, adult	52 W	10 kg	250	500	0.025	62 (56-68)
dom	Domestic Animals - goat, sheep		60 kg	2,400		0.04	G: 152 (148-156) S: 146 (144-147)
frg	Frog, adult		33 gm				
gpg	Guinea pig, adult		500 gm	30	85	0.06	68
grb	Gerbil		100 gm	5	5	0.05	25 (24-26)
ham	Hamster	14 W	125 gm	15	10	0.12	16
hmn	Human	adult	70 kg				
hor	Horse, donkey		500 kg	10,000			H: 339 (333-345) D: 365
inf	Infant	0-1 Y	5 kg				
mam	Mammal - species unspecified		200 gm				
man	Man	adult	70 kg				
mky	Monkey	2.5 Y	5 kg	250	500	0.05	165
mus	Mouse	8 W	25 gm	3	5	0.12	21
nml	Non-mammalian species						
pgn	Pigeon	8 W	500 gm				
pig	Pig		60 kg	2,400		0.041	114 (112-115)
qal	Quail (laboratory)		160 gm				
rat	Rat, adult female	14 W	200 gm	10	20	0.05	22
rat	Rat, adult male	14 W	250 gm	15	25	0.06	
rat	Rat, adult, sex unspecified	14 W	200 gm	15	25		
rat	Rat, weanling	3 W	50 gm	15	25	0.3	
rbt	Rabbit, adult	12 W	2 kg	60	330	0.03	31
sql	Squirrel		500 gm				44
tod	Toad		100 gm				
trk	Turkey	18 W	5 kg				
wmn	Woman	adult	50 kg				270

*NOTE: Values given here are within reasonable limits usually found in the published literature and are selected to facilitate calculations for data from publiications in which toxic dose information has not been presented for an individual animal of the study. See, for example, Association of Food and Drug Officials, *Quarterly Bulletin*, volume 18, page 66, 1954, and Guyton, *American Journal of Physiology*, volume 150, page 75, 1947. Data for lifetime exposure are calculated from the assumptions for adult animals for the entire period of exposure. For definitive dose data, the reader must review the referenced publication.

TABLE VI. MASTER FILE DATA TYPES (POSITION 10)

CODE	DATA TYPE	DETAILED FILE DESCRIPTION FORMAT SECTION NUMBER
A	Prime Name	1
B	Cross Reference	1
C	Chemical Definition	1
D	CAS Registry Number	3
E	Update Field	2
F	Molecular Formula	5
G	RTECS® Number	6
H	Molecular Weight	4
J	Wiswesser Line Notation	7
L	Synonym	8
N	Compound Descriptor Code	9
P	Irritation Data	10, 16
Q	Mutation Data	11, 16
R	Reproductive Effects Data	12, 16
S	Tumorigenic Data	13, 16
T	Toxicity Data	14, 16
U	Other Multiple Dose Toxicity Data	15, 16
V	Reviews	17
W	Standards and Regulations	18
X	NIOSH Documentation and Surveillance Data	19
Y	ATSDR, EPA, NIOSH, NTP, AND OSHA Status	20

TABLE VII. LINE NUMBERS FOR "V", "W", "X", AND "Y" DATA

LINE #	DATA
V010-039	ACGIH TLV Data
V100-299	IARC Cancer Reviews
V300	IARC Cancer Review, Supplement 7
V800-899	Toxicology Review References
W100-110	DOT Hazardous Substances Data
W200	EPA Farm Worker Field Re-entry Data
W400-410	MSHA Standard Data
W500-510	OSHA PEL Data
W550	OSHA Cancer Suspect Agent
W600-699	International OELs
X500-510	NIOSH REL Data
X600	NOHS (1974)
X610	NOES (1983)
Y010-035	EPA Genetic Toxicology Program Data
Y050	EPA TSCA Chemical Inventory Status
Y100	EPA TSCA 8(a) assessment final rule
Y110	EPA TSCA 8(a) assessment proposed rule
Y140-149	EPA TSCA 8(e) submission status
Y160	EPA TSCA Test Submission (TSCATS) Status
Y200-210	NIOSH CIB status
Y250	NIOSH Manual of Analytical Methods Status
Y300-340	NTP Technical Reports
Y400	NTP Annual Report on Carcinogens
Y510-540	NTP Progress Reports
Y600	OSHA Analytical Methods Status

TABLE VIII. LINE MATRIX FOR RTECS® MUTATION DATA

	MMO	MNT	MMA	SLT	DNR	MRG	OTR	DND	DNS	DNI	PIC	BFA	CYT	SCE	SLN	DLT	MSC	HMA	SPM	TRN
SAT	002	004	006	008	010	012	014	016	018	020	022	024								
ESC	026	028	030	032	034	036	038	040	042	044	046	048								
BCS	050	052	054	056	058	060	062	064	066	068	070	072								
SRM	074	076	078	080	082	084	086	088	090	092	094	096								
KLP	098	100	102	104	106	108	110	112	114	116	118	120								
HMI	122	124	126	128	130	132	134	136	138	140	142	144								
OMI	146	148	150	152	154	156	158	160	162	164	166	168	169							
DMG		170	172	174	176	178	180	182	184	186	188	190	192	194	196	198				
DPO		200	202	204	206	208	210	212	214	216	218	220	222	224	226	228				
BRH	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	259				
NSC	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288					
SMC	290	292	294	296	298	300	302	304	306	308	310	312	314	316	318					
ASN	320	322	324	326	328	330	332	334	336	338	340	342	344	346	348					
CLR/SSP	350	352	354	356	358	360	362	364	366	368	370	372	374	376	378					
EUG	380	382	384	386	388	390	392	394	396	398	400	402	404	406	408	409				
SLW	410	412	414	416	418	420	422	424	426	428	430	432	434	436	438	439				
GRH	440	442	444	446	448	450	452	454	456	458	460	462	464	466	468					
OIN/SAL	470	472	474	476	478	480	482	484	486	488	490	492	494	496	498					
HMN		500		504	508	512	516	520	524	538	532	536	540	544	548		550	554	558	560
RAT		562		566	570	574	578	582	586	590	594	598	602	606	610	614	618	622	626	630
MUS		634	636	638	642	646	650	654	658	662	666	670	674	678	682	686	690	694	698	702
HAM		706		710	714	718	722	726	730	734	738	742	746	750	754	758	762	766	770	774
GPG		778		782	786	790	794	798	802	806	810	814	818	822	826	830	834	838	842	846
DOM/MKY		850		854	858	862	866	870	874	878	882	886	890	894	898	902	906	910	914	918
MAM		922		926	930	904	938	942	946	950	954	958	962	966	970	974	978	982	986	990

TABLE IX. LINE MATRIX FOR RTECS® REPRODUCTIVE EFFECTS DATA

	orl	ihl	skn	ipr	scu	ivn	ims	ipl	ocu	idr	ice	par	itr	imp	unr	ipc	itt	other
hmn	010	014	018	022	026	030	034	038	042	046	050	054	058	062	066	070	074	078
rat	080	084	088	092	096	100	104	108	112	116	120	124	128	132	136	140	144	148
mus	150	154	158	162	166	170	174	178	182	186	190	194	198	202	206	210	214	218
dog	220	224	228	232	236	240	244	248	252	256	260	264	268	272	276	280	284	288
mky	290	294	298	302	306	310	314	318	322	326	330	334	338	342	346	350	354	358
cat	360	364	368	372	376	380	384	388	392	396	400	404	408	412	416	420	424	428
rbt	430	434	438	442	446	450	454	458	462	466	470	474	478	482	486	490	494	498
pig	500	504	508	512	516	520	524	528	532	536	540	544	548	552	556	560	564	568
gpg	570	574	578	582	586	590	594	598	602	606	620	624	628	622	626	630	634	638
ham	640	644	648	652	656	660	664	668	672	676	680	684	688	692	696	700	704	708
grb	710	714	718	722	726	730	734	738	742	746	750	754	758	762	766	770	704	708
sql	780	784	788	792	796	800	804	808	812	816	820	824	848	832	836	840	844	848
dom	850	854	858	862	866	870	874	878	882	886	890	894	898	902	906	910	914	918
mam	920	924	928	932	936	940	944	948	952	956	960	964	968	972	976	980	984	988

Dom - Cattle, sheep, horse and other domestic mammals.
Mam - Any other unlisted, unspecified mammals.
Other - Intrarenal (irn), Intravaginal (ivg), Intracervical (icv), Intraduodenal (idu), Intraarterial (iat), Intraaural (ial).

TABLE X. LINE MATRIX FOR RTECS® LETHALITY DATA

	orl	ihl	skn	ipr	scu	ivn	ims	ipl	ocu	idr	ice	par	itr	imp	unr	rec	itn	eye	mul	other
man	010	012	014	016	018	020	022	024	026	028	030	032	034	036	038	040	042	044	046	048
rat	050	052	054	056	058	060	062	064	066	068	070	072	074	076	078	080	082	084	086	088
mus	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138
dog	150	152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182	184	186	188
mky	200	202	204	206	208	210	212	214	216	218	220	222	224	226	228	230	232	234	236	238
cat	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288
rbt	300	302	304	306	308	310	312	314	316	318	320	322	324	326	328	330	332	334	336	338
pig	350	352	354	356	358	360	362	364	366	368	370	372	374	376	378	380	382	384	386	388
gpg	400	402	404	406	408	410	412	414	416	418	420	422	424	426	428	430	432	434	436	438
ham	450	452	454	456	458	460	462	464	466	468	470	472	474	476	478	480	482	484	486	488
pgn	500	502	504	506	508	510	512	514	516	518	520	522	524	526	528	530	532	534	536	538
ckn	550	552	554	556	558	560	562	564	566	568	570	572	574	576	578	580	582	584	586	588
qal	600	602	604	606	608	610	612	614	616	618	620	622	624	626	628	630	632	634	636	638
grb	650	652	654	656	658	660	662	664	666	668	670	672	674	676	678	680	682	684	686	688
sql	700	702	704	706	708	710	712	714	716	718	720	722	724	726	728	730	732	734	746	738
dck	740	742	744	746	768	750	752	754	756	758	760	762	764	766	768	770	772	774	776	778
frg	780	782	784	786	788	790	792	794	796	798	800	802	804	806	808	810	812	814	816	818
trk	820	822	824	826	828	830	832	834	836	838	840	842	844	846	848	850	852	854	856	858
dom	860	862	864	866	868	870	872	874	876	878	880	882	884	886	888	890	892	894	896	898
mam	900	902	904	906	908	910	912	914	916	918	920	922	924	926	928	930	932	934	936	938
bwd	940	042	044	046	948	950	952	954	956	958	960	962	964	966	968	970	972	974	976	978
brd	940	942	944	946	948	950	952	954	956	958	960	962	964	966	968	970	972	974	976	978

Dom - cattle (ctl), sheep, horse, and other domestic mammals.
Mam - mammal - any other unlisted or unspecified mammal.
Other route - intrarenal (irn), intravaginal (ivg), intracervical (icv), intraplacental (ipc), intraduodenal (idu).
Toxic effects go on odd numbered lines.

FIGURE 1.

A TYPICAL RTECS® RECORD LAYOUT IN COMPUTER TAPE FORMAT: PHENOL

SU4980000A010PHENOL
SU4980000D010000108992
SU4980000E0109203
SU4980000F010C6-H6-O
SU4980000G010SJ3325000
SU4980000H01094.12
SU4980000J010GR
SU4980000L030ACIDE CARBOLIQUE (French)
SU4980000L050BAKER'S P AND S LIQUID AND OINTMENT
SU4980000L070BENZENOL
SU4980000L100CARBOLIC ACID
SU4980000L120CARBOLIC ACID (DOT)
SU4980000L123CARBOLSAURE (German)
SU4980000L130FENOL (Dutch, Polish)
SU4980000L160FENOLO (Italian)
SU4980000L200HYDROXYBENZENE
SU4980000L300MONOHYDROXYBENZENE
SU4980000L310MONOPHENOL
SU4980000L340NA 2821 (DOT)
SU4980000L350NCI-C50124
SU4980000L400OXYBENZENE
SU4980000L500PHENIC ACID
SU4980000L540PHENOL (ACGIH,DOT,OSHA)
SU4980000L545PHENOL ALCOHOL
SU4980000L555PHENOL, molten (DOT)
SU3980000L560PHENOLE (German)
SU4980000L600PHENYL HYDRATE
SU4980000L700PHENYL HYDROXIDE
SU4980000L800PHENYLIC ACID
SU4980000L900PHENYLIC ALCOHOL
SU4980000L920RCRA MASTER NUMBER U188
SU4980000L940UN 1671 (DOT)
SU4980000L945UN2312 (DOT)
SU4980000L950UN2812 (D0T)
SU4980000N010A
SU4980000N020C
SU4980000N050M
SU4980000N060T
SU4980000N100S
SU4980000P303skn-rbt 500 mg/24H SEV — BIOFX* 27-4/73
SU4980000P304skn-rbt 535 mg open SEV — UCDS** 1/6/66
SU4980000P305skn-rbt 100 mg MLD — KSGZA3 33,518,80
SU4980000P334eye-rbt 5 mg SEV — UCDS** 1/6/66
SU4980000P335eye-rbt 5 mg/30S rinse MLD — TXCYAC 23,281,82
SU4980000Q006mma-sat 40 μmol/plate — MUREAV 90,91,81
SU4980000Q197sln-dmg:ovr 100 ppm — NATUAS 157,162,46
SU4980000Q330mrc-asn 15 μmol/L — MUTAEX 2,235,87
SU4980000Q494cyt-ofs-mul 300 nL/L — JFIBA9 26,13,85
SU4980000Q528oms-hmn:hla 17 mg/L — WATRAG 19,677,85
SU4980000Q530dni-hmn:hla 1 mmol/L — SAIGBL 16,453,74
SU4980000Q532oms-hmn:lym 5 μmol/L — CNREA8 45,2471,85
SU4980000Q545sce-hmn:lym 5 μmol/L — CNREA8 45,2471,85
SU4980000Q586dns-rat-orl 4 gm/kg — JJIND8 74,1283,85
SU4980000Q634mnt-mus-orl 265 mg/kg — MUREAV 208,61,88
SU4980000Q635mnt-mus-ipr 265 mg/kg — MUREAV 208,61,88
SU4980000Q637mma-mus:lym 300 mg/L — SCIEAS 236,933,87

FIGURE 1. A TYPICAL RTECS® RECORD LAYOUT IN COMPUTER TAPE FORMAT: PHENOL (Continued)

SU4980000Q654dnd-mus:lym 1500 μmol/L		MUREAV 203,155,88
SU4980000Q662dni-mus-orl 20 gm/kg		ARGEAR 51,605,81
SU4980000Q663dni-mus:lym 800 μmol/L		MOPMA3 28,560,85
SU4980000Q664oms-mus:oth 2500 μmol/L		CBT0E2 2,231,86
SU4980000Q690msc-mus:lym 1890 μmol/L		MUTAEX 3,193,88
SU4980000Q706mnt-ham:lng 4 mmol/L		EVHPAZ 82,81,89
SU4980000Q734dni-ham:lng 1900 μmol/L		MUTAEX 3,51,88
SU4980000Q746cyt-ham:ovr 2 gm/L		SCIEAS 236,933,87
SU4980000Q750sce-ham:ovr 300 mg/L		SCIEAS 236,933,87
SU4980000Q943dnd-mam:lym 250 mmol/L		PNASA6 48,686,62
SU4980000Q950oms-rbt:bmr 250 mmol/L		AJIMD8 7,485,85
SU4980000R0801T25	orl-rat TDLo:300 mg/kg (6-15D preg)	NTIS** PB83-247726
SU4980000R0811T34	orl-rat TDLo:1200 mg/kg (6-15D preg)	NTIS** PB83-247726
SU4980000R0921T34	ipr-rat TDLo:600 mg/kg (12-14D preg)	TXAPA9 19,373,71
SU4980000R1502T25T35	orl-mus TDLo:2300 mg/kg (6-15D preg)	NTIS** PB85-104461
SU4980000R1511T34	orl-mus TDLo:2600 mg/kg (6-15D preg)	NTIS** PB85-104461
SU4980000R1521T46	orl-mus TDLo:4 gm/kg (6-15D preg)	NTIS** PB85-104461
SU4980000R1532T34T43	orl-mus TDLo:2800 mg/kg (6-15D preg)	TJADAB 33,92C,86
SU4980000S1052V01R60	skn-mus TDLo:16 gm/kg/40W/I	CNREA8 19,413,59
SU4980000S9902V02R60	skn-mus TD :4000 mg/kg/24W/I	CNREA8 19,413,59
SU4980000T0092F18J24	orl-inf LDLo:10 mg/kg	34ZIAG -,463,69
SU4980000T0102F18J24	orl-hmn LDLo:14 gm/kg	34ZIAG -.463,69
SU4980000T0112F08R20	orl-hmn LDLo:140 mg/kg	29ZWAE -,329,68
SU4980000T0501F12	orl-rat LD50:317 mg/kg	PSEBAA 32,592,35
SU4980000T052	ihl-rat LCro:316 mg/m^3	GSIAAA 41(6),103,76
SU4980000T0543F11M14R13	skn-rat LD50:669 mg/kg	BJIMAG 27,155,70
SU4980000T056	ipr-rat LD50:127 mg/kg	FCTOD7 22,665,84
SU4980000T058	scu-rat LD50:460 mg/kg	TOIZAG 10,1,63
SU4980000T100	orl-mus LD50:270 mg/kg	GISAAA 38(8),6,73
SU4980000T102	ihl-mus LC50:177 mg/kg	GISAAA 41(6),103,76
SU4980000T106	ipr-mus LD50:180 mg/kg	PNMCAA 10, 172,68
SU4980000T108	scu-mus LD50:344 mg/kg	INHEAO 5,143,67
SU4980000T1101F11	ivn-mus LD50:112 mg/kg	QJPPAL 12,212,39
SU4980000T150	orl-dog LDLo:500 mg/kg	HBAMAK 4,1319,35
SU4980000T178	unr-dog LDLo:200 mg/kg	RMSRA6 15,561,1895
SU4980000T250	orl-cat LDLo:80 mg/kg	HBAMAK 4,1319,35
SU4980000T258	scu-cat LDLo:80 mg/kg	JPETAB 80,233,44
SU4980000T278	unr-cat LDLo;250 mg/kg	RMSRA6 15,561,1895
SU4980000T300	orl-rbt LDLo:420 mg/kg	JPRTAB 80,233,44
SU4980000T3042R10U01	skn-rbt LD50:850 mg/kg	AIHAAP 37,596,76
SU4980000T306	ipr-rbt LDLo:620 mg/kg	JPETAB 80,233,44
SU4980000T308	scu-rbt LDLo:620 mg/kg	JPETAB 80,233,44
SU4980000T310	ivn-rbt LDLo:180 mg/kg	JPETAB 80,233,44
SU4980000T328	unr-rbt LDLo:150 mg/kg	RMSRA6 15,561,1895
SU4980000T406	ipr-gpg LDLo:300 mg/kg	HBTXAC 1,228,55
SU4980000T408	scu-gpg LDLo:450 mg/kg	HBTXAC 1,228,55
SU4980000T788	scu-frg LDLO;75 mg/kg	HBAMAK 4,1319,35
SU4980000T8023C06F12G30	par-frg LDLo:290 mg/kg	AEPPAE 166,437,32
SU4980000T808	scu-frg LDLo:290 mg/kg	HBTXAC 1,228,55
SU4980000T906	ihl-mam LC50:74 mg/kg	GTPZAB 19(8),37,75
SU4980000V039ACGIH TLV-TWO 5 ppm (skin)		85INA8 5,469,86
SU4980000V200IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE		IMEMDT 47,263,89
SU4980000V210IARC CANCER REVIEW:HUMAN INADEQUATE EVIDENCE		IMEMDT 47,263,89
SU4980000V300IARC CANCER REVIEW:GROUP 3		IMEMDT 47,263,89
SU4980000V850TOXICOLOGY REVIEW		CMTVAS 10(3),49,73
SU4980000V851TOXICOLOGY REVIEW		JIHTAB 32,146,49
SU4980000V852TOXICOLOGY REVIEW		MUREAV 47,75,78

FIGURE 1. A TYPICAL RTECS® RECORD LAYOUT IN COMPUTER TAPE FORMAT: PHENOL (Continued)

SU4980000V853TOXICOLOGY REVIEW	FNSCA6 2,67,73
SU4980000V854TOXICOLOGY REVIEW	ZKKOBW 78,99,72
SU4980000W100DOT-HAZARD:POISON B: LABEL:POISON	CFRGBR 49,172.101,88
SU4980000W200EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION	FEREAC 54,4388,89
SU4980000W400MSHA STANDARD-air:TWA 5 ppm (19 mg/m^3) (skin)	DTLVS* 3,203,71
SU4980000W500OSHA PEL:8H TWA 5 ppm (19 mg/m^3)(skin)	FEREAC 54,2923,89
SU4980000W510OSHA PEL FINAL:8H TWA 5 ppm (19 mg/m^3)(skin)	FEREAC 54,2923,89
SU4980000X500NIOSH REL to PHENOL-air:10H TWA 20 mg/m^3;CL 60 mg/m^3/15M DHHS** 92-100	
SU4980000X600NOHS 1974: HZD 5546; NIS 185; TNF 23275; NOS 127; TNE 296662	
SU4980000X610NOES 1983: HZD 5546; NIS 229; TNF 31983; NOS 155; TNE 584372; TFE 120977	
SU4980000Y004ATSDR TOXICOLOGY PROFILE (NTIS** PB/90/181249/AS)	
SU4980000Y010EPA GENETOX PROGRAM 1988 Negative: N crassa-reversion	
SU4980000Y050EPA TSCA CHEMICAL INVENTORY, JUNE 1990	
SU4980000Y150On EPA IRIS database	
SU4980000y160EPA TSCA TEST SUBMISSION (TSCATS) database, JANUARY 1992	
SU4980000Y250NIOSH ANALYTICAL METHODS: see PHENOL, 3502; PHENOL and p-CRESOL in urine,8305	
SU4980000Y330NCI CARCINOGENESIS BIOASSAY(ORAL);NO EVIVENCE MOUSE,RAT NCITR* NCI-TR-203,80	
SU4980000Y600OSHA ANALYTICAL METHOD #32	