Attachment 4-2

Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)

Eco-SSL Standard Operating Procedure (SOP) # 3: Wildlife Toxicity Reference Value Literature Search and Retrieval

OSWER Directive 92857-55

November 2003

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Attachment 4-2
Ecological Soil Screening Levels (Eco-SSLs)
Standard Operating Procedure (SOP) #3: Wildlife Toxicity Reference Value Literature Search

Version 1.2

Prepared for AFCEE

by

T N & Associates, Inc.
Oak Ridge, Tennessee
under contract HF41624-97-D-8201
Delivery Order #0004

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FINAL DRAFT

Standard Operating Procedure 1

Acquisition of Literature to Support the Development of Toxicity Reference Values for Wildlife

Version 1.2

January 2000

Prepared by
T N & Associates, Inc.
Oak Ridge, Tennessee
for
EPA/AFCEE
under contract HF41624-97-D-8201
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Doris Anders	US Air Force
Janet Burris	ISSI Consulting Group, Inc.
David Charters	USEPA Emergency Response Team (ERT)
June Crowe	T N & Associates
Anne Fairbrother	EP&T, Inc.
Kinzie Gordon	Parsons Engineering Science
Dale Hoff	USEPA
Rosemary Holdsworth	T N & Associates
Mark Johnson	US Army CHPPM
Jackie Little	T N & Associates
Drew Rak	US Army Corps of Engineers
Chris Russom	USEPA MED-Duluth
Brad Sample	CH2M Hill
Julie Yamamoto	California EPA- Office of Environ. Health Hazard Assessment

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ACRONYMS AND ABBREVIATIONS

AGRICOLA	Agricultural OnLine Access
ATSDR	Agency for Toxic Substances and Disease Registry
BIOSIS	Toxicological Aspects of Environmental Health
CARA	Chemical Assessments and Related Activities
CAS	Chemical Abstract Service
CD-ROM	Compact disk-read only memory
ChemID	Chemical Identification
CIS	Chemical Information Systems
CRISP	Toxicology Research Projects
EcoSSL	Ecological Soil Screening Level
EPA	U.S. Environmental Protection Agency
FEDRIP	Federal Research in Progress
FTP	File Transfer Protocol
FWS	U.S. Fish and Wildlife Service
HSDB	Hazardous Substance Databank
IGM	Internet Grateful Med
IRIS	Integrated Risk Information System
KWIC	Keywords in Context
MESH	Medical Subject Headings
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NISC	National Information Services Corporation
NLM	National Library of Medicine
NTIS	National Technical Information Service
OERR	EPA Office of Emergency and Remedial Response
OHEA	Office of Health and Environmental Assessment
ORNL	Oak Ridge National Laboratory
RTECS	Registry of Toxic Effects of Chemical Substances
SIS	Specialized Information Services
SOP	Standard Operating Procedure
SSL	Soil Screening Level
TEHIP	Toxicology and Environmental Health Information Program
TRV	Toxicity Reference Value
Web	World Wide Web

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1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP), hereafter referred to as SOP1, *Acquisition of Literature to Support the Development of Toxicity Reference Values (TRVs) for Wildlife*, provides direction for the retrieval of toxicological literature. The toxicological literature will be used in the development of TRVs for birds, mammals, reptiles, and amphibians. However, the scope of this SOP is limited to toxicological literature retrieval from electronic databases and hardcopy sources.

2.0 OVERVIEW

The U.S. Environmental Protections Agency (EPA) developed *Soil Screening Guidance (EPA/540/R-96/018)* to accelerate and standardize the cleanup of contaminated soils at sites on the National Priorities List. This document describes a method for calculating soil screening levels (SSLs) for chemicals in soil. SSLs are site-specific risk-based concentrations that may be used to define areas of a site that do not require further study or action. SSLs are calculated to be protective of human health and do not address the protection of ecological receptors. To address the lack of SSLs protective of wildlife, the EPA Office of Emergency and Remedial Response (OERR) initiated the development of ecological SSLs (EcoSSLs), which are concentrations of chemicals in soil that are calculated to be protective of wildlife receptors. Initially, generic EcoSSLs will be developed and presented in an EPA guidance document as a reference table. Site-specific EcoSSLs will be developed at a later date. TRVs are derived from dose-response studies of the toxicity of chemicals to animal receptors and will be used as input to derive EcoSSL values.

A literature search is conducted to obtain information on contaminants of concern, their potential ecological effects, and species of concern (*Ecological Risk Assessment Guidance for Superfund*, EPA 1997). The literature search strategy presented in SOP1 is designed to facilitate the search, preliminary review, and acquisition of literature for developing TRVs. The flowchart in Appendix A summarizes this procedure.

3.0 PERSONNEL REQUIREMENTS

SOP1 presents the information necessary to perform a literature search and review the literature retrieved; however, specialists should be consulted regarding various aspects of the procedure. A research librarian with a specialization in technical information and experience in performing scientific literature searches should be consulted to develop the search strategy (see Section 5.3). A chemist should be consulted for review of specific chemical synonyms (see Section 5.1). A toxicologist should assess the abstracts and publications retrieved from the literature search for their suitability for TRV development (see Section 5.5.1).

4.0 DATABASE SELECTION

The following background information briefly describes the more commonly used electronic databases and nonelectronic sources of ecotoxicity data.

4.1 ELECTRONIC DATABASES AND PROVIDERS

The databases described in this section may be accessed via the World Wide Web (Web), dial-up modem, directly from the provider, and/or through a commercial information vendor. Some of the databases may be accessed without charge via the Web; however, there may be certain search limitations or restrictions. Individuals using these databases will need to obtain information and training concerning use of the various search systems.

The databases described below are grouped according to the information vendor, and instructions for obtaining access are provided. Database vendors include the DIALOG Corporation, the National Library of Medicine (NLM), EPA, Chemical Information Systems (CIS), and the National Information Services Corporation (NISC).

4.1.1 DIALOG

DIALOG offers more than 450 databases from a broad range of disciplines (e.g., chemistry, environment, science, technology, patents and trademarks, worldwide company information, and domestic and international news). See Appendix B for file descriptions and contents. File selection can be accomplished by using their Dialindex feature or by using a "OneSearch" strategy or a combination of these. Although much of the toxicological literature can be found in BIOSIS (File 5), MEDLINE (File 155), and TOXLINE (156), the following additional databases contain toxicological information:

- AGRICOLA (Agricultural OnLine Access) (File 10)
- AGRIS International (File 203)
- CAB Abstracts (File 50)
- CA Search (Chemical Abstracts) (File 399)
- CHEMTOX Online (File 337)
- Conference Papers Index (File 77)
- Dissertation Abstracts (File 35)
- Enviroline (File 40)
- Environmental Bibliography (File 68)
- Life Sciences Collection (File 76)
- NTIS (National Technical Information Service) (File 6)
- Pollution Abstracts (File 41)
- RTECS (Registry of Toxic Effects of Chemical Substances) (File 336)
- Science (File 370)
- Wilson Biological and Agricultural Index (File 143)
- Zoological Record (File 185)
- Pascal (File 144)
- SciSearch (File 434)

The OneSearch strategy in DIALOG allows up to 60 files to be searched simultaneously. This is advantageous because the "*remove duplicates*" command can be utilized to remove the majority of duplicate records from all the files. It is recommended that Files 68, 336, 337, 370, 143, and

144 not initially be used in the OneSearch strategy but rather be added as needed. Some chemical and receptor combinations do not have a large body of toxicological literature, and these files may be helpful in exhausting all the possible sources of information available on DIALOG. File 144 contains many foreign language publications, many of which have been translated from English originals. Therefore, the user should be aware that some of these records may be duplicates of English language papers retrieved from other files. File 336 is useful only as a source for background information on a particular chemical, not as a primary source of toxicological studies. Science Citation Index (File 434) is another database that could be used to expand the initial search. This source is further discussed in section 4.2.5.

DIALOG can be accessed via the Web at http://www.dialog.com and via modem using a telecommunications system. Additionally, selected databases are available on compact disk–read only memory (CD–ROM) through subscription. Information on pricing and access is available from the Web address or from The Dialog Corporation, U.S. Headquarters, 11000 Regency Parkway, Suite 400, Cary, NC 27511; telephone (919) 462-8600.

4.1.2 National Library of Medicine

The Specialized Information Services (SIS) Division of NLM is responsible for information coverage and services for several topics, including toxicology and environmental health, and directories to other information resources related to health and biomedicine. The SIS Division's Toxicology and Environmental Health Information Program (TEHIP) responds to information queries and develops interactive retrieval services in toxicology, environmental health, and other health-related areas. The SIS TEHIP online databases that contain toxicology information include TOXNET, TOXLINE, and Chemical Identification (ChemID). These databases are described below.

- TOXNET is a computerized system of files from which toxicological and related information may be obtained (see Appendix B for file descriptions and contents). TOXNET provides a free Web-based interface. The Hazardous Substances Databank (HSDB) and Integrated Risk Information System (IRIS) files in this system may be useful for their bibliographies. TOXNET files can be accessed without charge on the Web at http://sis.nlm.nih.gov. The Web interface provides an approach to searching files of varying formats and contents, and toxicology data and literature references on particular chemicals can be extracted from these files. Alternately, a search may be performed using subject terms to identify chemicals that cause certain effects. A variety of display options is available, including sending results by e-mail or FTP (File Transfer Protocol).

- The TOXLINE database produced by NLM contains more than 2 million bibliographic references including journal publications, letters to the editor, meeting abstracts, meeting papers, meeting reports, monographs, technical reports, theses, and research in progress. Subjects covered include pharmacological, biochemical, physiological, and toxicological effects of drugs, other chemicals, physical stressors, and biological agents. TOXLINE is updated monthly. Records in the Toxicology Research Projects (CRISP) and Federal Research in Progress (FEDRIP) subfiles in this system are not useful because they describe studies in progress and may not have been completed or peer reviewed.

TOXLINE can be accessed online without charge through NLM's Internet Grateful Med (IGM) search system (http://igm.nlm.nih.gov). TOXLINE searching through IGM is somewhat restricted in that search statements are limited by the number of terms that can be entered at one time. TOXLINE can be searched as a single file (File 156) (i.e., pre-1965–present) via DIALOG.

- ChemID is a database available from NLM via the IGM Web interface. ChemID is a chemical dictionary file of more than 339,000 compounds of biomedical and regulatory interest. Records include Chemical Abstract Service (CAS) registry numbers and other identifying numbers, molecular formulae, generic names, synonyms, MESH (Medical Subject Headings), and file locators that lead users to other files available through NLM.

4.1.3 Environmental Protection Agency

The ECOTOX Database System produced by EPA is a source of toxicity data for aquatic life, terrestrial plants, and wildlife. This system integrates three toxicology effects databases: AQUIRE (aquatic life), PHYTOTOX (terrestrial plants), and TERRETOX (terrestrial wildlife). TERRETOX contains 40,000 records related to the toxic effects of 1300 chemical substances on terrestrial animals, primarily mammals and birds. The subjects covered include chemical name identification, toxicology, test conditions, species identification, CAS numbers, assay results/analyses, and environmental effects.

The ACQUIRE database in ECOTOX can be accessed without charge at http://www.epa.gov/ecotox/. PHYTOTOX and TERRATOX are currently unavailable on the ECOTOX system; however, CIS, a commercial vendor, provides access to all three databases.

4.1.4 Chemical Information Systems

CIS is a commercial provider of the Oxford Molecular Group, Inc. CIS provides access to a number of databases including EPA's AQUIRE, PHYTOTOX, and TERRATOX. Access is available via dial-up modem. Questions regarding CIS should be directed to CIS User Support, Chemical Information Systems, 810 Gleneagle Court, Suite 300, Towson, MD 21286; telephone (800) CIS-USER. Product information may be accessed at http://www.oxmol.com/prods/cis/.

4.1.5 National Information Services Corporation

Wildlife Worldwide Index provides access to more than 345,000 records regarding wild mammals, birds, reptiles, and amphibians. Subject coverage includes all aspects of wildlife and wildlife management. This database can be accessed via BiblioLine, an online service at http://www.nisc.com, or by contacting NISC International, Inc., 3100 St. Paul Street, Baltimore, MD 21218; telephone (410) 243-1198.

4.2 OTHER DATABASES AND HARDCOPY SOURCES

The following sources may also be examined for toxicological information and references.

4.2.1 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (FWS) has published several contaminant-specific documents listing toxicological data on terrestrial, avian, and aquatic wildlife (e.g., those studies produced by Eisler, R. 1985). The FWS maintains a bibliographic database that is available online at http://FA.R9.FWS.gov/R9fwrs/Dbinfo.htm.

4.2.2 Agency for Toxic Substances and Disease Registry

The Agency for Toxic Substances and Disease Registry (ATSDR) has produced toxicological profiles (e.g., *Toxicological Profile for RDX*) (ATSDR 1995) for hazardous substances that are most commonly found at Superfund sites (e.g., ATSDR 1993). ATSDR records are available online at http://atsdr.cdc.gov/toxpro2.html.

4.2.3 Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) provides toxicological information on wildlife receptors in *Toxicological Benchmarks for Wildlife*: *1996 Revision* (ORNL 1996). ORNL records are available online at http://www.hsrd.gov/ecorisk/tm86r3.

4.2.4 Environmental Protection Agency

The *Wildlife Exposure Factors Handbook* (EPA 1993a,b) provides information and guidance for conducting exposure assessments for wildlife species exposed to toxic chemicals in the environment. Included is information on exposure factors (e.g., body weight, dietary composition, food ingestion rates, home range, etc.) for 34 selected wildlife species. The *Handbook* can be viewed at http://www.epa.gov/nceawww1/wefh.htm.

EPA-sponsored health effects documents are maintained in the *Chemical Assessments and Related Activities* (CARA) list (EPA 1994) produced by the Office of Health and Environmental Assessment (OHEA). CARA is an alphabetical file of chemicals and projects and lists the types of documents available, the OHEA offices responsible for producing the documents, the names of the client offices, and other publication information. CARA covers the period from 1980–1994. Documents listed in CARA include the following:

- Air Quality Criteria Documents
- Ambient Water Quality Criteria Documents
- Drinking Water Quality Criteria
- Exposure Assessments
- Health Assessment Documents
- Health Effects Assessments
- Health and Environmental Effects Documents
- Health and Environmental Effects Profiles
- Risk Assessments

4.2.5 Science Citation Index

The manual or electronic version of *Science Citation Index* is a useful resource, especially if more information for a particular chemical is needed to expand a search that has produced only a few retrievals. This database, produced by the Institute for Scientific Information, indexes 5300 major journals in science. The electronic version includes many minor journals and also includes abstracts. This tool is invaluable for updating searches.

4.2.6 Amphibian and Reptile Contamination and Toxicology Bibliography

The Amphibian and Reptile Contamination and Toxicology Bibliography is a useful Internet resource for amphibian and reptile toxicological literature. The file is located at http://www.cciw.ca/green-lane/herptox/ and is frequently updated.

5.0 LITERATURE SEARCH PROCEDURE

Sections 5.1 through 5.6 present the information required and the sequence of events necessary to execute a literature search and the subsequent screening process using the DIALOG system (refer to the flow chart in Appendix A). An example search is provided in Appendix C.

5.1 CHEMICAL NAME, SYNONYMS, AND CAS NUMBER IDENTIFICATION

The CAS registry number for the chemical of interest must be identified. Organic chemical nomenclature has undergone many revisions, and some compounds have several common names (synonyms), and in some instances many trade names, but the use of the CAS number provides positive identification for each particular chemical. CAS numbers appear in the format "nnnnn-nn-n," and the hyphens must be included when the DIALOG system is searched. Both CAS numbers and common names should be used to search DIALOG databases even though some files are not indexed by CAS number. Use of the root name of the parent compound captures most of the relevant publications. For example, use of the term "cadmium" captures "cadmium chloride," "cadmium acetate," etc. A list of recommended chemical terms, synonyms, and CAS numbers is presented in Appendix D.

Truncation of some terms is necessary to identify all variations of an element. For example, a search for copper should include "copper," its CAS number (7440-50-8), "cupr," and all of the CAS numbers listed for copper compounds listed in Appendix D. A search for an organic compound should include the common name, CAS number, and all synonyms. For example, a search for Dieldrin should include "dieldrin," its CAS number (60-57-1), and its synonyms (e.g., alvit, dieldrix, heod, etc.).

Searches containing truncations should be tested in a preliminary file before the search is performed because using the truncated term may retrieve more extraneous studies than if the term were actually spelled out in its various forms. For example, truncating chromium (chrom*) will retrieve numerous unrelated studies such as those for chromosome and chromatography.

CAS numbers and synonyms for chemicals not included in Appendix D may be obtained from printed sources such as *Sax's Dangerous Properties of Industrial Materials*, *The Merck Index*, *Patty's Industrial Hygiene & Toxicology*, *Handbook of Toxic & Hazardous Chemicals and Carcinogens*, the *Handbook of Environmental Data on Organic Chemicals*, the *Sigma* catalog of biochemicals and reagents, and the *Aldrich* catalog of fine chemicals. CAS numbers and synonyms can also be obtained from electronic databases available on the Web (e.g., ChemID) or from commercial vendors (e.g., DIALOG). The Internet is also an excellent source for the online versions of chemical catalogs and related chemical Web sites.

A chemist should review the results of the synonym search to ensure that it is fully inclusive and that the search queries for the metallic and other elements are constructed accurately. For example, the metallic element chromium may be identified in the literature as chromium, chromic, dichromate, chromate, chrome, Cr, Cr(III), or Cr(VI). The metallo-organic complexes, where they are known to exist (e.g., methylmercury) and all the valence states of metallic elements (e.g., "ferric" and "ferrous" for iron) should be included in a search. The CAS numbers of simple salts should be added to the search strategy for metallic elements [e.g., aluminum chloride (CAS No. 7446-70-0) and aluminum sulfate (CAS No. 16828-11-8)]. To retrieve all information for a compound such as phenol, incorporate CAS numbers for sodium phenate, potassium phenate, and phenol into the search strategy. It is essential that all synonyms in common usage for a chemical are used in the search strategy to provide an inclusive search.

5.2 RECOMMENDED RECEPTOR GROUPS

The terms in the recommended list presented below have proven to be the most useful in retrieving toxicological studies for both laboratory and wildlife receptors. Additional species-specific receptor terms can be added to address site-specific concerns. The recommended list for wild mammals includes all the major families found in the continental United States with the exception of bats, seals, and manatees. To avoid duplication of effort with the laboratory mammal search (which includes the terms rat, rats, mice, mouse), the family Muridae was omitted from the recommended list for the wild mammal receptors because most of the search results would come from the sub-family Murinae. Two sub-families, Sigmodontinae and Arvicolinae, and genera belonging to these sub-families, as well as some common names for members of the genera have been included in the recommended list for wild mammals. These terms will retrieve publications for the wildlife members of the family Muridae.

Common names have been included in the recommended list where testing has shown that their inclusion increased the number of literature retrievals for a family (e.g., *opossum, beaver*). When common names did not increase the total number of retrievals, they were not retained in the receptor list. The common names *cat* and *dog* were included in the recommended list for wild mammal receptors rather than in the laboratory mammal receptor list. The terms aves, avian, bird, waterfowl, waterbird, and songbird were included to broaden the strategy for the avian receptor search. Each of these terms was tested and resulted in more retrievals for wild birds.

Recommended Receptor List

Avian Receptors

chicken	quail	duck
duckling	ducks	mallard
Japanese quail	coturnix	gallus domesticus
platyrhyn*	anas	songbird
bobwhite	waterbird	waterfowl
aves	avian	bird

Laboratory Mammals

rat	rats	mouse
mice	hamster	guinea pig
monkey	rabbit	

Wild Mammals

Didelphidae	Soricidae	Talpidae
Dasypodidae	Ochotonidae	Leporidae
Aplodontidae	Sciuridae	Geomyidae
Heteromyidae	Castoridae	Arvicolinae
Dipodidae	Erethizontidae	Myocastoridae
Canidae	Ursidae	Procyonidae
Mustelidae	Felidae	Equidae
Suidae	Dicotylidae	Cervidae
Antilocapridae	Bovidae	Sigmodontinae
Harvest mice	Harvest mouse	Microtus
Peromyscus	Reithrodontomys	Onychomys
Sigmodon	vole	lemming
cat	dog	bear
opossum	beaver	weasel
skunk	marten	badger
ferret	mink	

Amphibians and Reptiles

amphibian	frog	salamander
newt	toad	reptile
crocodile	alligator	caiman
snake	lizard	turtle
tortoise	terrapin	

*Denotes the term is truncated

5.3 SEARCH STRATEGY DEVELOPMENT

When performing a literature search, it is important that the search be sufficiently broad to retrieve all relevant literature but not so broad that an undue number of unrelated records are retrieved. It is recommended that a preliminary search be performed in one or two database files for each chemical and receptor group combination before the strategy is executed in all files. Broad search strategies may need to be further refined to exclude as much irrelevant material as possible, whereas narrow search strategies may need to be expanded to capture more relevant studies. A review of the output of the preliminary search will indicate the necessity of using additional terms, exclusion terms, or truncations to focus the search.

The following search strategy example is constructed for use in the DIALOG search system.

Step 1: Identify and test the chemical name, synonyms, and CAS numbers and search the relevant databases in DIALOG listed in Section 4.1.1 to determine the total number of retrievals for the chemical. Appropriate synonyms should be included because not all files support CAS numbers. The proximity connector "***or***" should be used to connect search terms within a specific category of information, as illustrated below:

cobalt ***or*** RN=7740-48-4 ***or*** RN=7646-79-9

Step 2: Perform a preliminary test search. Test the terms and truncations in one or two files and remove those that do not retrieve any records. Files 5, 155 and 156 are suggested for this preliminary search.

Step 3: Combine the total number of chemical retrievals with a particular receptor group. The two categories are connected by the proximity connector "***and***". For example, combine the results of Step 1 with the following:

and(rat or rats or mouse or mice or hamster? or (guinea()pig?) or monkey? or rabbit?)

Step 4: Focus the search by combining the results of Step 3 with the following toxicological terms: Note that the asterisks denote where the word was truncated.

- reproduc*
- systemic
- development*
- histology
- growth
- neurological
- behav*
- mortal*
- lethal*
- diet

- dietary
- surviv*
- drinking()water

In DIALOG, the symbol for the question mark (?) is used to permit variations in word length or spelling. For example, "reproduction" when truncated to "reproduc?" will also capture terms such as "reproductive," "reproducing," "reproduce," or "reproduction." Combine the results of the previous searches with the toxicological terms as shown below:

and (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv? or (drinking()water))

Step 5: Focus the search with exclusion terms. Exclusion statements must be carefully constructed to ensure that relevant papers are not excluded. For example, the exclusion statement *not tumo?* may exclude publications that contain information about non-cancer endpoints as well as the carcinogenic effect that is the main subject of the document. In DIALOG, the use of the limiting connector "***not***" will eliminate records that contain terms that are not desired. Some recommended general exclusion terms are:

- human*
- vitro
- culture*
- inhalation
- subcutaneous
- inject*
- gene
- carcin*
- cancer*
- tumo*

The use of the "***not***" connector for these searches is limited to the title and descriptor fields to ensure that relevant articles are not eliminated from the search. However, in an effort to eliminate all instances of literature retrieval associated with the terms *human, inhalation, subcutaneous,* the MESH (medical subject heading) may also be included in the "***not***" statement. The abstract field should not be included because of the possibility that relevant papers will not be captured. Note that not all database files in DIALOG support medical subject headings. Proximity operators [e.g., *near* (n), *with* (w)] can be used to focus the strategy more precisely by requesting that terms be adjacent to each other and in the order specified. They may also be used to request that terms be within a certain number of words of each other and in the order specified as well as many other combinations. For example, not(aluminum(w)garnet(2n)laser).

It is helpful to use limiting connectors one-by-one to evaluate the effect of each exclusion term, at least in the preliminary searches. However, it is also possible to nest the exclusion statement. Combine the results of the chemical, receptor, and toxicological end-point retrievals and apply the exclusion terms as shown below:

not human?/ti,de,mesh

Alternatively the exclusion terms can be nested as indicated below:

not (human? or culture? or subcutaneous or vitro or gene or inject? or tumo? or inhalation or carcin? or cancer?)/ti,de,mesh

For more information concerning the use of proximity connectors, please consult with the Dialog Corporation, which provides manuals and intensive training sessions.

Step 6: The removal of duplicate records is the final step in refining the search and may need to be done by date-delimited increments if the number of retrievals exceeds 5,000 (the upper limit of retrievals for which duplicate detection is supported in DIALOG). Duplicates can only be removed by grouping the results into year range segments of less than 5,000 hits [e.g., group one may contain records with the publication year greater than (PY >1990) and and group two would contain all records with the publication year less than 1991 (PY<1991)]. The duplicate detection command, which is supported in most DIALOG files, is a useful command but does not always remove duplicate records within files. Foreign language papers may have more than one translation of the title, and descriptors and cannot be identified as a duplicate by the remove duplicate (*RD*) command.

5.4 SUMMARY

Although the search strategy is presented in this SOP in a linear manner, literature searching is actually an iterative process and requires collaboration between information specialists, chemists, and toxicologists. An example of this iterative process and the close collaboration between the information specialist and the toxicologist is illustrated by the search for the chemical cobalt. Examination of preliminary search results indicated that the literature associated with cobalt-60 (radiotherapy) needed to be excluded [e.g., ***not*** (irradiation or radiation or fission)].

After the preliminary search has been completed and reviewed, all files should be searched as a "OneSearch." The results (which can be several thousand records) should be downloaded and printed in Format 6 (title and keywords in context (KWIC)) for review and coding by a toxicologist. Printing the titles with the KWIC makes the preliminary review much easier and eliminates the cost of printing full abstracts for records unrelated to the development of TRVs.

Recommended Strategies for Receptor Groups

The following strategies have been tested and are recommended for the various receptor groups. Note that in DIALOG-Link, the type-ahead buffer is limited to 240 characters, thus some of the larger receptor groups (e.g., wild mammals and avian receptors) must be divided into smaller sets and the results combined. For example, each of the avian receptor groups can be searched as a separate set and then the results of each search combined. This total can then be combined with the total results from the chemical search. Site-specific species can be added to the receptor terms as needed. Truncations of receptor terms should be used with caution and be tested to avoid the retrieval of unrelated records. For example if the term "*newt*" is truncated, records with the word "*newton*" will be retrieved.

Avian Receptors

- chemical term and CAS numbers
- ***and*** (chicken? or duck or duckling? or ducks or mallard? or quail? or (Japanese()quail?) or coturnix or (gallus()domesticus) or platyrhyn? or anas)
- ***or*** ((song()bird?) or bobwhite? or (water()bird?) or (water()fowl) or aves or avian or bird?)
- ***and*** (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv? or (drinking()water))
- ***not*** (exclusion terms to be determined after initial review of search)
- ***rd*** (remove duplicates)

Laboratory Mammals

- chemical term and CAS numbers
- ***and*** (rat or rats or mouse or mice or hamster? or (guinea()pig?) or monkey? or rabbit?)
- ***and*** (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv? or (drinking()water))
- ***not*** (exclusion terms to be determined after initial review of search)
- ***rd*** (remove duplicates)

Wild Mammals

- chemical term and CAS numbers

- ***and*** (didelphidae or opossum? or soricidae or shrew? or talpidae or armadillo? or dasypodidae or ochotonidae or leporidae)

- ***or*** canidae or ursidae or procyonidae or mustelidae or felidae or cat or cats or dog or dogs or bear or bears or weasel? or skunk? or marten or martens or badger? or ferret? or mink or minks?

- ***or*** aplodontidae or beaver? or sciuridae or geomyidae or heteromyidae or castoridae or equidae or suidae or dicotylidae or cervidae or antilocapridae or bovidae

- ***or*** arvicolinae or mycocastoridae or dipodidae or erethizontidae or sigmodon? or (harvest()mice) or (harvest()mouse) or microtus or peromyscus or reithrodontomys or onychomys or vole or voles or lemming?

- ***and*** (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv? or (drinking()water))

- ***not*** (exclusion terms to be determined after initial review of search)

- ***rd*** (remove duplicates)

Amphibians and Reptiles

- chemical term and CAS numbers

- ***and*** (amphibi? or frog or frogs or salamander? or newt or newts or toad? or reptil? or crocodil? or alligator? or caiman? or snake? or lizard? or turtle? or tortoise? or terrapin?)

- ***and*** (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv? or (drinking()water))

- ***not*** (exclusion terms to be determined after initial review of search)

- ***rd*** (remove duplicates)

5.5 ELECTRONIC LITERATURE SEARCH

The following instructions relate to performing a literature search of the DIALOG databases. It is recommended that the DIALOG databases be searched first because this is the provider most likely to identify the greatest number of applicable references. The relevant DIALOG files should be searched as a "OneSearch" following the strategy developed in Section 5.3. For a large number of records, print titles and KWIC to facilitate the selection of relevant abstracts. This format is the most cost effective method of reducing the total costs of the search. If only a few records are retrieved, print the full abstracts rather than titles and KWIC.

The steps for conducting the electronic search are as follows:

- Use the "OneSearch" option to search the recommended DIALOG files as described in Section 4.1.1.
- If using DIALOG-Link, type the search statement and proofread the statement to correct possible errors. Save the search statement in a file for reuse.
- Search for the chemical of interest using the nomenclature described in Section 5.1.
- Combine the results of the chemical search with each receptor group as described in Section 5.2 (common names and taxonomic nomenclature of mammalian wildlife receptors, laboratory mammals, etc.).
- Combine the results with all of the toxicological terms.
- Combine the results with the exclusion terms listed in Section 5.3, Step 5.
- Remove duplicate records.
- Download titles and KWIC for review by a toxicologist
- Download applicable abstracts and print them.

5.5.1 Review and Coding of the Electronic Search Results

The results of the electronic search are coded in two stages.

In the first stage, the toxicologist reviews and codes the appropriate titles from the initial Dialog search output using "**RA**" to indicate that the full abstract should be retrieved or using the codes described below to indicate why they did not meet the necessary criteria for further consideration. The codes are marked directly on the printed search. The DIALOG accession numbers are used to retrieve those titles selected for retrieval which are then downloaded and printed for the second stage of review by the toxicologist.

In the second stage, the toxicologist reviews and codes the full abstracts (which were marked for retrieval from the initial stage) using "**RP**" to indicate the retrieval of the paper or using the codes outlined in the following paragraphs to indicate the reason it was eliminated from further consideration. Both of the screening processes are necessary to determine the relevance of the publication for TRV development. The codes used for eliminating records from further consideration are the same for both stages. All abstracts identified for possible use in TRV development as well as those that were coded with the appropriate rejection code(s) are downloaded into a data management system.

The review and coding procedures are described below.

1. For the titles and KWIC or abstracts meeting one or more of the following criteria, code appropriate KWIC as "**RA**" (retrieve abstract) or abstracts as "**RP**" (for retrieval of the entire publication) directly on the printed search results:

    - studies with relevant titles but no abstracts
    - review articles (use bibliography to acquire primary citations)
    - field studies describing the effect of a chemical on a target population or ecosystem (potential use as modifying information for TRV values derived from laboratory studies)
    - studies that describe changes in the following:

- morphology or histology of target organs
- patterns of growth and development
- fetal weight, fetal re-absorption, fetal abnormalities, and neonatal survival
- behavior of the test organism
- survival of the test organism

2. Do not retrieve publications for titles and KWIC or abstracts that meet one or more of the following criteria. Use the codes provided in parentheses below to indicate directly on the printed search results the reason the publication was rejected:

- genetic/mutagenicity studies (Gene)
- carcinogenicity studies (Carcin)
- physiology studies (Phys)
- in vitro studies (In Vit)
- human health effects studies (HHE)
- acute studies (Acu)
- analytical studies that describe the preparation and analysis of the chemical in the tissues of the receptor (Chem Meth)
- studies that describe the intermediary metabolism of the chemical (e.g., radioactive tracer studies) (Fate)
- studies that record the effects of two or more simultaneously administered chemicals (Simlt)
- studies that record the effects of a stressor (e.g., radiation, heat, etc.) and the chemical (QAC)
- studies that describe the effects of the chemical on surgically altered or chemically modified receptors (e.g., right nephrectomy, left renal artery ligature, hormone implant, etc.) (Alt)
- bioaccumulation/survey studies only measuring amounts of chemical present in tissues (Surv)
- studies using non-oral routes of chemical administration (i.e. injection, inhalation, skin absorption) (No Oral)
- studies that are unrelated to the chemical/receptor group of interest (Unrel)
- drug/therapeutic studies (Drug)
- anatomical studies (Anat)
- field studies (Field sur)
- field studies (Field sur –aquatic)
- field studies (Field sur – marine)
- field studies (Field Sur-sediment)
- mathematical model or model ecosystem (Model)
- lipid studies (lipid study)
- cardiovascular studies e.g. blood pressure changes (Cardiovas)
- physiological deficiency e.g., dietary study designed to deplete receptor of an element (Phys Defic)
- meeting poster/abstract (meeting poster/asbstract)
- conference proceeding (Conf Proc)

- behavioral studies, either simple or complex (behav -simple)(behav-complex)
- primate studies (primate)
- isolated, perfused organ studies (iso)
- larval stage of amphibians (larv)
- lead shot studies of effects of lead weights/sinkers and lead shot (lead shot)
- epilepsy studies describing induction of epilepsy by chemical agent (epilep)
- sub-chronic, generally a study of less than 10% of the test organism's lifetime (sub chronic)
- ecological risk assessment (risk assess)
- drug administered by intraruminal pellet, glass bolus, etc. (bul)

3. Code abstracts with questionable applicability as "?" for evaluation by a second reviewer.

Enter the retrieved abstracts and codes are into an electronic database management system such as ProCite or Microsoft Access.

Additional electronic databases (e.g., TOXNET, TERRATOX, BiblioLine, etc.) should be searched according to the providers' instructions. Although search strategies vary, follow the basic outline provided in Section 5.3 where applicable.

5.5.2 Retrieve Selected Publications

Retrieve publications with abstracts that meet the preliminary screening criteria. Selected publications may be obtained from a technical library; a national laboratory library; or from a commercial vendor such as Carl Uncover, OCLC (Online Computer Library Center), Purdue's Technical Information Service, or other commercial vendors.

5.6 MANUAL LITERATURE SEARCH

The basic components of the manual search include (1) identification and retrieval of applicable publications identified in the bibliographies of reviews retrieved from the results of the electronic search, and (2) search of other recommended sources (see Section 4.2).

The following steps should be undertaken in the manual search:

Step 1: Evaluate the bibliographies of review articles retrieved from the electronic search to identify potentially useful publications.

Step 2: Make a copy of the bibliographies from the review articles retrieved from the search.

Step 3: Code the potentially useful citations as "RP" for retrieval.

Step 4: Mark publications with questionable applicability as "?" for a second reviewer to evaluate.

Step 5: Consult the resources listed in Section 4.2 (e.g., ATSDR profiles, FWS reviews, CARA, Science Citation Index, etc.).

Step 6: Enter literature citations for retrieved publications into an electronic database management system.

5.7 SEARCH RESULTS DOCUMENTATION

The search results should be managed electronically in an electronic database management system such as *ProCite* or *Microsoft Access*. The electronic database management system should contain all the bibliographic information necessary to retrieve the record, including the abstract code, database file number, the chemical symbol, and the receptor. A well-designed database management system can be used for tracking the search and screening procedure and generating various reports.

Documentation for each electronic and manual search should include the following information:

- date of search
- name of person conducting search
- name and version of database or source citation
- publication years searched
- documentation of the search strategy (i.e., search terms)
- complete citation of abstracts retrieved [i.e., title, author(s), date, primary source]
- abstract code (e.g., "RP", HHE, Acu, etc.)
- recommendations for future search strategy

The above information can be used to determine the most appropriate databases to search, the most effective search strategy, and thoroughness of the search.

6.0 QUALITY ASSURANCE

The literature search and preliminary screening procedure is designed to be transparent, credible, and reproducible; therefore, maintaining comprehensive, accurate, and timely records is important. Electronic and paper copies should be maintained of all files and data generated during the course of the search.

Someone other than the person performing the initial task should review all entries into the database management system for completeness and accuracy . A review of all records marked for retrieval in the initial search should be made by someone other than the searcher and toxicologist.

7.0 REFERENCES

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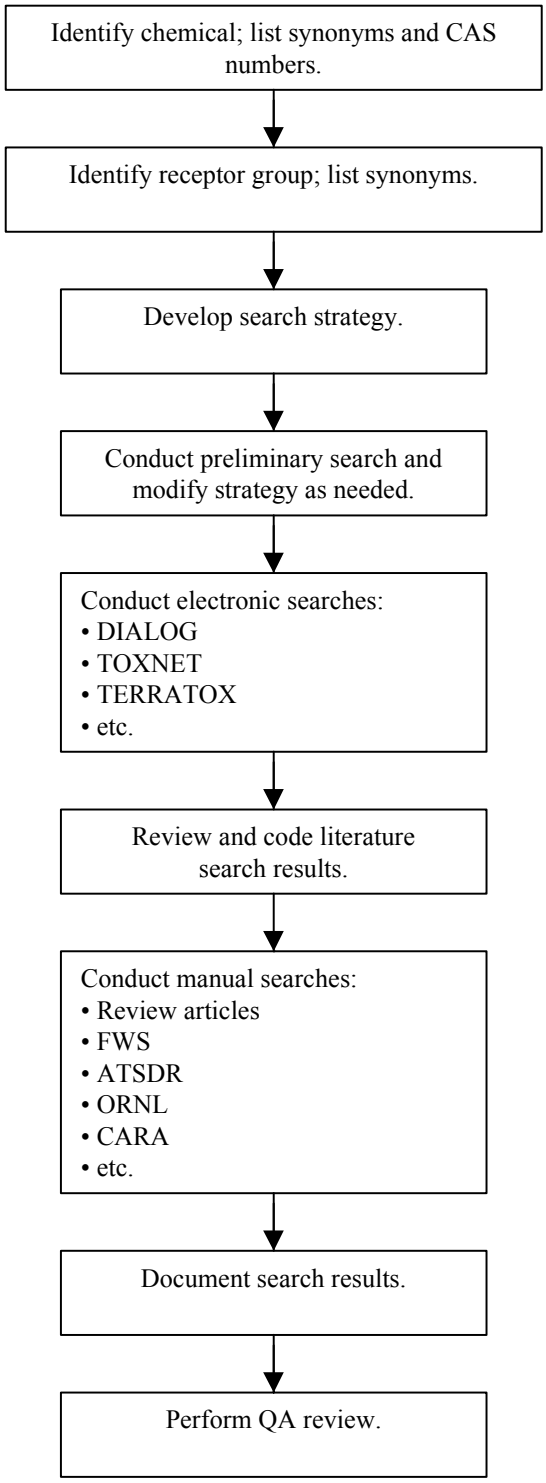
APPENDIX A
LITERATURE SEARCH FLOWCHART



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APPENDIX B

ELECTRONIC DATABASE FILE DESCRIPTIONS

National Library of Medicine

TOXNET includes the following files:

- CCRIS (Chemical Carcinogenesis Research Information System) – CCRIS is sponsored by the National Cancer Institute and contains scientifically evaluated data derived from carcinogenicity, mutagenicity, tumor promotion, and tumor inhibition tests on approximately 8000 chemicals.

- DART (Development and Reproductive Toxicology) and ETICBACK (Environmental Teratology Information Center Backfile) – DART is a bibliographic database containing literature on teratology and other aspects of developmental toxicology. It is managed by NLM and funded by EPA, the National Institute of Environmental Health Sciences (NIEHS), and the National Center of Toxicology Research of the Food and Drug Administration. ETICBACK contains literature published from 1950–1989.

- EMIC (Environmental Mutagen Information Center) and EMICBACK (Environmental Mutagen Information Center Backfile) – EMIC is a bibliographic database containing literature on chemical, biological, and physical agents that have been tested for genotoxic activity. It is produced by Oak Ridge National Laboratory (ORNL) and funded by EPA and NIEHS. EMIC contains literature published since 1991. EMICBACK contains literature published from 1950–1990.

- GENE-TOX (Genetic Toxicology) – GENE-TOX, produced by EPA, contains genetic toxicology test results on more than 3000 chemicals. Selected mutagenicity assay systems and the source literature are reviewed by panels of scientific experts for each of the test systems under evaluation. Each test system in GENE-TOX has been peer reviewed and is referenced.

- HSDB (Hazardous Substance Data Bank) – HSDB is a factual database focusing on the toxicology of over 4500 potentially hazardous chemicals. The file also includes information regarding emergency handling procedures, environmental fate, human exposure, detection methods, and regulatory requirements. The data are fully referenced and peer reviewed by a panel of expert toxicologists and other scientists.

- IRIS (Integrated Risk Information Services) – IRIS is an online database maintained by EPA. It contains information regarding carcinogenic and non-carcinogenic health risks of more than 500 chemicals. The data have been scientifically reviewed by groups of EPA scientists and represent EPA consensus. The IRIS database is also available without charge on the Web at http://www.epa.gov/iris.

TOXLINE contains the following subfiles:

- ANEUPL (Aneuploidy File)
- BIOSIS (Toxicological Aspects of Environmental Health)
- CIS (International Labour Office)
- CRISP (Toxicology Research Projects)
- DART (Developmental & Reproductive Toxicology)
- EMIC (Environmental Mutagen Information Center)
- EPIDEM (Epidemiology Information System)
- ETIC (Environmental Teratology Information Center)
- FEDRIP (Federal Research in Progress)
- HMTC (Hazardous Materials Technical Center)
- IPA (International Pharmaceutical Abstracts)
- NIOSHTIC (National Institute for Occupational Safety and Health (NIOSH)
- NTIS (Toxicology Document and Data Depository)
- PESTAB (Pesticides Abstracts)
- PPBIB (Poisonous Plants Bibliography)
- RISKLINE (Swedish National Chemicals Inspectorate)
- TOXBIB/MEDLINE (Toxicity Bibliography)
- TSCATS (Toxic Substances Control Act Test Submissions)

DIALOG

The following DIALOG databases contain toxicological information:

- AGRICOLA (Agricultural OnLine Access) (File 10) is an extensive bibliographic database with subject coverage including chemistry, pesticides, pollution, veterinary medicine, wildlife, and zoology.

- AGRIS International (File 203) is an international information system for agricultural science and technology. It reflects research in all aspects of world food supply. Subject coverage includes animal production, forestry, pollution, plant production, and other topics related to food production.

- BIOSIS (File 5) provides worldwide coverage in the biological and biomedical sciences. Subject coverage includes agriculture, botany, clinical medicine, environmental biology, genetics, immunology, toxicology, veterinary science, zoology, and much more.

- CAB Abstracts (File 50) is a comprehensive file of agricultural information containing all records in the more than 50 abstract journals published by CAB International, a leading scientific information service in agriculture and related sciences. Subject coverage includes veterinary medicine, environmental degradation, conservation, and amelioration.

- CA Search (Chemical Abstracts) (File 399) includes over 13 million citations of the worldwide literature regarding chemistry and its applications from 1967 forward. Some of the principal areas of chemical applications and technologies of chemical substances included are environmental chemistry and toxicology.

- CHEMTOX Online (File 337) is a collection of environmental, health, and safety data for chemical substances that are addressed by legislation or regulation and substances that are potential candidates for legislation or regulation.

- Conference Papers Index (File 77) provides access to more than 100,000 scientific and technical papers presented at over 1000 major regional, national, and international meetings each year. Main subject areas include the life sciences, chemistry, physical sciences, geosciences, and engineering.

- Dissertation Abstracts (File 35) provides a definitive subject, title, and author guide for almost every American dissertation accepted at an accredited institution since 1861. Subject coverage includes agriculture, biological and environmental sciences, chemistry, and other topics.

- Enviroline (File 40) contains international environmental information. It indexes and abstracts more than 1000 primary and secondary publications reporting all aspects of the environment.

- Environmental Bibliography (File 68) provides access to the contents of periodicals regarding the environment. Subject coverage includes human and animal ecology, and wildlife conservation.

- Life Sciences Collection (File 76) includes abstracts from the worldwide literature of the life sciences, corresponding to the series of 17 abstracting journals from Cambridge Scientific Abstracts. Subject coverage includes biology, medicine, ecology, and some aspects of veterinary science.

- MEDLINE (File 155), produced by NLM, includes indexing to articles from more than 3700 journals.

- NTIS (National Technical Information Service) (File 6) NTIS contains summaries of U.S. government-sponsored research, development, and engineering, plus analyses prepared by federal agencies, their contractors, or grantees. Also included are the results of government-sponsored research and development from countries outside the United States. Some state and local government agencies also contribute summaries of their reports to the database. NTIS has a broad range of subject coverage including environmental pollution and control, agriculture and food, medicine, and biology.

- Pollution Abstracts (File 41) is a leading resource for references to environmentally related literature on pollution, its sources, and its control. Subject coverage includes, air pollution, environmental quality, pesticides, and water pollution.

- RTECS (Registry of Toxic Effects of Chemical Substances) (File 336) is a non-bibliographic databank focusing upon the acute and chronic effects of potentially toxic chemicals, data on skin/eye irritation, carcinogenicity, mutagenicity, and reproductive consequences. References are available for all data. Toxicology and carcinogenic reviews, when available are cited. RTECS is built and maintained by NIOSH. This file is updated quarterly and contains toxicity information on more than 100,000 chemicals.

- Science (File 370) is published by the American Association for the Advancement of Science and covers the physical, biological, and social sciences.

- SCISEARCH (Files 34, 434, 294) is an international, multidisciplinary index to the literature of science, technology, biomedicine, and related disciplines, and is produced by the Institute for Scientific Information. It contains all of the records published in the Science Citation Index , plus additional records from the Current Contents publications. This file is useful for searching for specific authors and keeping abreast of current publications in the field of toxicology. It is not recommended for inclusion in standard searches.

- TOXLINE (File 156) is international in coverage and comprises several subfiles covering toxicological, pharmacological, biochemical, and physiological effects of chemicals and drugs. TOXLINE is updated monthly and contains more than 2,400,000 records.

- Wilson Biological and Agricultural Index (File 143) indexes approximately 258 periodicals that pertain to biology and agriculture. Subject coverage includes agricultural chemicals, biology, botany, ecology, environmental science, fishery sciences, genetics, and other topics.

- Zoological Record (File 185) provides extensive coverage of the world's zoological literature and includes a unique systematics field that provides complete taxonomic hierarchy information. Subject coverage includes ecology, genetics, habitat, histology, life cycle and development, and related topics.

- Pascal (File 144) is a multidisciplinary database including literature from international sources. Subjects include life sciences, biology, medicine, chemistry, food and agricultural sciences.

APPENDIX C

COBALT SEARCH EXAMPLE FOR LABORATORY MAMMALS

Cover Sheet

Date of Search 6/4/99
Performed By Carmen Diaz
Results Examined By Diego Reviera

Summary of Strategy

The following files in Dialog were searched:
154, 155, 156, 5, 10, 203, 399, 337, 77, 35, 40, 68, 76, 41, 336, 370, 143, 185, 6, 50, 144 with no year restrictions. File 154 was included in the example search but was dropped from subsequent searches because it overlaps with the information in File 155, the more comprehensive file in Medline. Please note that the term "*drinking water*" was not in the list of toxicological terms. Subsequent searches included this term.

The detailed search strategy from DIALOG is appended to this cover sheet. Included is a summarized version of the Cobalt search strategies for each receptor. Examination of preliminary searches for cobalt and laboratory mammal receptors indicated the need to add many exclusion terms specific to cobalt. It became apparent that the literature associated with the use of cobalt 60 as a radiotherapeutic agent would need to be excluded. Therefore, exclusion terms such as not *cobalt 60, irridation, co60, 60co* were used to focus the search. Similarly the large number of literature retrievals related to the use of cobalt alloys in surgical implants were excluded by using exclusion terms such as *prosthesis, implant, allo*y, and *cobalt samarium* were used. Retrieved abstracts were coded and downloaded into ProCite.

DIALOG Example of Cobalt Search for Laboratory Mammals
(Note that the bold and italicized wording is not system supplied.)

Enter an option number to view information or to connect to an online service. Enter a BEGIN command plus a file number to search a database (e.g., B1 for ERIC).

?***b154,155,156,5,10,203,399,337,77,35,40,68,76,41,336,370,143,185,6,50,144***

SYSTEM:OS - DIALOG OneSearch

File 154:MEDLINE(R) 1993-1999/Jul W4
(c) format only 1999 Dialog Corporation
*File 154: reloaded, note accession numbers changed.
File 155:MEDLINE(R) 1966-1999/Jul W4
(c) format only 1999 Dialog Corporation
*File 155: reloaded, note accession numbers changed.
File 156:Toxline(R) 1965-1999/May
(c) format only 1999 The Dialog Corporation
*File 156: reloaded, note accession numbers changed.
File 5:Biosis Previews(R) 1969-1999/May W4
(c) 1999 BIOSIS
File 10:AGRICOLA 70-1999/May
(c) format only 1999 The Dialog Corporation
File 203:AGRIS 1974-1999/Apr
Dist by NAL, Intl Copr. All rights reserved
File 399:CA SEARCH(R) 1967-1999/UD=13023
(c) 1999 American Chemical Society
*File 399: Use is subject to the terms of your user/customer agreement.
RANK charge added; see HELP RATES 399.
File 337:CHEMTOX (R) Online 1998/Q3
(c) 1998 MDL Info Systems
File 77:Conference Papers Index 1973-1999/May
(c) 1999 Cambridge Sci Abs
File 35:Dissertation Abstracts Online 1861-1999/Jun
(c) 1999 UMI
File 40:Enviroline(R) 1975-1999/Mar
(c) 1999 Congressional Information Service
File 68:Env.Bib. 1974-1999/May
(c) 1999 Internl Academy at Santa Barbara
File 76:Life Sciences Collection 1982-1999/Mar
(c) 1999 Cambridge Sci Abs
File 41:Pollution Abs 1970-1999/Jun
(c) 1999 Cambridge Scientific Abstracts
File 336:RTECS 1999/Q2
Comp & dist by NIOSH, Intl Copyright All Rights Res
File 370:Science 1996-1999/Apr W3
(c) 1999 AAAS
File 143:Biol. & Agric. Index 1983-1999/Apr
(c) 1999 The HW Wilson Co

File 185:Zoological Record Online(R) 1978-1999/V135P26
(c) 1999 BIOSIS
File 6:NTIS 64-1999/Jun W4
Comp&distr 1998 NTIS, Intl Copyright All Rights Res
File 50:CAB Abstracts 1972-1999/May
(c) 1999 CAB International
File 144:Pascal 1973-1999/May
(c) 1999 INIST/CNRS

STEP 1 Search the chemical name, synonyms, CAS numbers

Set Items Description
--- ----- -----------

?s *cobalt? or RN=7440-48-4 or rn=71-48-7 or rn=7646-79-9 or rn=10141-05-6 or rn=10124-43-3 or rn=544-18-3 or rn=60459-08-7 or rn=69098-14-2*

>>>One or more prefixes are unsupported
>>> or undefined in one or more files.
332504 COBALT?
126866 RN=7440-48-4
2513 RN=71-48-7
7238 RN=7646-79-9
2003 RN=10141-05-6
2295 RN=10124-43-3
103 RN=544-18-3
6 RN=60459-08-7
10 RN=69098-14-2
S1 399089 COBALT? OR RN=7440-48-4 OR RN=71-48-7 OR RN=7646-79-9 OR RN=10141-05-6 OR RN=10124-43-3 OR RN=544-18-3 OR RN=60459-08-7 OR RN=69098-14-2

TOTAL HITS FOR SET 1 = 399,089

STEP 2 Combine set 1 hits with receptors

?s ***s1 and (rat or rats or mice or mouse or hamster? or (guinea()pig?) or rabbit? or monkey?)***

Processing
Processing
Processed 10 of 21 files ...
Processing
Processed 20 of 21 files ...
Processing
Completed processing all files
399089 S1
2965989 RAT
2588600 RATS
1575461 MICE
1454660 MOUSE
308385 HAMSTER?
456112 GUINEA

1310041 PIG?
408460 GUINEA(W)PIG?
958907 RABBIT?
252393 MONKEY?
S2 18205 S1 AND (RAT OR RATS OR MICE OR MOUSE OR HAMSTER? OR (GUINEA()PIG?) OR RABBIT? OR MONKEY?)

TOTAL HITS FOR SET 2 =18,205

STEP 3 Combine set 2 hits with toxicological terms

?***s s2 and (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv?)***
Processing
Processing
Processed 10 of 21 files ...
Processing
Processing
Processed 20 of 21 files ...
Processing
Completed processing all files
18205 S2
1451016 REPRODUC?
801329 DIET
511117 DIETARY
473838 SYSTEMIC
4531328 DEVELOPMENT?
879511 HISTOLOG?
3464725 GROWTH
163753 NEUROLOGICAL
2562160 BEHAV?
857457 MORTAL?
229774 LETHAL?
1062016 SURVIV?
S3 4622 S2 AND (REPRODUC? OR DIET OR DIETARY OR SYSTEMIC OR DEVELOPMENT? OR HISTOLOG? OR GROWTH OR NEUROLOGICAL OR BEHAV? OR MORTAL? OR LETHAL? OR SURVIV?)

Total Hits for SET 3 = 4,622

?***s s3 not human/ti,de,mesh***
>>>Term "MESH" is not defined in one or more files
Processing
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
Processed 10 of 21 files ...
Completed processing all files
4622 S3
8984086 HUMAN/TI,DE,MESH
S4 4401 S3 NOT HUMAN/TI,DE,MESH

?***s s4 not vitro/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
4401 S4
1035942 VITRO/TI,DE
S5 4231 S4 NOT VITRO/TI,DE
?***s s5 not culture?/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
Processing
Processed 20 of 21 files ...
Completed processing all files
4231 S5
2025762 CULTURE?/TI,DE
S6 3817 S5 NOT CULTURE?/TI,DE
?***s s6 not inhalation/ti,de,mesh***
>>>Term "MESH" is not defined in one or more files
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
3817 S6
128292 INHALATION/TI,DE,MESH
S7 3768 S6 NOT INHALATION/TI,DE,MESH
?***s s7 not subcutaneous/ti,de,mesh***
>>>Term "MESH" is not defined in one or more files
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
3768 S7
88182 SUBCUTANEOUS/TI,DE,MESH
S8 3742 S7 NOT SUBCUTANEOUS/TI,DE,MESH
?***s s8 not inject?/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
3742 S8
501953 INJECT?/TI,DE
S9 3638 S8 NOT INJECT?/TI,DE
?***s s9 not gene/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
3638 S9
1853901 GENE/TI,DE
S10 3549 S9 NOT GENE/TI,DE
?***s s10 not tumo?/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
Processing
Processed 20 of 21 files ...
Completed processing all files
3549 S10
1541887 TUMO?/TI,DE
S11 3330 S10 NOT TUMO?/TI,DE

?***s s11 not carcin?/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
3330 S11
1110313 CARCIN?/TI,DE
S12 3233 S11 NOT CARCIN?/TI,DE
?***s s12 not cancer?/ti,de***
>>>Term "TI" is not defined in one or more files
>>>Term "DE" is not defined in one or more files
3233 S12
830864 CANCER?/TI,DE
S13 3212 S12 NOT CANCER?/TI,DE
?***s s13 not (60co or co60 or (cobalt()60) or irradiat? or (gamma()ray?) or neutron? or (gamma()irradiat?) or radiation or (x()ray?) or (fission) or alloy?)***
Processing
Processing
Processed 10 of 21 files ...
Processing
Processed 20 of 21 files ...
Processing
Processing
Completed processing all files
3212 S13
11936 60CO
1210 CO60
326867 COBALT
1117638 60
15594 COBALT(W)60
614534 IRRADIAT?
942297 GAMMA
1563886 RAY?
196437 GAMMA(W)RAY?
297005 NEUTRON?
942297 GAMMA
614534 IRRADIAT?
57791 GAMMA(W)IRRADIAT?
1853870 RADIATION
2068374 X
1563886 RAY?
927158 X(W)RAY?
76200 FISSION
1283639 ALLOY?
S14 1527 S13 NOT (60CO OR CO60 OR (COBALT()60) OR IRRADIAT? OR (GAMMA()RAY?) OR NEUTRON? OR (GAMMA()IRRADIAT?) OR RADIATION OR (X()RAY?) OR (FISSION) OR ALLOY?)
?***s s14 not (radiotherap? or prosthes? or implant? or radioiso? or (samarium()cobalt) or patient? or worker? or child? or epileps? or epilept?)***
Processing
Processing
Processed 10 of 21 files ...

Processing
Processed 20 of 21 files ...
Completed processing all files
1527 S14
276877 RADIOTHERAP?
36145 PROSTHES?
443740 IMPLANT?
306004 RADIOISO?
29125 SAMARIUM
326867 COBALT
2126 SAMARIUM(W)COBALT
5104818 PATIENT?
316132 WORKER?
2165976 CHILD?
137760 EPILEPS?
70125 EPILEPT?
S15 1245 S14 NOT (RADIOTHERAP? OR PROSTHES? OR IMPLANT? OR RADIOISO? OR (SAMARIUM()COBALT) OR PATIENT? OR WORKER? OR CHILD? OR EPILEPS? OR EPILEPT?)

STEP 5 Remove duplicates
?***rd***
>>>Duplicate detection is not supported for File 337.
>>>Duplicate detection is not supported for File 336.

>>>Records from unsupported files will be retained in the RD set.
...examined 50 records (50)
...examined 50 records (100)
...examined 50 records (150)
...examined 50 records (200)
...examined 50 records (250)
...examined 50 records (300)
...examined 50 records (350)
...examined 50 records (400)
...examined 50 records (450)
...examined 50 records (500)
...examined 50 records (550)
...examined 50 records (600)
...examined 50 records (650)
...examined 50 records (700)
...examined 50 records (750)
...examined 50 records (800)
...examined 50 records (850)
...examined 50 records (900)
...examined 50 records (950)
...examined 50 records (1000)
...examined 50 records (1050)
...examined 50 records (1100)
...examined 50 records (1150)
...examined 50 records (1200)

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...completed examining records
S16 760 RD (unique items)

TOTAL HITS USING ALL EXCLUSION TERMS = 760

EXAMPLE OF TITLES FROM THIS SEARCH WITH KEY WORDS IN CONTEXT
?***t s16/6,k/378-384***

>>>KWIC option is not available in file(s): 41, 77, 399
16/6,K/378 (Item 61 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01972309 Subfile: ETIC-35645
The influence of zinc and cobalt on the deoxyribonucleic acid biosynthesis and on the genetic information transmission in experimental animals. 2. Effect on the serum protein biosynthesis and on embryonic development
Publication Year: 1984

The influence of zinc and cobalt on the deoxyribonucleic acid biosynthesis and on the genetic information transmission in experimental animals. 2. Effect on the serum protein biosynthesis and on embryonic development
Descriptors/Keywords: RATTUS; MAMMAL, RAT; FEMALE; VIABILITY, FERTILITY AND MORTALITY ; GROWTH ; EXTRA-EMBRYONIC STRUCTURES; HEMIC AND LYMPHATIC SYSTEMS; CARDIOVASCULAR SYSTEM; ZINC CHLORIDE; COBALT CHLORIDE

16/6,K/379 (Item 62 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01971449 Subfile: ETIC-34372
The action of zn and co upon DNA synthesis and serum proteins during prenatal development of albino rats
Publication Year: 1984

The action of zn and co upon DNA synthesis and serum proteins during prenatal development of albino rats
Descriptors/Keywords: RATTUS, ALBINO; MAMMAL, RAT ; FEMALE; VIABILITY, FERTILITY AND MORTALITY ; GROWTH ; GENETICS; BIOCHEMISTRY AND METABOLISM; DIGESTIVE SYSTEM; ZINC CHLORIDE; COBALT CHLORIDE

16/6,K/380 (Item 63 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01970572 Subfile: ETIC-32560
Effect of short-term exposure to five industrial metals on the embryonic and fetal development of the mouse
Publication Year: 1984

Effect of short-term exposure to five industrial metals on the embryonic and fetal development of the mouse
Descriptors/Keywords: MUS, NMRI; MAMMAL, MOUSE ; FEMALE; VIABILITY, FERTILITY AND MORTALITY ; HEMIC AND LYMPHATIC SYSTEMS; GROWTH ; MUSCULOSKELETAL SYSTEM; NERVOUS SYSTEM; CRANIUM AND FACE; ALUMINUM CHLORIDE; COBALT DICHLORIDE; SODIUM MOLYBDATE; SODIUM TUNGSTATE; VANADIUM PENTOXIDE
CAS Registry No.: 7446-70-0; 7646-79-9 ; 7631-95-0; 13472-45-2; 1314-62-1

16/6,K/381 (Item 64 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01903739 Subfile: NTIS-PB83-209841
Development of a Toxicity Test System Using Primary Rat Liver Cells.
Publication Year: 1981

Development of a Toxicity Test System Using Primary Rat Liver Cells.
TD3: A model in vitro rat liver parenchymal cellular toxicity system employing cells obtained by the in situ collagenase perfusion technique...

... toxicants. The initial evaluation of this test system was accomplished using cadmium chloride, chromium chloride, cobalt chloride, mercuric chloride, nickelous chloride, sodium arsenite, sodium selenite, and ammonium vanadate. Linear regression analysis...

16/6,K/382 (Item 65 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01898117 Subfile: HEEP-82-13891
Cobaltous chloride effects on hexa chloro butadiene nephro toxicity
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1982

Cobaltous chloride effects on hexa chloro butadiene nephro toxicity
ABSTRACT RAT MORTALITY PROTEIN SYNERGISM
CAS Registry No.: 7646-79-9 ; 87-68-3

16/6,K/383 (Item 66 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01891217 Subfile: HEEP-82-06474
Serum lipoprotein patterns in rats and the effects of some pollutants.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1981

Serum lipoprotein patterns in rats and the effects of some pollutants.
Serum tissue lipids were analyzed to determine the suspected role of dietary oils in combination with some chemicals on induced hyperlipidemia in rats. Mustard and rapeseed oils increased triglyceride levels of tissues and blood. Trace elements (V) and...
CAS Registry No.: 8002-13-9; 7440-62-2; 7440-48-4 ; 57-06-7; 50-29-3

16/6,K/384 (Item 67 from file: 156)
DIALOG(R)File 156:(c) format only 1999 The Dialog Corporation. All rts. reserv.

01884542 Subfile: HEEP-81-08151
Iron, lead and cobalt absorption: Similarities and dissimilarities.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1981

Iron, lead and cobalt absorption: Similarities and dissimilarities.
Using isolated intestinal segments in rats , the absorption of Fe, Pb and Co was increased in Fe deficiency and decreased in...

... i.v. Fe injection and after parenteral endotoxin injection. Acute bleeding or abbreviated intervals of dietary Fe deprivation resulted in increased Fe absorption from isolated intestinal segments and in intact animals...

... absorptive mechanism apparently is selectively enhanced for Fe absorption by phlebotomy or brief periods of dietary Fe deprivation, or 2 or more mucosal pathways for Fe absorption may exist.
CAS Registry No.: 7440-48-4 ; 7439-92-1; 7439-89-6

Summarized version of Cobalt Search Strategies by Receptor

(***Note that the term "drinking water" should be added to list of toxicological endpoints for future searches)***

Cobalt Laboratory Mammal Search

b 155,156,5,10,203,399,337,77,35,40,68,76,41,336,370,143,185,6,50,144

s cobalt? or rn=7440-48-4 or rn=71-48-7 or rn=7646-79-9 or rn=10141-05-6 or rn=10124-43-3 or rn=544-18-3 or rn=60459-08-7 or rn=69098-14-2

and (rat or rats or mice or mouse or hamster? or (guinea()pig?) or rabbit? or monkey?)

and (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv?)

Not human/ti,de
Not vitro/ti,de
Not culture?/ti,de
Not inhalation/ti,de
Not subcutaneous/ti,de
Not gene/ti,de
Not inject?/ti,de
Not tumo?/ti,de
Not carcin?/ti,de
Not cancer?/ti,de

Additonal exclusions:

Not (60c or co60 or (cobalt()60) or irradiat? Or (gamma()ray?) or neutron? Or (gamma()irradiat?) or radiation or (x()ray?) or fission or alloy?)

Not (radiotherap? Or prosthes? Or implant? Or radioiso? Or (samarium()cobalt) or patient? Or worker? Or child? Or epileps? or epilept?)

Rd

Cobalt Wild Mammal Search

b 155,156,5,10,203,399,337,77,35,40,68,76,41,336,370,143,185,6,50,144

s cobalt? or RN=7440-48-4 or rn=71-48-7 or rn=7646-79-9 or rn=10141-05-6 or rn=10124-43-3 or rn=544-18-3 or rn=60459-08-7 or rn=69098-14-2

and (didelphidae or opossum? or soricidae or shrew? or talpidae or armadillo? or dasypodidae or ochotonidae or leporidae)

or canidae or ursidae or procyonidae or mustelidae or felidae or cat or cats or dog or dogs or bear or bears or weasel? or skunk? or marten or martens or badger? or ferret? or mink?

or aplodontidae or beaver? or sciuridae or geomyidae or heteromyidae or castoridae or equidae or suidae or dicotylidae or cervidae or antilocapridae or bovidae

or arvicolinae or mycocastoridae or dipodidae or erethizontidae or sigmodon? or (harvest()mice) or (harvest()mouse) or microtus or peromyscus or reithrodontomys or onychomys or vole or voles or lemming?

and (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv?)

Not human/ti,de
Not vitro/ti,de
Not culture?/ti,de
Not inhalation/ti,de
Not subcutaneous/ti,de

Not gene/ti,de
Not inject?/ti,de
Not tumo?/ti,de
Not carcin?/ti,de
Not cancer?/ti,de

Additonal exclusions:

Not (60c or co60 or (cobalt()60) or irradiat? Or (gamma()ray?) or neutron? Or (gamma()irradiat?) or radiation or (x()ray?) or fission or alloy?)

Not (radiotherap? Or prosthes? Or implant? Or radioiso? Or (samarium()cobalt) or patient? Or worker? Or child? Or epileps? or epilept?)

Rd

Cobalt Avian Receptor Search

b 155,156,5,10,203,399,337,77,35,40,68,76,41,336,370,143,185,6,50,144

s cobalt? or RN=7440-48-4 or rn=71-48-7 or rn=7646-79-9 or rn=10141-05-6 or rn=10124-43-3 or rn=544-18-3 or rn=60459-08-7 or rn=69098-14-2

and (chicken? or duck or duckling? or ducks or mallard? or quail? or (japanese()quail?) or coturnix or (gallus()domesticus) or platyrhyn? or anas or aves or avian or bird?)

or (song()bird?) or bobwhite? or (water()bird?) or (water()fowl)
and (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv?)

Not Human/ti,de
Not vitro/ti,de
Not culture?/ti,de
Not inhalation/ti,de
Not subcutaneous/ti,de
Not gene/ti,de
Not inject?/ti,de
Not tumo?/ti,de
Not carcin?/ti,de
Not cancer?/ti,de

Additonal exclusions:

Not (60c or co60 or (cobalt()60) or irradiat? Or (gamma()ray?) or neutron? Or (gamma()irradiat?) or radiation or (x()ray?) or fission or alloy?)

Not (radiotherap? Or prosthes? Or implant? Or radioiso? Or (samarium()cobalt) or patient? Or worker? Or child? Or epileps? or epilept?)

Rd

Cobalt Amphibians & Reptiles Search

b 155,156,5,10,203,399,337,77,35,40,68,76,41,336,370,143,185,6,50,144

s cobalt? or RN=7440-48-4 or rn=71-48-7 or rn=7646-79-9 or rn=10141-05-6 or rn=10124-43-3 or rn=544-18-3 or rn=60459-08-7 or rn=69098-14-2

and (amphibi? or frog? or salamander? or newt or newts or toad? or reptil? or crocodil? or alligator? or caiman? snake? or lizard? or turtle? or tortoise? or terrapin?)

and (reproduc? or diet or dietary or systemic or development? or histolog? or growth or neurological or behav? or mortal? or lethal? or surviv?)

Not human/ti,de
Not vitro/ti,de
Not culture?/ti,de
Not inhalation/ti,de
Not subcutaneous/ti,de
Not gene/ti,de
Not inject?/ti,de
Not tumo?/ti,de
Not carcin?/ti,de
Not cancer?/ti,de

Additonal exclusions:

Not (60c or co60 or (cobalt()60) or irradiat? Or (gamma()ray?) or neutron? Or (gamma()irradiat?) or radiation or (x()ray?) or fission or alloy?)

Not (radiotherap? Or prosthes? Or implant? Or radioiso? Or (samarium()cobalt) or patient? Or worker? Or child? Or epileps? or epilept?)

Rd

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APPENDIX D

CHEMICAL LIST

METALS: The names of salts marked with a bullet (•) are included as general information.

CHEMICAL	CAS #
ALUMINUM (alumin*)	
•Aluminum	7429-90-5
•Aluminum chloride	7446-70-0
•Aluminum fluoride	7784-18-1
•Sulfuric acid, Aluminum ammonium salt (2:1:1)	7784-25-0
•Sulfuric acid, Aluminum salt (3:2)	10043-01-3
•Sulfuric acid, Aluminum potassium salt	10043-67-1
•Aluminum nitrate (A1(NO3)3)	13473-90-0
•Aluminum potassium sulfate (A1K(SO4)2)	10043-67-1
•Aluminum sulfate	10043-01-3
•Aluminum sulfate hydrate	17927-65-0
•Aluminum nitrate nonahydrate	7784-27-2
•Aluminum chloride hexahydrate	7784-13-6
•Aluminum fluoride trihydrate	15098-87-0
•Aluminum chloride hydrate	10124-27-3
•Aluminum sulfate octahydrate	7784-31-8
•Aluminum fluoride dihydrate	32287-65-3
•Aluminum sulfate hydrate	16828-11-8

•These terms were not used in the search strategy. All references to these aluminum salts are retrieved by truncating alumin* and using the CAS numbers.

ANTIMONY (antimon*)	
•Antimony III	7440-36-0
•Potassium antimonate	1333-78-4
• Antimony potassium tartrate	28300-74-5
•Antimony trichloride	10025-91-9
•Antimony trifluoride	7783-56-4
•Antimony trisulfide	1345-04-6
•L-Antimony potassium tartrate	11071-15-1
•Potassium hexahydroantimonate	12208-13-8
•Sodium hexahydroxy antimonate	33908-66-6
•Hexahydroxyantimonate (1-) potassium	63994-33-2

•These terms were not used in the search strategy. All references to these antimony salts are retrieved by truncating antimon* and using the CAS numbers.

****ARSENIC (arsen*)**

Arsenic	7440-38-2
Arsenic acid, Sodium salt	7631-89-2
Arsenic acid (H3AsO4)	7778-39-4
Arsenic acid, Disodium salt	7778-43-0
Arsenous trichloride	7784-34-1
Arsenic acid, Lead (2+) salt (1:1)	7784-40-9
Arsenic acid, Diammonium salt	7784-44-3
Arsenenous acid, Sodium salt	7784-46-5
Arsenic acid, Disodium salt, Heptahydrate (Na2AsH3O4.7H2O)	10048-95-0
Sodium arsenate (NaAsO3)	15120-17-9
Sodium arsenate (NaAsO4)	13464-38-5
Sodium arsenate (generic form)	7631-89-2
Sodium arsenite (Na2HAsO3)	13466-06-3
Sodium arsenate (Na3AsO3)	13464-37-4

****BARIUM (barium/ barite)**

Barium carbonate	513-77-9
Barium acetate	543-80-6
Barium nitrate hydrate	115216-77-8
Barium chloride hydrate	10326-27-9
Barium	7440-39-3
Barium sulfate	7727-43-7
Barium nitrate	10022-31-8
Barium chloride	10361-37-2
Barite (barium sulfate)	13462-86-7
Barium sulfide	21109-95-5

****BERYLLIUM (beryllium)**

Beryllium	7440-41-7
Beryllium chloride	7787-47-5
Beryllium fluoride	7787-49-7
Beryllium hydroxide	13327-32-7
Beryllium nitrate (Be(NO3)2.3H20)	7787-55-5
Beryllium nitrate (BeN2O6)	13597-99-4
Beryllium silicate	12161-82-9
Beryllium sulfate	13510-49-1
Beryllium sulfate tetrahydrate	7787-56-6

CADMIUM (cadmium)

Cadmium	7440-43-9
•Cadmium acetate	543-90-8
•Cadmium bromide	7789-42-6
•Cadmium chloride	10108-64-2
•Cadmium iodide (CdCI2)	7790-80-9
•Nitric acid, Cadmium salt tetrahydrate	10022-68-1
•Cadmium nitrate	10325-94-7
•Cadmium sulfate	10124-36-4
•Cadmium chloride hydrate	7790-78-5
•Cadmium sulfate 8/3H2O	7790-84-3
•Cadmium acetate hydrate	89759-80-8

•Cadmium chloride hydrate	34330-64-8

• These terms were not used in the search strategy. All references to these cadmium salts are retrieved by cadmium and the CAS numbers.

CHROMIUM (chromium, chromate, chromic, chrome, (chrome(n)6), (chromium(n)6), hexachrome, chromous)

•Acetic acid, Chromium (3+) salt	1066-30-4
Chromium	7440-47-3
•Chromic acid (+6)	7738-94-5
•Sodium chromate (+6)	7775-11-3
•Chromic acid, Dipotassium salt (+6)	7778-50-9
•Chromium fluoride (+3)	7788-97-8
•Chromic acid, Diammonium salt (+6)	7788-98-9
•Chromic acid, Dipotassium salt (+6)	7789-00-6
•Chromium chloride (+3)	10025-73-7
•Sulfuric acid, Chromium (3+) salt (3:2)	10101-53-8
•Chromium potassium sulfate (+3)	10141-00-1
•Sodium dichromate (+6)	10588-01-9
•Sodium chromate (unknown formula)	12680-48-7
•Chromic acid (+6)	13530-68-2
•Chromium (III) nitrate (+3)	13548-38-4
•Chromate (CrO4) (+6)	13907-45-4
•Chromate (+6)	13907-47-6
•Chromium sulfate pentahydrate (+3)	15244-38-9
Hexavalent chromium	18540-29-9
•Chromium nitrate nonahydrate	7789-02-8

• These terms were not used in the search strategy. All references to these chromium salts are retrieved by the use of the terms: chromium, chromate, chromic, chrome, (chrome(n)6), (chromium(n)6), hexachrome, chromous and the CAS numbers.

COBALT (cobalt*)

•Cobalt	7440-48-4
•Cobalt acetate	71-48-7
•Cobalt chloride	7646-79-9
•Cobalt nitrate	10141-05-6
•Cobalt sulfate	10124-43-3
•Cobalt(2)formate	544-18-3
•Cobalt sulfate hydrate	60459-08-7
•Cobalt chloride hydrate	690098-14-2

• These terms were not used in the search strategy. All references to these cobalt salts are retrieved by the truncation of cobalt* and the CAS numbers.

COPPER (copper, cupr*)

Copper	7440-50-8
•Copper chloride	1344-67-8
•Copper sulfate	1333-22-8
•Copper sulfate	7758-98-7
•Copper acetone	598-54-9
•Copper chloride hydroxide	1332-65-6
•Copper acetate	4180-12-5
•Acetic acid, Copper 2+ salt monohydrate	6046-93-1
•Sulfuric acid copper (2+) salt (1:1), Pentahydrate	7758-99-8
•Cupric acetate	142-71-2
•Cupric nitrate	3251-23-8
•Cuprous nitrate	3251-29-4
•Cupric chloride	7447-39-4
•Cuprous chloride	7758-89-6
•Cupric perchlorate	13770-18-8
•Copper acetate hydrate	66923-66-8
•Cupric chloride hydrate	13468-85-4
•Cupric nitrate hydrate	19004-19-4
•Copper chloride dihydrate	10125-13-0

• These terms were not used in the search stragegy. All references to these copper salts are retrieved by using the terms copper and truncating cupr* and the CAS number.

****IRON (iron, ferr*)**

Carbonic acid, Iron(2+)salt (1:1)	563-71-3
Iron	7439-89-6
Iron chloride	7705-08-0
Iron chloride FeC12	7758-94-3
Iron sulfates	10124-49-9
Nitric acid, Iron(3+) salt	10421-48-4
Iron hydroxide	11113-66-9
Iron chloride	12040-57-2
Carbonic acid, Iron (3+) salt	26273-46-1
Ferric hydroxide	1309-33-7
Ferrous sulfide	1317-37-9
Ferrous sulfate	7720-78-7
Ferric sulfate	10028-22-5
Ferrous hydroxide	18624-44-7
Ferric sulfate hydrate	10028-22-5
Iron trichloride hexahydrate	7705-08-0
Iron dichloride tetrahydrate	13478-10-9

•LEAD

The term "lead" cannot be used in a search strategy because the word is commonly used as a verb and noun. The following terms were developed to search this element and were used in combination with the CAS numbers listed below.

Lead level*	7439-92-1
Lead intake	301-04-2
Lead induce*	7758-95-4
Lead poison*	10099-74-8
Lead intoxi*	7446-14-2

Blood lead	546-67-8
Lead toxic*	13826-65-8
Lead metabol*	5224-23-7
Lead burden*	78-00-2
Dietary lead	7442-13-9
Lead emcephalopathy	15347-57-6
Lead expos*	
Trimethyl lead	
Trimethyllead	
Tributyl lead	
Tributyllead	
Lead tetraacetate	
Lead acetate	
Tetraethyl lead	
Trialkyl lead	
Inorganic lead	
Ambient lead	
Lead compound*	
Lead acetic	
TEL	
Pb	
Lead chloride	
Lead nitrate	
Lead sulfate	
Lead concentrat*	
Diethyl lead	
Plumbic	
Plumbous	

The term "*lead compound*" was used in the search strategy for this metal, but its use for future searches is not recommended. The pharmaceutical industry uses the term as a description for a particularly promising therapeutic agent from a group of structurally closely related compounds. Use of this term will retrieve many unrelated records.

****MANGANESE (manganese)**

Manganese	7439-96-5
Manganese (III) sulfate	13444-72-9
Manganese chloride	11132-78-8
Manganese chloride (MnC12)	7773-01-5
Manganese nitrate	10377-66-9
Manganese nitrate hydrate	15710-66-4
Manganese sulfate hydrate	15244-36-7

****NICKEL (nickel)**

Acetic acid, Nickel (2+) salt	373-02-4
Nickel chloride hexahydrate	7791-20-0
Nickel chloride hydrate	69098-15-3
Nickel (II) selenate	15060-62-5
Nickel	7440-02-0
Nickelous chloride	7718-54-9
Nickelous nitrate	13138-45-9
Sulfuric acid, nickel (2+) salt (1:1)	7786-81-4

Nickel sulfate hexahydrate	10101-97-0
Nickelous acetate tetrahydrate	373-02-4
Nickel (II) chloide hydrate	13478-00-7

SELENIUM (, seleni*, selenate, selenium)

•Selenium dioxide	7446-08-4
•Potassium selenate	7790-59-2
•Potassium selenite	10431-14-7
•Selenium	7782-49-2
•Selenous acid	7783-00-8
•Sodium selenate	13410-01-0
•Sodium selinite	10102-18-8

• **These terms were not used in the search strategy. All references to these selenium salts are retrieved by using the terms seleni*, selenate, selenium and the CAS number.**

****SILVER (silver)**

Acetic acid, Silver (1+)salt	563-63-3
Silver	7440-22-4
Silver nitrate	7761-88-8
Silver chloride	7783-90-6
Silver iodide	7783-96-2
Silver sulfate	10294-26-5

****VANADIUM (vanad*)**

Vanadium	7440-62-2
Vanadium chloride	7718-98-1
Vanadyl chloride	7727-18-6
Vanadic acid, Ammonium salt	7803-55-6
Sodium vanadate	13718-26-8
Vanadic acid, Trisodium salt	13721-39-6
o-Vanadate	14333-18-7

****ZINC (zinc)**

Zinc	7440-66-6
Zinc chloride	7646-85-7
Zinc nitrate	7779-88-6
Zinc sulfate	7733-02-0
Zinc acetate	557-34-6
Zinc peroxide	1314-22-3
Zinc phosphide	1314-84-7
Zinc sulfate heptahydrate	7446-20-0
Zinc bromide	7699-45-8
Zinc iodide	10139-47-6
Sulfurous acid, Zinc salt (1:1)	13597-44-9
Zinc nitrate hydrate	10196-18-6
Zinc acetate dihydrate	5970-45-6

ORGANICS

CHEMICAL	**CAS #**
DIELDRIN	60-57-1
dieldrin*	
alvit	
dieldrex	
heod	
panoram	
quintox	
dimethanonaphthalene	
****DDT GROUP**	50-29-3
DDT	
agritan	
anofex	
arkotine	
azotox	
bosan	
bovidermol	
chlorophenothan	
citox	
clofenotane	
dedelo	
deoval	
detox	
detoxan	
dibovan	
dichlorodiphenyltrichloroethane	
dicophane	
didigam	
didimac	
diphenyltrichloroethane	
dodat	
dykol	
estonate	
genitox	
gesafid	
gesapon	
gesarex	
gesarol	
guesapon	
guesarol	
byron	
havero*	
hildit	
ivoran	
ixodex	
kopsol	
mutoxin	
neocide	
parachlorocidum	
pentachlorin	

pentech
rukseam
santobane
ze*dane

****DDD** 72-54-8
dichlorodiphenyl(w)dichloroethane
dilene
rhothane
TDE

****DDE** 72-55-9
dichlorodiphenyl(w)dichloroethylene

****PENTACHLOROPHENOL** 87-86-5
pentachlorophen*
PCP
acutox
chem-penta
chem-tol
chlorophen
cryptogil
dowcide
crotox
fungifen
lauxtol
liroprem
nci
penchlorol
pentachlorofen*
pentacon
penta-kil
pentasol
penwar
peratox
permite
pervenol
priltox
santo*
weedone
witophen

RDX 121-82-4
RDX
hexolite
cyclonite
cyclotrimethylene*
trinitro(w)triazine
hexogen
pbx
trimethylenetrinitramine
trinitrocyclotrimethylene
triaza(n)trinitro(n)cycloc(n)hexane
trinitro(n)hexahydro(n)triazine

hexahydro(n)trinitro()triazine

Note: The term PBX was used in the search strategy for 121-82-4 but its use is not recommended. PBX is an acronym for several organic chemicals, e.g. piperonyl butoxide and the use of the term will retrieve unrelated records.

****TNT**	118-96-7
TNT	
trinitrotoluene	
tolit*	
entosufon	
tritol	
triton	
trotyl	
trinitrotoluol	

******These chemicals terms have not been tested in a search strategy.

Wildlife PAH Literature Search and Acquisition

OVERVIEW

This Standard Operating Procedure (SOP) documents the procedure for used for polycyclic aromatic hydrocarbon (PAH) wildlife toxicological literature acquisition. The literature search and acquisition was completed by EPA MED-Duluth. These procedures were developed from Eco-SSL Standard Operating Procedure (SOP #3): *Acquisition of Literature to Support the Development of Toxicity Reference Values (TRVs) for Wildlife* , which provides direction for the retrieval of wildlife (birds, mammals, reptiles and amphibians) toxicological literature. Additional procedures for chemical terms, search strategy, literature tracking and acquisition were incorporated from the *Attachment 3-1 Eco-SSL SOP #1*: *Plant and Soil Invertebrate Literature Search and Acquisition*

LITERATURE IDENTIFICATION

Literature Identification in MED-Duluth Files

The literature identification process includes the scanning the terrestrial toxicity reference file for PAH citations. This reference file is located at the U.S. EPA, National Health and Ecological Effects Research Laboratory (NHEERL), Mid-Continent Ecology Division-Duluth (MED-Duluth). If the citation includes a PAH chemical and an identified species group, the citation was forwarded to the appropriate party for review of applicability.

Computerized Literature Searches

Online searches were performed using the DIALOG or SilverPlatter commercial database vendors. The search terms used for each database are listed in Attachment A. The first group of databases that were the focus of Eco-SSL literature searches were:

- AGRICOLA database (http://www.nal.usda.gov) provides a strong U.S. agricultural focus that has strict indexing codes for both toxicity and soil organisms.

- AGRIS International (http://www.icpa.ro/AgroWeb/AIC/RACC/Agris.htm) provides a strong international agricultural focus that has toxicity indexing codes.

- BIOSIS database (http://www.biosis.org/) provides a strict taxonomical indexing system. BIOSIS recently (1998) began adding Chemical Abstract Service (CAS) Registry numbers.

- CA Search database (http://www.cas.org/) provides a strict chemical indexing system, but lacks a taxonomical indexing system.

- Life Sciences Abstracts (http://www.csa.com/) provides toxicology abstracts. Some portions are already included in PolTox.

- PolTox database includes Toxline, NTIS and Pollution Abstracts, provided through SilverPlatter is available on CD-ROM at MED-Duluth.

DEVELOPMENT OF LITERATURE SEARCH STRATEGY

Literature search strategies were developed iteratively with each section of terms examined using different criteria. The search strategies included category codes, chemical terms, species specific terms, publication years, and exclusion terms. Attachment B provides a detailed summary of the literature search strategy development documentation.

Category Codes

Category codes are used within DIALOG databases to group documents by subject or topic. By specifically selecting category codes relevant to the Eco-SSL effort, the literature search output should result in a more focused data set. The Eco-SSL literature search strategy documentation (Attachment B) includes a summary of the category codes selected to focus the search (if necessary) for each DIALOG database.

Chemical Terms

The Eco-SSL Steering Committee identified the following list of terms as the initial focus of the polycyclic aromatic hydrocarbon (PAH) Eco-SSL effort.

> *Chemical Abstract Registry Numbers:* 83329, 208968, 120127 56553, 50328, 205992, 191242, 207089, 218019, 53703, 206440, 86737, 193395, 91203, 85018 , 129000, 130498292
>
> *Chemical Name Terms:* acenaphthene, acenaphth?lene, albocarbon, anthrac?n, anthrac?ne , benz*(w) (acephenanthrylene or anthracene or chrysene or fluoranthene, or fluorene or perylene or phenanthrene or pyrene or pyrilene), benzacenaphthene, benzanthracene, benzanthrazen, benzanthrene, benzfluoranthene, benzindene, benzoanthracene, benzochrysene, benzofluoranthene, benzofluorene, benzoperylene, benzophenanthrene, benzopyrene, benzopyrilene, benzperylene, benzphenanthrene, benzpyrene, benzypyrene, beta-pyren*, binaphthylene, biphenylenemethane, biphenylmethane, bis-alkylamino(w)anthracene, camphor(n1)tar, chrysene, coal(w)tar(w)pitch, cyclopenta(w)naphthalene, dezodorator, dibenz(w)antracene, dibenz*(w)anthracene, dibenz*(w)fluorene, dibenzanthracene, dibenzoanthracene, dibenzofluorene, dibenzonaphthalene, dihydroacenaphthylene, diphenylenemethane, ethylenenaphthalene, fluoranthene, fluorene, green(w)oil, idryl, inden*(w)pyrene, indenopyrene, methylenebiphenyl, mighty(w)(150 or rd1), naphthal?n, naphthal?ne, naphthalenediylbenzene, naphthanthracene, naphthene, naphthalenebenzene, naphthylenebenzene, naphthyleneethylene, ortho-phenylenepyrene, paranaphthalene,

peri-ethyl?nenaphthalene, phenanthr?n*, phenantrin, phenylenepyrene, pyrene, ravatite, tetra(w)olive, tetraphene, white(w)tar, (polynuclear or polycyclic(w) arom*(w)hydrocarbon*)

Species Terms

For species terms, refer to Table 1

CONDUCTING THE LITERATURE SEARCH

Instructions for performing the searches and defining BIBLIOLINKS output format for DIALOG and SilverPlatter are found in Eco-SSL Attachment 3-1. The following procedures were followed when conducting the literature search using an electronic abstracting database system.

- All chemicals were searched within a single search strategy.
- An attempt was made to search all databases at the same time, allowing for removal of duplicate entries across the various databases prior to downloading citations.
- Each species term grouping (amphibian/reptile, avian, mammal) was conducted as a separate search to reduce the number of records downloaded in a single search and to allow for the use of more specific search strategies.
- The Eco-SSL task group responsible for development of the wildlife toxicity reference values (TRVs) approved any modification to the search strategy prior to conducting the search.
- The strategies used for all searches were saved and downloaded electronically to avoid the possibility of typographical errors.
- Any modifications to the literature search strategy was examined by a second person before conducting the search.
- Copies of all search strategies and results (number of hits) were saved and a report provided to EPA (see 'Analysis of Search Results' section below).
- All data retrieved from the computerized literature search were transferred to a temporary ProCite database file using BIBLIOLINKS software and procedures according to the specifications provided for each commercial database.

IDENTIFICATION OF POTENTIALLY APPLICABLE PUBLICATIONS

The temporary ProCite bibliographic file containing the computerized search results was provided to the staff (contractor) responsible for identification of publications to be physically retrieved.

ATTACHMENT A: Literature Search Strategy

AGRICOLA, AGRIS International, BIOSIS, CASearch, databases provide an index code(s) for toxic effects data (see detailed search strategies below). Life Sciences Abstracts and PolTox do not require category codes to refine the search. The basic search will intersect two or three areas:

- species terms in the title, descriptor and abstract fields only
- PAH chemical terms in the title, descriptor and abstract fields only
- toxic effects indexing codes, as needed

Exclusion terms may also be used to further reduce the number of non-applicable citations located by a search strategy and included in the species list.

AGRICOLA Search

Species Terms (See Species List)

Chemical Names

acenaphthene, acenaphth?lene, albocarbon, anthrac?n, anthrac?ne , benz*(w) (acephenanthrylene or anthracene or chrysene or fluoranthene, or fluorene or perylene or phenanthrene or pyrene or pyrilene), benzacenaphthene, benzanthracene, benzanthrazen, benzanthrene, benzfluoranthene, benzindene, benzoanthracene, benzochrysene, benzofluoranthene, benzofluorene, benzoperylene, benzophenanthrene, benzopyrene, benzopyrilene, benzperylene, benzphenanthrene, benzpyrene, benzypyrene, beta-pyren*, binaphthylene, biphenylenemethane, biphenylmethane, bis-alkylamino(w)anthracene, camphor(n1)tar, chrysene, coal(w)tar(w)pitch, cyclopenta(w)naphthalene, dezodorator, dibenz*(w)antracene, dibenz*(w)anthracene, dibenz*(w)fluorene, dibenzanthracene, dibenzoanthracene, dibenzofluorene, dibenzonaphthalene, dihydroacenaphthylene, diphenylenemethane, ethylenenaphthalene, fluoranthene, fluorene, green(w)oil, idryl, inden*(w)pyrene, indenopyrene, methylenebiphenyl, mighty(w)(150 or rd1), naphthal?n, naphthal?ne, naphthalenediylbenzene, naphthanthracene, naphthene, naphthalenebenzene, naphthylenebenzene, naphthyleneethylene, ortho-phenylenepyrene, paranaphthalene, peri-ethyl?nenaphthalene, phenanthr?n*, phenantrin, phenylenepyrene, pyrene, ravatite, tetra(w)olive, tetraphene, white(w)tar, (polynuclear or polycyclic(w) arom*(w)hydrocarbon*)

Category Codes

(SH=W000 Pollution or L600 Animal Physiology)

AGRIS International Search

Species Terms (See Species List)

Chemical Names

acenaphthene, acenaphth?lene, albocarbon, anthrac?n, anthrac?ne , benz*(w) (acephenanthrylene or anthracene or chrysene or fluoranthene, or fluorene or perylene or phenanthrene or pyrene or pyrilene), benzacenaphthene, benzanthracene, benzanthrazen, benzanthrene, benzfluoranthene, benzindene, benzoanthracene, benzochrysene, benzofluoranthene, benzofluorene, benzoperylene, benzophenanthrene, benzopyrene, benzopyrilene, benzperylene, benzphenanthrene, benzpyrene, benzypyrene, beta-pyren*, binaphthylene, biphenylenemethane, biphenylmethane,

bis-alkylamino(w)anthracene, camphor(n1)tar, chrysene, coal(w)tar(w)pitch, cyclopenta(w)naphthalene, dezodorator, dibenz*(w)antracene, dibenz*(w)anthracene, dibenz*(w)fluorene, dibenzanthracene, dibenzoanthracene, dibenzofluorene, dibenzonaphthalene, dihydroacenaphthylene, diphenylenemethane, ethylenenaphthalene, fluoranthene, fluorene, green(w)oil, idryl, inden*(w)pyrene, indenopyrene, methylenebiphenyl, mighty(w)(150 or rd1), naphthal?n, naphthal?ne, naphthalenediylbenzene, naphthanthracene, naphthene, naphthalenebenzene, naphthylenebenzene, naphthyleneethylene, ortho-phenylenepyrene, paranaphthalene, peri-ethyl?nenaphthalene, phenanthr?n*, phenantrin, phenylenepyrene, pyrene, ravatite, tetra(w)olive, tetraphene, white(w)tar, (polynuclear or polycyclic(w) arom*(w)hydrocarbon*)

Category Codes

(SC=T01 Pollution or L74 Animal Production (Miscellaneous Disorders of Animals)

BIOSIS Search

Species Terms

Use species terms from Species List

Category Codes

CC=22501	Toxicology-general; Methods and Experimental
CC=22506	Toxicology-Environmental And Industrial Toxicology
CC=37015	Public Health: Air, Water or Soil Pollution
	(add CC22508 Veterinary Toxicology for lab mammals)

Chemical name/CAS#

Chemical Abstract Registry Numbers: 83329, 208968, 120127 56553, 50328, 205992, 191242, 207089, 218019, 53703, 206440, 86737, 193395, 91203, 85018 , 129000, 130498292

acenaphthene, acenaphth?lene, albocarbon, anthrac?n, anthrac?ne , benz*(w) (acephenanthrylene or anthracene or chrysene or fluoranthene, or fluorene or perylene or phenanthrene or pyrene or pyrilene), benzacenaphthene, benzanthracene, benzanthrazen, benzanthrene, benzfluoranthene, benzindene, benzoanthracene, benzochrysene, benzofluoranthene, benzofluorene, benzoperylene, benzophenanthrene, benzopyrene, benzopyrilene, benzperylene, benzphenanthrene, benzpyrene, benzypyrene, beta-pyren*, binaphthylene, biphenylenemethane, biphenylmethane, bis-alkylamino(w)anthracene, camphor(n1)tar, chrysene, coal(w)tar(w)pitch, cyclopenta(w)naphthalene, dezodorator, dibenz*(w)antracene, dibenz*(w)anthracene, dibenz*(w)fluorene, dibenzanthracene, dibenzoanthracene, dibenzofluorene, dibenzonaphthalene, dihydroacenaphthylene, diphenylenemethane, ethylenenaphthalene, fluoranthene, fluorene, green(w)oil, , idryl, inden*(w)pyrene, indenopyrene, methylenebiphenyl, mighty(w)(150 or rd1), naphthal?n, naphthal?ne, naphthalenediylbenzene, naphthanthracene, naphthene, naphthalenebenzene, naphthylenebenzene, naphthyleneethylene, ortho-phenylenepyrene, paranaphthalene, peri-ethyl?nenaphthalene, phenanthr?n*, phenantrin, phenylenepyrene, pyrene, ravatite, tetra(w)olive, tetraphene, white(w)tar, (polynuclear or polycyclic(w) arom*(w)hydrocarbon*)

CA Search Terms

Species Terms

Use species terms from Species List

Category Codes

SC=CA?04* (Toxicology)

CAS#

Chemical Abstract Registry Numbers: 83329, 208968, 120127 56553, 50328, 205992, 191242, 207089, 218019, 53703, 206440, 86737, 193395, 91203, 85018 , 129000, 130498292

PolTox and LifeSciences Abstracts Search

Species Terms Use species terms from Species List

Chemical names

acenaphthene, acenaphth?lene, albocarbon, anthrac?n, anthrac?ne , benz*(w) (acephenanthrylene or anthracene or chrysene or fluoranthene, or fluorene or perylene or phenanthrene or pyrene or pyrilene), benzacenaphthene, benzanthracene, benzanthrazen, benzanthrene, benzfluoranthene, benzindene, benzoanthracene, benzochrysene, benzofluoranthene, benzofluorene, benzoperylene, benzophenanthrene, benzopyrene, benzopyrilene, benzperylene, benzphenanthrene, benzpyrene, benzypyrene, beta-pyren*, binaphthylene, biphenylenemethane, biphenylmethane, bis-alkylamino(w)anthracene, camphor(n1)tar, chrysene, coal(w)tar(w)pitch, cyclopenta(w)naphthalene, dezodorator, dibenz*(w)antracene, dibenz*(w)anthracene, dibenz*(w)fluorene, dibenzanthracene, dibenzoanthracene, dibenzofluorene, dibenzonaphthalene, dihydroacenaphthylene, diphenylenemethane, ethylenenaphthalene, fluoranthene, fluorene, green(w)oil , idryl, inden*(w)pyrene, indenopyrene, methylenebiphenyl, mighty(w)(150 or rd1), naphthal?n, naphthal?ne, naphthalenediylbenzene, naphthanthracene, naphthene, naphthalenebenzene, naphthylenebenzene, naphthyleneethylene, ortho-phenylenepyrene, paranaphthalene, peri-ethyl?nenaphthalene, phenanthr?n*, phenantrin, phenylenepyrene, pyrene, ravatite, tetra(w)olive, tetraphene, white(w)tar, (polynuclear or polycyclic(w) arom*(w)hydrocarbon*)

Category Codes: none

Table 1: Wildlife PAH Species List

Amphibian/Reptile	**Avian**	**Mammals**
alligator alligators amphibi* caiman crocodil* frog frogs lizard lizards newt newts reptil* salamander* snake snakes terrapin* toad toads tortoise* turtle turtles *Biosystemic Codes (BIOSIS only)*# BC= Amphibians or Reptiles *Exclusion Terms* human (in descriptor field) venom*	aves avian* bird birds bobwhite* chicken chickens gallus duck ducks duckling* mallard* or anas quail or coturnix quails songbird* turkey turkeys waterbird* waterfowl *Biosystemic Codes (BIOSIS only)*# BC Birds *Exclusion Terms:* human (in descriptor field) food* (in descriptor field) cooking (in descriptor field)	***To Be Developed* *Species Terms:* *Effect/Toxicity Terms#:* *Biosystemic Codes (BIOSIS only)*# BC= nonhuman mammals *Exclusion Terms:*

All species terms are intersected with all effect/process terms and biosystemic codes.
NOTE: 3n= the second term is within three terms either before or after the first term;
w = the second term is adjacent to the first word

Attachment B: Search Development Documentation

The Task Group 1 SOP1 listing of applicable wildlife toxicity databases are listed in Table 1. This table is annotated with additional information to recommending the use in PAH searches. The recommendation is noted in Table 1:

Yes = high confidence that database will yield applicable citations and will be searched in the initial literature search strategy

? = unsure of confidence that the database will yield applicable citations or may only use for laboratory animals. These databases will be tested to determine a recommendation

No = low confidence that database will yield applicable citations and will not be tested further.

Tables 2 and 3 contain the amphibian/reptile and bird species term testing, respectively.

Table 1: Wildlife Search Database Listing from Task Group 1, SOP 1

Wildlife SOP Database	Cost*	Notes	Recommendation
Agricola (File 10)	DU: $2.50 PR: $1.20	Mostly oriented toward plants and soil organisms, but has useful toxicity data.	Yes
AGRIS International	DU:$2.25 PR:$1.25	International companion to Agricola (which is U.S. only)	Yes
BIOSIS (File 50)	DU:$5.25 PR:$1.55	Good categorization of toxicity, species and chemical terms that should be used in a large database.	Yes
CAB Abstracts (File 55)	DU:$2.75 PR:$1.60		?
CA Search (File 399)	DU:$11.75 PR:$2.45		Yes
CHEMTOX	DU:$3.00 PR:$12.90	Substance list, but has RTECS file imbedded it it.	?
Conference Papers Index (File 77)	DU:$2.75 PR:$1.80	Not useful, since we want fully completed research publications	No
Dissertation Abstracts	DU:$4.00 PR:$2.10	? Find in PolTox and other sources.	No
Enviroline	DU:$6.50 PR:$1.10	Few toxicity tests	No
Environmental Bibliography	DU:$2.25 PR:$1.05	Few toxicity tests	No
Life Science Collection (SilverPlatter)	DU:$4.75 PR:$1.65	Would not generally recommend, but can since we have the CDROM disks at MED. Overlaps with PolTox databases.	Yes

Wildlife SOP Database	Cost*	Notes	Recommendation
MEDLINE	DU:$3.00 PR:$0.20	Only for laboratory animal tests?	Lab mammals only ?
NTIS (SilverPlatter)	DU:$5.50 PR:$1.70	Toxicity related dissertations included in PolTox/Toxline	Yes, within PolTox database
Pascal	DU:$3.25 PR:$1.45		?
Pollution Abstracts (SilverPlatter)	DU:$4.50 PR:$1.65		Yes, within PolTox database
RTECS	DU:$2.75 PR:$2.65	Search within CHEMTOX?	?
Science	DU:$3.25 PR:$2.10	Large database that does not specifically categorize toxicity data.	No
Toxline (SilverPlatter)	DU:$2.50 PR:$0.75		Yes
Wilson Biological and Agricultural Index	DU:$2.25 PR:$1.05		?
Zoological Record	DU:$5.75 PR:$2.05	Very few toxicity tests. Mostly related to ecological and taxonomic research.	No

* DU= Dialog Unit prices for online time, PR= Print cost per citation in DIALOG

Agricola

Documents cataloged and indexed in the AGRICOLA database are selected from current acquisitions of NAL and cooperating institutions. More than 2,000 serial titles are reviewed for indexing. Books, pamphlets, conference proceedings, translations, book chapters, research reports, government documents, in both English and many non-English languages, are included in the database. For additional coverage of non-U.S. agricultural materials, see AGRIS INTERNATIONAL, File 203. AGRICOLA includes audio-visual and microform media, and some computer software. Specific source information is indexed in the Subfile field, which contains codes for access of USDA, State Experiment Station, Cooperative Extension Service, and other U.S. publications. Subfile codes are also useful in searching non-U.S. imprints. Past use of subfile tags for subject specific sources has varied over the life of the database.

AGRIS International

AGRIS International is the international information system for agricultural sciences and technology. The AGRIS International database serves as a comprehensive inventory of worldwide agricultural literature which reflects research results, food production, and rural development to help users identify problems involved in all aspects of world food supply. Emphasis in AGRIS International is non-U.S. This file corresponds in part to the printed publication, Agrindex, published monthly by the Food and Agriculture Organization (FAO) of the United Nations.

AGRIS is a cooperative, decentralized system in which over 100 national and multinational centers take part. It collects and makes available current information on the agricultural literature of the world appearing in journals, books, reports, and conference papers. Each country which participates in AGRIS

does so by submitting information about documents published within its own territories. All contributing sources are of non-U.S. origin. FAO acts as a coordinating agency within this global information system, facilitating the exchange of agricultural information to
its member countries.

BIOSIS Previews
BIOSIS Previews® contains citations from Biological Abstracts® (BA), and Biological Abstracts/ Reports, Reviews, and Meetings® (BA/RRM) (formerly BioResearch Index®), the major publications of BIOSIS®. Together, these publications constitute the major English-language service providing comprehensive worldwide coverage of research in the biological and biomedical sciences. Biological Abstracts includes approximately 350,000 accounts of original research yearly from nearly 6,000 primary journal and monograph titles. Biological Abstracts/RRM includes an additional 200,000+ citations a year from meeting abstracts, reviews, books, book chapters, notes, letters, selected institutional and government reports, and research communications. U.S. patents are included from 1986 through 1989.

Abstracts are available for records from the Biological Abstracts portion of the database starting in mid-1976 and for book synopses in BA/RRM starting in 1985. Most BA/RRM records do not contain abstracts.

CA SEARCH
The CA SEARCH®: Chemical Abstracts® database includes over 13 million citations to the worldwide literature of chemistry and its applications from 1967 forward. CA SEARCH corresponds to the bibliographic information and complete indexing found in the print Chemical Abstracts® published by CAS® (Chemical Abstracts Service). The controlled vocabulary CA General Subject Index Headings, related general subject terminology from the CA Index Guide, and CAS® Registry Numbers, each with its modifying phrase are included. Chemical substances are represented by CAS® Registry Numbers, unique numbers assigned to each specific chemical compound: corresponding substance information may be searched in the DIALOG chemical substance files such as CHEMSEARCHTM (File 398). All records from the 8th Collective Index Period forward are contained in File 399; Files 308-314 contain records from the individual Collective Index (CI) Periods as indicated in the File Data.

CAB Abstracts
CAB Abstracts is a comprehensive file of agricultural information containing all records in the more than 50 abstract journals published by CAB INTERNATIONAL (CABI). CABI has long been recognized as a leading scientific information service in agriculture and related sciences. Of particular note are sections in the database comprehensively covering literature in the fields of veterinary medicine, human nutrition, developing countries, leisure, recreation, and tourism. Over 14,000 serial journals in over 50 languages are scanned, as well as books, reports, and other publications. About 150,000 items per year are selected for inclusion in CAB Abstracts; over 95 percent of the literature is abstracted, while less important works are reported with bibliographic details only. An online thesaurus is available as an aid in locating broader, narrower, and related subject terms. File 250, ONTAP CAB Abstracts, is available for ONline Training And Practice; it contains approximately 38,000 CAB Abstracts records from early 1993.

CHEMTOX
The CHEMTOX® Online database is a collection of environmental, health, and safety data for chemical substances that have properties that either cause them to be addressed by legislation or regulation, or make them potential candidates for legislation or regulation. Currently, CHEMTOX includes information on chemicals identified and regulated by the U.S. Environmental Protection Agency (EPA) under regulations such as the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), the Clean Water Act (CWA), the Toxic Substances Control Act (TSCA), Superfund Amendments and Reauthorization Act (SARA), and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); the U.S. Department of Transportation (DOT) under the Hazardous Materials Transport Act; and the U.S. Occupational Safety and Health Administration (OSHA) under the Occupational Safety and Health Act. In addition, chemicals listed by the U.S. National Institute for Occupational Safety and Health (NIOSH)

as workplace safety hazards and chemicals in the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS) are included in CHEMTOX. Various lists of chemicals maintained by various agencies and governments are included in the CHEMTOX database. These lists include the carcinogens listed by the U.S. National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), and state lists provided by New Jersey, Pennsylvania, and California (Proposition 65). Chemicals listed under Canada's Workplace Hazardous Materials Information System (WHMIS) are also included in CHEMTOX.

Conference Papers Index

Conference Papers Index (CPI) provides access to records of the more than 100,000 scientific and technical papers presented at over 1,000 major regional, national, and international meetings each year. Conference Papers Index provides a centralized source of information on reports of current research and development from papers presented at conferences and meetings; it provides titles of the papers as well as the names and addresses (when available) of the authors of these papers. Also included in this database are announcements of any publications issued from the meetings, in addition to available preprints, reprints, abstract booklets, and proceedings volumes, including dates of availability, costs and ordering information. Primary subject areas covered include the life sciences, chemistry, physical sciences, geosciences, and engineering.

Dissertations Abstracts Online

Dissertation Abstracts Online is a definitive subject, title, and author guide to virtually every American dissertation accepted at an accredited institution since 1861. Selected Masters theses have been included since 1962. In addition, since 1988, the database includes citations for dissertations from 50 British universities that have been collected by and filmed at The British Document Supply Centre. Beginning with DAIC Volume 49, Number 2 (Spring 1988), citations and abstracts from Section C, Worldwide Dissertations (formerly European Dissertations), have been included in the file.

Abstracts are included for doctoral records from July 1980 (Dissertation Abstracts International, Volume 41, Number 1) to the present. Abstracts are included for masters theses from Spring 1988 (Masters Abstracts, Volume 26, Number 1) to the present.

DOSE

The Dictionary of Substances and their Effects (DOSE) is a unique guide to the impact of chemicals on organisms and the environment. DOSE contains detailed records for more than 4000 chemicals. These chemicals have been selected from sources such as Europe's Black List and Grey List of dangerous substances, the UK's Red List, priority pollutant lists from the USA and Canada, and the pollutant list from Germany. Other chemicals which are reported to have adverse effects on the environment are also covered.

Enviroline

Enviroline® covers the world's environmental related information. It provides indexing and abstracting coverage of more than 1,000 international primary and secondary publications reporting on all aspects of the environment. These publications highlight such fields as management, technology, planning, law, political science, economics, geology, biology, and chemistry as they relate to environmental issues. Enviroline corresponds to the print Environment Abstracts.

Environmental Bibliography

Environmental Bibliography provides access to the contents of periodicals dealing with the environment. Coverage includes periodicals on water, air, soil, and noise pollution; solid waste management; health hazards; urban planning; global warming; and many other specialized subjects of environmental consequence. The print equivalent is Environmental Periodicals Bibliography. More than 400 of the world’s journals concerning the environment are scanned to create Environmental Bibliography. Journals represented are from the world’s major publishers in science and technology (e.g., Elsevier/Pergamon, Kluwer Academic, John Wiley & Sons, Blackwell, Plenum, and Springer), as well as from smaller

publishers from many parts of the world. Many university press, society, and private publications are covered as well, some of which are available only on the Internet . (Availability of the Web publications is noted in the Notes field, along with the relevant URL.)

Environmental Bibliography covers conference papers and journal articles dating from 1973. Author abstracts appear in the file from July 1997 onward. Descriptors provide excellent indexing for scientific and common names, chemical compounds, geographic designations, computer model names, dates, trademark names, company names, and court cases.

Life Sciences Collection

Life Sciences Collection contains abstracts and bibliographic citations from recent worldwide research literature in major areas of biology, medicine, biochemistry, biotechnology, ecology, and microbiology, and some aspects of agriculture and veterinary science. Life Sciences Collection is produced by Cambridge Scientific Abstracts and corresponds to print series of more than 20 abstracting journals.

MEDLINE

MEDLINE (MEDLARS® onLINE), produced by the U.S. National Library of Medicine (NLM), is one of the major sources for biomedical literature. MEDLINE corresponds to three print indexes: Index Medicus TM, Index to Dental Literature, and International Nursing Index. Additional materials not published in Index Medicus are included in the MEDLINE database in the areas of communication disorders, and population and reproductive biology. MEDLINE is indexed using NLM's controlled vocabulary, MeSH® (Medical Subject Headings). An online thesaurus is available to aid in locating MeSH descriptors.

Abstracts, which are taken directly from the published articles, are included for over 59% of the records added from 1975 forward. Records added before 1975 do not contain abstracts; records added from 1985 to the present have abstracts for about 69% of the records. Approximately 400,000 records are added per year, of which more than 85% are in English.

NTIS

The NTIS: National Technical Information Service database consists of summaries of U.S. government-sponsored research, development, and engineering, plus analyses prepared by federal agencies, their contractors, or grantees. It is the means through which unclassified, publicly available, unlimited distribution reports are made available for sale from agencies such as NASA, DOD, DOE, HUD, DOT, Department of Commerce, and some 240 other agencies. Additionally, some state and local government agencies now contribute summaries of their reports to the database. NTIS also provides access to the results of government-sponsored research and development from countries outside the U.S. Organizations that currently contribute to the NTIS database include: the Japan Ministry of International Trade and Industry (MITI); laboratories administered by the United Kingdom Department of Industry; the German Federal Ministry of Research and Technology (BMFT); the French National Center for Scientific Research (CNRS); and many more. ONTAP® NTIS, File 206, is available for ONline Training And Practice; it contains records from January through June 1987 from File 6.

PASCAL

PASCAL is produced by the Institut de l'Information Scientifique et Technique (INIST) of the French National Research Council (CNRS). It provides access to the world's scientific and technical literature and includes about 450,000 new citations per year. Available in machine-readable form since 1973, PASCAL corresponds to the print publication Bibliographie internationale (previously Bulletin signaletique).

Each citation includes the article's original title, and, in most cases, a French translated title; for material since 1973, an English translated title is also provided. Most abstracts are in French. Analyzed documents come from all over the world, in 100 different languages. French journals are particularly well

represented. The file's breakdown by language is as follows: English 63%, French 12%, Russian 10%, German 8%, and other languages 7%.

Controlled descriptors from a vocabulary of over 80,000 terms are provided in English, French, and, in some cases, Spanish; German descriptors are also provided in the area of metallurgy.

Pollution Abstracts
Pollution Abstracts is a leading resource for references to environmentally related literature on pollution, its sources, and its control. The following subjects are covered by the Pollution Abstracts database: air pollution, environmental quality, noise pollution, pesticides, radiation, solid wastes, and water pollution.

RTECS
The Registry of Toxic Effects of Chemical Substances (RTECS®) is a comprehensive database of basic toxicity information for over 100,000 chemical substances including: prescription and non-prescription drugs, food additives, pesticides, fungicides, herbicides, solvents, diluents, chemical wastes, reaction products of chemical waste, and substances used in both industrial and household situations. Reports of the toxic effects of each compound are cited. In addition to toxic effects and general toxicology reviews, data on skin and/or eye irritation, mutation, reproductive consequences and tumorigenicity are provided. Federal standards and regulations, NIOSH recommended exposure limits and information on the activities of the EPA, NIOSH, NTP, and OSHA regarding the substance are also included. The toxic effects are linked to literature citations from both published and unpublished governmental reports, and published articles from the scientific literature. The database corresponds to the print version of the Registry of Toxic Effects of Chemical Substances, formerly known as the Toxic Substances List started in 1971, and is prepared by the National Institute for Occupational Safety and Health (NIOSH).

Toxicity information appearing in RTECS is derived form reports of acute, chronic, lethal and non-lethal effects of chemical substances. The reviewed information from the scientific literature and published governmental reports plus unpublished test data from the EPA TSCA test submissions database (TSCATS) are included in the file.

Science
Science, published by the American Association for the Advancement of Science (AAAS), serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science. Emphasis is on material pertaining to the interactions among science, technology, government, and society. The peer-reviewed section of the journal presents cutting-edge research of either interdisciplinary interest or unusual significance to the specialist. Topical coverage reflects the range of AAAS's interest across the physical, biological, and social sciences. Major sections of the journal are This Week in Science, News and Comments, Research News, Articles, Research Articles, and Reports. Science also includes book reviews, editorial and letters sections, policy forums, perspectives, and information about new techniques
and instrumentation.

TOXLINE
TOXLINE covers the toxicological, pharmacological, biochemical, and physiological effects of drugs and other chemicals. It is composed of a number of subfiles, several of which are unique to TOXLINE. About 45% of the approximately 120,000 records added per year are from the TOXBIB subfile, which is derived from MEDLINE. The TOXBIB and BIOSIS (since August 1985) subfiles may be searched using the U.S. National Library of Medicine's Medical Subject Headings (MeSH). The records in these two subfiles are updated annually with the current version of MeSH headings. An Online thesaurus is available to aid in locating MeSH descriptors.

Wilson Biological and Agricultural Index
Biological & Agricultural Index provides thorough, reliable indexing of 258 periodicals common to most libraries. Periodical coverage includes a wide range of scientific journals, from popular to professional,

that pertain to biology and agriculture. About 45% of the focus is on agriculture. Types of materials indexed include feature articles, biographical sketches, reports of symposia and conferences, review articles, abstracts and summaries of papers, selected letters to the editor, special issues or monographic supplements, and book reviews.

Zoological Record

Zoological Record Online®, produced by BIOSIS, provides extensive coverage of the world's zoological literature, with particular emphasis on systematic/taxonomic information. The database corresponds closely to the printed index, Zoological Record. The database includes thorough subject indexing in both controlled- and natural-language format. It also includes a unique systematics field, which gives complete taxonomic hierarchy information for most organisms discussed.

Zoological Record Online indexes articles from over 6,000 international serial publications. Theses, monographs, conference proceedings, and special reports are also scanned for relevant information.

Table 2: Amphibian Search Term Testing (PolTox Database 7/99)

SOP Term	SOP Term Example hits/Notes	Recommended Term(s)
alligator*	alligator(s) alligatorweed alligatorfish	alligator alligators
amphibi*	amphibiotic amphibious (sometimes get amphibious plants) amphibia(n)(s)	amphibi*
caiman	caiman	caiman
crocodil*	crocodile(s)	crocodil*
frog*	froglegs frogmen *froggahimyia* (parasite specific name) *froggatti* (insect specific name)	frog frogs
lizard*	lizard lizards lizardfish lizardite (rock) lizardo	lizard lizards
newt*	newt newts newtech (new technology name for wastewater management) newton	newt newts
reptil*	reptile reptiles reptillia	reptil*
salamander*	salamander(s)	salamander*
snake*	snake snakes snakehead snakeroot snakeweed	snake snakes
terrapin*	terrapin terrapins	terrapin*
toad*	toad toads toadfish(es)	toad toads
tortoise*	tortoise tortoises	tortoise*

turtle*	turtle turtles turtledove turtlegrass turtleplant	turtle turtles

Table 3 Bird Search Term Testing (PolTox Database 7/99)

SOP Term	SOP Term Example hits/Notes	Recommended Term(s)
bird	bird birds birdcage birders birding birdlife birdsville birdwatcher	bird birds
chicken gallus domesticus	chicken chickens chickenpox gallus domesticus	chicken chickens gallus
duck or ducks	duck ducks duckling ducklings duckweed duckbill	duck ducks duckling*
mallard or anas or pltyrhyn	mallard mallards anas	mallard* anas
quail or coturnix Japanese quail	quail quails quaility	quail quails coturnix
songbird	songbird songbirds	songbird*
bobwhite	bobwhite bobwhites	bobwhite*
turkey	turkey (country or organism) turkey turkeyfish	turkey turkeys
aves or avian	aves avian avians	aves avian*
waterfowl	waterfowl	waterfowl

waterbird	waterbird waterbirds	waterbird*