TOXNET and Beyond:

Using the National Library of Medicine's Environmental Health and Toxicology Portal

Disclaimer

Every effort has been made to ensure that the screen graphics and the exercises in this document are up-to-date and accurate. However, due to the frequency of Web updates, they may have changed.

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Preface

Our lives are filled with chemical exposures. How do we discover more about these chemicals for ourselves and our organization? The National Library of Medicine's Environmental Health and Toxicology Portal provides access to numerous databases that can help you explore environmental chemicals and risks. *TOXNET and Beyond: Using NLM's Environmental Health and Toxicology Portal* conveys the fundamentals of searching the NLM's TOXNET system of databases in chemistry, toxicology, environmental health, and related fields. In addition to TOXNET, the course will highlight various resources available through the Environmental Health and Toxicology Portal. The National Library of Medicine's Environmental Health and Toxicology Information Program was created in 1967 to serve as the federal government's centralized resource for toxicology and environmental health information. Throughout history, the effects and importance of poisons and exposure to toxic substances has been recognized. A history of congressional legislation and events contributed to the creation of the initial Toxicology and Environmental Health Information Program, TEHIP. Eventually, the program grew into what is now the NLM's Environmental Health and Toxicology Program which is offered through an online portal.

Historical Timeline

- Poisons recognized throughout time
- Socrates - hemlock. Cleopatra - asp.
- Lucretia Borgia – 15th & 16th Centuries
- Harvey W. Wiley's Poison Squad (1903)
- The Jungle (1906) Upton Sinclair – lack of hygiene in the meat-packing industry
- Food and Drugs Act (1906) – prohibited adulterated or misbranded items
- Federal Food, Drug and Cosmetic Act (1938) – enhanced safety requirements for drugs
- Drug Amendments (1962) – effectiveness required for drugs
- Silent Spring (1962) Rachel Carson – sparked public awareness about hazards of synthetic chemicals
- President's Science Advisory Committee (1966) – "Report on the Handling of Toxicological Information"
- TEHIP Created (1967)
- Situated within NLM's Division of Specialized Information Services (SIS)

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Environmental Health & Toxicology Portal Decision Tree
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Introduction

Course Overview

Purpose

The purpose of this training is to familiarize participants with reliable online environmental health and toxicology information, from the National Library of Medicine and other reliable sources. Skills and knowledge acquired in this training class will enable participants to access, utilize, and refer others to environmental health and toxicology information.

Objectives

After completing this course, participants will be able to:

- Identify quality, accurate, and authoritative online resources pertaining to environmental health, toxicology, and related medical information.
- Demonstrate the ability to perform strategic search techniques to find relevant online information.
- Apply the skills and knowledge obtained in this class to their organization's health information needs.

NLM Online Resources Covered in this Class

The following resources will be covered with time for hands-on practice:

- **ChemIDplus**—access to structure and nomenclature authority databases for the identification of chemical substances cited in NLM databases
- **Hazardous Substances Data Bank (HSDB)**—comprehensive, peer-reviewed toxicological data for over 5,000 chemicals
- **Toxicology Literature Online (TOXLINE)**—a bibliographic toxicology database covering over 3.5 million bibliographic citations
- **Chemical Carcinogenesis Research Information System (CCRIS)**—scientifically evaluated and fully referenced data on over 8,000 chemicals
- **Developmental and Reproductive Toxicology Database (DART)**—a bibliographic database containing more than 200,000 references to literature published since 1965
- **GENE-TOX**—genetic toxicology test data on over 3,000 chemicals resulting from expert peer review of the open scientific literature
- **Integrated Risk Information System (IRIS)**—carcinogenic and non-carcinogenic information on over 500 chemicals
- **International Toxicity Estimates for Risk (ITER)**—side-by-side comparisons of international risk assessment information on over 600 chemicals with links to source documentation

- **LactMed**—a database of drugs and other chemicals to which breastfeeding mothers may be exposed
- **Toxics Release Inventory (TRI)**—information on annual environmental releases of over 600 toxic chemicals by U.S. facilities from the U.S. Environmental Protection Agency (EPA)
- **TOXMAP**—a Geographic Information System that uses maps of the United States to help users visually explore TRI data
- **Haz-Map**—an occupational toxicology database that links job tasks to occupational diseases and their symptoms
- **Household Products Database**—human health effects information on over 7,000 brand-name consumer products

Information on the following resources is included in the "More to Explore" section of this manual.

- **Drug Information Portal**—current drug information for over 15,000 drugs with links to additional online resources with potential drug information
- **Dietary Supplements Labels Database**—information from the labels of over 2,000 brands of dietary supplements in the marketplace
- **Tox Town**—an interactive guide to commonly encountered toxic substances and environmental health risks
- **Radiation Event Medical Management**—guidance on clinical diagnosis and treatment during mass casualty radiological/nuclear events, primarily for physicians but usable to those without formal radiation medicine expertise
- **Wireless Information System for Emergency Responders (WISER)**—provides a wide range of information on hazardous substances, including substance identification support, physical characteristics, human health information, and containment and suppression advice
- **Enviro-Health Links**—selected links to Internet resources on toxicology and environmental health issues of special interest

These additional resources will be demonstrated:

- **Disaster Information Management Research Center (DIMRC)**—health information resources and informatics research related to disasters of natural, accidental, or deliberate design
- **Carcinogenic Potency Database (CPDB)**—analyses of the results of 6,540 chronic, long-term animal cancer tests, conducted in support of cancer risk assessments for humans, on 1547 chemicals

NLM's Environmental Health & Toxicology Portal

NLM's **Environmental Health and Toxicology Portal** provides a starting point for seeking reliable information on toxicology, hazardous chemicals, environmental health, and toxic releases.

http://sis.nlm.nih.gov/enviro.html

Browse the easily navigable site by topic or audience. Explore related resources under **More to Explore**. The **Reference Tools** include database descriptions, fact sheets, a list of NLM databases and electronic resources, toxicology tutorials, and links to related listservs. You can also search all TOXNET databases from this page, or click a particular database to search.

Additional Resources

For further information, we recommend these additional resources:

- Getting the Most from SIS's Environmental Health and Toxicology Resources http://sis.nlm.nih.gov/getthemostfromsis.html
- NLM's Environmental Health and Toxicology Resources Quick Tour http://sis.nlm.nih.gov/enviro/captivate/tehipoverview.htm
- Publications and Reference Materials http://sis.nlm.nih.gov/enviro/enviropubs.html

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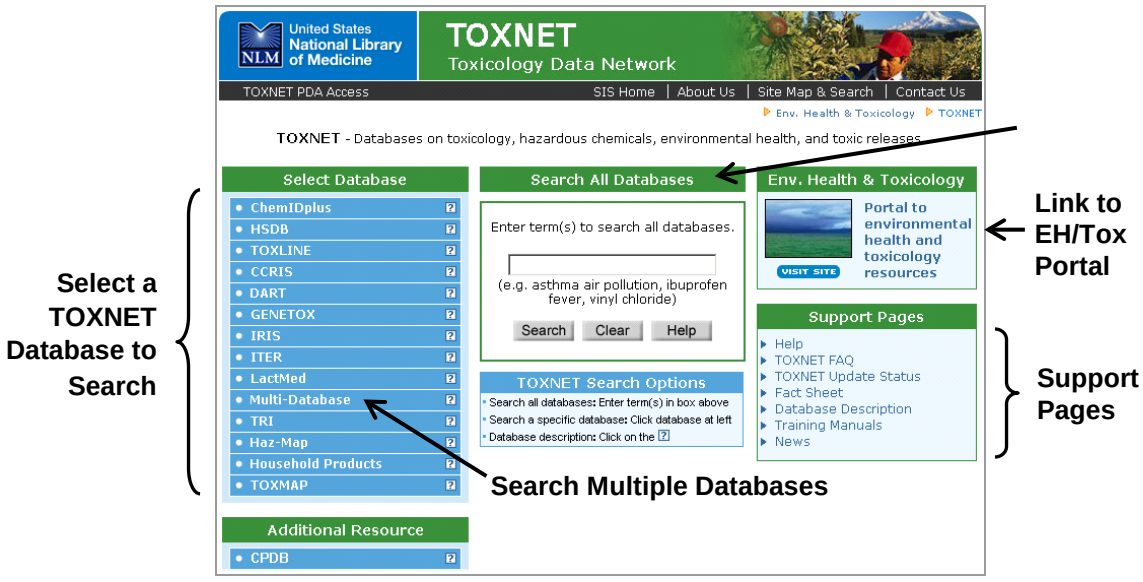
TOXNET

TOXNET Overview

NLM's **TOXNET** (Toxicology Data Network) is a free, Web-based system of databases on toxicology, environmental health, hazardous chemicals, toxic releases, chemical nomenclatures, and specialty areas such as occupational health and consumer products.



http://toxnet.nlm.nih.gov

Types of information in the TOXNET databases include:

- Specific chemicals, mixtures, and products
- Unknown chemicals
- Special toxic effects of chemicals in humans and/or animals

Click the information icon (?) to the right of each database in the Select Database column for a description of the database, a link to the fact sheet, and a sample record.

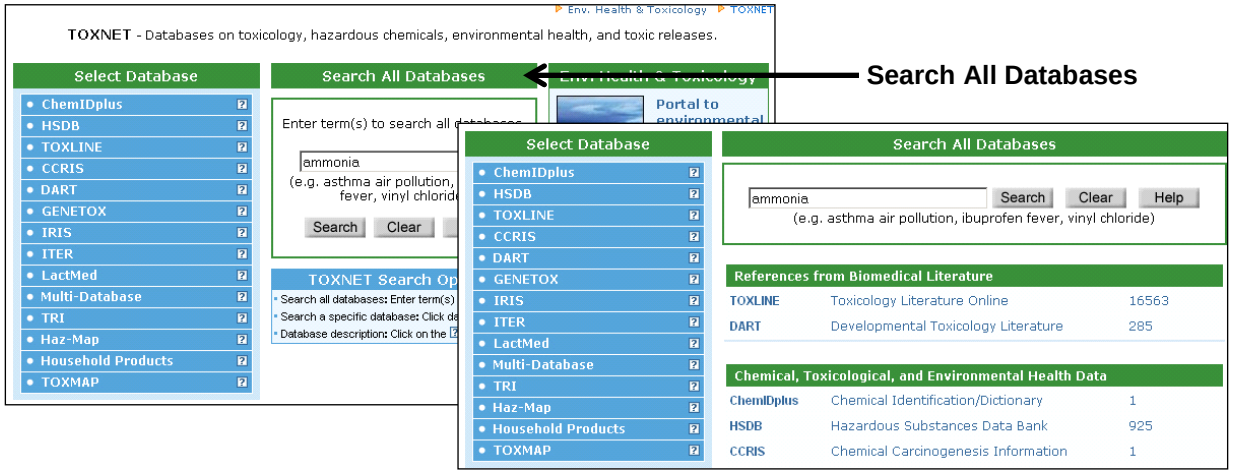
The TOXNET Databases

The TOXNET databases can be grouped in the following categories:

- Chemical Nomenclature—ChemIDplus
- Toxicology Data (one record per chemical)—HSDB, IRIS, CCRIS, GENE-TOX, ITER, and LactMed—can also search any combination of these files with the **Multi Database** feature
- Toxicology Literature (bibliographic references)—TOXLINE and DART
- Toxic Releases—TRI and TOXMAP
- Specialty Databases—Haz-Map, Household Products Database

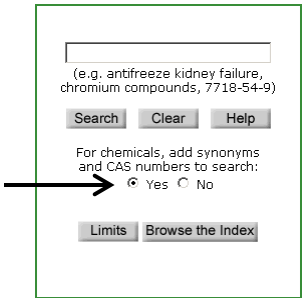
TOXNET Basic Searching

From the TOXNET home page, you can search all TOXNET databases simultaneously. Your results will be displayed as links to the databases in which your search term(s) were found and the number of records in each—under the headings: **References from the Biomedical Literature** (TOXLINE and DART) and **Chemical, Toxicological, and Environmental Health** (all others).



Entering search term(s)—You may enter any combination of words, chemical names, and numbers, including Chemical Abstracts Service (CAS) registry numbers. Common "stop words" such as "a," "an," "and," "for, "the," and "it" will not be searched. When searching for terms other than chemicals, the system automatically searches for singular and plural forms of the term(s) entered.

Synonym searching—By default the system will search for the exact name, synonyms, and CAS number as derived from ChemIDplus. Select "No" to search only for the exact chemical term or CAS Registry Number entered. In LactMed, the CAS number refers to the parent compound (i.e., not the salt form).



Truncation—The asterisk (*) is the right-handed truncation symbol for any number of characters.

Phrase searching—Search phrases with quotation marks.

Boolean searching—Use the logical operators "AND," "OR," and "NOT" to limit a search of two or more terms to specific criteria. In searches with combinations of these operators, "AND" takes precedence, followed by "NOT" and then "OR." This default precedence may be overridden with the use of parentheses, which may also be nested (i.e., parentheses within parentheses). Examples:

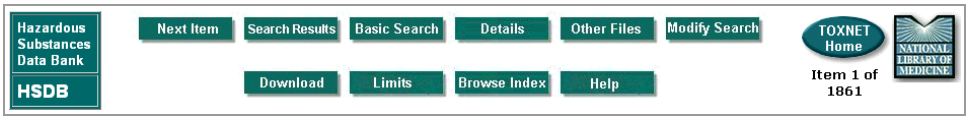
- Pulmonary **AND** edema—Retrieves all records with the two words appearing together
- Liver **OR** kidney—Retrieves all records containing either of these words (or both of them)
- Carcinoma **NOT** squamous—Retrieves records from which one or more terms have been excluded

Browse the Index—This feature provides a scannable index of all terms beginning with the search term you entered and the number of records for each term. In the Toxicology Data databases, selectable items indexed are **All Words**, **CAS Registry Number**, and **Chemical Name**. In the Toxicology Literature databases, selectable items indexed are **All Words**, **MeSH Headings/Keywords**, **Authors**, and **CAS Registry Number**.

Search Results buttons—Buttons on the left of the search results screen allow you to:

- **Save Checked Items**—Save items in a set for displaying, sorting, and downloading
- **Sort**—Sort the entire search results or items saved in a set
- **Download**—Download the entire search results or items save in a set in brief, full, abstract, or tagged format
- **Modify Search**—Make changes to the most recent search
- **Basic Search**—Conduct a new search in the same database
- **Browse Index**—Browse all words, CAS Registry Number, chemical name, and in bibliographic databases MeSH headings/keywords and authors
- Go to the **Help** file for that database
- Go to **TOXNET Home**

Navigation buttons—Buttons at the top of the record screen allow you to:



- Go to the **Next Item** in the search results
- Go back to the **Search Results** screen
- Perform a new **Basic Search** in the same database
- View **Details** of the search
- Display links to **Other Files** (NLM databases) containing information on the substance
- **Modify** [your] **Search**
- **Download** the record or portions of the record
- Perform a new search in the same database with **Limits** applied
- **Browse** [the] **Index**
- Go to the **Help** file for that database
- Go to **TOXNET Home**

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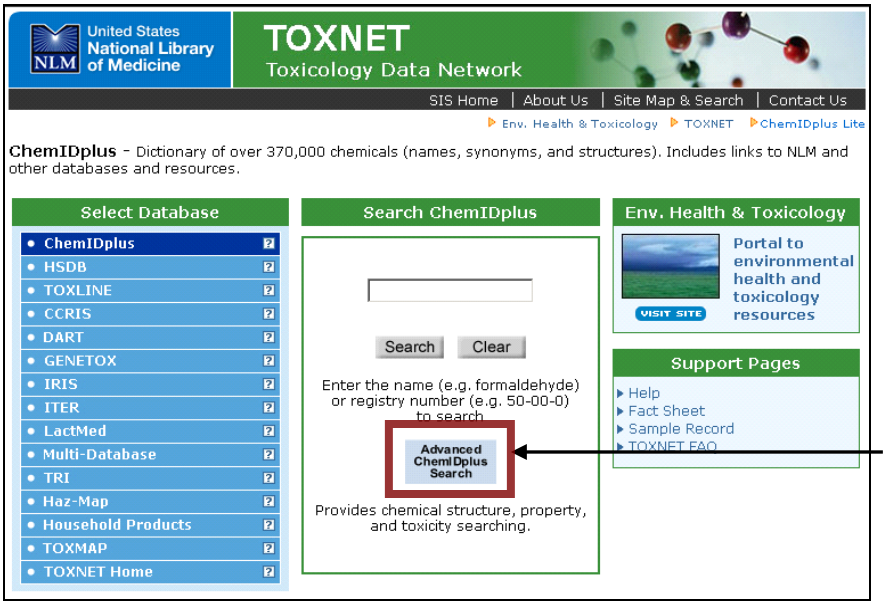
ChemIDplus

ChemIDplus

ChemIDplus is a free, Web-based search system that provides access to structure and nomenclature authority files used for the identification of chemical substances cited in NLM databases. It contains over 380,000 chemical records, of which over 290,000 include chemical structures. The ChemIDplus database has two different applications: **ChemIDplus Lite** (for basic searching) and **ChemIDplus Advanced** (for more experienced users).



ChemIDplus Lite

Link to ChemIDplus Advanced

http://toxnet.nlm.nih.gov

Content

Information in the ChemIDplus database includes:

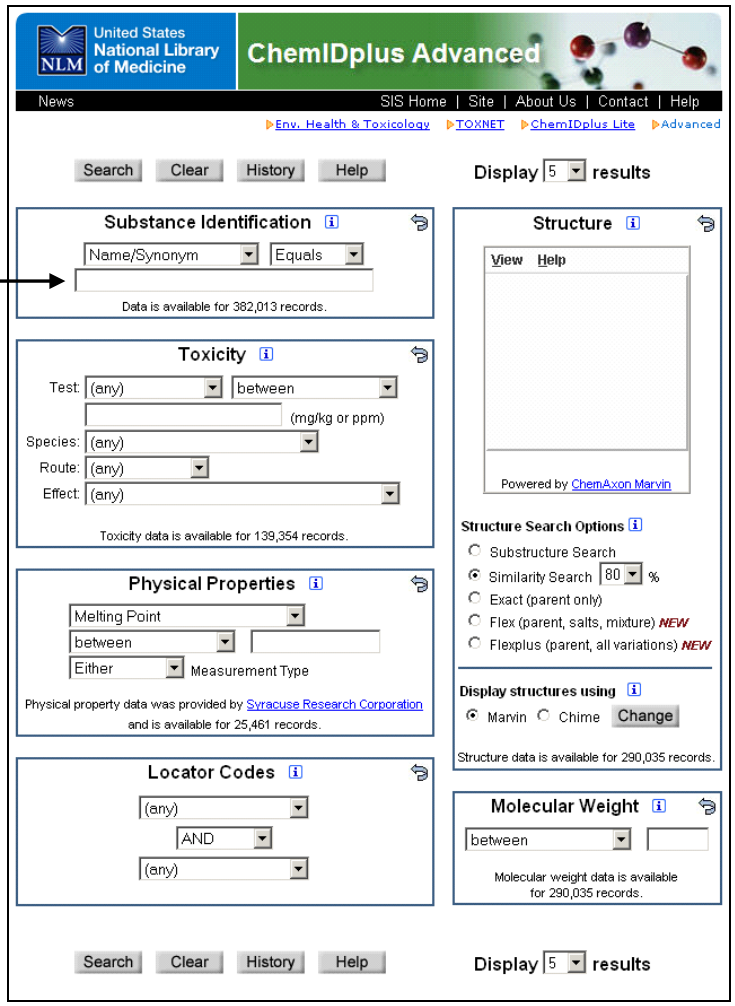
- Systematic, generic, and trade names
- Synonyms
- CAS registry numbers
- Molecular formulas
- Classification codes
- Chemical structures (ChemIDplus Advanced)

ChemIDplus also provides links to many biomedical resources at NLM and on the Internet for chemicals of interest.

Searching ChemIDplus

Search ChemIDplus by name, synonym, Chemical Abstracts Service (CAS) registry number, molecular formula, classification code, locator code, structure, toxicity, and/or physical properties within two distinct applications:

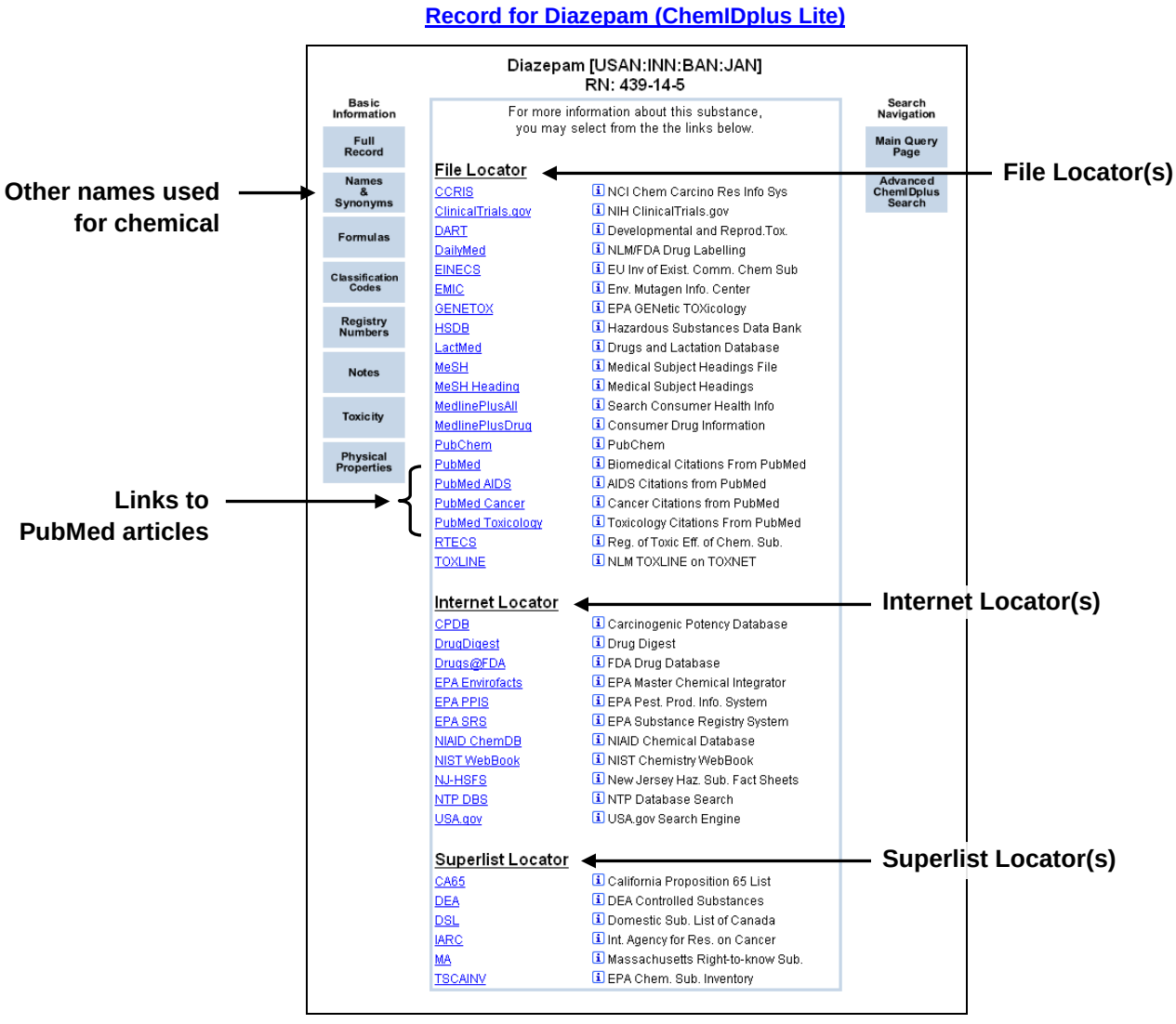
- **ChemIDplus Lite** (ChemIDplus home page) is designed for simple searching on name or registry number to retrieve basic information about a chemical and provide locator links to other resources and does not require special software applets or plug-ins. The Lite version displays structures, but does not allow drawing or searching on structures.
- **ChemIDplus Advanced** (see below) is designed for more advanced searching on any combination of name, registry number, molecular formula, classification code, locator code, toxicity, physical property, structure, or molecular weight. In addition, ChemIDplus Advanced allows users to draw their own structures and perform similarity and substructure searches. For more tips on how to search using the ChemIDplus Advanced search features, access the Help section.



Search Results

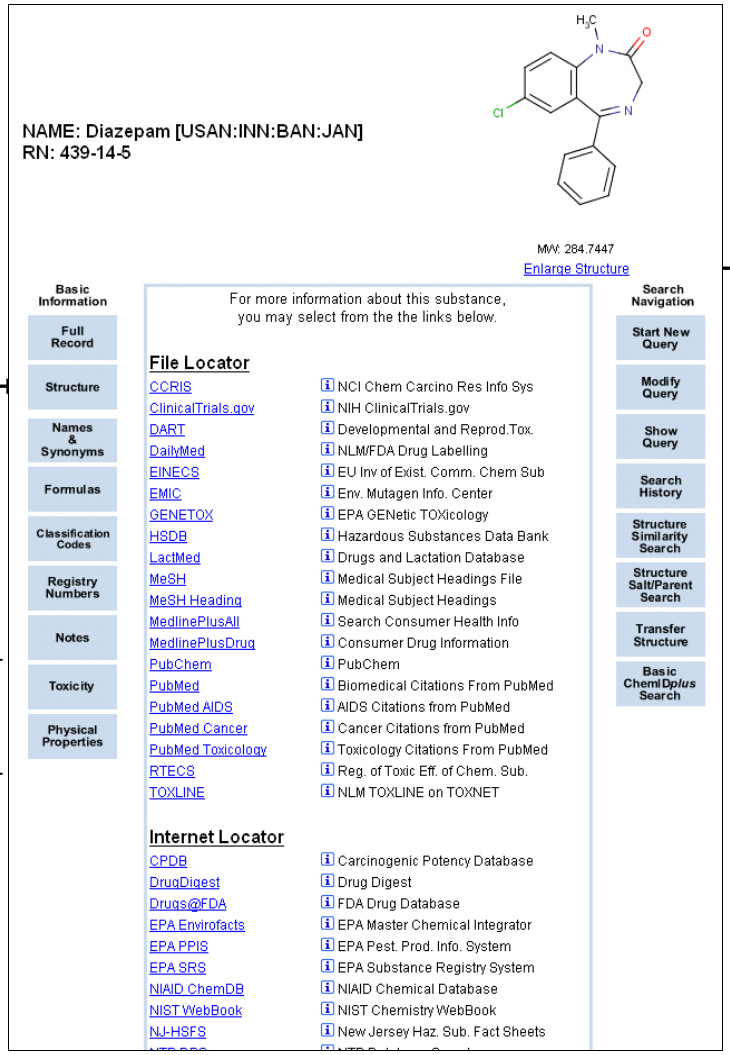
If you searched ChemIDplus Lite, the system displays the record with basic information for the chemical, including links to additional information. If multiple records were retrieved, a list of names would be shown. Following is the ChemIDplus Lite record for *diazepam*. Use buttons on the left to retrieve categories of detailed information such as Names & Synonyms, Formulas, Classification Codes, Registry Numbers, and Notes. The Toxicity and Physical Properties buttons display data in tables. Toxicity data contain links to the PubMed citation, if available. In the center of the page, lists of "locators" provide links to other resources in three categories:

- **File Locators**—point to a set of NLM associated databases
- **Internet Locators**—point to a set of resources with biomedical data of interest for the chemical
- **SuperList Locators**—point to a set of regulatory and scientific lists that contain information about the chemical



The advanced record shows the same locator lists and basic information as the ChemIDplus Lite record with the addition of structures including structure navigation buttons.

Record for Diazepam (ChemIDplus Advanced)



Additional Resources

For further information, we recommend these additional resources:

- ChemIDplus Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/chemidplusfs.html
- TOXNET Manual
  http://sis.nlm.nih.gov/enviro/manuals.html

ChemIDplus Search Exercises

Scenario 1: Chemical Identification

Linda works for a government agency that monitors ingredients in cigarettes. Linda and her team receive ingredient submissions from cigarette manufacturers. The team is tasked with verifying chemical ingredient names and registry numbers. Linda receives an ingredient submission which lists *acetoin* with CAS registry number 513-86-0. The previous submission listed *acetyl methyl carbinol* with the same registry number.

Search ChemIDplus Lite to verify the information: Locate the record for *acetoin*. Since 513-86-0 is the registry number for the *acetoin* record, verify whether, or not, *acetyl methyl carbinol* is a synonym for *acetoin*. Is there a regulatory source for this synonym?

Suggested Solution:

Type	**acetoin** in the search box
Click	the **Search** button
Click	the **Names & Synonyms** button on the left
Scroll	down to **Superlist Name**
	Remember that the Superlist heading indicates government regulatory information (U.S. and International)
Click	the **button** next to "Acetyl methyl carbinol" to view the source
Close	the **Data Source Information** window
Close	the **Names & Synonyms** window

Scenario 2: Research Data

Dr. Stein is conducting research and has a need to examine the toxic effects of chemicals produced in high volumes in mice. Dr. Stein would like to focus on extremely toxic chemicals, but exclude pesticides from his initial short list for his team.

Search ChemIDplus Advanced to form a list of chemicals and view some of the effects listed in literature: Enter toxicity criteria for extremely toxic chemicals. Qualify the type of chemical by using Locator Codes. View the effects in the toxicity table. Return to the Search Results page to continue with Scenario 3.

Suggested Solution:

Click	the **Advanced ChemIDplus Search** button
In the	**Toxicity** search box, select LD50 from the "Test:" drop-down menu
In the	next drop-down menu (to the right), qualify the value as less than

Enter a value of 50 mg/kg in the next search box

Select mouse from the "Species:" drop-down menu

Select oral from the "Route:" drop-down menu

In the **Locator Codes** search box, select EPA HPVIS in the first drop-down menu

The EPA HPVIS locator is the resource for High Production Volume Chemical Information System from the Environmental Protection Agency (EPA).

Select AND NOT from the second drop-down menu

The AND NOT qualifier excludes pesticides from the search results. The shaded rows indicate an exact match on the search query. The red text indicates a partial match. Notice links to PubMed in the Source column.

Select EPA PPIS from the last drop-down menu

The EPA PPIS is the EPA's Pesticide Product Information System.

Click the **Search** button

Click the first record in the search results

Click the **Toxicity** button on the left side of the page

View the **Effect** column

Click **Search Results Page** on the right side of the page to continue with Scenario 3

Scenario 3 – Structure Similarity

Dr. Stein takes a look at his search results. He notices *chloroacetyl chloride* in the results list. Dr. Stein would like to identify chemicals structurally similar to this compound.

Use the ChemIDplus Advanced search results from Scenario 2 to identify similar structures: From the previous search results, locate the chloroacetyl chloride record and transfer the structure to the main query page. On the main query page, choose a level of similarity in the structure search box. The Similarity Search should be pre-selected as the default.

Suggested Solution:

Click the button on the right side of the chloroacetyl chloride structure

Select 70% from the drop-down menu

Click the **Search** button

Notice the similar halogenated structures.

Return to ChemIDplus Lite to prepare for the next search

Additional Exercises

Go to http://toxnet.nlm.nih.gov

Click  in the **Select Database** column

Exercise 1: Locate the record for *trifluralin*. Is *trifluralin* on the U.S. EPA Clean Air List (CAA1)?

Suggested solution:

Type	**trifluralin** in the search box
Click	the **Search** button
Click	CAA1 under **SuperList Locator**
Review	the information in the pop-up window and close the window
Click	the **Main Query Page** button at the right to prepare for a new search

Exercise 2: Check the File Locator field in the *selenium* record to see what other NLM databases contain information on *selenium*. View the listing of *selenium* synonyms.

Suggested solution:

Type	**selenium** in the search box
Click	the **Search** button
Review	the other NLM databases (under **File Locator**), that contain information on the chemical
Click	the **Names & Synonyms** button on the left of the page
Review	the record in the pop-up window and close the window
Click	the **Main Query Page** button at the right to prepare for a new search

Exercise 3: Find the lowest toxic dose tested (TDLo) for *phenobarbital* in infants.

Suggested solution:

Type	**phenobarbital** in the search box
Click	the **Search** button
Click	Phenobarbital [USAN:INN:JAN]
Click	the **Toxicity** button on the left of the page
Review	the chart and close the window
Click	the **Main Query Page** button at the right to prepare for a new search

Exercise 4: Locate the record for *formaldehyde* and link to the Internet Locator ATSDR ToxFAQs. Then link to the NIOSH Pocket Guide. Use the Classification Code button to find the Overall Carcinogenic Evaluation classification and the source for the rating.

Suggested solution:

Type	**formaldehyde** in the search box
Click	the **Search** button
Click	ATSDR ToxFAQs under **Internet Locator**
Review	the **ToxFAQs for Formaldehyde** in the ATSDR window and close the window
Click	NIOSH Pocket Guide under **Internet Locator**
Review	the information and close the CDC window
Click	the **Classification Codes** button on the left of the page
Review	the **Superlist Classification Code** list to find "Overall Carcinogenic Evaluation: Group 1"
Click	the information icon (i) next to "Overall Carcinogenic Evaluation: Group 1" to find the data source – IARC (International Agency for Research on Cancer)
Close	the **Data Source Information** window, then the **Classification Codes** window and return to the **Formaldehyde [USAN]** record
Click	the **Main Query Page** button at the top right to prepare for a new search

Exercise 5: Find the *xylene* record in ChemIDplus and use its structure to do substructure and 70% similarity searches, respectively. How many structures are in each category?

Suggested solution:

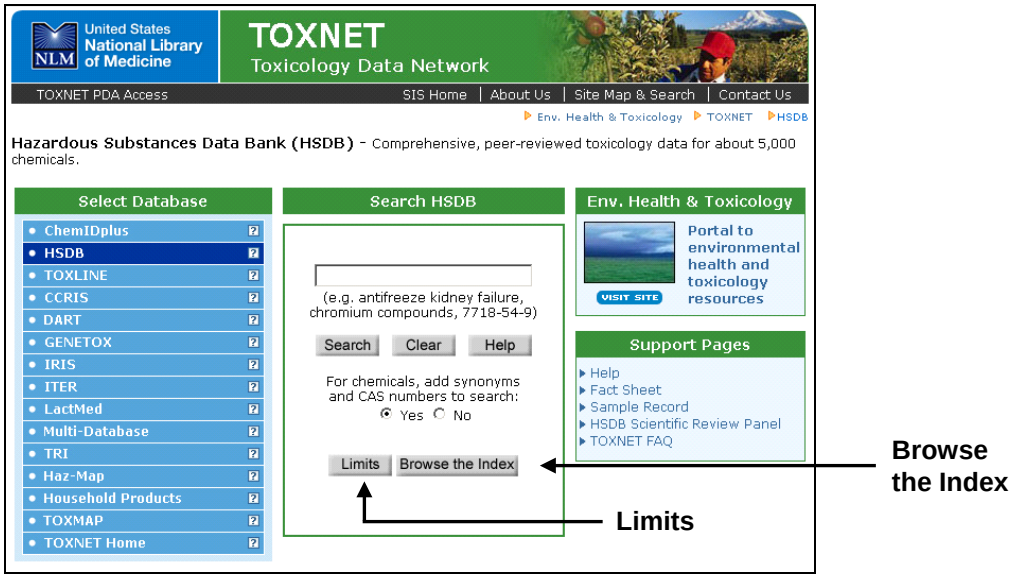
Click	the **Advanced ChemIDplus Search** button
Type	**xylene** in the Substance Identification search box
Click	the **Search** button and review the information retrieved
Click	the **Transfer Structure** button at the right
Click	the Similarity Search option in the Structure Search Options box and change the percentage to 70 in the pull-down menu
Click	the **Search** button and review the information retrieved
Click	the **TOXNET Home** button at the left of the page to prepare for the next session

4

Hazardous Substances Data Bank (HSDB)

HSDB

HSDB (Hazardous Substances Data Bank) is a comprehensive toxicology data file on NLM's TOXNET system. It contains data on approximately 5,000 chemicals, organized into individual records—the average record is approximately 25 printed pages. Content is peer-reviewed by the Scientific Review Panel, a committee of experts in the major subject areas within the data bank's scope. HSDB is enhanced with information on human exposure, industrial hygiene, emergency handling procedures, environmental fate, regulatory requirements, and related areas.



http://toxnet.nlm.nih.gov

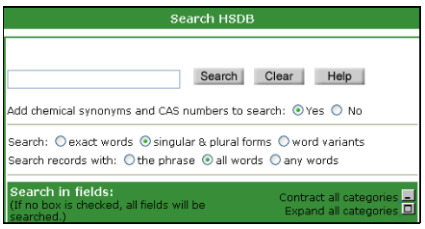
Searching HSDB

Search HSDB by chemical or other name, chemical name fragment, Chemical Abstracts Service (CAS) Registry Number, and/or subject terms (basic searching). By default, the system searches for synonyms and CAS numbers of chemicals.

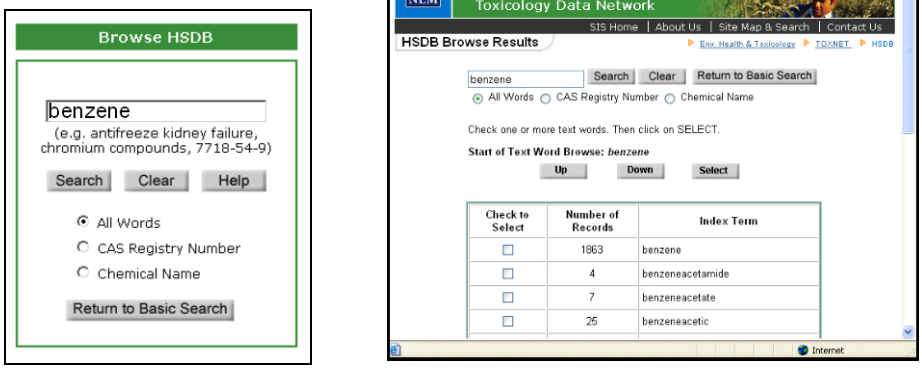
Use truncation (*), Boolean operators (AND, OR, NOT), phrase searching, nested parentheses, limits, and index browsing to refine your search results.

Click the **Limits** button on the home page to search:

- Exact words, singular & plural forms, or word variants
- All the words, any of the words, or as a phrase
- In specific fields or categories of fields (see "HSDB Limits Search Fields" in this section)



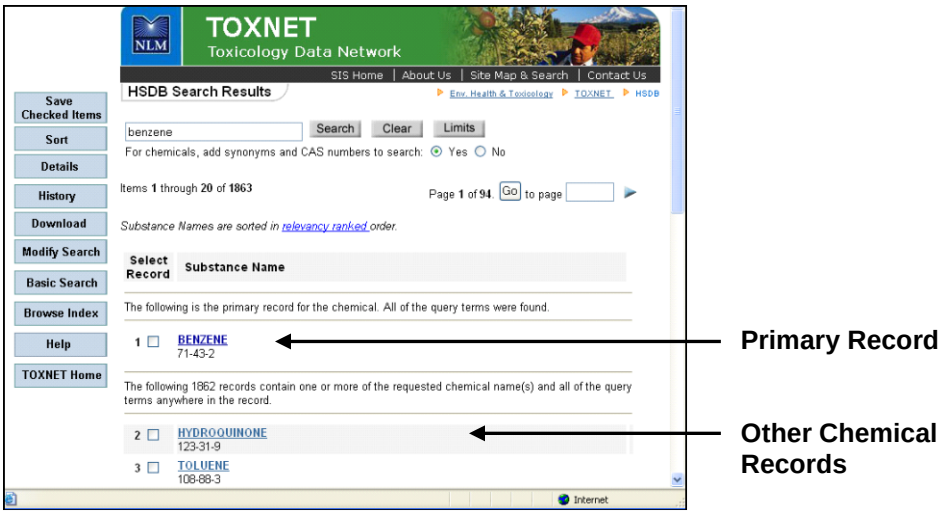
Click the **Browse the Index** button on the home page to search a list of index terms related to the search term entered and the number of records containing that term. Select the record(s) you want to view by clicking the appropriate box in the "Check to Select" column and clicking the **Select** button. Scan the index above or below the original display by clicking the **Up** or **Down** button.



Search Results

Your initial retrieval is displayed as a list of substance names in blue and their CAS Registry Numbers. Substances are listed in **relevancy ranked order**. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

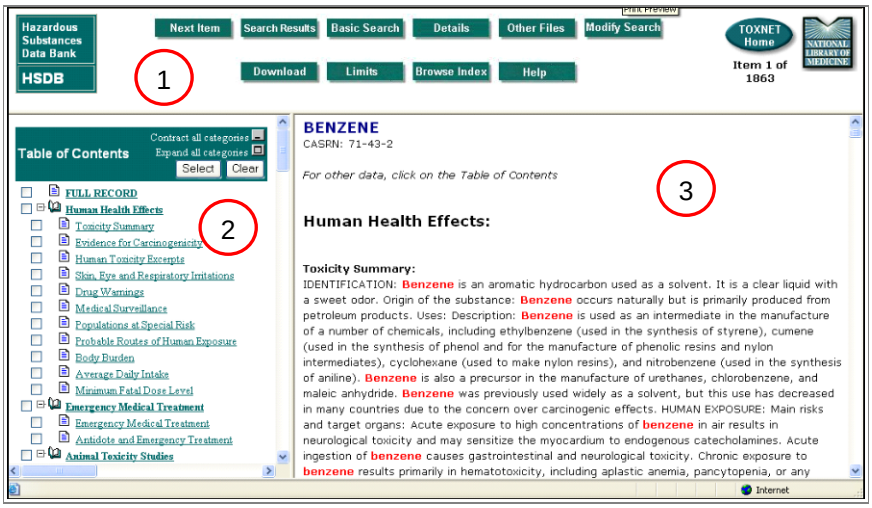
When searching for a chemical, the initial matching chemical record (the "primary record") may be followed by additional chemical records that contain the chemical name or search term you entered.



Search Results Screen

Click on a substance name on the search results screen to retrieve the record for that substance. The **Record** screen is organized into three sections:

1. Navigation buttons at the top of the screen allow you to link to **Other Files** (NLM databases), modify your search (**Modify Search**), **Download**, return to the **Basic Search** screen, and more.
2. A **Table of Contents** in the left frame allows you to choose categories and fields for display.
3. Chemical data is shown in the right frame. Your search term(s) appear in red.



Record Screen

If you click the primary record, the system displays the **Human Health Effects**. If you click a different chemical record, or if your search was for a term other than a chemical, the system will display the sections of the record best matching your query terms (**Best Sections**), those where the chemical search term appears with greatest frequency.

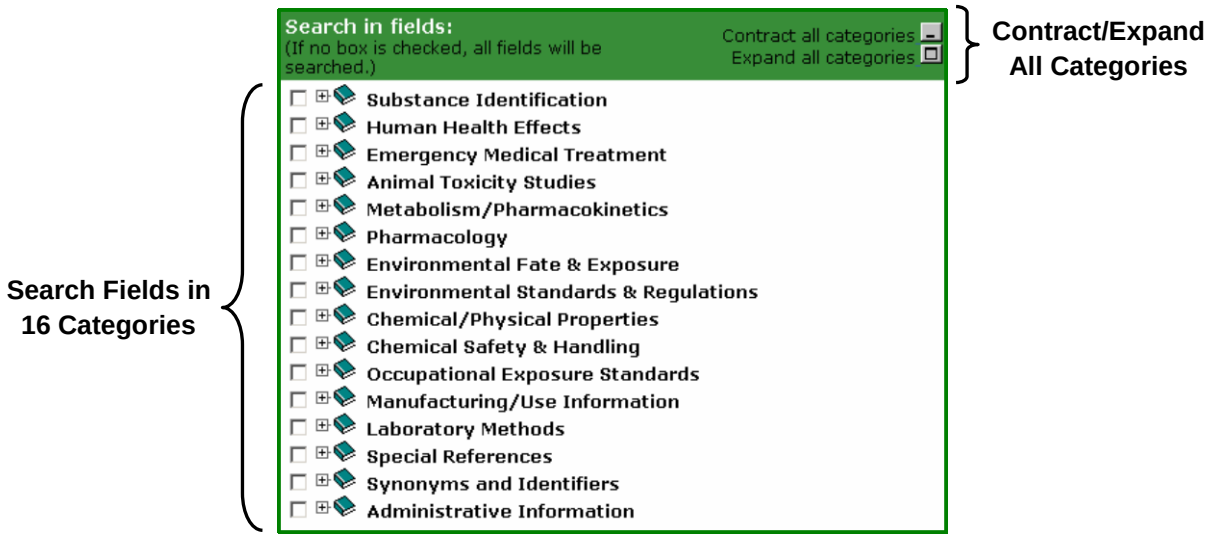
Additional Resources

For further information, we recommend these additional resources:

- HSDB Skill Kit
  http://www.nlm.nih.gov/pubs/techbull/ma07/ma07_hsdb_skill_kit.html
- HSDB Animated Tutorial
  http://sis.nlm.nih.gov/enviro/captivate/basicsearchinghsdb_skin.swf

HSDB Limits Search Fields

The **Limits** feature allows you to specify a particular field or category of fields to search. By default, the system will search all fields in all categories. To see all fields within a specific category, click the "+" beside that category.



Expanded Categories (All Fields)

Substance Identification
- Chemical Names
- CAS Registry Number

Human Health Effects
- Toxicity Summary
- Evidence for Carcinogenicity
- Human Toxicity Excerpts
- Human Toxicity Values
- Skin, Eye and Respiratory Irritations
- Drug Warnings
- Medical Surveillance]
- Populations at Special Risk
- Probably Routes of Human Exposure
- Body Burden
- Average Daily Intake
- Minimum Fatal Dose Level

Emergency Medical Treatment
- Emergency Medical Treatment
- Antidote and Emergency Treatment

Animal Toxicity Studies
- Toxicity Summary
- Evidence for Carcinogenicity
- Non-Human Toxicity Excerpts
- Ecotoxicity Excerpts
- National Toxicology Program Studies
- Non-Human Toxicity Values
- Ecotoxicity Values
- Ongoing Test Status
- TSCA Test Submissions

Metabolism/Pharmacokinetics
- Metabolism/Metabolites
- Absorption, Distribution & Excretion
- Biological Half-Life
- Mechanism of Action
- Interactions

Pharmacology
- Therapeutic Uses
- Drug Warnings
- Interactions
- Drug Idiosyncrasies
- Drug Tolerance
- Minimum Fatal Dose Level
- Maximum Drug Dose
- Bionecessity

Environmental Fate & Exposure
- Environmental Fate/Exposure Summary
- Probably Routes of Human Exposure
- Body Burden
- Average Daily Intake
- Natural Pollution Sources
- Artificial Pollution Sources
- Environmental Fate
- Environmental Biodegradation
- Environmental Abiotic Degradation
- Environmental Bioconcentration
- Soil Adsorption/Mobility
- Volatilization from Water/Soil
- Environmental Water Concentrations
- Effluent Concentrations
- Sediment/Soil Concentrations
- Atmospheric Concentrations
- Food Survey Values
- Plant Concentrations
- Fish/Seafood Concentrations
- Animal Concentrations
- Milk Concentrations
- Other Environmental Concentrations

Environmental Standards & Regulations
- FIFRA Requirements
- Acceptable Daily Intakes
- TSCA Requirements
- CERCLA Reportable Quantities
- RCRA Requirements
- Atmospheric Standards
- Clean Water Act Requirements
- Federal Drinking Water Standards
- Federal Drinking Water Guidelines
- State Drinking Water Standards
- State Drinking Water Guidelines
- Soil Standards
- FDA Requirements
- Allowable Tolerances

Chemical/Physical Properties
- Molecular Formula
- Molecular Weight
- Color/Form
- Odor
- Taste
- Boiling Point
- Melting Point
- Corrosivity
- Critical Temperature & Pressure
- Density/Specific Gravity
- Dissociation Constants
- Heat of Combustion
- Heat of Vaporization
- Octanol/Water Partition Coefficient
- pH
- Solubilities
- Spectral Properties
- Surface Tension
- Vapor Density
- Vapor Pressure
- Relative Evaporation Rate
- Viscosity
- Other Chemical/Physical Properties

Chemical Safety & Handling
- Hazards Summary
- DOT Emergency Guidelines
- Odor Threshold
- Skin, Eye and Respiratory Irritations
- Fire Potential
- NFPA Hazard Classification
- Flammable Limits
- Flash Point
- Autoignition Temperature
- Fire Fighting Procedures
- Toxic Combustion Products
- Firefighting Hazards
- Explosive Limits & Potential
- Hazardous Reactivities & Incompatibilities
- Hazardous Decomposition
- Hazardous Polymerization
- Other Hazardous Reaction
- Prior History of Accidents
- Immediately Dangerous to Life or Health
- Protective Equipment & Clothing
- Preventive Measures
- Stability/Shelf Life
- Shipment Methods and Regulations
- Storage Conditions
- Cleanup Methods
- Disposal Methods
- Radiation Limits & Potential

Occupational Exposure Standards
- OSHA Standards
- Threshold Limit Values
- NIOSH Recommendations
- Immediately Dangerous to Life or Health
- Other Occupational Permissible Levels

Manufacturing/Use Information
- Major Uses
- Manufacturers
- Methods of Manufacturing
- General Manufacturing Information
- Formulations/Preparations
- Impurities
- Consumption Patterns
- U. S. Production
- U. S. Import
- U. S. Exports

Laboratory Methods
- Clinical Laboratory Methods
- Analytic Laboratory Methods
- Sampling Procedures

Special References
- Special Reports

Synonyms and Identifiers
- Related HSDB Records
- Synonyms
- Associated Chemicals
- Formulations/Preparations
- Shipping Name/ Number DOT/UN/NA/IMO
- Standard Transportation Number
- EPA Hazardous Waste Number
- Wiswesser Line Notation
- RTECS Number

Administrative Information
- Hazardous Substances Databank Number
- Last Review Date

HSDB Search Exercises

Scenario 1 – Regulatory Information

Sonya, the parent of an elementary school student, receives a letter from the school stating that over the summer water from all sinks and drinking fountains in the building was tested for *lead* compounds. The letter states that the water contains safe levels of *lead* for consumption. None of the detected *lead* levels exceeded 2.0 micrograms per liter. Sonya would like to confirm that this level is safe for drinking water.

Search HSDB to determine the safe level: Locate the *lead* compounds record in HSDB. Open the *lead* compounds record. Locate the Federal Drinking Water Standards.

Suggested Solution:

Type	**lead** in the search box
Click	the **Search** button
Click	**LEAD COMPOUNDS** in the search results list
Scroll	down to the **Environmental Standards & Regulations** section in the **Table of Contents**
Click	Federal Drinking Water Standards
	States whose standards and guidelines differ from the federal values are listed when the data is available. States not listed follow the federal standards and guidelines.
View	the federal action level for safe drinking water: 15 ug/l

Scenario 2 – Chemical Toxicity / Testing

A researcher reads an FDA consumer update on *Bisphenol A* (*BPA*), a compound used in plastic food and beverage packaging, including baby bottles. The article states that "current evidence indicates that exposure levels to *BPA* from food contact materials…are below those that may cause health effects." The researcher decides to take a look at completed and/or ongoing studies that may be included in the "current evidence."

Search HSDB to examine studies: Locate the *Bisphenol A* record. Open the *Bishpenol A* record. Navigate the table of contents to locate information on scientific testing and toxicity.

Suggested Solution:

Type	**bisphenol a** in the search box
Click	the **Search** button
Click	the primary record for Bisphenol A
Scroll	through **Human Health Effects** to examine case reports, surveillance, biomonitoring, and in vitro tests

Click National Toxicology Program Studies and Ongoing Test Status in the **Table of Contents** to view NTP study results

Scenario 3 – Environmental Fate & Exposure

An environmental scientist is interested in examining current information on how *ethylene glycol* behaves in the environment based on the chemical's physical properties.

Search HSDB to find the information: Locate the *ethylene glycol* record in HSDB. Open the *ethylene glycol* record. Navigate the table of contents to locate the Environmental Fate & Exposure section.

Suggested Solution:

Type **ethylene glycol** in the search box

Click the **Search** button

Click the primary record for ethylene glycol

Scroll down to the Environmental Fate & Exposure section in the Table of Contents

The Environmental Fate & Exposure Summary provides information on how a chemical behaves in air, soil, and water; routes of human occupational exposure; and more.

Scroll through the Summary and other subsections

Notice the physical properties provided to support statements within the summary (vapor pressure, octanol-water partition coefficient (Koc), and Henry's Law constant). Ethylene glycol is used in antifreeze and various other automotive and consumer products.

Scenario 4 – Limiting a search

A Department of Homeland Security employee is interested in finding out what chemical warfare agents have a record in HSDB.

Search HSDB using limits: Pull up the limits search options. Limit your search to major uses under Manufacturing/Use Information. Enter your specified use query.

Suggested Solution:

Click the **Limits** button at the bottom of the search box

Click the ⊞ icon to expand the Manufacturing/Use Information field

Click to check the box next to major uses

Type **chemical warfare** in the search box. Select "exact words" and "the phrase" below the search box. Click search

Examine the use field text. Results may contain chemicals used against chemical warfare agent exposure.

Additional Exercises

Go to http://toxnet.nlm.nih.gov

Click • HSDB in the **Select Database** column

Exercise 1: What are the concerns of *bisphenol A* residue in baby bottles?

Suggested Solution:

Type	**bisphenol a baby bottles** in the search box
Click	the **Search** button
Click	**BISPHENOL A**
Review	the **Best Sections** information in the right frame
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 2: What is the military usage of *arsine*? View the ChemIDplus record for *arsine*.

Suggested Solution:

Type	**arsine military** in the search box
Click	the **Search** button
Click	**ARSINE**
Review	the **Best Sections** information in the right frame
Click	the **Other Files** button at the top of the page
Click	**ChemIDplus Chemical Structure** in the pop-up window
Click	CDC EP&R (CDC Emerg. Prep. & Response) under **Internet Locator**
Review	the information retrieved and close the CDC window
Close	the ChemIDplus window and return to HSDB
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 3: What is the average daily intake of *mercury*?

Suggested Solution:

Type	**mercury** in the search box
Click	the **Search** button
Click	**MERCURY COMPOUNDS**
Click	Average Daily Intake under **Human Health Effects** in the Table of Contents
Review	the information retrieved
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 4: Using the CAS Registry Number 298-00-0, find information on the occurrence or effects of this chemical in soil.

Suggested Solution:

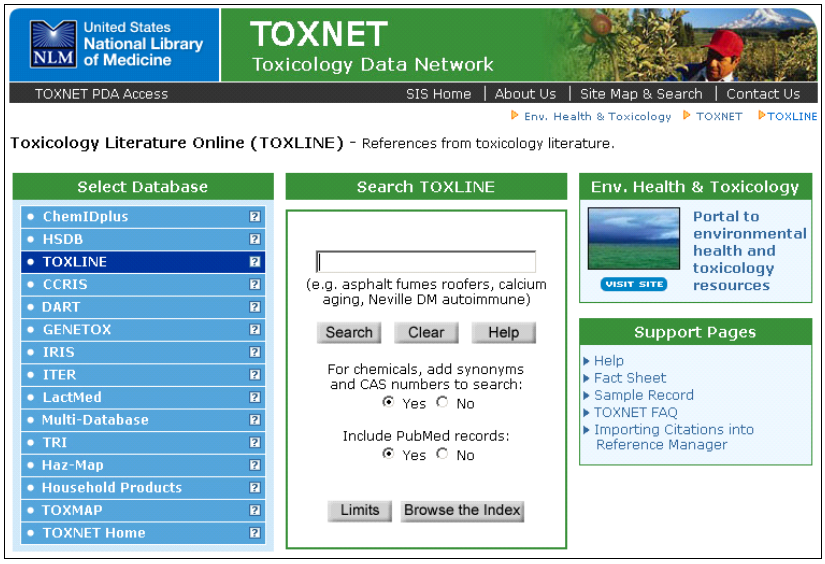
Type	**298-00-0** in the search box
Click	the **Search** button
Click	**METHYL PARATHION**
Review	the **Best Sections** information in the right frame
Click	the **TOXNET Home** button at the top right of the page to prepare for the next session

5

Toxicology Literature Online (TOXLINE)

TOXLINE

TOXLINE is NLM's bibliographic database for toxicology, providing information covering the biochemical, pharmacological, physiological, and toxicological effects of drugs and other chemicals. It contains over 3.5 million bibliographic citations from 1965 to the present, most with abstracts and/or indexing terms and Chemical Abstracts Service (CAS) Registry Numbers.



http://toxnet.nlm.nih.gov

TOXLINE Components

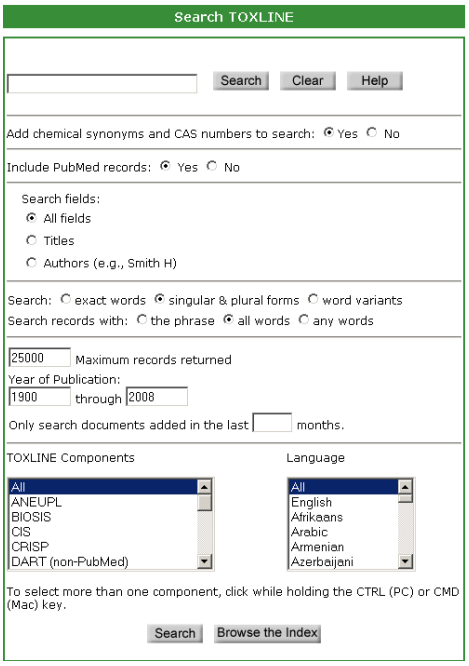
TOXLINE references come from various sources organized into components. These components are searched together but may be used to limit searches.

- Standard biomedical/toxicology journal literature
  - MEDLINE/PubMed
- Special journal and other research literature
  - Developmental and Reproductive Toxicology (DART)
  - International Labour Office (CIS)
- Technical reports and research projects
  - Federal Research in Progress (FEDRIP)
  - Toxic Substances Control Act of Test Submissions (TSCATS)
  - Toxicology Document and Data Depository (NTIS)
  - Toxicology Research Projects (CRISP)

- Meeting Abstracts
- Archival Collection (no longer being updated)
    - Aneuploidy (ANEUPL)
    - Environmental Mutagen Information Center File (EMIC)
    - Environmental Teratology Information Center File (ETIC)
    - Epidemiology Information System (EPIDEM)
    - Hazardous Materials Technical Center (HMTC)
    - Health Aspects of Pesticides Abstract Bulletin (HAPAB)
    - International Pharmaceutical Abstracts (IPA)
    - NIOSHTIC (NIOSH)
    - Pesticides Abstracts (PESTAB)
    - Poisonous Plants Bibliography (PPBIB)
    - Swedish National Chemicals Inspectorate (RISKLINE)
    - Toxicological Aspects of Environmental Health (BIOSIS)

Searching TOXLINE

Any terms you enter in the query box will automatically be searched against both the keyword and MeSH fields, in addition to other fields such as title, abstract, and author. Chemical names are mapped to names, synonyms, and CAS Registry Numbers derived from ChemIDplus. Words such as "a," "an," "and," "for," "the," and "it" will not be searched.



Limits may be applied to narrow your search to:

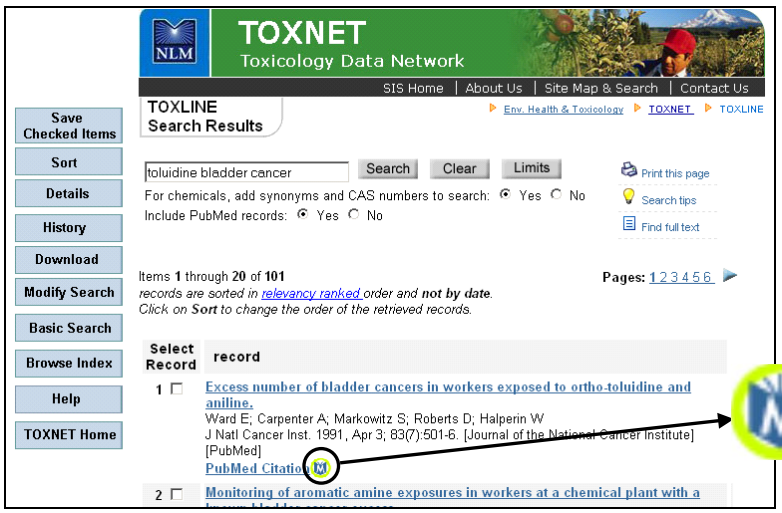
- Titles or authors
- Exact words or word variants
- Year of publication
- Documents added within a specified number of months
- TOXLINE components (more than one component can be selected)
- Language

You may also specify the maximum number of records you would like retrieved.

Search Results

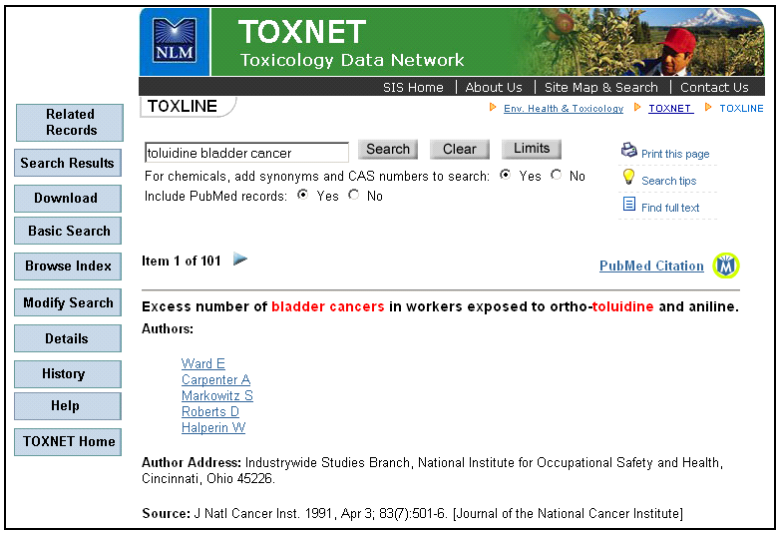
Your initial retrieval is displayed as a list of bibliographic references in **relevancy ranked order** with the titles in blue and underlined. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

Each reference is followed by the field tag [in brackets] of the subfile from which the article was retrieved. References that come from MEDLINE/PubMed are identified with a green and blue M-encircled icon (Ⓜ) and are linked to the same reference in PubMed. Clicking on this link takes you to PubMed where you can use functions such as LinkOut, Related Links, and document ordering.



Link to PubMed Citation

The **Record** screen displays the complete record for the item you selected on the Results screen with your search terms shown in red:



Individual author names, MeSH headings, keywords, and CAS Registry Numbers are in blue and linked to similar records in the database. Thus, by clicking on an author you can find other articles by that author, and by clicking on a keyword you can find other articles indexed with that keyword.

Other information on the record screen includes the article language, the month it was entered into the system, the year of publication, and a secondary source ID—a unique identifying number for the record and tagged to its subfile. References from PubMed again have the PubMed citation designation and the green-and-blue PubMed icon ( ).

Navigation buttons on the left are the same as shown on the results screen with two additions:

Related Records—search for articles similar in subject matter to the one displayed. The search used a formula based on data in the displayed record.

Search Results—return to the complete list of results.

Additional Resources

For further information, we recommend these additional resources:

- PubMed
  http://pubmed.gov
- TOXLINE Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/toxlinfs.html
- Importing Citations into Reference Manager
  http://sis.nlm.nih.gov/enviro/captivate/toxlinespecialimports.htm
- Free Full Text Health Science/Medical Journals
  http://sis.nlm.nih.gov/pdf/FreeFullTextListApril07.pdf

TOXLINE Search Exercises

Scenario 1 – General Search

Michelle, a graduate student, is aware that many studies on pesticides have been conducted. She is also aware that pesticides are regulated in the United States. Michelle would like to get an idea of how much literature exists on cancer among agricultural workers since they may experience higher exposure to pesticides than the general public.

Suggested Solution:

Type	**cancer agricultural workers** in the search box
Click	the **Search** button
Review	the citation(s)
Click	the **Basic Search** button at the left of the page to prepare for the next search

Scenario 2 – Limiting Search Results

Thomas, a principle investigator, is designing a new breast cancer study for women. He would like to perform a literature search for recent articles focused on the effects of diet on breast cancer. Thomas would like articles published since 2006.

Suggested Solution:

Type	**diet breast cancer** in the search box
Click	the **Limits** button
Select	Titles under "Search fields:"
Type	**2006** in the first Year of Publication box (replacing "1900")
Click	the **Search** button
Review	record(s) of your choice
Click	the **Basic Search** button at the left of the page to prepare for the next search

Scenario 3 – Sorting Search Results

Jean, an industrial hygienist, would like to examine articles on worker exposure to *caprolactam*. She is interested in how studies have changed over time, beginning older articles and ending with the most recent. Jean would also like to retrieve only English citations.

Search TOXLINE and sort the results:

Suggested Solution:

Type	**occupational exposure caprolactam** in the search box
Click	the **Limits** button
Select	English in the Language box
Click	the **Search** button
Click	the **Sort** button in the left margin
Select	Ascending after Year of Publication
Click	Sort
Review	the citation(s)
Click	the **Basic Search** button at the left of the page to prepare for the next search

Additional Exercises

Go to http://toxnet.nlm.nih.gov

Click • TOXLINE in the **Select Database** column

Exercise 1: Search for the chemical of concern in baby bottles, *bisphenol A (BPA)*. Explore navigating through your retrieval, examining individual records, and going to linked records.

Suggested Solution:

Type	**bisphenol a baby bottles** in the search box
Click	the **Search** button
Review	record(s) of your choice
Click	the **Basic Search** button at the left of the page to prepare for the next search

Exercise 2: Find citations on the salmonella contamination in eggs. Limit your results to citations since 2006.

Suggested Solution:

Type	**salmonella eggs** in the search box
Click	the **Limits** button
Type	**2006** in the first Year of Publication box
Click	the **Search** button
Review	the citation(s)
Click	the **TOXNET Home** button at the right to prepare for the next session

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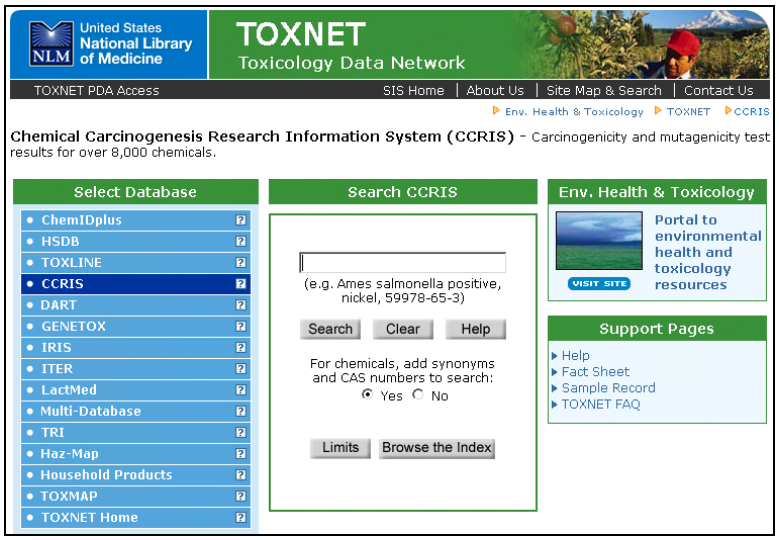
6

Chemical Carcinogenesis Research Information System (CCRIS)

CCRIS

CCRIS (Chemical Carcinogenesis Research Information System) is a toxicology data file of the NLM's TOXNET system. It is a scientifically evaluated and fully referenced data bank, developed and maintained by the National Cancer Institute (NCI). It contains over 9,000 chemical records with carcinogenicity, mutagenicity, tumor promotion, and tumor inhibition test results. Data are derived from studies cited in primary journals, current awareness tools, NCI reports, and other special sources. Test results have been reviewed by experts in carcinogenesis and mutagenesis.

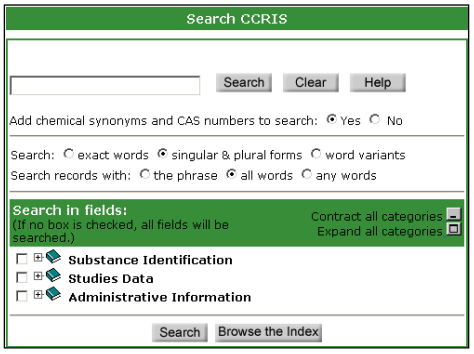


http://toxnet.nlm.nih.gov

Searching CCRIS

Search CCRIS by any combination of words, chemical names, and numbers, including Chemical Abstracts Service (CAS) Registry Numbers (RN). By default, the system adds synonyms and CAS numbers to chemical searches.

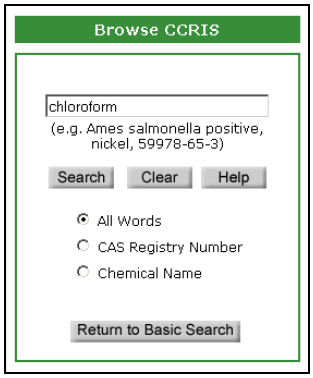
Use truncation (*), Boolean operators (AND, OR, NOT), nested parentheses, limits, and index browsing to refine your search results.

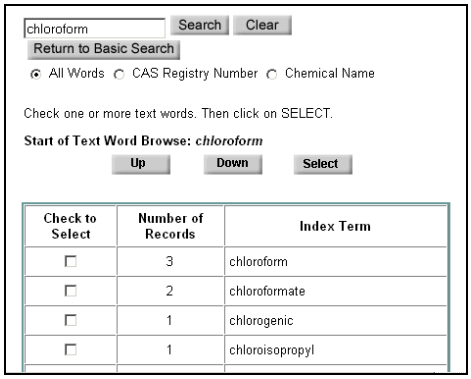


Click the **Limits** button on the home page to search:

- Exact words, singular & plural forms, or word variants
- Records with the phrase, all words, or any words
- In specific fields or categories of fields—Click the plus sign (+) to the left of a category to show all fields in that category. Use the (-) and (□) buttons above and to the right of the list of categories to contract or expand all categories.

With the **Browse the Index** feature, the system returns a list of index terms related to the search term entered and the number of records containing that term. Select one or more index terms in the **Check to Select** column and click the **Select** button for the search results. Scan the index above or below the original display by clicking the **Up** or **Down** button.

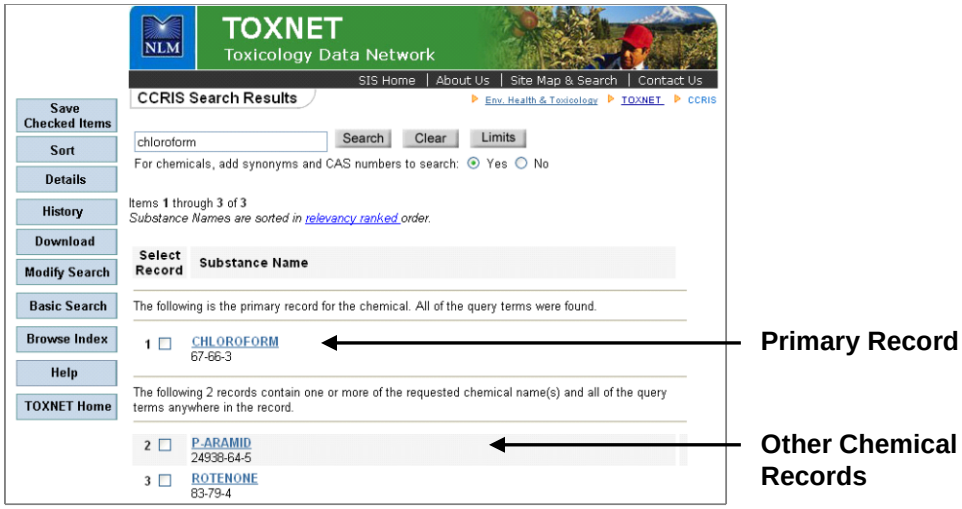




Search Results

Your initial retrieval is displayed as a list of substance names in blue and their CAS Registry Numbers. Substances are listed in **relevancy ranked order**. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

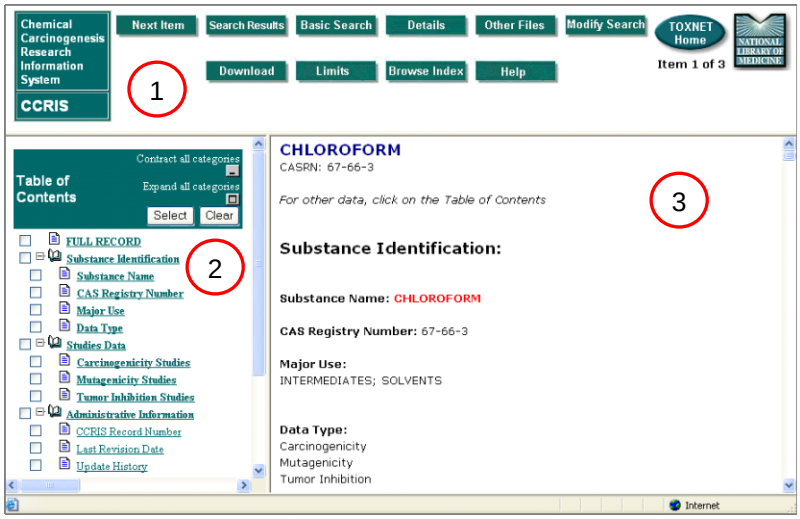
When searching for a chemical, the initial matching chemical record (the "primary record") may be followed by additional chemical records that contain the chemical name or search term you entered.



Search Results Screen

Click on a Substance Name on the search results page to retrieve the record for that substance. The **Record** screen is organized into three sections:

1. Navigation buttons at the top of the screen allow you to link to **Other Files** (NLM databases), **Modify Search**, **Download**, return to the **Basic Search** screen, and more.
2. A **Table of Contents** in the left frame allows you to choose categories and fields for display.
3. Chemical Data is shown in the right frame. Your search term(s) appear in red.



Record Screen

If you click the primary record, the system displays the full record. If you click a different chemical record, or if your search was for a term other than a chemical, the system will display the sections of the record best matching your query terms (**Best Sections**), those where the chemical search term appears with greatest frequency.

Additional Resources

For further information, we recommend these additional resources:

- CCRIS Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/ccrisfs.html

CCRIS Search Exercises

Go to http://toxnet.nlm.nih.gov

Click  in the Select Database column

Exercise 1: Does the record for *naphthalene* contain any positive carcinogenicity studies? Does it contain any positive mutagenicity studies?

Suggested Solution:

Type	**naphthalene** in the search box
Click	the **Search** button
Click	**NAPHTHALENE**
Click	**Carcinogenicity Studies** under **Studies Data**
Review	the information retrieved in the right frame
Click	**Mutagenicity Studies** under **Studies Data**
Review	the information retrieved in the right frame
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 2: Locate the *mirex* record and review the tumor promotion studies.

Suggested Solution:

Type	**mirex** in the search box
Click	the **Search** button
Click	**MIREX**
Click	Tumor Promotion Studies under Studies Data
Review	the information in the right frame
Click	the **Basic Search** button at the top of the page to prepare for a new search

Exercise 3: Review the *citral* record for carcinogenicity data and any associated human health effects.

Suggested Solution:

Type	**citral** in the search box
Click	the **Search** button
Click	**CITRAL**
Click	Carcinogenicity Studies under Studies Data
Review	the information in the right frame

Click	the Other Files button on the top of the page
Click	HSDB Record in the pop-up window
Review	the information in the right frame
Click	the **Return to CCRIS** button at the top of the page
Click	the **Basic Search** button at the top of the page to prepare for a new search

Exercise 4: How many substances are identified in CCRIS as positive for brain cancer?

Suggested Solution:

Type	**positive brain cancer** in the search box
Click	the **Search** button
Click	chemical record(s) of your choice
Review	the information in the right frame
Click	the **TOXNET Home** button at the top right of the page to prepare for a new session

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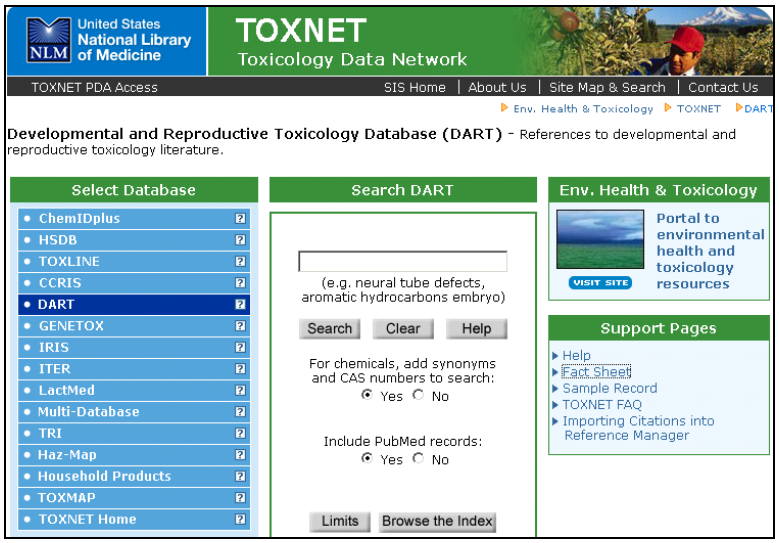
7

Developmental and Reproductive Toxicology Database (DART)

DART

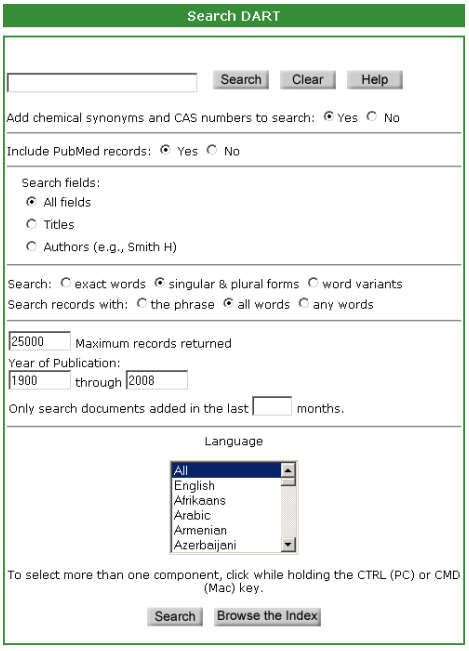
DART is a bibliographic database that covers teratology and other aspects of developmental and reproductive toxicology. It contains over 200,000 references to literature published since 1965.



http://toxnet.nlm.nih.gov

Searching DART

Any term(s) you enter in the query box will automatically be searched against both the keyword and MeSH fields, in addition to other fields such as title, abstract, and author. Chemical names are mapped to names, synonyms, and CAS Registry Numbers derived from ChemIDplus. Words such as "a," "an," "and," "for," "the," and "it" will not be searched.



Limits may be applied to narrow your search to:

- Titles or Authors
- Exact words or word variants
- Year of publication
- Documents added within a specified number of months
- Language

You may also specify the maximum number of records you would like retrieved.

Search Results

Your initial retrieval is displayed as a list of bibliographic references in **relevancy ranked order** with the titles highlighted in blue and underlined. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

Each reference is followed by the field tag [in brackets] of the subfile from which the article was retrieved. References that come from MEDLINE/PubMed are identified with a green and blue M-encircled icon and are linked to the same reference in PubMed. Clicking on this icon takes you to PubMed where you can use functions such as LinkOut, Related Links, and document ordering.

The **Record** screen displays the complete record for the item you selected on the Results screen with your search terms shown in red.

Individual author names, MeSH headings, keywords, and CAS Registry Numbers are in blue and linked to similar records in the database. Thus, by clicking on an author you can find other articles by that author, and by clicking on a keyword you can find other articles indexed with that keyword.

Other information on the record screen includes the article language, the month it was entered into the system, the year of publication, and a secondary source ID—a unique identifying number for the record and tagged to its subfile. References from PubMed again have the PubMed citation designation and the green-and-blue PubMed icon ( ).

Navigation buttons on the left are the same as shown on the results screen with two additions:

Related Records—search for articles similar in subject matter to the one displayed. The search used a formula based on data in the displayed record.

Search Results—return to the complete list of results.

Additional Resources

For further information, we recommend these additional resources:

- DART Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/dartfs.html
- PubMed
  http://pubmed.gov
- Importing citations into Reference Manager
  http://sis.nlm.nih.gov/enviro/captivate/toxlinespecialimports.htm

DART Search Exercises

Go to http://toxnet.nlm.nih.gov

Click • DART in the Select Database column

Exercise 1: Find the latest citations pertaining to food allergies and prevention. Sort the citations by author in descending order.

Suggested Solution:

Type	**food allergies prevention** in the search box
Click	the **Search** button
Review	the citation(s)
Click	the **Sort** button on the left of the page
Select	**Author** and **Descending** order
Click	the gray **Sort** button to the right
Review	the citation(s) as they now appear
Click	the **Basic Search** button at the left of the page to prepare for the next search

Exercise 2: Locate articles on psychomotor stimulants.

Suggested Solution:

Type	**psychomotor stimulants** in the search box
Click	the **Search** button
Review	the citation(s)
	The results will be in relevancy ranked order.
Click	The Basic Search button at the left of the page to prepare for a new search

Exercise 3: Find information on the effects of alcohol on the fetus.

Suggested Solution:

Type	**alcohol fetus** in the search box
Click	the **Search** button
Click	the record of your choice to view the abstract
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 4: Find articles on the adverse effect of *citalopram*. Download the first three records to full format.

Suggested Solution:

Type	**adverse effect citalopram** in the search box
Click	the **Search** button
Review	the citation(s)
Click	the box to the left of the first three records
Click	the **Download** button to the left of the page
Change	the number in the "Download" box to **3** (for the first 3 records)
Select	Full for the format
Click	the **Download** button to the right
Close	the pop-up window
Review	the full format records
Click	your browser's **Back** button to return to the DART Search Results page
Click	The **TOXNET Home** button at the left of the page to prepare for the next session

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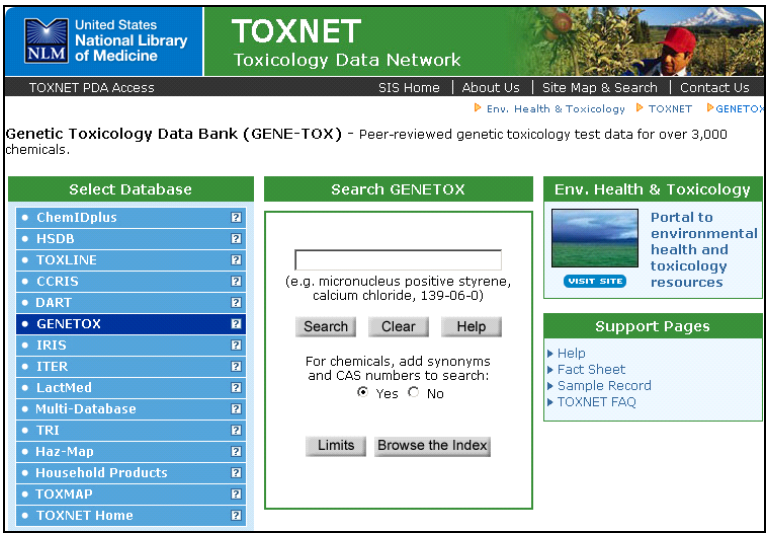
8

Genetic Toxicology Data Bank (GENE-TOX)

GENE-TOX

GENE-TOX is a toxicology data file of the National Library of Medicine's Toxicology Data Network (TOXNET®). It is created by the U.S. Environmental Protection Agency and contains genetic toxicology (mutagenicity) test data, resulting from expert peer review of the open scientific literature, on over 3,000 chemicals. The GENE-TOX program was established to select assay systems for evaluation, review data in the scientific literature, and recommend proper testing protocols and evaluation procedures for these systems.



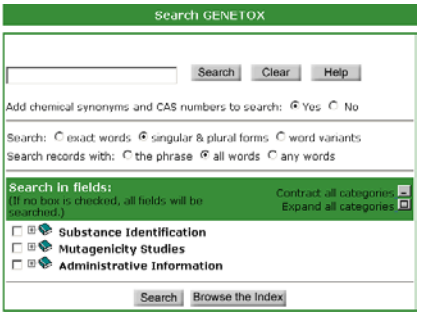
http://toxnet.nlm.nih.gov

Searching GENE-TOX

Search GENE-TOX by chemical or other name, chemical name fragment, Chemical Abstracts Service (CAS) Registry Number, and/or subject terms. By default, the system adds synonyms and CAS numbers to chemical searches.

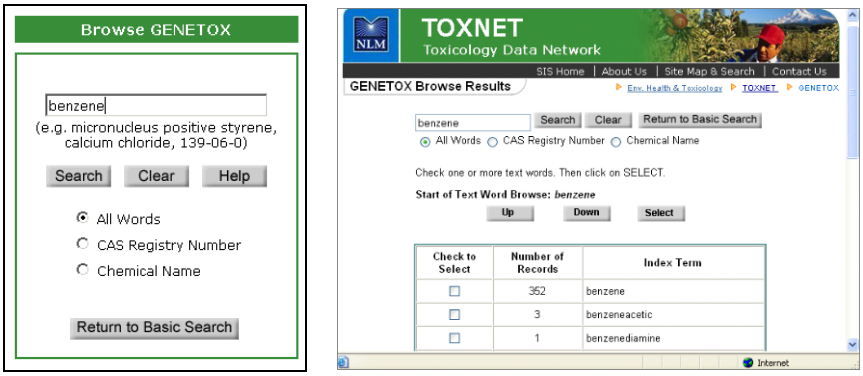
Use truncation (*), Boolean operators (AND, OR, NOT), nested parentheses, limits, and index browsing to refine your search results.

Click the **Limits** button on the home page to search:



- Exact words, singular & plural forms, or word variants
- Records with the phrase, all words, or any words
- In specific fields or categories of fields—Click the plus sign (+) to the left of a category to show all fields in that category. Use the (-) and (□) buttons above and to the right of the list of categories to contract or expand all categories.

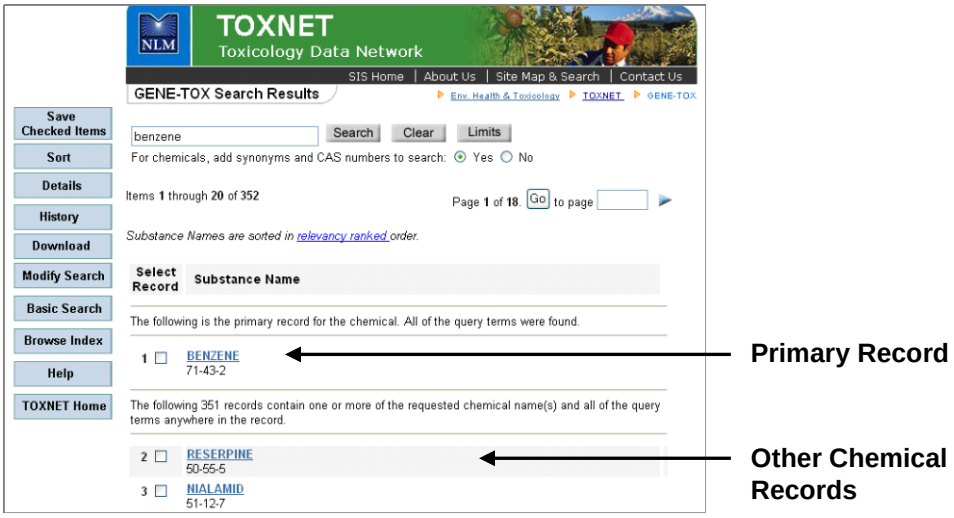
Click the **Browse the Index** button on the home page to search a list of index terms related to the search term entered and the number of records containing that term. Select the record(s) you want to view by clicking the appropriate box in the "Check to Select" column and clicking the **Select** button. Scan the index above or below the original display by clicking the **Up** or **Down** button.



Search Results

Your initial retrieval is displayed as a list of substance names in blue and their CAS Registry Numbers. Substances are listed in **relevancy ranked order**. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

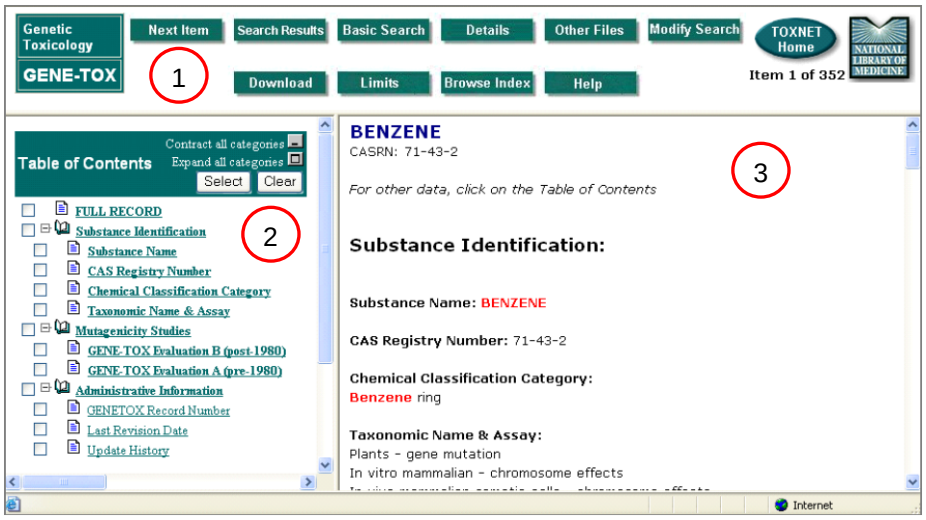
When searching for a chemical, the initial matching chemical record (the "primary record") may be followed by additional chemical records that contain the chemical name or search term you entered.



Search Results Screen

Click on a Substance Name on the search results page to retrieve the record for that substance. The **Record** screen is organized into three sections:

1. Navigation buttons at the top of the screen allow you to link to **Other Files** (NLM databases), **Modify Search**, **Download**, return to the **Basic Search** screen, and more.
2. A **Table of Contents** in the left frame allows you to choose categories and fields for display.
3. Chemical Data is shown in the right frame. Your search term(s) appear in red.



Record Screen

If you click the primary record, the system displays the entire record. If you click a different chemical record, or if your search was for a term other than a chemical, the system will display the sections of the record best matching your query terms (**Best Sections**), those where the chemical search term appears with greatest frequency.

Additional Resources

For further information, we recommend these additional resources:

- GENE-TOX Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/genetxfs.html

GENE-TOX Search Exercises

Go to http://toxnet.nlm.nih.gov

Click • GENETOX in the Select Database column

Exercise 1: Using the CAS registry number 108-95-2, identify the chemical it represents. Review the mutagenicity studies panel report.

Suggested Solution:

Type	**108-95-2** in the search box
Click	the **Search** button
Click	**PHENOL**
Click	**Mutagenicity Studies** in the Table of Contents frame on the left
Review	the information retrieved in the right frame
Click	the link for the Panel Report of your choice to view the abstract
Review	the abstract
Click	your browser's Back button to return to the GENE-TOX results page
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 2: Has *cyclophosphamide* been studied for effects on human male fertility and sterility?

Suggested Solution:

Type	**cyclophosphamide human male fertility** in the search box
Click	the **Search** button
Click	**CYCLOPHOSPHAMIDE**
Review	the **Best Sections** information in the right frame
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 3: Search GENE-TOX for Mutagenicity study results for *caffeine*. How do study results compare with results in CCRIS?

Suggested Solution:

Type	**caffeine** in the search box
Click	the **Search** button
Click	**Mutagenicity Studies** in the Table of Contents frame on the left
Review	the information retrieved in the right frame
Click	the Other Files button on the top of the page
Click	CCRIS Record in the pop-up window
Click	**Mutagenicity Studies** in the Table of Contents frame on the left
Review	the information in the right frame
Click	the **Return to GENE-TOX** button at the top of the page
Click	the **TOXNET Home** button at the top right of the page to prepare for the next session

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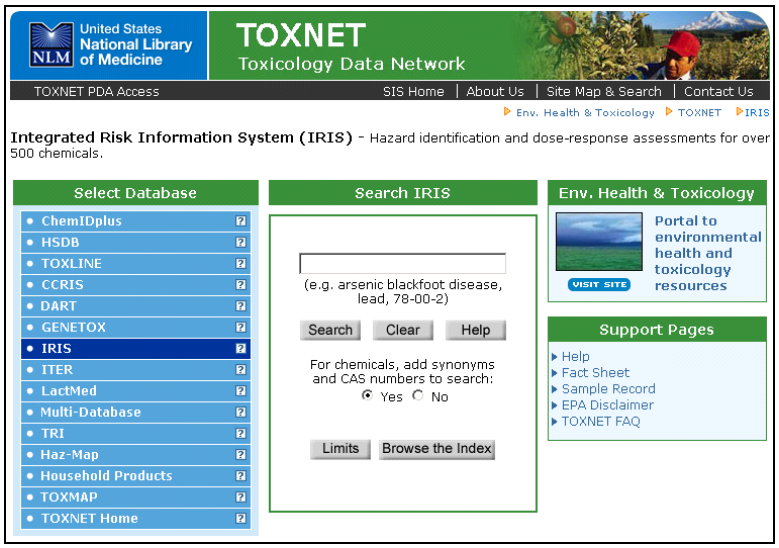
9

Integrated Risk Information System (IRIS)

IRIS

The **Integrated Risk Information System (IRIS)** contains data for over 600 chemicals, compiled by the Environmental Protection Agency (EPA), in support of human health risk assessment. Overall, IRIS focuses on the human health effects that may result from exposure to various substances found in the environment with data on hazard identification and dose-response assessments.

The TOXNET Databases



http://toxnet.nlm.nih.gov

IRIS data are reviewed by work groups of EPA scientists and represent EPA consensus. Key data provided in IRIS include EPA carcinogen classifications, unit risks, slope factors, oral reference doses, and inhalation reference concentrations.

Searching IRIS

Search IRIS by chemical or other name, chemical name fragment, Chemical Abstracts Service (CAS) Registry Number (RN), and/or subject terms. Search results, displayed in relevancy ranked order, can easily be viewed, printed, or downloaded.

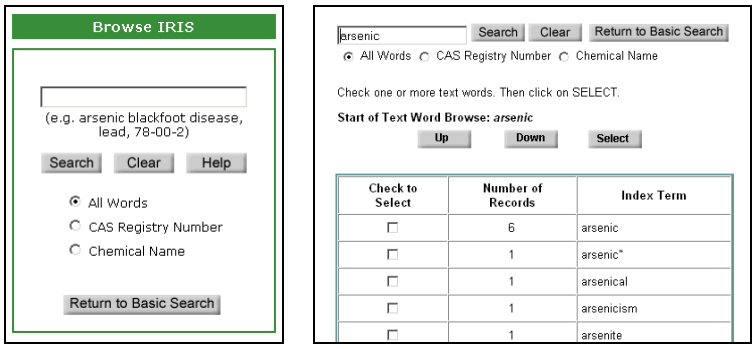
Use truncation (*), Boolean operators (AND, OR, NOT), phrase searching, nested parentheses, limits, and index browsing to refine your search results.

Click the **Limits** button on the home page to search:

- Exact words, singular & plural forms, or word variants
- Records with the phrase, all words, or any words

- In specific fields or categories of fields—Click the plus sign (+) to the left of a category to show all fields in that category. Use the (-) and (□) buttons above and to the right of the list of categories to contract or expand all categories.

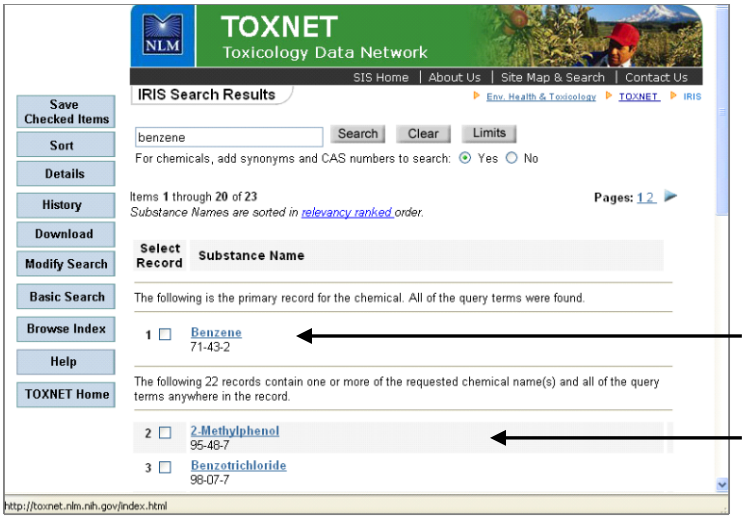
Click the **Browse the Index** button on the home page to search a list of index terms related to the search term entered and the number of records containing that term. Select the record(s) you want to view by clicking the appropriate box in the "Check to Select" column and clicking the **Select** button. Scan the index above or below the original display by clicking the **Up** or **Down** button.



Search Results

Your initial retrieval is displayed as a list of chemical names, in blue and underlined, and their CAS Registry Numbers. Substances are listed in **relevancy ranked order**. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

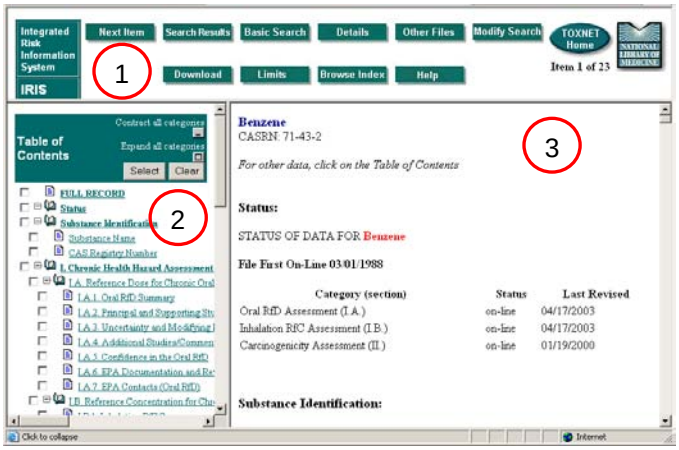
When searching for a chemical, the initial matching chemical record (the "primary record") may be followed by additional chemical records that contain the chemical name or search term you entered.



Search Results Screen

Click on a Substance Name on the search results screen to retrieve the record for that substance. The **Record** screen is organized into three sections:

1. Navigation buttons at the top of the screen allow you to link to **Other Files** (NLM databases), **Modify Search**, **Download**, return to the **Basic Search** screen, and more.
2. A **Table of Contents** in the left frame allows you to choose categories and fields for display.
3. Chemical data is shown in the right frame. Your search term(s) appear in red.



Record Screen

If you click the primary record, the system displays the entire record. If you click a different chemical record, or if your search was for a term other than a chemical, the system will display the sections of the record best matching your query terms (**Best Sections**), those where the chemical search term appears with greatest frequency.

Additional Resources

For further information, we recommend these additional resources:

- IRIS Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/irisfs.html
- EPA IRIS Web Site
  http://www.epa.gov/iriswebp/iris

IRIS Search Exercises

Go to http://toxnet.nlm.nih.gov

Click • IRIS in the Select Database column

Exercise 1: What is the NOAEL (No Observed Adverse Effect Level) for significant proteinuria from *cadmium*?

Suggested Solution:

Type	**cadmium proteinuria** in the search box
Click	the **Search** button
Click	**Cadmium**
Review	the **Best Sections** information in the right frame
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 2: What is the Inhalation Reference Concentration (RfC) of *ammonia*? (Note: The RFC is a non-carcinogenic risk assessment parameter) Also, view the Download options available.

Suggested Solution:

Type	**ammonia** in the search box
Click	the Search button
Click	**Ammonia**
Click	I.B. Reference Concentration for Chronic Inhalation Exposure (RfC)
Click	the Download button at the top of the page
Review	the Custom Formats

Exercise 3: How does the U.S. Environmental Protection Agency characterize the carcinogenicity of *methylmercury*?

Suggested Solution:

Type	**methylmercury** in the search box
Click	the **Search** button
Click	**methylmercury (MeHg)**
Click	II.A. Evidence for Human Carcinogenicity
Review	the information retrieved

Exercise 4: What is the Inhalation BMC (Benchmark Concentration) for *n-hexane*?

Suggested Solution:

Type	**n-hexane** in the search box
Click	the **Search** button
Click	**n-Hexane**
Click	I.B.1. Inhalation RfC Summary
Review	the information retrieved
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 5: Review the carcinogenicity assessment documentation listed for *boron*.

Suggested Solution:

Type	**boron** in the search box
Click	the **Search** button
Click	II. Carcinogenicity Assessment for Lifetime Exposure
Review	the information retrieved
Click	the **TOXNET Home** button at the top right of the page to prepare for the next session

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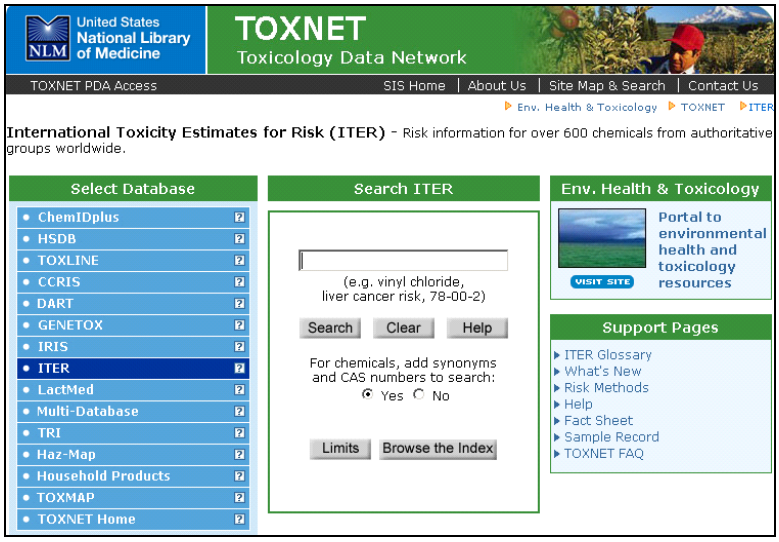
10

International Toxicity Estimates for Risk (ITER)

ITER

ITER (International Toxicity Estimates for Risk) is a toxicology data file on the National Library of Medicine's (NLM) Toxicology Data Network (TOXNET) and contains data in support of human health risk assessments. Compiled by Toxicology Excellence for Risk Assessment, ITER is a small database with data on 650 chemical records. It is structured to provide a comparison of international risk assessment information in a side-by-side format and explains differences in risk values derived by different organizations.



http://toxnet.nlm.nih.gov

ITER provides both risk data and cancer classifications. Information is derived from:

- Agency for Toxic Substances & Disease Registry (ATSDR)
- Health Canada
- U.S. Environmental Protection Agency (EPA)
- International Agency for Research on Cancer (IARC)
- NSF International (National Sanitation Foundation)
- National Institute of Public Health & the Environmental (RIVM), The Netherlands

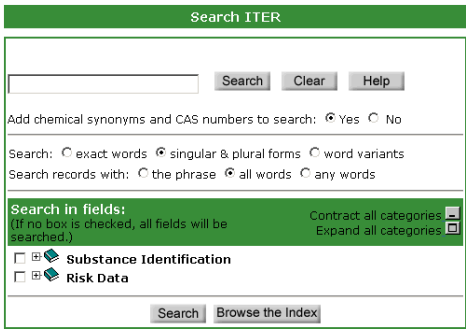
Searching ITER

Search ITER by chemical or other name, chemical name fragment, Chemical Abstracts Service (CAS) Registry Number, and/or subject terms. By default, the system adds synonyms and CAS numbers to chemical searches.

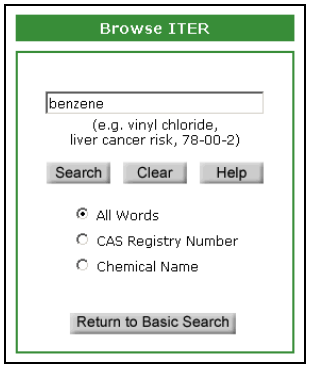
Use truncation (*), Boolean operators (AND, OR, NOT), nested parentheses, limits, and index browsing to refine your search results.

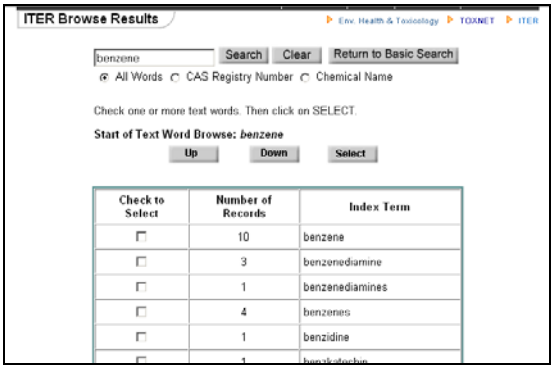
Click the **Limits** button on the home page to search:

- Exact words, singular & plural forms, or word variants
- Records with the phrase, all words, or any words
- In specific fields or categories of fields—Click the plus sign (+) to the left of a category to show all fields in that category. Use the (-) and (□) buttons above and to the right of the list of categories to contract or expand all categories.



Click the **Browse the Index** button on the home page to search a list of index terms related to the search term entered and the number of records containing that term. Select the record(s) you want to view by clicking the appropriate box in the "Check to Select" column and clicking the **Select** button. Scan the index above or below the original display by clicking the **Up** or **Down** button.





ITER Search Results

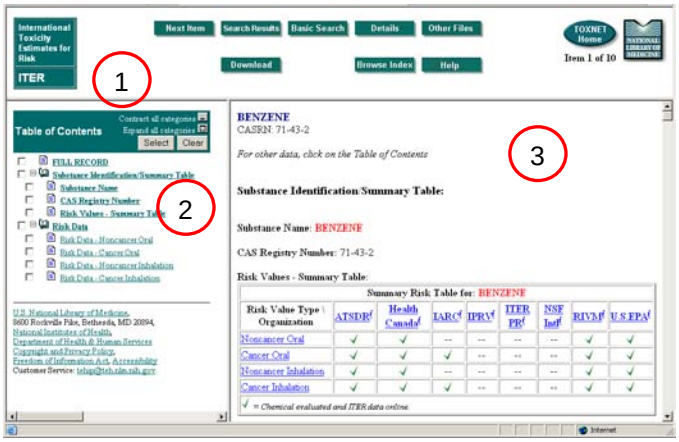
Your initial retrieval is displayed as a list of substance names highlighted in blue and their CAS Registry Numbers. Substances are listed in relevancy ranked order. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

Search Results Page

When searching for a chemical, the initial matching chemical record (the "primary record") may be followed by additional chemical records that contain the chemical name or search term you entered. (See next page.)

Click on a Substance Name on the search results screen to retrieve the record for that substance. The **Record** screen is organized into three sections:

1. Navigation buttons at the top of the screen allow you to link to **Other Files** (NLM databases), **Modify Search**, **Download**, return to the **Basic Search** screen, and more.
2. A **Table of Contents** in the left frame allows you to choose categories and fields for display.
3. Chemical Data is shown in the right frame. Your search term(s) appear in red.



Record Screen

If you click the primary record, the system displays the entire record. If you click a different chemical record, or if your search was for a term other than a chemical, the system will display the sections of the record best matching your query terms (**Best Sections**), those where the chemical search term appears with greatest frequency.

Additional Resources

For further information, we recommend these additional resources:

- ITER Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/toxnetfs.html

ITER Search Exercises

Go to http://toxnet.nlm.nih.gov

Click • ITER in the **Select Database** column

Do ATSDR and U.S. EPA currently have any noncancer oral risk data for the chemical *acetone*?

Suggested Solution:

Type	**acetone** in the search box
Click	the **Search** button
Click	**ACETONE**
Click	Risk Data – Noncancer Oral under **Risk Data** in the Table of Contents frame on the left
Review	the **Noncancer Oral Risk Table** in the right frame
Click	Risk Data – Cancer Oral under **Risk Data** in the Table of Contents frame on the left
Review	the **Cancer Oral Risk Table** in the right frame
Click	the **Basic Search** button at the top of the page to prepare for the next search

Exercise 2: How many international agencies have classified *dichloroacetic acid* as carcinogenic to humans?

Suggested Solution:

Type	**dichloroacetic acid** in the search box
Click	the **Search** button
Click	**DICHLOROACETIC ACID**
View	the full record
Click	the **TOXNET Home** button at the top right of the page to prepare for the next search

Exercise 3: How do the Dutch RIVM, Health Canada, and ATSDR compare in their non-cancer inhalation risk values for *nickel oxide*?

Suggested Solution:

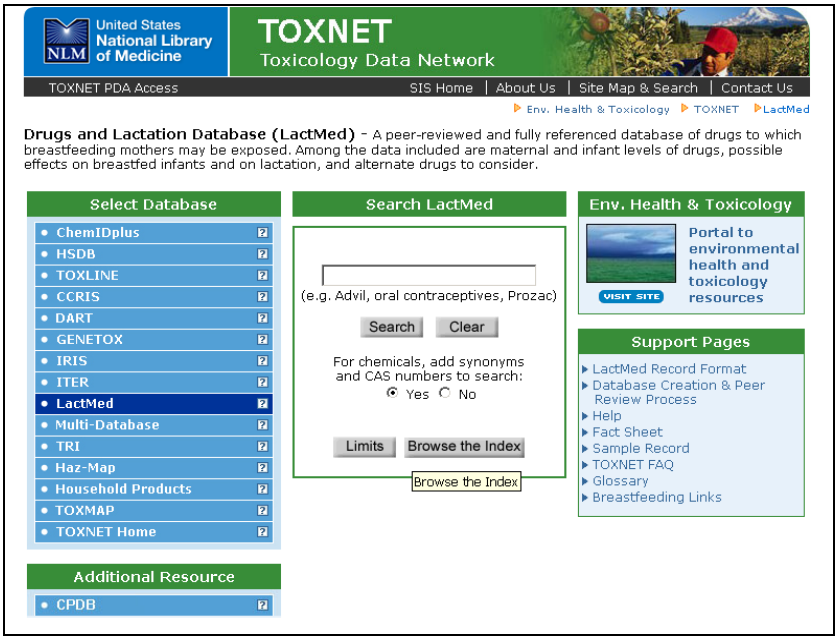
Type	**nickel oxide** in the search box
Click	the **Search** button
Click	**NICKEL OXIDE**
Click	RISK Data – Noncancer Inhalation in the Table of Contents to the left
Review	the Noncancer Inhalation Table
Click	the **Basic Search** button at the top of the page to prepare for the next search

11

LactMed

LactMed

LactMed is a database of over 500 drugs and other chemicals to which breastfeeding mothers may be exposed. It includes information on the levels of such substances in breast milk and infant blood, and the possible adverse effects in the nursing infant. All data are derived from the scientific literature and fully referenced. Data are organized into substance-specific records, which provide a summary of the pertinent reported information and include links to other NLM databases.



http://toxnet.nlm.nih.gov

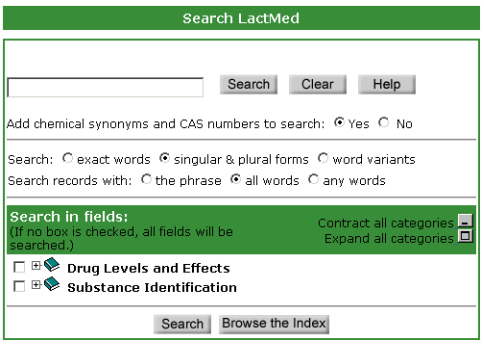
Searching LactMed

Search LactMed by chemical, brand name, Chemical Abstracts Service (CAS) Registry Number, pharmacologic category, and/or subject terms. By default, the system adds synonyms and CAS numbers to chemical searches. Search results, displayed in relevancy ranked order, can easily be viewed, printed, or downloaded.

Limits

Click the **Limits** button on the home page to search:

- Exact words, singular & plural forms, or words variants
- Records with the phrase, all words, or any words



- In specific fields or categories of fields: LactMed contains ten search fields organized under two broad categories. Click the plus sign (+) to the left of a category to show all fields in that category. Use the (_) and (□) buttons above and to the right of the list of categories to contract or expand all categories.

Search Results

Your initial retrieval is displayed as a list of chemical names, highlighted in blue and underlined, and their CAS Registry Numbers. If your search was for a chemical or drug (e.g., codeine) and there is a match for it in the database, the record for this chemical—referred to as the primary chemical record—will display first, followed by a list of other chemical records which also contain some mention of the chemical you entered. This latter list of chemicals is displayed according to a Relevancy Ranking algorithm. Clicking directly on any of the items will provide a display of the Selected Record Screen, containing all the data for that item.

If your query consists of words that are not chemical or drug terms, this same Relevancy Ranking algorithm determines the order of display of all your search results.

Records in LactMed include:

- Generic Name
- Summary of use during lactation
- Drug levels
- Effects in Breastfed Infants
- Possible Effects on Lactation
- AAP Category
- Alternative Drugs
- Drug Class

Additional Resources

For further information, we recommend these additional resources:

- Drugs and Lactation Database (LactMed) Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/lactmedfs.html
- LactMed Basics Brochure
  http://nnlm.gov/mcr/resources/consumer/LactMed.pdf
- Pregnancy Riskline (University of Arizona College of Pharmacy)
  http://www.pharmacy.arizona.edu/outreach/pregnancy
- Organization of Teratology Information Specialists
  http://otispregnancy.org/otis_find_a_tis.asp

LactMed Search Exercises

Scenario 1 – Summary Information

Carolyn, a nursing mother, has been prescribed *methotrexate* due to an early onset of rheumatoid arthritis. Her doctor has told her that she may continue to nurse her baby since he has prescribed a low dose of the medication. Carolyn would like to do some research herself to confirm her doctor's statements.

Search LactMed to gather information: Locate the *methotrexate* record in LactMed. Open the *methotrexate* record. Browse the record for information.

Suggested Solution:

Type	**methotrexate** in the search box
Click	the **Search** button
Click	the **Methotrexate** record in the search results list
Scroll	through the record or use the Table of Contents
	The Summary of Use during Lactation supports the doctor's statements.

Scenario 2 – Alternative Drug Field

While browsing the *methotrexate* record, Carolyn (Scenario 1) notices *auranofin* listed as an alternate drug to consider. Have any effects in infants been reported after use of *auranofin* by a nursing mother?

Use links within the *methotrexate* record to find information: Locate the alternate drugs within the *methotrexate* record. Open the *auranofin* record. Locate the infant effects section of the record.

Suggested Solution:

Click	**Alternate Drugs to Consider** in the Table of Contents
Click	the link to the auranofin record
Click	**Auranofin**
Click	**Effects in Breastfed Infants** in the table of contents

Additional Exercises

Go to http://toxnet.nlm.nih.gov

Click  in the **Select Database** column

Exercise 1: To which class of drugs does *clomipramine* belong?

Suggested Solution:

Type	**clomipramine** in the search box
Click	the **Search** button
Click	**Clomipramine**
Click	**Drug Class** under **Substance Identification** in the Contents frame to the left
Click	the **Basic Search** button at the top of the screen to prepare for the next search

Exercise 2: Is there a substitute for the use of *hydrocodone* during lactation?

Suggested Solution:

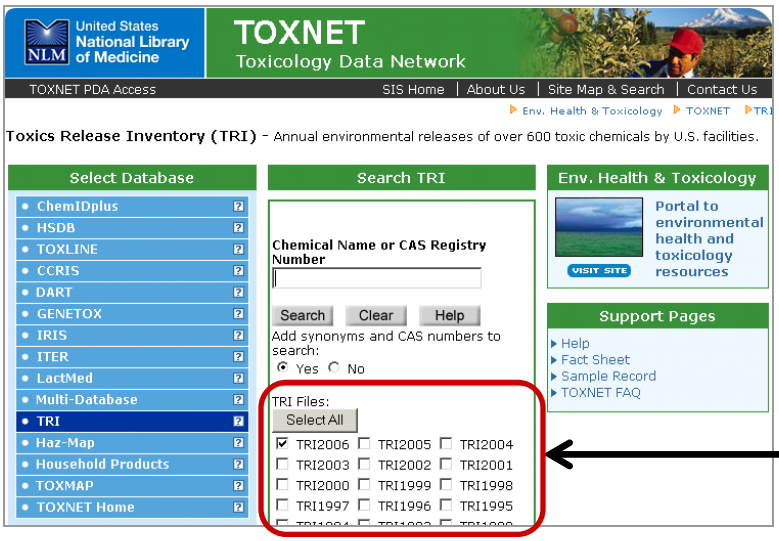
Type	**hydrocodone** in the search box
Click	the **Search** button
Click	**Hydrocodone**
Click	**Alternate Drugs to Consider** under **Drug Levels and Effects** in the Contents frame to the left
Click	**TOXNET Home** button at the top right of the page to prepare for the next session

12

Toxics Release Inventory (TRI) and TOXMAP

Toxics Release Inventory

The **Toxics Release Inventory (TRI)**, a resource of the U.S. Environmental Protection Agency, is a set of publicly available databases containing information on releases of over 650 toxic chemicals and their management as waste, as reported annually by U.S. industrial and federal facilities. This inventory was established under the Emergency Planning and Community Right to Know Act of 1986 (EPCRA). TRI's data, beginning with the 1987 reporting year, cover air, water, land, and underground injection releases, as well as transfers to waste sites. In agreement with the Pollution Prevention Act of 1990, source reduction and recycling data is also included in TRI.



http://toxnet.nlm.nih.gov

Searching TRI

Search TRI by chemical or other name, chemical name fragment, Chemical Abstracts Service (CAS) Registry Number, and/or subject terms. By default, the system adds synonyms and CAS numbers to chemical searches. Use truncation (*), Boolean operators (AND, OR, NOT), nested parentheses, and limits to refine your search results.

TRI currently contains data from 1987 through 2006. By default the system will search the most current year. You can also limit your search with the following criteria:

- Facility Name
- Facility Location
  - Select State, City/State, County/State, or Zip

- Standard Industrial Classification Code or North American Industry Classification System Code
  - Separate multiple entries with commas
- Weight in pounds (**Greater Than**)
- Type of release (air, water, land, underground injection, or total environmental release)

With the **Browse the Index** feature, the system returns a list of index terms related to the search term entered and the number of records containing that term. Select one or more index terms and click the **Select** button for the search results. Scan the index above or below the original display by clicking the **Up** or **Down** button.

TRI Search Results

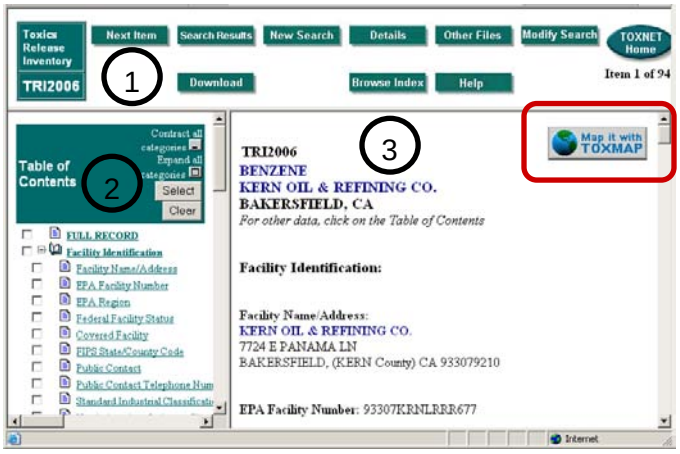
Your initial retrieval is displayed in relevancy ranked order as a list of abbreviated records with facility name in blue and hot-linked, chemical name, and city and state where the facility is located. Relevancy ranking is based on the number of individual search terms occurring in a document, the number of times each search term occurs in a document, the rarity of the search terms within the database, and the nearness of search terms to each other. Records containing combinations of search terms tend to be ranked higher than records with isolated occurrences of search terms.

The **Record** screen is organized into three sections:

1. Navigation buttons at the top of the screen allow you to link to **Other Files** (NLM databases), **Modify Search**, **Download**, return to the **Basic Search** screen, and more.

2. A **Table of Contents** in the left frame allows you to choose categories and fields for display.

3. Data is shown in the right frame—Click the **Map it with TOXMAP** button to visually explore the data in TOXMAP



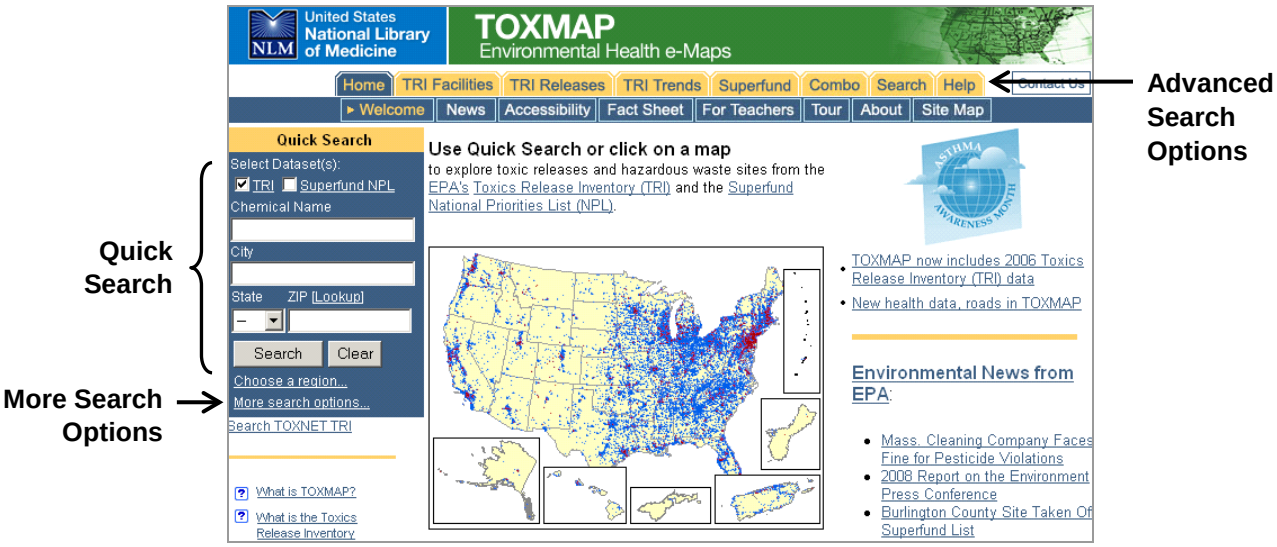
Additional Resources

For further information, we recommend these additional resources:

- TRI Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/trifs.html

TOXMAP

TOXMAP is a Geographic Information System (GIS) that uses maps of the United States to help users visually explore data from the Environmental Protection Agency's Toxics Release Inventory (TRI) and Superfund programs. TOXMAP helps users create nationwide, regional, or local area maps showing where TRI chemicals are released on-site into the air, water, and ground. Maps can also show locations of Superfund sites on the National Priorities List (NPL). The NPL is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.



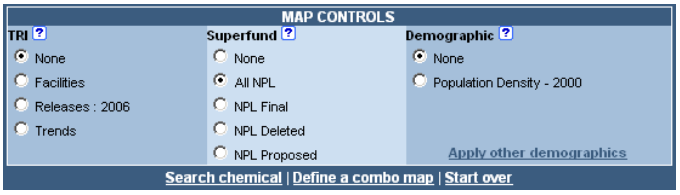
http://toxmap.nlm.nih.gov

Map Features

TOXMAP offers several ways to create maps using the tabs and buttons along the top of the page, the **Quick Search** box on the home page, and the map controls below the map.

TOXMAP can create several types of maps:

- TRI Facilities
- TRI Chemical Releases
- TRI Chemical Trends
- Superfund Maps
- Combination (Combo) Maps



TOXMAP also overlays map data such as:

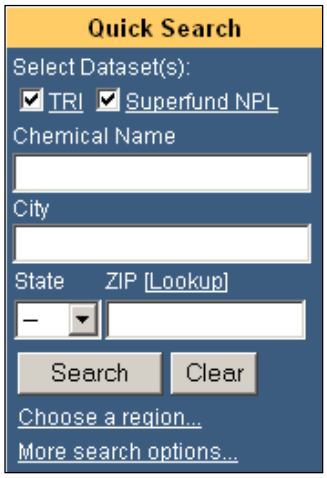
- U.S. Census Data—1990 and 2000 demographics (population, ethnicity, age, gender ratio)
- Income Data—per capita personal Income
- Health Data—mortality data for cancer and various causes
- Reference Data—cities, roads, federal land, and urban areas

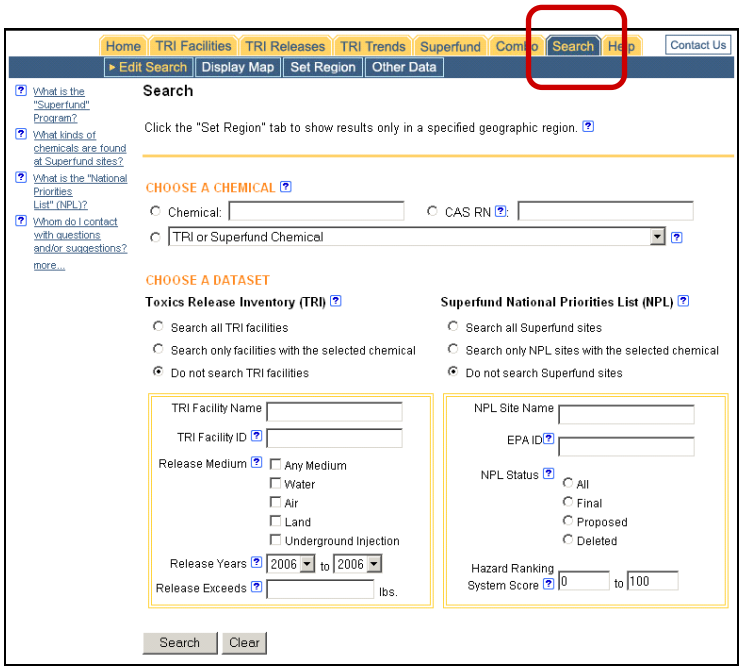
DISCLAIMER: The co-occurrence of a substance and a particular health problem does not by itself imply an effect on human health by that substance.

Searching and Creating Maps in TOXMAP

TOXMAP's **Quick Search** feature on the home page allows you to search TRI and Superfund data by chemical and to zoom the resulting map to a specific city, state, or zip code. More advanced search options are available by clicking the More search options… link or by selecting the **Search** tab at the top of the page.

The **Search** tab page allows users to search a chemical CAS/RN, TRI facility name/ID, release year ranges, release amount, Superfund NPL site name/ID, and Hazard Ranking System (HRS) score.





Additional Resources

For further information, we recommend these additional resources:

- Online Tutorial: TOXMAP Basics
  http://toxmap.nlm.nih.gov/toxmap/tour/misc/ToxmapBasics.html
- TOXMAP Tour
  http://toxmap.nlm.nih.gov/toxmap/tour/index.html
- TOXMAP Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/toxmap.html

TRI/TOXMAP Decision Tree

TRI (Toxics Release Inventory) is the Environmental Protection Agency's (EPA) publicly available database that contains information on toxic chemical releases and waste management activities, and more recently, source reduction and recycling information, reported annually by U.S. industrial and federal facilities beginning with the 1987 reporting year. TRI is accessible via the National Library of Medicine's (NLM) **TOXNET®** (TOXicology Data NETwork) databases, which cover toxicology, hazardous chemicals, environmental health and related areas.

TOXMAP is a geographic information system from the NLM's Division of Specialized Information Services that uses maps of the United States to help users visually explore data from the EPA's TRI and Superfund Program. With TOXMAP, users can create nationwide, regional, or local area maps showing where TRI chemicals are released on-site into the air, water, and ground. Information on the releasing facilities is provided. Maps can also show locations of Superfund sites, with listings of all chemical contaminants present at these sites.

Use this Decision Tree to choose the correct database:

TOXNET/TRI	TOXMAP
You want full-reference, book-style information on TRI facilities or releases	You are interested in a health-related presentation of TRI data
You are using other TOXNET resources	You want to see TRI locations on a map
You want to benefit from chemical synonyms	You are interested only in on-site chemical releases
You would like to use a browse interface	You want to search by combinations of states and/or counties
You want to calculate the total release of chemicals	You are also interested in Superfund sites and/or demographic data
You want the release mediums for air, water, underground injection, and land	You want location data from the Federal Registry System (not self-reported locations)

TRI/TOXMAP Search Exercises

Scenario 1: General Search by State using TRI

Michael, a senior in high school, is writing a report for chemistry class. He has decided to report on methanol, a widely used solvent. Michael would like to include an environmental section in his report and provide some information specific to his state, Mississippi. Michael would like to include information in his report such as: how much methanol was released in Mississippi, where did these release(s) occur, and what type of release(s) occurred.

Search the Toxics Release Inventory to gather information.

Suggested Solution:

Type	**methanol** in the Chemical Name or CAS Registry Number search box
Type	**MS** in the **Facility Location** search box
	Note below the search box that "State" is selected by default.
Click	the **Search** button
Click	the **Calculate Release!** button at the left of the page
	Information is for the most recently reported year available from EPA.
Click	the **TOXNET Home** button to prepare for the next search

Scenario 2: Mapping TRI and Health Data in TOXMAP

Teresa, an epidemiologist, is familiar with the TRI database. She has learned about TOXMAP and decides to take a look at cancer data for females and chemical release trends for styrene in her home state of New Jersey for all reporting years, excluding Superfund NPL. Monitoring data indicate that populations may be exposed through inhalation of air polluted by industrial sources. Teresa knows current studies do not provide adequate evidence to classify styrene as a human carcinogen.

Search TOXMAP to examine information.

Suggested Solution:

Click	to deselect the Superfund NPL dataset at the top of the **Quick Search** section
Type	**styrene** in the Chemical Name search box
Select	NJ in the state search box
Click	the **Search** button
Select	Trends under **MAP CONTROLS** in the **TRI** column

Click	Health Data under **Map Other Data** on the left side of the page
Select	Mortality, Cancer 2001-2005
	The default is all cancers for females of all races.
Click	the **Submit** button
View	the map legend to interpret the information

Additional Exercises

The following exercises have been designed to be searched in sequence, beginning in TRI and moving to TOXMAP.

Go to http://toxnet.nlm.nih.gov

Click • TRI in the **Select Database** column

Exercise 1: Did any facilities in Mississippi release more than 100 pounds of *methanol* to the air in 2006? Map the releases in TOXMAP and view the environmental release information for the first facility.

Suggested Solution:

Type	**methanol** in the Chemical Name search box
Select	MS in the state search box
Select	100 lbs from the **Greater Than** pull-down menu at the bottom of the TRI home page
Select	Total Air Release from the **for** pull-down menu
Click	the **Search** button
Click	the first facility link in the list of **Facility/Substance** names
Click	**Environmental Release of Chemical** in the Table of Contents
Review	the information in the right frame
Click	the **Map it with TOXMAP** button (Map it with TOXMAP)
Select	MS from the **ZOOM TO** pull-down menu at the right of the map
Click	TRI onsite releases at the right of the map below **See details for this map**
Click	the facility name link under **Facilities reporting to TRI** to the right of the map
Review	the **Emissions Estimates** and All chemicals reported by this facility

Exercise 2: Link to NLM's HSDB to explore the human health effects of *methanol*.

Suggested Solution (continued from previous exercise):

Scroll	to the top of the page and find the **Chemical Information** section to the top left of the map
Click	Human Health Effects under **Information about this Chemical**
Review	the information in the HSDB Search Results window
Close	the HSDB window and return to the TOXMAP results page
Click	the **Home** tab to prepare for the next search

Exercise 3: Perform a search of your choice in TOXMAP.

After completing your search:

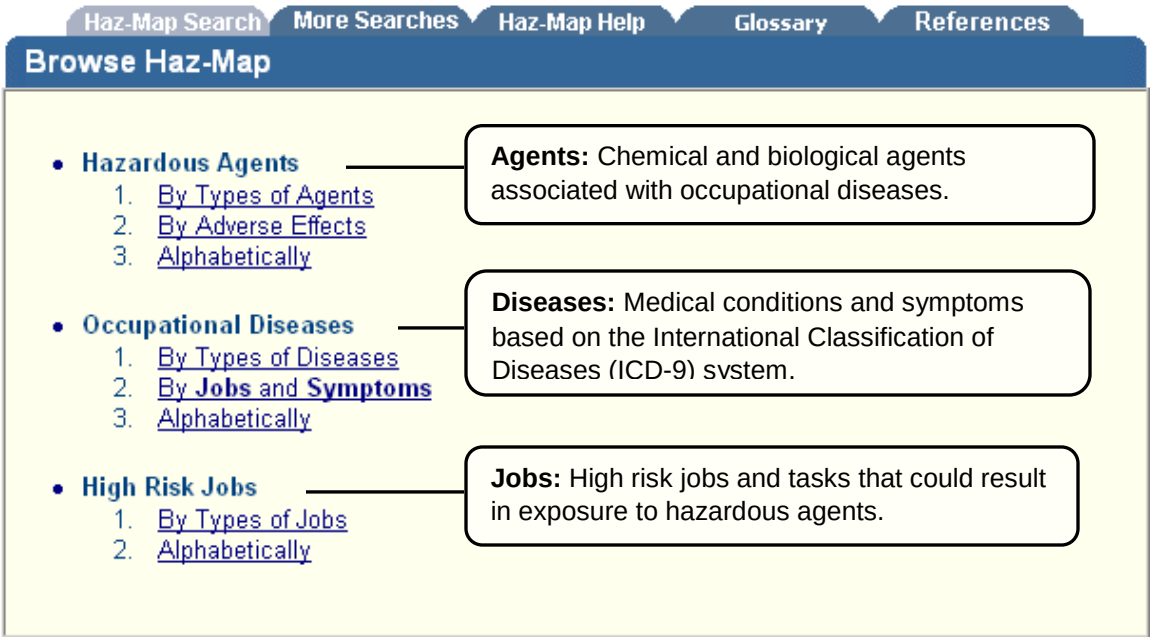
Click	the **Home** tab
Click	the link to the Environmental Health and Toxicology Portal at the bottom of the page to prepare for the next session

13

Haz-Map

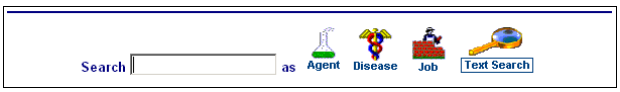
Haz-Map

Haz-Map is an occupational health database designed for health and safety professionals and for consumers seeking information about the health effects of exposure to chemical and biological agents used in industry, on the job and at home. Haz-Map lists more than 2,030 chemical/biological agents with links to at-risk occupations and approximately 225 associated occupational diseases and their symptoms. The database was compiled from information from occupational medicine textbooks, journal articles, and electronic databases.



http://hazmap.nlm.nih.gov

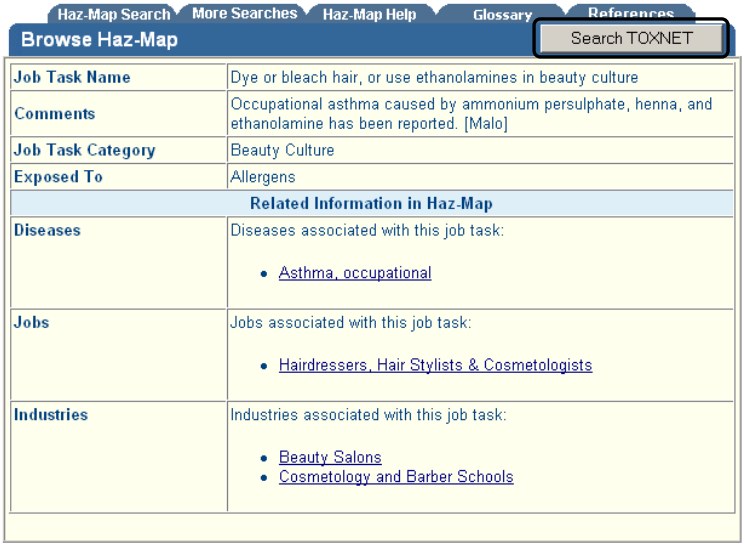
Searching Haz-Map



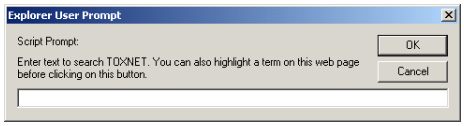
You can search Haz-Map by keyword, agent, disease, or job from almost any page of the site. Simply enter your query in the search box and click the appropriate button (**Agent**, **Disease**, **Job**, or **Text Search**) to the right of "as." You can also browse alphabetically in each category or by Types of Agents, Adverse Effects, Types of Diseases, Jobs and Symptoms, or Types of Jobs by clicking the appropriate link (see above).

Special features for chemical searching: If there is an exact match of an agent name with the query, the primary record will be returned first in the search results. If the search query is enclosed by double quotes (“), only the primary record will be displayed. You can also search a chemical by its CAS Registry Number.

Other categories: Click the More Searches tab for additional categories of information, including Activities, Industries, Job Tasks, Processes, and Symptoms. The query words will be searched as text words in the selected category and the results will display in relevancy ranked order.



Click the **Search TOXNET** button to search all TOXNET databases. Enter search words in the pop-up prompt box:



You may also highlight text on the results page and then click the **Search TOXNET** button to launch a search.

Additional Resources

For further information, we recommend these additional resources:

- Haz-Map Help
  http://hazmap.nlm.nih.gov/hazhelp.html
- Haz-Map Brochure
  http://hazmap.nlm.nih.gov/635906-brochure.pdf
- Sources of Information for Haz-Map
  http://hazmap.nlm.nih.gov/hazref.html

Haz-Map Search Exercises

Scenario: Jobs and Agents Associated with Disease

Gloria, an occupational analyst, performs research used to assist in the processing of employee compensation claims for a government agency. Gloria has a list of specific chemicals from various work sites where certain job tasks were performed. She needs to determine if specific conditions/diseases are associated with these chemicals and job tasks. Gloria needs to begin her research by determining if aplastic anemia is associated with aviation mechanics that performed maintenance on fuel tanks.

Search Haz-Map to identify associations: Browse the High Risk Jobs by type. Select the appropriate job category. Select the appropriate job name. Select the appropriate job task. Browse related information.

Suggested Solution:

Click	By Types of Jobs under High Risk Jobs
Click	Installation, Maintenance, & Repair
Click	Aircraft Mechanics & Service Technicians
Click	Repair or maintain gasoline or jet fuel tanks
View	the job task record and note any chemicals and diseases listed
Click	aplastic anemia under diseases
View	the disease record and note additional information and references

Additional Exercises

Go to http://hazmap.nlm.nih.gov

Exercise 1: What are some high risk tasks associated with sheet metal workers?

Keyboard Help:

Click	Alphabetically under **High Risk Jobs**
Click	S
Click	Sheet Metal Workers
Click	the high risk job task of your choice under Related Information in Haz-Map
Review	the information about this job task
Click	the **Haz-Map Search** tab to prepare for the next search

Exercise 2: What are some of the agents, jobs, and diseases associated with asthma? Perform a text search.

Keyboard Help:

Type	**asthma** in the search box
Click	**Text Search** to the right of the search box
Scroll	down the page and view the lists of records under each category
Click	the record of your choice in the **Agents** list
Review	the results
Click	your browser's back button to return to the search results page
Scroll	down to the search results found in the **Jobs** table
Click	the record of your choice
Review	the results
Click	the **Haz-Map Search** tab to prepare for the next search

14

Household Products Database

Household Products Database

Household Products Database links more than 7,000 consumer brands of household products to their health effects from Material Safety Data Sheets provided by the manufacturers.

Quick Search ►

http://hpd.nlm.nih.gov

Household Products Database is designed to help answer the following typical questions:

- What are the chemical ingredients and their percentage in specific brands?
- Which products contain specific chemical ingredients?
- Who manufactures a specific brand? How do I contact this manufacturer?
- What are the acute and chronic effects of chemical ingredients in a specific brand?
- What other information is available about chemicals in the toxicology-related databases of the National Library of Medicine?

Searching Household Products Database

The Household Products Database is divided into four categories: **Products**, **Manufacturers**, **Ingredients**, and **Health Effects**. Navigate to a category by clicking the appropriate tab at the top of the page.

Search Household Products by using the Quick Search box on the home page or by selecting the Advanced Search link for a more detailed search. Clicking the **Health Effects** tab will bring up the Advanced Search screen with the Health Effects category selected for searching.

Browse Household Products by product category or alphabetically by product names, types of products, manufacturers, or ingredients (see left sidebar).

Additional Resources

For further information, we recommend these additional resources:

MSDS Information Resources

- SIRI MSDS Archive
  http://hazard.com/msds
- MSDSprovider: Free Access to Manufacturer-Direct MSDSs
  http://www.msdsprovider.com

Government Information Resources

- OSHA's MSDS Regulation – Hazard Communication 1910.1200
  http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10099&p_text_version=FALSE
- Read the Label *First!* Campaign (EPA)
  http://www.epa.gov/oppt/labeling/pubs/campaign.htm
- Household Hazardous Waste (EPA)
  http://www.epa.gov/epawaste/conserve/materials/hhw.htm

From the National Library of Medicine

- TOXNET—databases in toxicology and environmental health
  http://toxnet.nlm.nih.gov
- Tox Town—an interactive guide to commonly encountered toxic substances
  http://toxtown.nlm.nih.gov

Product Recalls

- Product Safety and Recall Lists
  http://hpd.nlm.nih.gov/recalls.htm

Household Products Database Search Exercises

Scenario: Browse by Category

Cassie, an avid home gardener, adopted a puppy to enjoy with her grandchildren. She is concerned about a weed killer product she uses in spring and fall since the children and puppy will be playing in the yard. She uses a popular brand of extended residual fertilizer with weed control. Are there health effects Cassie should be aware of?

Browse the Household Products Database to find information: Select the appropriate product category. Select the appropriate Landscape/Yard product category. Select the appropriate type of product. Select the appropriate product.

Suggested Solution:

Click	**Landscape/Yard** in the left margin or next to the picture on the main page
Click	Weed Killer
Click	preemergent weed killer under **Type**
Click	the extended residual product with weed control
View	the **Health Effects** and **Handling/Disposal** information

Additional Exercises

Go to http://hpd.nlm.nih.gov

Exercise 1: How can I find information about specific brands of teeth whiteners, including their manufacturing information, ingredients, and health effects?

Suggested Solution:

Click	Personal Care
Click	Oral Hygiene in the Personal Care column
Click	teeth whitener in the Type column
Click	the Brand Name of your choice and review the product information
Click	the Home tab to prepare for the next search

Exercise 2: What household products are associated with cyanosis?

Suggested Solution:

Click	the **Health Effects** tab
Type	**cyanosis** in the search box
Click	the **Search** button and view the list of products
Click	a product of your choice and review the information under **Health Effects**
Click	the **Home** tab to prepare for the next search

Exercise 3: How can I do a quick search to find information on *bleach*?

Suggested Solution:

Type	**bleach** in the **Quick Search** box on the left of the home page
Click	the **Go** button
Click	the Bleach (unspecified) link at the top of the page
Click	the Search TOXNET link in the **Chemical Information** section to the right of **Toxicity Information** to launch a search in TOXNET
Click	the HSDB link in the results list under **Chemical, Toxicological, and Environmental Health Data**
Click	record(s) of your choice and review the information
Close	the HSDB window and return to Household Products Database
Click	the **Home** tab to prepare for the next search

Exercise 4: What auto products contain *oleic acid*?

Suggested Solution:

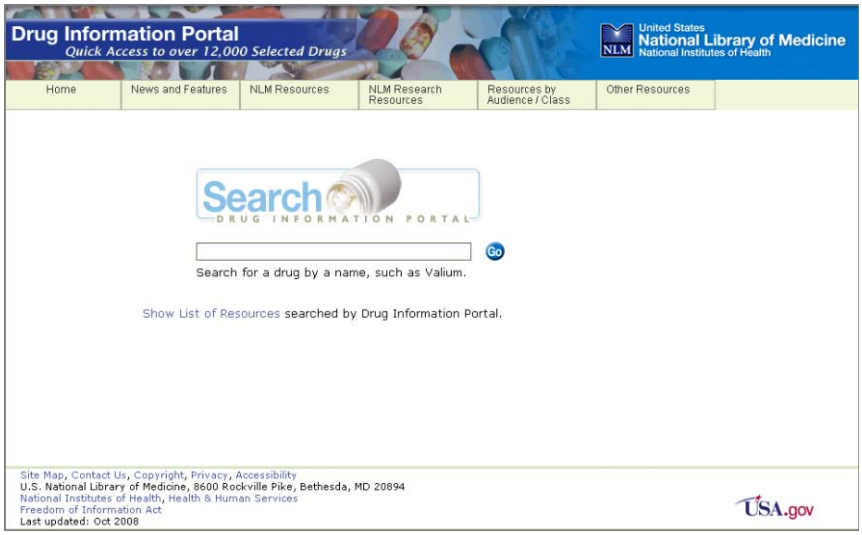
Click	the **Ingredients** tab
Click	O in the alphabetic list at the top
Select	Oleic acid from the list of ingredients
Click	the **brand name** of your choice with **"**Auto products" in the **Category** column
Review	the information retrieved
Click	the NLM logo in the header bar at the top of the page to prepare for the next session

15

More to Explore

Drug Information Portal

NLM's **Drug Information Portal** provides current information on more than 15,000 selected drugs from their entry into clinical trials through entry into the market place. Information includes consumer health, clinical trials, AIDS-related drug information, MeSH® pharmacological actions, PubMed biomedical literature.



http://druginfo.nlm.nih.gov

Resources include summaries tailored to various audiences, NLM search systems useful in searching for a drug, NLM research resources, resources organized by drug audience and class, and other NIH and government resources such as FDA and CDC. Resources are shown as links at the top of the page. Experimental drugs or untested folk remedies not covered by NIH and government resources are not covered in this portal.

Searching the Drug Information Portal

Search on a drug's trade name or generic name by entering your search term(s) in the search box on the home page to search many resources simultaneously. A spellchecker provides suggestions for misspelled names. You can find embedded portions of names by using an asterisk (*) at the beginning and/or end of a search term. Results will include the drug's type and usage as well as links leading to further information. JavaScript must be enabled in your browser for the NLM Drug Information Portal to work properly.

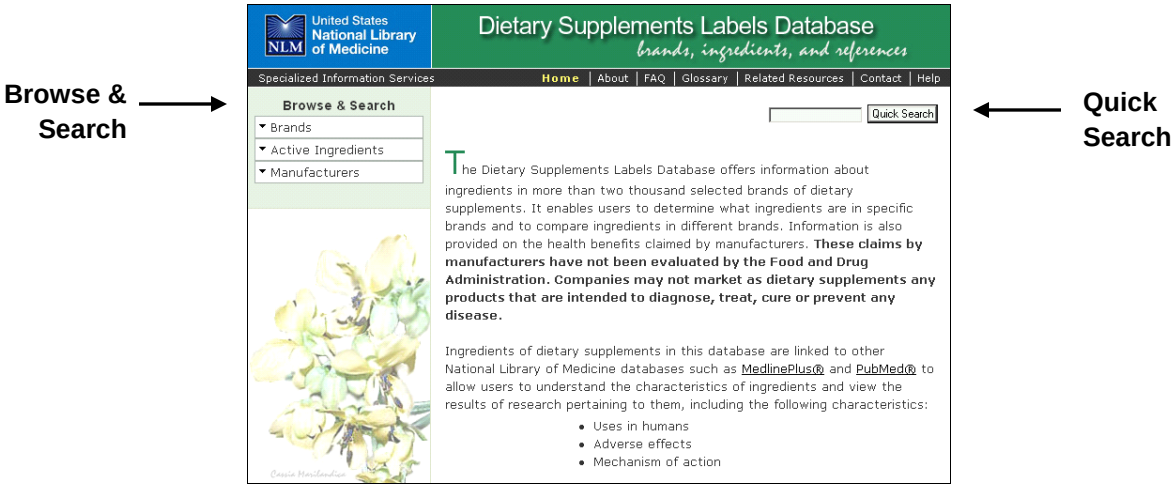
Additional Resources

For further information, we recommend these additional resources:

- Drug Information Portal Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/druginfoportalfs.html
- MedlinePlus
  http://medlineplus.gov
- PubMed
  http://pubmed.gov
- DailyMed
  http://dailymed.nlm.nih.gov/dailymed
- AIDS*info*
  http://aidsinfo.nih.gov
- Federal Drug Administration Center for Drug Evaluation and Research
  http://www.fda.gov/cder
- CDC Drug Service Scientific Resources Program
  http://www.cdc.gov/ncidod/srp/drugs/drug-service.html
- U.S. Drug Enforcement Administration Drug Information
  http://www.usdoj.gov/dea/concern/concern.htm
- USA.gov – Prescription Drugs
  http://www.usa.gov/Citizen/Topics/Health/Prescription_Drugs.shtml
- National Guideline Clearinghouse
  http://www.guideline.gov

Dietary Supplements Labels Database

The **Dietary Supplements Labels Database** contains information from the labels of more than 2,000 brands of dietary supplements in the marketplace, including online stores and practitioners, and provides direct links to pertinent health information, fact sheets, research findings and on-going clinical studies at the National Institutes of Health (NIH).



http://dietarysupplements.nlm.nih.gov

Features include a glossary, Warnings and Recalls from the U.S. Food and Drug Administration, and links to other NLM databases such as MedlinePlus and PubMed for further information including that on the characteristics of ingredients and the results of research pertaining to them.

Searching the Dietary Supplements Labels Database

Enter an active ingredient or a manufacturer in the Quick Search box to query the whole database. You can also search or browse brand names, active ingredients, and manufacturers by clicking the appropriate link under **Browse and Search** in the left sidebar.

Additional Resources

For further information, we recommend these additional resources:

- Office of Dietary Supplements
  http://dietary-supplements.info.nih.gov
- MedlinePlus Herbs and Supplements
  http://www.nlm.nih.gov/medlineplus/druginfo/herb_All.html

Tox Town

Tox Town provides an introduction to toxic chemicals and environmental health risks that may be encountered in everyday life, in everyday places. Tox Town allows visitors to tour a **Town**, **City, Farm**, **Port**, or **US-Mexico Border** community to identify common environmental hazards. It is a companion to the extensive information in the TOXNET collection of databases that are typically used by toxicologists and health professionals.

Spanish version →

http://toxtown.nlm.nih.gov

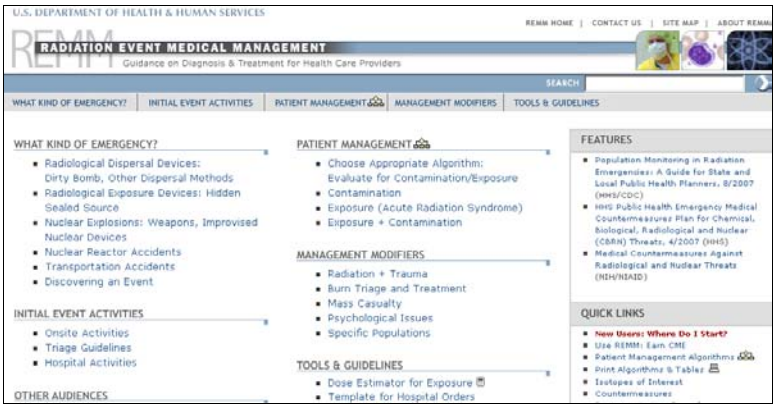
Tox Town is highly interactive, with graphics, animation, and sound to add interest to learning about connections between chemicals, the environment, and the public's health. It is recommended for high school and college students, educators, and the concerned public. This is an excellent resource for health educators who are asked to find easy-to-understand information about environmental toxins in their community.

The Tox Town Web site is designed to give you information on:

- Non-technical descriptions of chemicals
- Links to selected, authoritative chemical information on the Internet
- How the environment can impact human health
- Internet resources on environmental health topics

Radiation Event Medical Management System

Radiation Event Medical Management System (REMM) provides easy-to-follow algorithms on clinical diagnosis, treatment, and management of radiation contamination and exposure during mass casualty radiological/nuclear events. REMM is primarily for physicians with little to no formal radiation training. REMM also provides information for those who may be involved in responding to a radiation event in other capacities. REMM can be downloaded in advance, so that it can be used offsite and if the Internet is not available.



http://remm.nlm.gov

REMM is extensively hyperlinked and interconnected. The hyperlinks are organized in eight content categories. The following are the most commonly used categories and appear across the top of the page, beneath the REMM logo.

- **What Kind of Emergency?**—information relevant to each type of radiation event, including radiological dispersal devices, radiological exposure devices, nuclear explosions, nuclear reactor accidents, and transportation accidents
- **Initial Event Activities**—information regarding activities that should occur as part of an initial response following an event, including onsite activities, triage guidelines, and hospital activities
- **Patient Management**—patient management procedures to assist medical responders following a radiological or nuclear event determine whether patients have been exposed contaminated, or both
- **Management Modifiers**—provides detailed information about radiation + trauma (combined injury), burn triage and treatment, mass casualty, psychological issues and specific populations
- **Tools & Guidelines**—tools to facilitate quick look-up of information

"Quick Links," on the right hand side of most REMM pages, can help you navigate through the portal. Quick Links offers easy access to some of the portal's most important features and tools, including a link to all of the animations, illustrations, and photos founding REMM.

REMM was produced by the Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, Office of Planning and Emergency Operations, in cooperation with the National Library of Medicine, Division of Specialized Information Services, with subject matter experts from the National Cancer Institute, the Centers for Disease Control and Prevention, and many U.S. and international consultants.

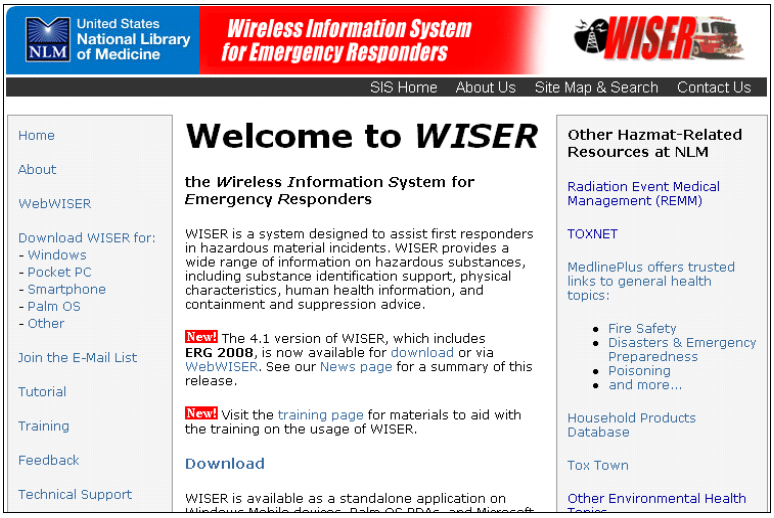
Additional Resources

For further information, we recommend these additional resources:

- Sources of Radiological/Nuclear Information
  http://remm.nlm.nih.gov/remm_SourcesofRadInfo.htm
- Animated, 13-minute tour of REMM
  http://remm.nlm.gov/quicktour/index.htm
- Earn Continuing Medical Education credits
  http://remm.nlm.gov/cme.htm
- REMM Lesser
  http://remm.nlm.gov/Aboutthissite.htm#listserv
- Download REMM to Your Computer
  http://remm.nlm.gov/download.htm

Wireless Information System for Emergency Responders

Wireless Information System for Emergency Responders (WISER) provides a wide range of information on hazardous substances, including substance identification support, physical characteristics, human health information, and containment and suppression advice.



http://wiser.nlm.nih.gov

Features of WISER include rapid access to the most important information about a hazardous substance, comprehensive decision support, access to NLM's Hazardous Substances Data Bank, radiological support, and more. WISER is currently available on Palm, Pocket PC, and Microsoft Windows™ platforms and a Web-based WISER (WebWISER) supports Web browsers for PCs and PDAs, including BlackBerry.

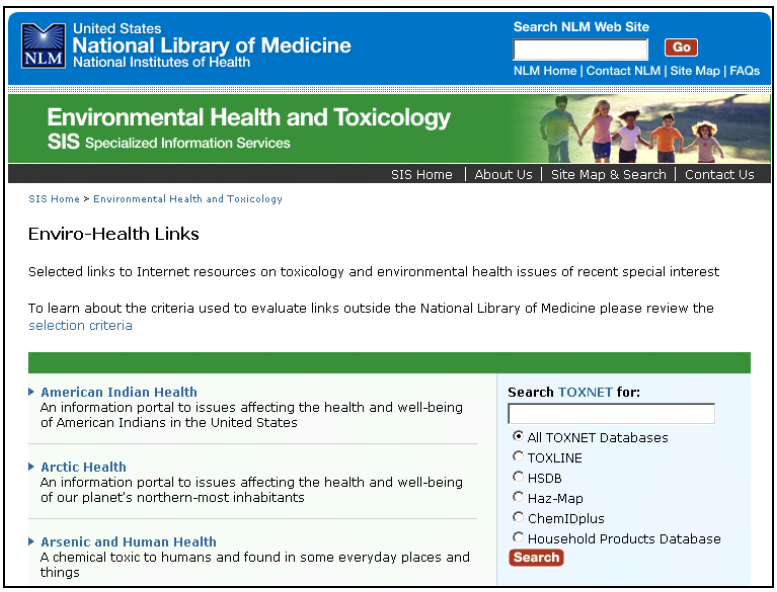
Additional Resources

For further information, we recommend these additional resources:

- WISER Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/wiser.html
- WISER updates and news
  http://wiser.nlm.nih.gov/listserv_join.html

Enviro-Health Links

Enviro-Health Links, available from the NLM Environmental Health and Toxicology Portal, is a list of links to Internet resources on toxicology and environmental health issues of recent special interest. All resources are evaluated and selected according to specific criteria. You may also search TOXNET from this page. From the Environmental Health and Toxicology Portal, click Enviro-Health Links under **More to Explore**.



http://sis.nlm.nih.gov/enviro/envirohealthlinks.html

Links to information of special interest include:

- Arsenic and Human Health
- Biological Warfare
- California Wildfires
- Chemical Warfare
- Dietary Supplements
- Health Effects from the Collapse of the World Trade Center
- Environmental Justice Internet Guide
- Hurricanes: Links to Health Information
- Indoor Air Pollution
- Keeping the Artist Safe: Hazards of Arts and Crafts Materials
- Lead and Human Health
- Mercury and Human Health
- Outdoor Air Pollution
- Pesticide Exposure
- Special Populations: Emergency and Disaster Preparedness
- Tornadoes
- Toxicogenomics
- West Nile Virus: Pesticides Used for Mosquito Control

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Additional Resources

Disaster Information Management Research Center

The **Disaster Information Management Research Center (DIMRC)** provides health information resources and informatics research related to disasters of natural, accidental, or deliberate design.

http://disasterinfo.nlm.nih.gov

Areas of research and activities supported by the DIMRC include.

- Participation in emergency preparedness and response efforts at local, State, and Federal levels
- Information Triage Hubs/Databases
- Education/Training
- Research & Development of Communications Interoperability Technologies and Maintaining Information Access
- Syndromic & other Surveillance Research

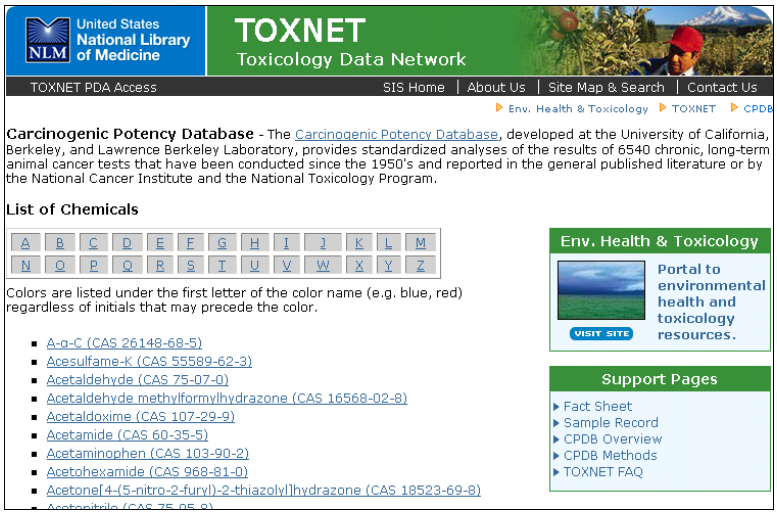
Additional Resources

For further information, we recommend these additional resources:

- **DIMRC** Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/dimrcfs.html

Carcinogenic Potency Database

The **Carcinogenic Potency Database (CPDB)**, developed at the University of California, Berkeley, and Lawrence Berkeley Laboratory, provides standardized analyses of the results of 6540 chronic, long-term animal cancer tests (both positive and negative for carcinogenicity) that have been conducted since the 1950's and reported in the general published literature or by the National Cancer Institute and the National Toxicology Program.



http://toxnet.nlm.nih.gov

Searching CPDB

Search by chemical name or fragment, or Chemical Abstracts Service Registry Number. Results include a summary for each sex-species tested, including carcinogenicity, target organs, and carcinogenic potency values. Detailed results from each experiment on that particular chemical are given in a plot format suitable for screen viewing.

Additional Resources

For further information, we recommend these additional resources:

- Carcinogenic Potency Database Fact Sheet
  http://www.nlm.nih.gov/pubs/factsheets/cpdbfs.html

Environmental Health & Toxicology Portal
Decision Tree

The National Library of Medicine's Environmental Health and Toxicology Portal provides access to many resources. The following chart is a guide to selecting the appropriate resource or database depending on user information needs. Database and resource links can be accessed at: http://sis.nlm.nih.gov/enviro.html.

Use this Decision Tree to choose the correct database or resource:

FOR THE FOLLOWING TYPE OF INFORMATION:	GO TO:
Bibliographic references to toxicology literature including developmental/reproductive and teratology information	TOXLINE or DART
Summary of peer-reviewed human health effects and emergency medical treatment for chemicals	HSDB
Animal Toxicity Studies	HSDB
Environmental Fate, Exposure, Standards and Regulations	HSDB
Chemical/Physical properties and safety/handling/disposal of chemicals	HSDB
Manufacturing, formulation and use of chemicals	HSDB
Chemical names and synonyms	ChemIDplus or HSDB
Chemical structures and structure searching/drawing capability	ChemIDplus
InChI and/or SMILES structure notations	ChemIDplus
List of links to NLM/NIH and other government agency information for a single chemical	ChemIDplus
Carcinogenicity, mutagenicity, tumor promotion and tumor inhibition data from the National Cancer Institute (NCI)	CCRIS
Peer-reviewed mutagenicity test data from the U.S. EPA including species, type of assay, test result and more	GENE-TOX
Hazard identification and dose-response risk assessment information from the U.S. EPA	IRIS
Cancer and noncancer oral and inhalation risk values and types from government and independent risk information groups worldwide	ITER

FOR THE FOLLOWING TYPE OF INFORMATION:	GO TO:
Results and analyses of chronic and long-term animal cancer test from NCI, NTP and the general published literature	CPDB
Drug information related specifically to breastfeeding mothers and their lactating infants including maternal/infant drug levels, possible effects and more	LactMed
Environmental releases of chemicals and waste management activities reported by facilities to the U.S. EPA	TRI
Electronic maps of chemical releases, Superfund sites, health , census, income data and more	TOXMAP
Chemicals, occupations, job tasks, and associated diseases/conditions	Haz-Map
Drug information including names, descriptions, labels, drug categories and links to additional resources	Drug Information Portal
Ingredient, health benefit claims and manufacturer information for dietary supplements with links to research	Dietary Supplements Labels Database
Safety and health information for products used in and around the home	Household Products Database
Material Safety Data Sheets (MSDS) and consumer product recalls	Household Products Database
Health information and research related to natural, accidental or deliberate disasters	DIMRC
PDA and/or online tool about chemicals of concern for first responders, hazmap workers, firefighters and others	WISER
Diagnosis and treatment information for radiological events and emergencies	REMM
Interactive website on toxic chemicals and environmental health concerns in the community	ToxTown
Bibliography on alternatives to animal testing in biomedical research	ALTBIB
Selected links to internet resources on environmental issues of special interest	Enviro-Health Links
Directory of Health Organizations	DIRLINE
Online tutorials on basic toxicology principles and concepts	Toxicology Tutorials