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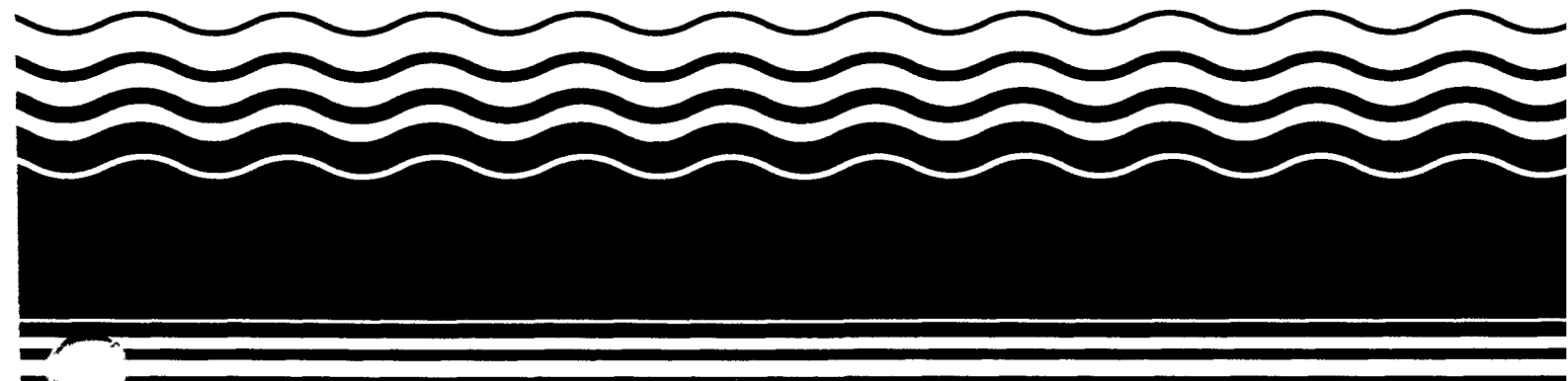
Superfund

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# Health Effects Assessment Summary Tables

## FY-1994 Annual



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PB94-921199  
March 1994

## **HEALTH EFFECTS ASSESSMENT**

### **SUMMARY TABLES**

FY-1994 Annual

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## **DISCLAIMER**

This report has been prepared by the U.S. Environmental Protection Agency. The information contained herein has been taken from final documents prepared by the Office of Health and Environmental Assessment for the Office of Solid Waste and Emergency Response and the Office of Water, Washington, DC and the Office of Air Quality Planning and Standards, Research Triangle Park, NC. These documents were reviewed in accordance with Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

## TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION .....	1
WHAT'S NEW IN THE ANNUAL FY94 HEAST. ....	11
USER'S GUIDE: CHEMICAL TOXICITY .....	19
USER'S GUIDE: RADIONUCLIDE CARCINOGENICITY .....	32
HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) .....	1-1
REFERENCES FOR HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) .....	R1-1
HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) .....	2-1
REFERENCES FOR HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) .....	R2-1
HEAST TABLE 3: CARCINOGENICITY .....	3-1
REFERENCES FOR HEAST TABLE 3: CARCINOGENICITY .....	R3-1
HEAST TABLE 4A: RADIONUCLIDE CARCINOGENICITY - SLOPE FACTORS (IN PICOCURIES) .....	4A-1
HEAST TABLE 4B: RADIONUCLIDE CARCINOGENICITY - SLOPE FACTORS (IN BECQUERELS) .....	4B-1
APPENDIX A: TECHNICAL INFORMATION .....	A-1



## INTRODUCTION

This document is the FY94 Annual Update of the Health Effects Assessment Summary Tables (HEAST) prepared by EPA's Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for use at both Superfund and RCRA sites. It **completely** replaces all former editions of the HEAST.

This version of the HEAST will be updated in 1994 by a July 1994 Supplement No. 1 and a November 1994 Supplement No. 2. These supplements will supercede the information in this document, the March 1994 HEAST Annual Update. Therefore, if the supplement(s) are available they should be checked whenever this document is consulted. These supplements, however, will not be produced to stand alone and will not contain the User's Guides or Appendix that are available in the annual update. Thus, the user is strongly encouraged to refer to the March 1994 HEAST Annual Update for this information.

The HEAST is a comprehensive listing consisting almost entirely of PROVISIONAL RISK ASSESSMENT INFORMATION relative to oral and inhalation routes for chemicals of interest to Superfund, the Resource Conservation and Recovery Act (RCRA), and the EPA in general. These entries in the HEAST are limited to chemicals that have undergone review and have the concurrence of individual Agency Program Offices, and each is supported by an Agency reference. This risk assessment information has not, however, had enough review to be recognized as high quality, Agency-wide consensus information.

The Integrated Risk Information System (IRIS) is the Agency's official repository of Agency-wide consensus chronic human health risk information. IRIS evaluations are conducted by the Agency's Work Group Review process, i.e., they have been examined by either the Reference Dose/Reference Concentration (RfD/RfC) Work Group or the Carcinogen Risk Assessment Verification Endeavor (CRAVE) Work Group. These Agency Work Groups conduct a process that leads to internal Agency scientific consensus regarding risk assessment information on a chemical. This information is recorded on IRIS, is considered to be "Work Group Verified", and does not appear on the HEAST. Thus, provisional risk assessment information on the HEAST is subject to possible review and revision by these Agency Work Groups.

There are two exceptions to the above discussion. The HEAST also contains information on chemicals that are a part of the National Ambient Air Quality Standards (NAAQS) or the Drinking Water Criteria Document (DWCD) series. In each of these cases, the chemicals are subject to extensive scientific peer review processes of extremely high quality.

## **CHEMICAL STATUS DEFINITIONS**

Chemicals reviewed by the Agency Work Groups are classified according to their status as either "verified", "not verifiable", or "under review". The toxicity values (other than NAAQS or DWCD values) listed on the HEAST are considered to be "provisional". The Agency has no official definitions for these terms, but the HEAST user may interpret them as follows:

**Provisional:** A toxicity value or a cancer value is "provisional" if the value has had some form of Agency review, but it does not appear on the IRIS system. These values are generated in several ways. Often they are determined in the course of developing an Agency document on a chemical or on a class of chemicals. Some have been generated through the Work Group process, but have not yet been input to the IRIS system. At the time each value was derived, all available information on the chemical was evaluated, the value was calculated using the most current methodology, and a consensus was reached on the value by Agency scientists.

Brackets are placed around the names of toxicity and carcinogenicity values on the HEAST to distinguish these "provisional" values from information on IRIS. The following names are affected: RfD to [RfD], RfC to [RfC], slope factor to [slope factor], EPA group to [EPA Group] and unit risk to [unit risk].

**These "provisional" values are found on the HEAST. They do not appear on IRIS.**

**Verified:** A toxicity value or a cancer value is "Work Group Verified" if all available information on the value has been examined by an Agency Work Group, the value has been calculated using current Work Group methodology, a unanimous consensus has been reached on the value by the Work Group, and the value appears on IRIS.

Some numbers that have achieved unanimous consensus by the Work Group may appear on the HEAST for a short time until they are loaded onto IRIS, at which time they are termed, "verified." During the interim, they are considered to be "provisional" values that are still "under review" by the Work Group.

**These "verified" numbers only appear on IRIS. They do not appear on the HEAST.**

**Not verifiable:** A toxicity value is "not verifiable" if an Agency Work Group has considered all available data on a chemical and has unanimously determined that data are inadequate to generate a value that would be suitable for inclusion on IRIS. No toxicity value is calculated; no toxicity value is available for IRIS or the HEAST.

**This "not verifiable" status is noted on IRIS, and is sometimes found on the HEAST, with a pointer to the IRIS system.**

**Under Review:** A toxicity value is "under review" if an Agency Work Group is in the process of considering all available data on a chemical. All Work Group chemicals will have this status until the toxicity value is placed on the IRIS system. Toxicity values that have been withdrawn from IRIS by a Work Group for further review will have this status.

**This "under review" status may be indicated on IRIS or on the HEAST. During this time, "provisional" toxicity values may appear on the HEAST.**

In all cases, the status of a chemical may change as new data become available, and the assessment is revisited.

## **CAUTION**

It is imperative for each user of the HEAST to recognize that the values listed in the toxicity tables and the cancer table are generally considered to be PROVISIONAL RISK ASSESSMENT INFORMATION. The user is referred to IRIS for "Work Group Verified" values. It is also important to remember that the numbers in these tables alone tell very little about the adverse effects of a chemical or the quality of evidence on which risk assessment information is based. Original assessment documents must be consulted by users of the HEAST in order to fully appreciate the strengths and limitations of a specific data base. Original source documents will allow for the most complete characterization of potential toxicity associated with the range of exposure pathways generally evaluated at Superfund and RCRA sites. The Reference Tables point the user to these sources.

## **CONTRIBUTORS**

Chemicals commonly found at RCRA sites as identified by the Office of Solid Waste's (OSW) Technical Assessment Branch are included in the HEAST. The Office of Radiation Programs has provided data on radionuclide carcinogenicity for Tables 4A and 4B of the HEAST. Finally, the Office of Air Quality Planning and Standards (OAQPS) has provided information on chemicals for which Air Quality Criteria Documents and National Ambient Air Quality Standards have been developed.

## **CHEMICALS LISTED**

Most of the chemicals included on the toxicity tables and carcinogenicity table are those for which at least one of the following EPA documents has been written: Health Effects Assessment Document (HEA), Health and Environmental Effects Profile (HEEP), Health and Environmental Effects Document (HEED), Health Assessment Document (HAD), Air Quality Criteria Document (AQCD), Drinking Water Criteria Document (DWCD). A description of each is provided in Appendix A, Section I. In a few cases, the values are supported by other written material, such as Work Group meeting notes or Carcinogen Assessment Group (CAG) Profiles. Radionuclide slope factor values are calculated by the EPA's Office of Radiation Programs.

The names of criteria pollutants that are regulated as National Ambient Air Quality Standards (NAAQS) under the Clean Air Act are listed in the main body of the HEAST, but the actual criteria are included as Section V of Appendix A: Technical Information. The NAAQS were not included in the tables in order to distinguish them from the reference concentration ([RfC]) values. The NAAQS and [RfC]s represent different levels

of review and different methods of calculation and thus, must be interpreted and used differently.

## **HIERARCHY OF SOURCES**

It is recognized that at any point in time there may be multiple old and new Agency documents or data bases that present different values on a specific chemical. For chemicals other than those represented by the NAAQS or DWCDs, the following hierarchy of sources is recommended in evaluating chemical toxicity for Superfund sites:

1. The Agency's Integrated Risk Information System (IRIS) and cited references. Changes are made in this data base on a monthly basis, but there may be data gaps. Call IRIS USER SUPPORT at (513)569-7254 for further information.
2. The Health Effects Assessment Summary Tables (HEAST) and cited references.
3. Consultation with the Superfund Health Risk Technical Support Center (TSC) at (513)569-7300.
4. Do not consult either the toxicity tables (Appendix A) in the Superfund Public Health Evaluation Manual (SPHEM, U.S. EPA, 1986) or the September 1988 Public Health Risk Evaluation Data Base (PHRED) as these sources are likely to contain numerous values that have since become out-of-date.

## **QUESTIONS**

### **Chemical Toxicity and Carcinogenicity**

Regional EPA Superfund Staff may direct questions regarding the contents of the chemical toxicity and carcinogenicity tables on the HEAST (e.g., chemicals not covered, chemicals with pending [RfD]s) to EPA's Superfund Health Risk Technical Support

Center (TSC) in Cincinnati, OH at (513)569-7300. Questions from other users must be submitted to the TSC in writing and must contain the following information:

- Superfund site name, site location and twelve-digit site number;
- Name and phone number of the site Remedial Project Manager (RPM) or Regional Risk Assessor/Toxicologist;
- Detailed description of the risk assessment related question.

Please send requests via mail or FAX to:

Superfund Health Risk Technical Support Center  
US EPA  
26 W. ML King Dr.  
Environmental Criteria and Assessment Office  
MS 117  
Cincinnati, OH 45268  
FAX#: (513)569-7159

## **RCRA Chemicals**

Questions about RCRA chemicals may be addressed by calling the Office of Solid Waste at (202)260-4761.

## **Radionuclide Carcinogenicity**

Questions concerning radionuclide carcinogenicity should first be addressed by contacting the appropriate Regional Radiation Program Manager. A listing of these managers and several contacts in the Office of Radiation Programs can be found in Exhibit 2 of the User's Guide - Radionuclide Carcinogenicity.

## **REFERENCES**

Most cited Agency references (e.g., HEAs, HEEPs, HEEDs), are (or will soon be) available through the National Technical Information Service (NTIS), 5285 Port Royal

Road, Springfield, VA 22161 [(703)487-4650]. Carcinogen Assessment Group (CAG) Profiles cited in Table 3 are available through the RCRA docket (202)260-9327.

Drinking water documents are available by calling the Drinking Water Docket at (202)260-3027.

## **ORDERING INFORMATION**

Limited copies of the HEAST are available for EPA Superfund staff, State Superfund programs and other Federal agencies working on Superfund sites, and EPA contractors working for the EPA Superfund program. Users in these groups can call Syracuse Research Corporation (202)479-0881 to be put on the mailing list.

EPA's Office of Solid Waste (OSW) requests that their users (i.e., OSW staff, contractors, State solid waste programs) call the Health Assessment Section (202)260-4761 to obtain copies of the HEAST. Regional OSW staff are reminded that copies are sent to all EPA Regional libraries.

Users of the HEAST in EPA's Office of Air and Radiation and State air programs should call Kelly Rimer of EPA's Office of Air Quality Planning and Standards at (919)541-2962.

All other users must purchase the document from:

National Technical Information Service (NTIS)  
5285 Port Royal Road  
Springfield, VA 22161  
(703)487-4650

For ordering information, call the NTIS Subscriptions Department at (703)487-4630. NTIS normally ships 4th class United States mail. When ordering the



1994 Health Effects Assessment Summary Table annual update from NTIS refer to the following order number:

PB94-963310: Annual HEAST update

## **STRUCTURE OF THE HEAST**

The HEAST Introduction contains explanatory material relative to the quality of information on the HEAST, its sources, and its availability. This is followed by a listing of changes since the last HEAST was published and then by User's Guides for both Chemical Toxicity and Carcinogenicity, and Radionuclide Carcinogenicity. The values on the HEAST are presented in a series of five tables that contain toxicity information and three tables of references. The information contained in each table and their designations are as follows:

### **HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

Table 1 lists subchronic and chronic non-cancer toxicity values that were calculated using the current methodology practiced by the RfD/RfC Work Group.

### **HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

Table 2 lists subchronic and chronic non-cancer toxicity values that are found in Agency documents, but were calculated by alternative methods that are not currently practiced by the RfD/RfC Work Group. These values are considered to be adequate provisional values for risk assessment purposes at Superfund and RCRA sites, but are subject to being reviewed by the RfD/RfC Work Group and revised when necessary to reflect current work group practices.

### **HEAST TABLE 3: CARCINOGENICITY**

Table 3 lists carcinogenicity values that were calculated using the current methodology of the CRAVE Work Group.

#### **HEAST TABLES 4A AND 4B: RADIONUCLIDE CARCINOGENICITY – SLOPE FACTORS**

Tables 4A and 4B list ingestion, inhalation and external exposure carcinogenicity slope factors for radionuclides in two equivalent, but different units, picocuries and becquerels, respectively.

#### **HEAST TABLE 1 REFERENCES: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

The references for Table 1 are numerically coded to associate each toxicity value clearly with its corresponding reference.

#### **HEAST TABLE 2 REFERENCES: ALTERNATE METHODS – SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

The references for Table 2 are numerically coded to associate each toxicity value clearly with its corresponding reference.

#### **HEAST TABLE 3 REFERENCES: CARCINOGENICITY**

The references for Table 3 are numerically coded to associate each toxicity value clearly with its corresponding reference.

Following the tables, a Technical Appendix (Appendix A) is available, containing the following sections:

- I. Data Sources and Selection Criteria Used in HEAST
- II. Dose Conversions on HEAST
- III. Chemical Name and Chemical Abstracts Service Registry Number Cross Reference
- IV. Effect Level Definitions
- V. National Ambient Air Quality Standards (NAAQS)

## WHAT'S NEW IN THE FY94 HEAST

### GENERAL CHANGES - CHEMICAL TOXICITY AND CARCINOGENICITY

The changes in this version of the HEAST reflect changes in IRIS through January 1, 1994. It is also current with RfD/RfC and CRAVE Work Group activities through January 1, 1994.

### CHEMICAL-SPECIFIC CHANGES -- CHEMICAL TOXICITY AND CARCINOGENICITY

#### A. CHEMICAL-SPECIFIC CHANGES ON HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

##### Aldicarb 000116-06-3

The chronic oral RfD has been replaced on IRIS. The chronic oral RfD on IRIS was adopted as the subchronic oral [RfD].

##### Bromoform 000075-25-2

A comment was added to indicate that the chronic inhalation RfC is considered not verifiable by the RfD/RfC (02/11/93) Work Group.

##### Dichlorobenzene, 1,4- 000106-46-7

An indicator was added to show that the inhalation RfC is now available on IRIS. The chronic inhalation RfC on IRIS was modified to derive the subchronic inhalation [RfC].

##### Dichloroethane, 1,2- 000107-06-2

The CAS Registry Number was corrected from 106-06-2 to 107-06-2. No other changes in the table.

##### Glycidaldehyde 000765-34-4

The NOAEL which was inadvertently omitted from the 1993 HEAST has been replaced and converted from 10 ppm to 29 mg/cu m.

##### Hexachlorocyclopentadiene 000077-47-4

No change in the tables. Reference to one of two studies used in the HEED to derive the RfC (Batelle Northwest Laboratories, 1984) was replaced in the reference section.

##### Manganese 007439-96-5

The chronic inhalation RfC has been replaced on IRIS. A subchronic inhalation [RfC] has not been derived.

##### Methoxychlor 000072-43-5

A comment was added to indicate that the chronic inhalation RfC is considered not verifiable by the RfD/RfC (11/07/91) Work Group.

Trichloro-2'-hydroxydiphenylether, 2,2,4'- 003380-34-5

The Target and Critical effect which were inadvertently omitted from the 1993 Annual HEAST have been replaced.

**B. CHEMICAL-SPECIFIC CHANGES ON HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

Dichlorobenzene, 1,2- 000095-50-1

The subchronic inhalation [RfC] which had inadvertently been omitted from the 1993 Annual HEAST has been replaced.

Ethoxyethanol acetate, 2- 000111-15-9

The NOEL units were corrected.

**C. CHEMICAL-SPECIFIC CHANGES ON HEAST TABLE 3: CARCINOGENICITY**

Dimethyl hydrazine, 1,1- 000057-14-7

No EPA Group Classification was provided in the reference document, therefore this compound was removed from Table 3.

Methyl hydrazine 000060-34-4

No EPA Group Classification was provided in the reference document, therefore this compound was removed from Table 3.

Metholachlor 051218-45-2

An indicator was added to show that the EPA Group Classification is now available on IRIS.

**D. CHEMICAL-SPECIFIC CHANGES IN THE JULY 1993 AND NOVEMBER 1993 SUPPLEMENTS ON HEAST TABLE 4A AND 4B: RADIONUCLIDE CARCINOGENICITY -- SLOPE FACTORS**

Uranium (92) U-238 +D

The ingestion, inhalation, and external slope factors in Tables 4A and 4B have changed to correct an error in summation for the +D values of U-238.

**Announcement of Upcoming Changes to Radionuclide Slope Factors**

Slope factors for radionuclides are currently being revised to incorporate EPA's revised methodology for estimating radiogenic cancer risk. The new methodology is being reviewed by experts within and outside the EPA. Users of the HEAST should expect revised radionuclide slope factors to be available sometime during 1994. The new

values and a synopsis of the revised methodology will be published in the HEAST quarterly update when available.

## **CHEMICAL SPECIFIC CHANGES MADE IN THE JULY 1993 SUPPLEMENT NO. 1 AND THE NOVEMBER 1993 SUPPLEMENT NO. 2 TO THE MARCH 1993 HEAST ANNUAL UPDATE**

The following changes were made in the July 1993 and November 1993 supplemental editions of the March 1993 Heast Annual Update and represent those changes that have occurred between the publication of the March 1993 HEAST Annual Update and this document, the March 1994 Heast Annual Update. Because some HEAST users may have been unaware of the publications of these supplements, the following information will indicate additional changes in toxicity information that should be noted. Note: These changes have been incorporated into the March 1994 Annual Update.

### **A. CHEMICAL-SPECIFIC CHANGES IN THE JULY 1993 AND NOVEMBER 1993 SUPPLEMENTS ON HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

#### Acrylonitrile      000107-13-1

Added to Table 1. The chronic oral [RfD] under review by the RfD/RfC Work Group was modified to derive the subchronic oral [RfD].

#### Arochlor 1248      012672-29-6

Added to Table 1. A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/20/93) by the RfD/RfC Work Group.

#### Atrazine      001912-24-9

An indicator was added to show that the chronic oral RfD is now available on IRIS. The chronic oral RfD on IRIS was adopted as the subchronic oral [RfD].

#### Barium cyanide      000542-62-1

A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/20/93) by the RfD/RfC Work Group.

#### Benzenethiol / (Thiophenol)      000108-98-5

Added to Table 1. The chronic oral [RfD] under review by the RfD/RfD Work Group was modified to derive the subchronic oral [RfD].

Boron 007440-42-8

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Boron was added.

Bromoethene / (Vinyl bromide) 000593-60-2

Added to Table 1. An indicator was added to show that the chronic inhalation RfC is now available on IRIS. The chronic inhalation RfC on IRIS was adopted as the subchronic inhalation [RfC].

Bromoform 000075-25-2

A comment was added to indicate that the chronic inhalation RfC is considered not verifiable (02/11/93) by the RfD/RfC Work Group.

Bromomethane 000074-83-9

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Bromomethane was added.

Chlorobenzilate 000510-15-6

A comment was added to indicate that the chronic inhalation RfC is considered not verifiable (02/11/93) by the RfD/RfC Work Group.

Chromium(III) 016065-83-1

The subchronic oral [RfD] was changed to agree with IRIS. The uncertainty factor was changed to incorporate an additional Modifying Factor of 10 as on IRIS.

Cresol, p- / (Methylphenol, 4-) 000106-44-5

Study information was changed to be consistent with information under review by the RfD/RfC work group. The NOEL is changed to a NOAEL, critical effects are changed, and the chronic oral [RfD] is adopted as the subchronic oral [RfD].

Cyanazine 021725-46-2

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Cyanazine was added.

Dicamba 001918-00-9

Added to Table 1. An indicator was added to show that the chronic oral RfD is available on IRIS. The chronic oral RfD was adopted as the subchronic oral [RfD].

Dichloropropene, 1,3- / (Telone II) 000542-75-6

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for 1,3-Dichloropropene was added.

Dinitro-o-cresol, 4,6- 000534-52-1

A comment was added to indicate that the chronic inhalation RfC is considered not verifiable (02/11/93) by the RfD/RfC Work Group.

Endosulfan 000115-29-7

The chronic oral RfD was withdrawn from IRIS (12/01/92). The chronic oral [RfD] was changed to reflect the value currently under review by the RfD/RfC Work Group (11/04/92). The chronic oral [RfD] was adopted as the subchronic oral [RfD].

Hexachlorobutadiene 000087-59-1

The chronic oral RfD was withdrawn from IRIS (05/01/93). The chronic oral [RfD] was changed to reflect the value currently under review by the RfD/RfC Work Group (04/01/93).

Isophorone 000078-59-1

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Isophorone was added.

Manganese 007439-96-5

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Criteria Document for Manganese was added.

Methoxyethanol, 2- 000109-86-4

The chronic oral [RfD] and the subchronic oral [RfD] were moved from Table 1 to Table 2 because they were derived from methodology that is not current with the interim methodology used by the RfD/RfC Work Group.

Methyl ethyl ketone 000078-93-3

An indicator was added to show that the chronic oral RfD is now available on IRIS. The subchronic oral [RfD] and the subchronic inhalation [RfC] were changed to be consistent with IRIS.

Methyl ethyl ketone peroxide 001338-23-4

Added to Table 1. A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/20/93) by the RfD/RfC Work Group

Methylene-bis(2-chloroaniline), 4,4'- 000101-14-4

A comment was added to indicate that the chronic inhalation RfC is considered not verifiable (02/10/93) by the RfD/RfC Work Group.

Methyl isobutyl ketone 000108-10-1

The chronic oral [RfD] was changed to reflect the value currently under review by the RfD/RfC Work Group (07/22/93). The chronic oral [RfD] was modified to derive the subchronic oral [RfD].

Metolachlor 051218-45-2

Added to Table 1 from the 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Metolachlor. The chronic oral [RfD] was adopted as the subchronic oral [RfD].

Metribuzin 021087-64-9

Added to Table 1. An indicator was added to show that the chronic oral RfD is now available on IRIS. The chronic oral RfD on IRIS was adopted as the subchronic oral [RfD].

Naphthalene 000091-20-3

The record for Naphthalene, which was inadvertently omitted from Table 1 of the Annual HEAST, has been replaced.

Nickel cyanide 000557-19-7

Added to Table 1. A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/20/93) by the RfD/RfC Work Group

Nitroaniline, 2- 000088-74-4

The record for Nitroaniline, 2-, which was inadvertently omitted from Table 1 of the Annual HEAST, has been replaced.

Osmium tetroxide 020816-12-0

Added to Table 1. A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/22/93) by the RfD/RfC Work Group

Simazine 000122-34-9

An indicator was added to show that the chronic oral RfD is now available on IRIS. The chronic oral RfD on IRIS was adopted as the subchronic oral [RfD].

Tetrachloroethane, 1,1,1,2- 000630-20-6

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for 1,1,1,2-Tetrachloroethane was added.

Thallic oxide 001314-32-5

A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/20/93) by the RfD/RfC Work Group.

Thallium Selenite 012039-52-0

The chronic oral RfD was withdrawn from IRIS (08/93). A comment was added to indicate that the chronic oral RfD is considered not verifiable (07/20/93) by the RfD/RfC Work Group

Trichlorobenzene, 1,2,4- 000120-82-1

The chronic inhalation [RfC] was removed from Table 2. The chronic inhalation [RfC] under review by the RfD/RfC Work Group was added to Table 1. The chronic inhalation [RfC] under review by the RfD/RfC Work Group was modified to derive the subchronic inhalation [RfC].



Trifluralin 001582-09-8

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Trifluralin was added.

Zinc (metallic) 007440-66-6

The record for Zinc (metallic), which was inadvertently omitted from Table 1 of the Annual HEAST, has been replaced.

**B. CHEMICAL-SPECIFIC CHANGES IN THE JULY 1993 AND NOVEMBER 1993 SUPPLEMENTS ON HEAST TABLE 2. SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

Methoxyethanol, 2- 000109-86-4

The chronic oral [RfD] and the subchronic oral [RfD] were moved from Table 1 to Table 2 because they were derived from methodology that is not current with the interim methodology used by the RfD/RfC Work Group.

Trichlorobenzene, 1,2,4 000120-82-1

The chronic inhalation [RfC] was removed from Table 2 and the chronic inhalation [RfC] under review by the RfD/RfC Work Group was added to Table 1.

**C. CHEMICAL-SPECIFIC CHANGES IN THE JULY 1993 AND NOVEMBER 1993 SUPPLEMENTS ON HEAST TABLE 3: CARCINOGENICITY**

Chloromethane / (Methyl chloride) 000074-87-3

The record for Chloromethane, which was inadvertently omitted from Table 3 of the Annual HEAST, has been replaced.

Coke Oven Emissions 008007-45-2

An indicator was added to show that the EPA Group classification is now on IRIS.

Cyanazine 021725-46-2

Carcinogenicity information was added to Table 3 of the July 1993 Supplement from the 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Cyanazine. The record was revised (cancers reported and the references changed) on the November 1993 Supplement to reflect CRAVE Work Group review. There was no change in quantitative values.

Dibromo-3-chloropropane, 1,2- 000096-12-8

The inhalation [slope] and the inhalation [unit risk] were inadvertently reversed on the July 1992 Supplement 1.

Dichloropropene, 1,3- / (Telone II) 000542-75-6

The record was revised (cancers reported and the references changed) to reflect the information currently under review by the CRAVE Work Group.

Ethylene thiourea 000096-45-7

The oral [slope] and the oral [unit risk] were changed to reflect the values currently under review by the CRAVE Work Group.

Methylenebis(benzeneamine), 4,4- 000101-77-9

No [EPA Group] classification was provided in the reference document, therefore the compound was removed from Table 3.

Metolachlor 051218-45-2

Added to Table 3 from the 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for Metolachlor.

Mirex 002385-85-5

The oral [slope] and the oral [unit risk] are under review by the CRAVE Work Group and were removed from Table 3.

TCDD, 2,3,7,8- 001746-01-6

The units for the inhalation [unit risk] were added to Table 3. There are no additional changes to the Table.

Tetrachloroethane, 1,1,1,2- 000630-20-6

No change in the tables. Reference to 1993 Revised and Updated Drinking Water Quantification of Toxicologic Effects for 1,1,1,2-Tetrachloroethane was added.

Trichloropropane, 1,2,3- 000096-18-4

The oral [slope] and the oral [unit risk] being considered by the CRAVE Work Group and were added to Table 3.

**D. CHEMICAL-SPECIFIC CHANGES IN THE JULY 1993 AND NOVEMBER 1993 SUPPLEMENTS ON HEAST TABLE 4A AND 4B: RADIONUCLIDE CARCINOGENICITY -- SLOPE FACTORS**

No new radionuclide slope factors were added to Tables 4A and 4B, and none of the slope factors listed in the March 1993 HEAST Annual Update were changed.

## USER'S GUIDE: CHEMICAL TOXICITY

The HEAST summarizes provisional toxicity and cancer values as well as values developed for the NAAQS and DWCD chemicals. The provisional status of the toxicity and cancer values is indicated by placing brackets around the title of the value. These include provisional reference concentrations ([RfC]) and provisional reference doses ([RfD]) for toxicity from subchronic and chronic inhalation and oral exposure (Tables 1 and 2) and provisional slope factors ([slope factor]), provisional cancer classifications ([EPA Group]) and provisional unit risk values ([unit risk]) for carcinogenicity, based on lifetime inhalation and oral exposure (Table 3). Brackets should be included with the acronym whenever a user quotes the value in an assessment document, and the provisional nature of the value should be noted. A more complete discussion of how Superfund develops and considers the toxicity assessment in hazardous waste sites is presented in Chapter 7 of Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual, Part A, EPA/540/1-89/002.

The references listed for each chemical in the Reference Tables for Tables 1, 2 and 3 represent the study or studies that are the basis for the [RfC], [RfD], [slope factor], [EPA Group], or [unit risk], as well as the EPA reference that is the source of the Agency analysis or risk assessment information. In some cases, additional EPA documents are also listed as a source of information on the chemical. Work Group verified values found on IRIS are not found on the HEAST, but are indicated in the tables by the word "IRIS" in place of the number.

**TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

The [RfC] or [RfD] is a provisional estimate (with uncertainty spanning perhaps an order of magnitude) of the daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a portion of the lifetime, in the case of a subchronic [RfC] or [RfD], or during a lifetime, in the case of a chronic [RfC] or [RfD]. The [RfC] and [RfD] values are listed in Tables 1 and 2 in columns with the headings "Subchronic" and "Chronic". The critical dose or concentration level is usually a No-Observed-Adverse-Effect Level (NOAEL) or a Lowest-Observed-Adverse-Effect Level (LOAEL) (See Appendix A, Section IV: Effect Level Definitions, for more information). The [RfC] or [RfD] is derived by dividing the NOAEL or LOAEL by an uncertainty factor (UF) times a modifying factor (MF):

$$[RfC] \text{ or } [RfD] = \frac{NOAEL \text{ or } LOAEL}{UF \times MF}$$

In Tables 1 and 2, the information listed is the following:

Chemical	=	Chemical Name/CASRN
Level	=	Effect Level
Dose	=	Administered Dose or Concentration
Route	=	Route of Administration
Species	=	Tested Species
Experiment Length	=	Length of Exposure
Target	=	Target Organ(s) Affected at Critical Level
Critical Effect	=	Effect(s) Observed at Critical Level
Subchronic [RfC]	=	Subchronic Inhalation [Reference Concentration]
UF	=	Uncertainty Factor for the Subchronic Inhalation [Reference Concentration]
Subchronic [RfD]	=	Subchronic Oral [Reference Dose]
UF	=	Uncertainty Factor for the Subchronic Oral [Reference Dose]
Chronic [RfC]	=	Chronic Inhalation [Reference Concentration]

UF	=	Uncertainty Factor for the Chronic Inhalation [Reference Concentration]
Chronic [RfD]	=	Chronic Oral [Reference Dose]
UF	=	Uncertainty Factor for the Chronic Oral [Reference Dose]
Reference	=	Reference Identification Number for All Toxicity Values on the Same Line.

An example of this information is shown in Figure 1, HEAST Table 1:

Chemical	=	GLYCIDALDEHYDE/000765-34-4
Level	=	NOAEL
Dose	=	10 PPM
Route	=	INHALATION: INTERMITTENT
Species	=	RAT
Experiment Length	=	12 WEEKS
Target	=	WHOLE BODY, BLOOD, KIDNEY
Critical Effect	=	DECREASED WEIGHT GAIN, HEMATOPOIETIC EFFECTS, EFFECTS
Subchronic [RfC]	=	1E-2 mg/cu.m
UF	=	300
Subchronic [RfD]	=	4E-3 mg/kg/day
UF	=	300
Chronic [RfC]	=	1E-3 mg/cu.m
UF	=	3000
Chronic [RfD]	=	IRIS
UF	=	IRIS
Reference	=	005968

Notice that a Chronic RfD for Glycidaldehyde is available on IRIS, so it is not listed here. Also notice that there are footnotes for this chemical that indicate a route-to-route extrapolation was performed and that there is information available on Table 3: Carcinogenicity.

Also given in Figure 1 is an example of the References for Table 1 for the same chemical. The reference is identified by the chemical name (Glycidaldehyde), the CASRN (00765-34-4), and the reference number that links it with the toxicity values (005968).

The uncertainty factor used in calculating the [RfC] or [RfD] reflects scientific judgment regarding the various types of data used to estimate [RfC] or [RfD] values. An

FIGURE 1

## Example Data and References for Chemical Toxicity

HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) January 1992

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
GLYCIDALDEHYDE NOAEL	10 PPM INHALATION INTERMITTENT	RAT 12 WEEKS	000765-34-4 WHOLE BODY BLOOD KIDNEY	DECREASED WEIGHT GAIN HEMATOPOIETIC EFFECTS	1E-2 300	4E-3 300	1E-3 3000	IRIS	005968
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5									
GENERAL COMMENT: ALSO SEE TABLE 3 CARCINOGENICITY									

REFERENCES FOR HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

January 1992

- GLYCIDALDEHYDE 000765-34-4  
005968 HINE, CH. R.J. GUZMAN, M.K. DUNLAP, R. LIMA AND GS. LOQUVAM. 1961. STUDIES ON THE TOXICITY OF GLYCIDALDEHYDE. ARCH. ENVIRON. HEALTH 2: 23-30.
- US EPA. 1989. HEALTH AND ENVIRONMENTAL EFFECTS DOCUMENT FOR GLYCIDALDEHYDE. PREPARED BY THE OFFICE OF HEALTH AND ENVIRONMENTAL ASSESSMENT, ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE, CINCINNATI, OH FOR THE OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE, WASHINGTON, DC.

uncertainty factor of 10 is usually used to account for variation in human sensitivity among populations. An additional 10-fold factor is usually used to account for each of the uncertainties assumed when extrapolating from animal data to humans, when extrapolating from a LOAEL to a NOAEL, and when extrapolating from subchronic to chronic exposure. In order to reflect professional assessment of the uncertainties of the study and the data base not explicitly addressed by the above uncertainty factors (e.g., completeness of the overall data base), an additional uncertainty factor or modifying factor ranging from greater than 0 to less than or equal to 10 is applied. The default value for this modifying factor is 1.

For chemicals for which a chronic [RfC] or [RfD] is presented in Tables 1 and 2, a subchronic [RfC] or [RfD] is usually derived, if not previously derived in the Agency documents that originally addressed the chemical. Subchronic toxicity values are not evaluated by the RfD/RfC Work Group. The subchronic [RfC] or [RfD] is derived in either of two ways: 1) If an uncertainty factor was used to account for extrapolation from subchronic to chronic exposure in the derivation of the chronic [RfC] or [RfD], then, the subchronic [RfC] or [RfD] is derived from the same benchmark concentration or dose without applying the uncertainty factor for subchronic to chronic exposure extrapolation. 2) If the chronic [RfC] or [RfD] was derived without use of an uncertainty factor for extrapolating from subchronic to chronic exposure (e.g., if chronic data were available), then, the chronic [RfC] or [RfD] is adopted as the subchronic [RfC] or [RfD].

Tables 1 and 2 list the uncertainty factor and modifying factor, multiplied together, to form a single factor under the heading "Uncertainty Factor." For example, the uncertainty factor of 3000 listed for the chronic inhalation [RfC] for Glycidaldehyde reflects an uncertainty factor of 1000 (10 for human sensitivity, 10 for extrapolation from

animal to human, and 10 for extrapolation from subchronic to chronic) and a modifying factor of 3 (for an inadequate data base); the uncertainty factor of 500 listed for the subchronic oral [RfD] for cyanide reflects an uncertainty factor of 100 (10 for human sensitivity, and 10 for extrapolation from animal to human) and a modifying factor of 5 (to account for tolerance to cyanide when ingested by food rather than administration by gavage or by drinking water).

[RfC] and [RfD] values are specific for the route of exposure for which they are listed on Tables 1 and 2. In the few instances where an [RfD] or [RfC] has been determined from another exposure route, route-to-route extrapolation is indicated by a footnote.

The current methodology for the derivation of inhalation RfCs is detailed in the document, "Interim Methods for Development of Inhalation Reference Doses" (U.S. EPA, 1990, EPA/600/8-88/066F, NTIS PB90-145723). These methods are different from those used for oral RfDs because of (1) the dynamics of the respiratory system and its diversity across species, and (2) differences in the physicochemical properties of contaminants (such as the size and shape of a particle or whether the contaminant is an aerosol or a gas). Parameters such as deposition, clearance mechanisms and the physicochemical properties of the inhaled agent are considered in the determination of the effective dose delivered to the target organ.

An RfC value calculated using this interim methodology is generally reported as a concentration in air ( $\text{mg}/\text{m}^3$ ), although it may be converted to a corresponding inhaled dose ( $\text{mg}/\text{kg}/\text{day}$ ) by dividing by 70 kg (an assumed human body weight), multiplying by  $20 \text{ m}^3/\text{day}$  (an assumed human inhalation rate), and adjusting by an appropriate absorption factor. This conversion, however, may often be technically incorrect, and the



appropriateness of doing this must be evaluated on a case-by-case basis. It is recommended that HEAST users that plan to use this technique read a further discussion of the difficulties inherent in this dose conversion that can be found in Appendix A, Section II: Dose Conversions On HEAST.

Inhalation [RfC] values reported in HEAs and early HEEDs that were finalized prior to the implementation of the interim methods were calculated using methods similar in concept to those used for oral [RfD]s. These values are reported both as a concentration in air (in mg/m<sup>3</sup> for continuous, 24 hours/day exposure) under the column [RfC], and as a corresponding inhaled dose (in mg/kg/day) in the footnotes called, Chronic (Subchronic) [RfC] Comment. These chemicals are listed in Table 2: Alternate Methods - Subchronic and Chronic Toxicity (Other Than Carcinogenicity).

[RfD] values for oral exposure are reported as mg/kg/day. An oral [RfD] value can be converted to a corresponding concentration in drinking water, assuming human body weight of 70 kg and water consumption of 2 L/day, as follows:

$$mg/L \text{ in water} = \frac{\text{oral [RfD]} (in \text{ mg/kg/day}) \times 70 \text{ kg}}{2 \text{ L/day}}$$

The [RfC] or [RfD] is used as a reference point for gauging the potential effects of other exposures. Usually, exposures that are less than the [RfC] or [RfD] are not likely to be associated with health risks. As the frequency of exposures exceeding the [RfC] or [RfD] increases and as the size of the excess increases, the probability increases that adverse health effects may be observed in a human population. Nonetheless, a clear distinction that would categorize all exposures below the [RfC] or [RfD] as "acceptable" (risk-free) and all exposures in excess of the [RfC] or [RfD] as

"unacceptable" (causing adverse effects) cannot be made. In addition, [RfC] and [RfD] values, and particularly those with limitations in the quality or quantity of supporting data, are subject to change as additional information becomes available.

When [RfC] or [RfD] values are listed in Tables 1 or 2 for chemicals that are carcinogens, a footnote will refer to Table 3 if additional information concerning carcinogenicity is available in that table. [RfC] and [RfD] values that have been derived for carcinogens are based on noncancer endpoints only and should not be assumed to be protective against carcinogenicity.

**TABLE 2: ALTERNATE METHODS – SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

Chemicals are listed in Table 2 when the [RfD] or [RfC] was derived from alternative methods that are not currently practiced by the RfD/RfC Work Group. The table consists primarily of inhalation [RfC] values determined from methodology that does not follow the interim inhalation methods adopted by the Agency, and [RfC] or [RfD] values based on route-to-route extrapolation with inadequate pharmacokinetic and toxicity data. A footnote is added to each chemical to provide a short explanation of the specific methodology used in calculating these provisional toxicity values. Most of these toxicity values were formerly listed in Table 1. In some instances, the chemical may be listed in both Tables 1 and 2 if the chemical has more than one toxicity value. Table 2 follows the same format as Table 1 (refer to Figure 1).

### TABLE 3: CARCINOGENICITY

In assessing the carcinogenic potential of a chemical, the Human Health Assessment Group (HHAG) of EPA classifies the chemical into one of the following groups, according to the weight of evidence from epidemiologic and animal studies:

- Group A - Human Carcinogen (sufficient evidence of carcinogenicity in humans)
- Group B - Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
- Group C - Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)
- Group D - Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)
- Group E - Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies).

These classifications are shown under [EPA Group] on Table 3.

Quantitative carcinogenic risk assessments are performed for chemicals in Groups A and B, and on a case-by-case basis for chemicals in Group C. Cancer [slope factors] (formerly called cancer potency factors in the Superfund Public Health Evaluation Manual) are estimated through the use of mathematical extrapolation models, most commonly the linearized multistage model, for estimating the largest possible linear slope (within the 95% confidence limit) at low extrapolated doses that is consistent with the data. The [slope factor] or risk is characterized as an upper-bound estimate, i.e., the true risk to humans, while not identifiable, is not likely to exceed the upper-bound estimate and in fact may be lower.

Quantitative carcinogenic estimates listed in Table 3 include the following:

[slope factor] = risk per unit dose = risk per mg/kg/day

[unit risk] for inhalation exposure = risk per concentration unit in air = risk per  $\mu\text{g}/\text{m}^3$

[unit risk] for oral exposure = risk per concentration unit in water = risk per  $\mu\text{g}/\text{L}$

[Unit risk] estimates for inhalation and oral exposure can be calculated by dividing the appropriate [slope factor] by 70 kg and multiplying by the inhalation rate (20  $\text{m}^3/\text{day}$ ) or the water consumption rate (2 L/day), respectively, for risk associated with unit concentration in air or water. Hence,

$$\text{risk per } \mu\text{g}/\text{m}^3 \text{ (air)} = (\text{risk per mg/kg/day}) \times \frac{1}{70 \text{ kg}} \times 20 \text{ m}^3/\text{day} \times 10^{-3} (\text{mg}/\mu\text{g})$$

$$\text{risk per } \mu\text{g}/\text{L} \text{ (water)} = (\text{risk per mg/kg/day}) \times \frac{1}{70 \text{ kg}} \times 2 \text{ L/day} \times 10^{-3} (\text{mg}/\mu\text{g})$$

Quantitative estimates of carcinogenic risk are listed under [Unit Risk] or [Slope Factor] in Table 3. Information on the study and data set used for estimation of the [slope factor] is given in the other columns of Table 3.

In Table 3, the information listed is the following:

Chemical	= Chemical Name/CASRN
Route	= Route of Administration
Species	= Tested Species
Experiment Length	= Length of Exposure
Target	= Target Organ(s) Affected at Critical Level
Cancer	= Tumors Observed at Critical Level (Not Specified if More Than One Type of Tumor)
[EPA Group]	= EPA Classification by Weight of Evidence
Oral [Slope Factor]	= Risk Per Unit Dose
Inhalation [Slope Factor]	= Risk Per Unit Dose
Oral [Unit Risk]	= Risk Per Concentration Unit in Water
Inhalation [Unit Risk]	= Risk Per Concentration Unit in Air
Reference	= Reference Identification Number for All Toxicity Values on the Same Line.

An example of this information is shown in Figure 2, HEAST Table 3:

Chemical	= DIMETHYLHYDRAZINE, 1,2-/000077-78-1
Route	= ORAL: DRINKING WATER
Species	= MOUSE
Experiment Length	= LIFETIME
Target	= CARDIOVASCULAR SYSTEM
Cancer	= TUMORS
[EPA Group]	= B2
Oral [Slope Factor]	= 3.7E+1 (MG/KG/DAY)-1
Inhalation [Slope Factor]	= 3.7E+1 (MG/KG/DAY)-1
Oral [Unit Risk]	= 1.1E-3 (UG/L)-1
Inhalation [Unit Risk]	= 1.1E-2 (UG/CU M)-1
Reference	= 009993

Notice that the inhalation values for 1,2-Dimethylhydrazine was extrapolated from the oral data.

Also given in Figure 2 is an example of the References for Table 3 for the same chemical. The reference is identified by the chemical name (Dimethylhydrazine, 1,2-), the CASRN (000077-78-1), and the reference number that links it with the toxicity values (009993).

Quantitative carcinogenic estimates are specific for the route of exposure for which they are listed on Table 3. Footnotes are used to indicate those instances in which the values for inhalation or oral exposure are based on extrapolation from another route of exposure. The route-to-route conversion required to present inhalation [slope factors] in the units of mg/kg/day is considered by the CRAVE Work Group to be technically incorrect. It is recommended that HEAST users who plan to use this information read a further discussion of the difficulties inherent in this dose conversion which can be found in Appendix A, Section II: Dose Conversions On HEAST.

To estimate risk-specific concentrations in air from the [unit risk] in air as presented in Table 3, the specified level of risk is divided by the [unit

FIGURE 2  
Example Data and References for Carcinogenicity

HEAST TABLE 3: CARCINOGENICITY

January 1992

CHEMICAL ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
	SPECIES					ORAL (mg/kg/day) <sup>1</sup>	INHALATION (mg/kg/day) <sup>1</sup>	ORAL (ug/L) <sup>1</sup>	INHALATION (ug/cu m) <sup>1</sup>	
DIMETHYLHYDRAZINE. 1,2- ORAL DRINKING WATER	MOUSE	LIFETIME	CARDIOVASCULAR SYSTEM	TUMORS	B2	3.7E+1	3.7E+1	1.1E-3	1.1E-2	009993
Inhalation [Slope] Comment: BASED ON ROUTE TO ROUTE EXTRAPOLATION										

REFERENCES FOR HEAST TABLE 3: CARCINOGENICITY

January 1992

DIMETHYLHYDRAZINE. 1,2- 000077-78-1  
 009993 TOTH B AND K PATEL 1982 CARCINOGENICITY DOSE-RESPONSE STUDY BY CONTINUOUS ADMINISTRATION OF 1,2-DIMETHYLHYDRAZINE DI-HYDROCHLORIDE IN MICE I LIGHT AND TRANSMISSION ELECTRON MICROSCOPIC STUDY OF COLONIC NEOPLASMS AM. J OF PATH 84 69-86.  
 US EPA 1988 CARCINOGEN RISK ASSESSMENT VERIFICATION ENDEAVOR (CRAVE) WORK GROUP

risk] for air. Hence, the air concentration (in  $\mu\text{g}/\text{m}^3$ ) corresponding to an upper-bound increased lifetime cancer risk of  $1 \times 10^{-5}$  is calculated as follows:

$$\mu\text{g}/\text{m}^3 \text{ in air} = \frac{1 \times 10^{-5}}{[\text{unit risk}] \text{ in } (\mu\text{g}/\text{m}^3)^{-1}}$$

To estimate risk-specific concentrations in drinking water from the oral [slope factor] values presented in Table 3, the specified level of risk is multiplied by 70 kg and divided by the [slope factor] times 2 L/day. Hence, the water concentration corresponding to an upper-bound increased lifetime cancer risk of  $1 \times 10^{-5}$  is calculated as follows:

$$\text{mg}/\text{L} \text{ in water} = \frac{1 \times 10^{-5} \times 70 \text{ kg}}{[\text{slope factor}] \text{ in } (\text{mg}/\text{kg}/\text{day})^{-1} \times 2 \text{ L}/\text{day}}$$

## USER'S GUIDE: RADIONUCLIDE CARCINOGENICITY

### INTRODUCTION

EPA classifies all radionuclides as Group A (known human) carcinogens. HEAST Tables 4A and 4B list ingestion, inhalation and external exposure cancer slope factors for radionuclides in units of picocuries and becquerels, respectively.<sup>1</sup> Ingestion and inhalation slope factors are best estimates (i.e., median or 50th percentile values) of the age-averaged, lifetime excess cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk/pCi or risk/Bq. External exposure slope factors are best estimates of the lifetime excess cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, and are expressed as risk/yr per pCi (or Bq)/gram of soil. When combined with site-specific media concentration data and appropriate exposure assumptions<sup>2</sup>, slope factors can be used to estimate lifetime cancer risks to members of the general population due to radionuclide exposures.

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1 Slope factors are reported in Tables 4A and 4B in two different units of activity. Table 4A presents slope factors in the customary units of picocuries (1 pCi =  $10^{-12}$  curies (Ci) =  $3.7 \times 10^{-2}$  nuclear transformations per second) for consistency with the system used for radionuclides in the IRIS database; Table 4B presents slope factors in the International System (SI) units of becquerels (1 Bq = 1 nuclear transformation per second; approximately 27 pCi). Users can calculate cancer risks using slope factors expressed in either customary units or SI units with equivalent results, provided that they also use air, water and soil concentration values in the same system of units.

2 Agency standardized default exposure scenarios and assumptions for use in baseline risk assessment are provided in EPA (1991), *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"* (Interim Final), Office of Emergency and Remedial Response, OSWER Directive 9285.6-03. [NTIS order number: PB 91-921314.]



## INTENDED USERS AND APPLICATIONS

HEAST users include individuals from the EPA, other Federal agencies, States and contractors who are responsible for the identification, characterization and remediation of sites contaminated with radioactive materials. Radionuclide slope factors are calculated by EPA's Office of Radiation and Indoor Air (ORIA) to assist HEAST users with risk-related evaluations and decision-making at various stages of the remediation process. During site assessment, for example, slope factors are used in EPA's Hazard Ranking System (HRS) to assign toxicity factor values to radionuclides to calculate site scores. During the remedial investigation and feasibility study (RI/FS), slope factors are used to determine baseline site risk, to develop preliminary remediation goals, and to evaluate cleanup alternatives. For further examples on the application of radionuclide slope factors in risk evaluations, users are referred to the following EPA documents:

- Hazard Ranking System (HRS), *Federal Register* (55 FR 515320), December 1990.
- *Risk Assessment Guidance for Superfund; Volume I - Human Health Evaluation Manual* (RAGS/HHEM), Part A, Baseline Risk Assessment (EPA/540/1-89/002).
- RAGS/HHEM Part B, Development of Risk-Based Preliminary Remediation Goals (OSWER Directive 9285.7-01B). [NTIS order number: PB 92-963333.]
- RAGS/HHEM Part C, Risk Evaluation of Remedial Alternatives (OSWER Directive 9285.7-01C). [NTIS order number: PB 92-963334.]

Copies of RAGS/HHEM Parts A, B and C are available to the public from the National Technical Information Service (NTIS) at (703)487-4650. Copies are available to EPA staff by calling the Superfund Documents Center at (202)260-9760.

## **RADIATION EFFECTS**

Ionizing radiation has been shown to be a carcinogen, a mutagen, and a teratogen. At sufficiently high doses, radiation acts as a complete carcinogen, serving as both an initiator and promoter, and can induce cancers in nearly any tissue or organ in both humans and animals. At lower doses and dose rates, radiation produces delayed responses in the form of increased incidence of cancer long after the exposure period. These delayed responses have been documented extensively in epidemiological studies of Japanese atomic bomb survivors, underground uranium miners, radium dial painters, and patients subject to a variety of radiation treatments. Laboratory animal research and mammalian tissue culture studies have provided additional, collaborative data.

Mutagenic effects of radiation have been demonstrated primarily in animal and tissue culture studies; limited data from studies of A-bomb survivors indicate that humans may be as sensitive or less sensitive than animals to radiogenic mutagenicity. Data are also available from both human and animal studies on the teratogenic effects of radiation. These data show that the fetus is most sensitive to radiation injury during the early stages of organ development (between 8 and 15 weeks for the human fetus). Resultant radiation-induced malformations depend on which cells are most actively differentiating at the time of exposure.

EPA classifies all radionuclides as Group A carcinogens, based on their property of emitting ionizing radiation and on the extensive weight of evidence provided by epidemiological studies of radiogenic cancers in humans. At Superfund radiation sites, EPA generally evaluates potential human health risks based on the radiotoxicity, i.e., adverse health effects caused by ionizing radiation, rather than on the chemical toxicity, of each radionuclide present. These evaluations consider the carcinogenic effects of

radionuclides only. In most cases, cancer risks are limiting, exceeding both mutagenic and teratogenic risks.

## DERIVATION OF RADIONUCLIDE SLOPE FACTORS

EPA's Office of Radiation and Indoor Air (ORIA) calculates radionuclide slope factor values using health effects data and dose and risk models from a number of national and international scientific advisory commissions and organizations, including the National Academy of Sciences (NAS), the National Council on Radiation Protection and Measurements (NCRP), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), and the International Commission on Radiological Protection (ICRP). A detailed discussion of ORP's approach and assumptions is provided in *Risk Assessment Methodology, Environmental Impact Statement, NESHAPS for Radionuclides, Background Information Document - Volume I* (EPA 520/1-89-005: September 1989).

Radionuclide slope factors are calculated for each radionuclide individually, based on its unique chemical, metabolic and radioactive properties. The calculation uses EPA's computer code RADRISK<sup>3</sup>, life table analyses (described in EPA 520/1-89-005), and cancer risk estimates based largely on the results of the NAS BEIR III report.<sup>4</sup> Ingestion and inhalation slope factors for radionuclides account for:

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3 Dunning, D.E. Jr., Leggett, R.W., and Yalcinatas, M.G. (1980). "A Combined Methodology for Estimating Dose Rates and Health Effects from Exposure to Radioactive Pollutants." ORNL/TM-7105.

4 National Academy of Sciences (1980). The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Committee on the Biological Effects of Ionizing Radiation (BEIR III), National Research Council, Washington, D.C. EPA anticipates that the slope factors for radionuclides in HEAST will be modified in the future to incorporate the results of BEIR V (1990) and/or other relevant sources.

- the amount of radionuclide transported into the bloodstream from either the gastrointestinal (GI) tract following ingestion, or from the lungs following inhalation;
- the ingrowth and decay of radioactive progeny produced within the body subsequent to intake;
- the distribution and retention of each radionuclide (and its associated progeny, if appropriate) in body tissues and organs;
- the radiation dose delivered to body tissues and organs from the radionuclide (and its associated progeny, if appropriate); and
- the sex, age, and organ-specific risk factors over the lifetime of exposure.

The slope factors are the average risk per unit intake or exposure for an individual in a stationary population with vital statistics (mortality rates) of the United States in 1970. (The expected lifetime for an individual in this population is about 70 years.) Consequently, radionuclide ingestion and inhalation slope factors are not expressed as a function of body weight and time, and do not require corrections for gastrointestinal absorption or lung transfer efficiencies.

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**NOTE: The GI absorption values ( $f_{GI}$ ), ICRP lung classifications (D, W, Y) and radioactive half-lives are provided in HEAST Tables 4A and 4B for reference only and should not be used to correct, modify, or in any way adjust radionuclide slope factors or intake assumptions in risk calculations.**

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External slope factors provide cancer risk estimates per unit exposure to a uniform radionuclide concentration in soil. These factors, which account for photon energy flux attenuation and buildup in soil, are calculated for each radionuclide using volume and surface dose factors derived using the computer code DFSOIL.<sup>5</sup>

Because of the radiation risk models employed for both internal and external exposures, slope factors for radionuclides are characterized as best estimates (i.e., median or 50th percentile values) of the age-averaged lifetime total excess cancer incidence risk per unit intake or exposure.

#### **ABOUT THE INFORMATION PROVIDED IN TABLES 4A AND 4B:**

Tables 4A and 4B list ingestion, inhalation and external exposure slope factors of principal radionuclides, and provide key parameter values used in the derivation of slope factor values. In both tables, radionuclides are presented alphabetically by element and atomic weight.

Selected radionuclides that have radioactive Decay products are designated within the HEAST tables with the suffix "+D" (e.g., U-238+D, Ra-226+D, Cs-137+D) to indicate

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Sjoreen, A.L., Kocher, D.C., Killough, G.G. and Miller C.W. (1984). "MLSOIL and DFSOIL - Computer Codes to Estimate Effective Ground Surface Concentrations for Dose Computations." Oak Ridge National Laboratory. Oak Ridge, TN. ORNL-5974.

that the cancer risk estimates for such radionuclides include the contributions from either all, or only some, of their decay products. The slope factor for a radionuclide marked with a "+D" accounts for risk from all direct progeny with half-lives of less than one year. The slope factor for U-238+D, for example, includes the risk from U-238, Th-234, and Pa-234, but not from U-234 or any of its progeny.

Decay sub-chains included in the HEAST Tables 4A and 4B are identified in Exhibit 1, and members of such sub-chains are noted in the HEAST tables with a dagger ("†"). The rationale for the one year half-life cutoff for members of a sub-chain is that such radionuclides are likely to achieve secular equilibrium with the parent over the time scales commonly encountered in environmental remediation, while radionuclides with longer half-lives may not.

When a radionuclide is in secular equilibrium with all its progeny, one should add the slope factors for all the relevant sub-chains. To assess risk from Ra-226 in equilibrium with all its progeny, for example, one adds the slope factors for Ra-226+D and Pb-210+D.

In most cases, site-specific analytical data should be used to establish the actual degree of equilibrium between each parent radionuclide and its decay products in each media sampled. However, in the absence of empirical data, the "+D" values for radionuclides should be used unless there are compelling reasons not to. For example, the external slope factors for Cs-137 and Cs-137+D are 0.0 and  $2 \times 10^{-6}$  (risk per year per pCi/gram), respectively. The value for Cs-137+D is higher because it includes the risk contribution from cesium's short-lived gamma-emitting decay product Ba-137m (half-life, 25.5 minutes) which, under most environmental conditions, will be in secular equilibrium with Cs-137.

Note that there may be circumstances, such as long disposal times or technologically enhanced concentrations of naturally occurring radionuclides, that may necessitate the combination of the risks of a parent radionuclide and its decay products over several contiguous subchains. For example, Ra-226 soil analyses at a site might show that all radium decay products are present in secular equilibrium down to stable Pb-206 (See Exhibit 1). In this case, Ra-226 risk calculations should be based on the ingestion, inhalation and external exposure slope factors for the Ra-226+D subchain, plus the ingestion, inhalation and external exposure factors for the Pb-210+D subchain. For actual sites, users should consult with a health physicist or radiochemist (1) to evaluate the site-specific analytical data to determine the degree of equilibrium between parent radionuclides and decay members of contiguous decay chains, and (2) to assist in the combination of appropriate slope factor values. For health physics and radioanalytical support, HEAST users may contact EPA's Regional Radiation Program Staff, ORIA's National Air and Radiation Laboratory (NAREL) in Montgomery, Alabama, ORIA's Las Vegas Laboratory (ORP-LV) in Las Vegas, Nevada, or the ORIA staff at EPA Headquarters in Washington, DC, listed in Exhibit 2.

A Chemical Abstract System Reference Number (CASRN) is assigned to each radionuclide for identification and reporting accuracy during risk assessments. Users should report a CASRN for all radionuclides (both parent and decay product radionuclides) included in risk calculations. Radioactive half-lives are provided in the HEAST tables for reference.

The designations "D", "W", and "Y" presented under the heading "ICRP Lung Class" in the tables refer to the lung clearance times for inhaled particulate radionuclides, expressed as days (D), weeks (W), or years (Y), as recommended by the International

Commission on Radiological Protection (ICRP). Gaseous radionuclides, e.g., Rn-222, are designated with an asterisk (\*). "GI Absorption Factors,  $f_1$ " are the fractional amounts of each radionuclide that may be absorbed from the gastrointestinal (GI) tract into blood following an oral intake. The ICRP lung clearance classifications and GI absorption factors provided in Tables 4A and 4B are the default values that EPA used to calculate radionuclide slope factors for inhalation and ingestion exposures, respectively. These factors are provided for reference only (see the Note Box on the previous page).

## **WHERE TO ADDRESS QUESTIONS ABOUT RADIONUCLIDE SLOPE FACTORS**

EPA continuously reviews the scientific literature on radiation effects to ensure that the Agency's risk assessment methodologies are consistent with current models and assumptions. As risk assessment methodologies are refined, the slope factors in Tables 4A and 4B will be revised and updated.

HEAST users with questions about radionuclide slope factor values and their use in radiation risk assessments should contact the Remedial Guidance Section of the Radiation Assessment Branch of ORIA at (202)233-9350. Written requests for assistance can be sent by fax to (202)233-9650.



**Exhibit 1: Radioactive Decay Chains Included in HEAST Tables 4A and 4B\***

Principal Decay Chain	Subchain <sup>a</sup>	Members <sup>b</sup>	Half-life <sup>c</sup>
Uranium-238	U-238+D	U-238 Th-234 Pa-234	4.468E+09 Y 2.410E+01 D 1.170E+00 M
	U-234	U-234	2.445E+05 Y
	Th-230	Th-230	7.700E+04 Y
	Ra-226+D	Ra-226 Rn-222'' Po-218 Pb-214 Bi-214 Po-214	1.600E+03 Y 3.823E+00 D 3.050E+00 M 2.680E+01 M 1.990E+01 M 1.637E-04 S
	Pb-210+D	Pb-210 Bi-210 Po-210	2.226E+01 Y 5.013E+00 D 1.384E+02 D
	Pb-206	Pb-206	[Stable]
	U-235+D	U-235 Th-231	7.038E+08 Y 2.552E+01 H
	Pa-231	Pa-231	3.726E+04 Y
Uranium-235	Ac-227+D	Ac-227 Th-227 [99%] Ra-233 Rn-219 Po-215 Pb-211 Bi-211 Tl-207	2.177E+01 Y 1.872E+01 D 1.143E+01 D 3.960E+00 S 1.778E-03 S 3.610E+01 M 2.130E+00 M 4.770E+00 M
	Pb-207	Pb-207	[Stable]
	Th-232	Th-232	1.405E+10 Y
	Ra-228+D	Ra-228 Ac-228	5.750E+00 Y 6.130E+00 H
	Th-228+D	Th-228 Ra-224 Rn-220 Po-216 Pb-212 Bi-212 Po-212 [64%] Tl-208 [36%]	1.913E+00 Y 3.620E+00 D 5.561E+01 S 1.460E-01 S 1.064E+01 H 6.055E+01 M 2.980E-07 S 3.053E+00 M
Thorium-232	Pb-208	Pb-208	[Stable]

**Exhibit 1: Radioactive Decay Chains Included in HEAST  
Tables 4A and 4B**

(Continued) \*

Principal Decay Chain	Subchain <sup>a</sup>	Members <sup>b</sup>	Half-life <sup>c</sup>
Neptunium-237	Np-237+D	Np-237	2.140E+06 Y
		Pa-233	2.700E+01 D
	U-233	U-233	1.592E+05 Y
	Th-229+D	Th-229	7.340E+03 Y
		Ra-225	1.480E+01 D
		Ac-225	1.000E+01 D
		Fr-221	4.800E+00 M
		At-217	3.230E-02 S
		Bi-213	4.565E+01 M
		Po-213 [98%]	4.200E-06 S
		Tl-209 [2%]	2.200E+00 M
		Pd-209	3.253E+00 H
	Bi-209	Bi-209	[Stable]
Americium-243	Am-243+D	Am-243	7.380E+03 Y
		Np-239	2.355E+00 D
Cesium-137	Cs-137+D	Cs-137	3.017E+01 Y
		Ba-137m	2.552E+00 M
Strontium-90	Sr-90+D	Sr-90	2.860E+01 Y
		Y-90	6.410E+01 H

\* See the discussion on radioactive decay chains in the User's Guide.

<sup>a</sup> Radioactive decay chains included in HEAST Tables 4A and 4B. Radionuclides marked with the suffix "+D" include risks from decay chain members, assuming secular equilibrium (i.e., equal activity concentrations) in the environment.

<sup>b</sup> The chain of decay products of a parent radionuclide extends to (but does not include) members of the next subchain (e.g., U-238+D includes U-238, Th-234 and Pa-234, but not U-234). Note that there may be circumstances when it may be necessary to combine the risks for a parent radionuclide over several contiguous subchains, depending on the conditions of equilibrium. Branches in the decay chain are indicated in square brackets with branching percentages in parentheses.

<sup>c</sup> A radon-222 decay subchain, Rn-222+D, is also included in the HEAST tables, comprised of ingestion, inhalation and external exposure slope factors for Rn-222 plus the corresponding slope factors for each of its decay products (Po-218, Pb-214, Bi-214 and Po-214). For the ingestion and external exposure slope factors for Rn-222+D, decay products are assumed to be in secular equilibrium. For the inhalation slope factor, decay products are assumed to be in 50% equilibrium.

<sup>c</sup> Radioactive half-life in years (Y), days (D), hours (H), minutes (M) or seconds (S).

## Exhibit 2. EPA Radiation Program Staff

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## Exhibit 2. EPA Radiation Program Staff (Continued)

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**Exhibit 2. EPA Radiation Program Staff (Concluded)**

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# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
ACENAPHTHENE000083-32-9									
	NOEL 175 MG/KG/DAY ORAL: GAVAGE	MOUSE 90 DAYS	LIVER	HEPATOTOXICITY		6E-1 300		IRIS	010165
ACENAPHTHYLENE000208-96-8									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005202
ACEPHATE030560-19-1									
	LOEL 2 PPM ORAL: DIET	RAT 13 WEEKS	BRAIN	DECREASED CHOLINESTERASE ACTIVITY		4E-3 30		IRIS	005833
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
ACETONE000067-64-1									
	NOEL 100 MG/KG/DAY ORAL: GAVAGE	RAT 90 DAYS	LIVER KIDNEY KIDNEY	INCREASED WEIGHT INCREASED WEIGHT NEPHROTOXICITY		1E+0 100		IRIS	005204
ACETONE CYANOHYDRIN000075-86-5									
	NOEL 10.8 MG CN/KG/DAY ORAL: DIET	RAT 104 WEEKS	WHOLE BODY THYROID CENTRAL NERVOUS SYSTEM	ALTERED WEIGHT EFFECTS EFFECTS		7E-2 500		7E-2 500	005776

SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)  
 SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.  
 CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)  
 CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	(RfD) (mg/kg/day) UF	(mg/cu m) UF	(RfD) (mg/kg/day) UF	
ACETONITRILE									
	NOAEL 100 PPM	MOUSE							
	INHALATION: INTERMITTENT	92 DAYS	ERYTHROCYTES BLOOD LIVER	DECREASED CELL COUNT DECREASED HEMATOCRIT HEPATIC LESIONS		6E-2 300		IRIS	005210
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5.									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5. UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
ACETOPHENONE									
	NOAEL 10,000 PPM	RAT							
	ORAL: DIET	17 WEEKS		NONE OBSERVED		1E+0 300		IRIS	005212
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (06/25/92) BY THE RfD/RfC WORK GROUP.									
ACROLEIN									
	NOAEL 15.6 MG/KG/DAY	RAT							
	ORAL: WATER	90 DAYS						2E-2 1000	010390
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
ACRYLAMIDE									
	NOEL 0.2 MG/KG/DAY	RAT							
	ORAL: DRINKING WATER	90 DAYS	NERVE	DAMAGE		2E-3 100		IRIS	005835
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (09/20/90) BY THE RfD/RfC WORK GROUP.									

**HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
ACRYLIC ACID		000079-10-7							
NOAEL	83 MG/KG/DAY ORAL: DRINKING WATER	RAT 3 MONTHS	WHOLE BODY ORGANS, MAJOR	DECREASED WEIGHT ALTERED WEIGHT		8E-1 100		IRIS	005836
LOAEL	5 PPM INHALATION: INTERMITTENT	MOUSE 13 WEEKS	NASAL MUCOSA	LESIONS	3E-3 100			IRIS	010346
ACRYLONITRILE		000107-13-1							
NOAEL	1 MG/(KG-DAY) ORAL: GAVAGE	MOUSE 60 DAYS	TESTES TESTES	DECREASED SPERM COUNTS SEMINIFEROUS TUBULE DEGENERATION		1E-2 100		1E-3 1000	010939
SUBCHRONIC [RfD] COMMENT: THE CHRONIC [RfD] UNDER REVIEW BY THE RfD/RfC WORK GROUP WAS MODIFIED TO DERIVE THE SUBCHRONIC [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY									
ADIPONITRILE		000111-69-3							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005157
ALACHLOR		015972-60-8							
NOEL	1 MG/KG/DAY ORAL: CAPSULE	DOG 1 YEAR	BLOOD SITES, MULTIPLE	ANEMIA HEMOSIDEROSIS		1E-2 100		IRIS	005837
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
ALDICARB		000116-06-3							
NOAEL	0.01 MG/KG-DAY ORAL	HUMAN ACUTE	CENTRAL NERVOUS SYSTEM	SWEATING		1E-3 10		IRIS	010960
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: CLINICAL SIGNS OF ACETYL CHOLINESTERASE INHIBITION INCLUDING SWEATING, PINPOINT PUPILS, LEG WEAKNESS, NAUSEA, DIARRHEA AND OTHER EFFECTS WERE OBSERVED IN THE PRINCIPAL AND SUPPORTING STUDIES.									
ALDRIN		000309-00-2							
LOAEL	0.025 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	LIVER	LESIONS		3E-5 1000		IRIS	005159
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
ALLIDOCHLOR		000093-71-0							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005838
ALLYL ALCOHOL		000107-18-6							
NOEL	50 PPM ORAL: DRINKING WATER	RAT 15 WEEKS	LIVER KIDNEY	EFFECTS EFFECTS		5E-2 100		IRIS	005839
ALLYL CHLORIDE		000107-05-1							
NOAEL	17 MG/CU M INHALATION: INTERMITTENT	RABBIT 5 MONTHS	NERVOUS SYSTEM	NEUROTOXICITY	1E-2 300			IRIS	010369
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
ALUMINUM		007429-90-5							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005162

HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	Chronic [RfD] (mg/kg/day) UF	REFERENCE
ALUMINUM PHOSPHIDE 020859-73-8									
NOAEL	0.43 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY UNSPECIFIED	ALTERED WEIGHT ALTERED CLINICAL PARAMETERS		4E-4 100		IRIS	010255
AMETRYN 000834-12-8									
NOEL	10 MG/KG/DAY ORAL: GAVAGE	RAT 13 WEEKS	LIVER	EFFECTS		9E-2 100		IRIS	005841
AMINO-2-NAPHTHOL, 1- 002834-92-6									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005842
AMINO-2-NAPHTOL HYDROCHLORIDE, 1- 001198-27-2									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005843
AMINOPHENOL, M- 000591-27-5									
NOAEL	1300 PPM ORAL: DIET	RAT 13 WEEKS	WHOLE BODY THYROID	ALTERED WEIGHT ALTERED WEIGHT		7E-1 100		7E-2 1000	005844
AMINOPHENOL, O- 000095-55-6									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005845
AMINOPHENOL, P- 000123-30-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005846
AMINOPYRIDINE, 4- 000504-24-5									
NOAEL	3 PPM ORAL: DIET	RAT 90 DAYS	LIVER BRAIN	INCREASED WEIGHT INCREASED WEIGHT		2E-4 1000		2E-5 10000	005847

HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
AMMONIA									
	NOAEL 34 MG/L	HUMAN							
	ORAL: DRINKING WATER		SENSORY	TASTE THRESHOLD		34 MG/L 1		34 MG/L 1	005166
	SUBCHRONIC [RfD] COMMENT: GIVEN AS CONCENTRATION IN DRINKING WATER. SPECIFICALLY RELATED TO ORGANOLEPTIC THRESHOLD. SAFE CONCENTRATION MAY BE HIGHER, BUT DATA ARE INADEQUATE TO ASSESS.								
	CHRONIC [RfD] COMMENT: GIVEN AS CONCENTRATION IN DRINKING WATER. SPECIFICALLY RELATED TO ORGANOLEPTIC THRESHOLD. SAFE CONCENTRATION MAY BE HIGHER, BUT DATA ARE INADEQUATE TO ASSESS.								
	NOAEL 6.4 MG/CU M	HUMAN							
	INHALATION: INTERMITTENT		NASAL CAVITY LUNGS LUNGS	RHINITIS PNEUMONIA LESIONS	1E-1 30		IRIS		010392
ANILINE									
	NOAEL 19 MG/CU M	MOUSE							
	INHALATION: INTERMITTENT	20-26 WEEKS	SPLEEN	PATHOLOGY	1E-2 300		IRIS		010370
		RAT	20-26 WEEKS	SPLEEN					
		GUINEA PIG	20-26 WEEKS	SPLEEN					
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
ANTHRACENE									
	NOEL 1000 MG/KG/DAY	MOUSE							
	ORAL: GAVAGE	90 DAYS		NONE OBSERVED		3E+0 300		IRIS	010166
ANTIMONY PENTOXIDE									
	LOAEL 0.46 MG/KG/DAY	RAT							
	ORAL: DRINKING WATER	LIFETIME	WHOLE BODY BLOOD	INCREASED MORTALITY ALTERED CHEMISTRIES		5E-4 1000		5E-4 1000	005174
	SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.								
	CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.								

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
ANTIMONY POTASSIUM TARTRATE 000304-61-0									
LOAEL 0.91 MG/KG/DAY	RAT								
ORAL: DRINKING	LIFETIME		WHOLE BODY	INCREASED MORTALITY		9E-4		9E-4	005234
WATER			BLOOD	ALTERED CHEMISTRIES		1000		1000	
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
ANTIMONY TETROXIDE 001332-81-6									
LOAEL 0.44 MG/KG/DAY	RAT								
ORAL: DRINKING	LIFETIME		WHOLE BODY	INCREASED MORTALITY		4E-4		4E-4	005238
WATER			BLOOD	ALTERED CHEMISTRIES		1000		1000	
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
ANTIMONY TRIOXIDE 001309-64-4									
LOAEL 0.42 MG/KG/DAY	RAT								
ORAL: DRINKING	LIFETIME		WHOLE BODY	INCREASED MORTALITY		4E-4		4E-4	005242
WATER			BLOOD	ALTERED CHEMISTRIES		1000		1000	
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ANTIMONY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
ANTIMONY, METALLIC 007440-36-0									
LOAEL 0.35 MG SB/KG/DAY	RAT								
ORAL: DRINKING	LIFETIME		WHOLE BODY	INCREASED MORTALITY		4E-4		IRIS	005170
WATER			BLOOD	ALTERED CHEMISTRIES		1000			

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE	
					(mg/cu m)	[RfD]	[RfC]		[RfD]
					UF	UF	UF		UF
ARAMITE		000140-57-8							
NOAEL	100 PPM	RAT							
	ORAL: DIET	104 WEEKS	LIVER	INCREASED WEIGHT			5E-2 100	005850	
NOAEL	500 PPM	DOG							
	ORAL: DIET	52 WEEKS	LIVER	DEGENERATION		1E-1 100		005849	
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
AROCHLOR 1248		012672-29-6							
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/20/93) BY THE RfD/RfC WORK GROUP.								010940	
ARSENIC, INORGANIC		007440-38-2							
NOAEL	0.009 MG/L	HUMAN							
	ORAL		SKIN SKIN	KERATOSIS HYPERPIGMENTATION		3E-4 3	IRIS	010434	
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
ATRAZINE		001912-24-9							
NOEL	3.5 MG/KG/DAY	RAT							
	ORAL: DIET	2 YEARS	WHOLE BODY	DECREASED WEIGHT GAIN		3.5E-2 100	IRIS	010855	
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
BARIUM		007440-39-3							
NOAEL	0.21 MG/KG/DAY	HUMAN							
	ORAL: WATER	10 WEEKS	CARDIOVASCULAR SYSTEM	INCREASED BLOOD PRESSURE		7E-2 3	IRIS	010348	
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	
BARIUM CYANIDE 000542-62-1								
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/20/93) BY THE RfD/RfC WORK GROUP.								010941
BENEFIN 001861-40-1								
NOAEL 25 MG/KG/DAY	DOG							
ORAL: DIET	1 YEAR	ERYTHROCYTE	DECREASED COUNT			3E-1 100	IRIS	005852
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].								
BENZAL CHLORIDE 000098-87-3								
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005853
BENZALDEHYDE 000100-52-7								
NOEL 200 MG/KG/DAY	RAT							
ORAL: GAVAGE	13 WEEKS	KIDNEY FORESTOMACH	EFFECTS LESIONS			1E+0 100	IRIS	005854
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS MODIFIED TO DERIVE THE SUBCHRONIC ORAL [RfD].								
BENZALDEHYDE CYANOHYDRIN 000532-28-5								
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005781
BENZENE 000071-43-2								
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.								
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
BENZENETHIOL / (THIOPHENOL) 000108-98-5								
LOAEL 0.1 MG/(KG-DAY)	RAT							
ORAL: GAVAGE	90 DAYS	LIVER	CENTRILOBULAR EOSINOPHILIC CHANGES			1E-4 1000	1E-5 10,000	010942
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] UNDER REVIEW BY THE RfD/RfC WORKGROUP WAS MODIFIED TO DERIVE THE SUBCHRONIC [RfD].								

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
BENZIDINE		000092-87-5							
	LOAEL 2.7 MG/KG/DAY	MOUSE							
	ORAL: DRINKING WATER	33 MONTHS	BRAIN LIVER	CELLULAR CHANGES CELLULAR CHANGES		3E-3 1000		IRIS	005830
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (03/28/91) BY THE RfD/RfC WORK GROUP.									IRIS 010877
BENZOIC ACID		000065-85-0							
	NOAEL 312 MG/DAY	HUMAN							
	ORAL: DIET			NONE OBSERVED		4E+0 1		IRIS	005260
SUBCHRONIC [RfD] COMMENT: THE HUMAN DAILY PER CAPITA INTAKE WAS USED AS THE CRITICAL DOSE LEVEL. THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: THE HUMAN DAILY PER CAPITA INTAKE WAS USED AS THE CRITICAL DOSE LEVEL.									
BENZO[B]FLUORANTHENE		000205-99-2							
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
BENZYL ALCOHOL		000100-51-6							
	LOAEL 286 MG/KG/DAY	RAT							
	ORAL: GAVAGE	103 WEEKS	FORESTOMACH	EPITHELIAL HYPERPLASIA				3E-1 1000	005855
	NOAEL 143 MG/KG/DAY	RAT							
	ORAL: GAVAGE	13 WEEKS	WHOLE BODY	DECREASED WEIGHT		1E+0 100			005856

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	
BERYLLIUM		007440-41-7						
	NOAEL 0.54 MG/KG/DAY ORAL: DRINKING WATER	RAT LIFETIME		NONE OBSERVED		5E-3 100	IRIS	005262
	SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].							
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							
BIPHENYL, 1,1'		000092-52-4						
	NOAEL 50 MG/KG/DAY ORAL: DIET	RAT 700 DAYS	KIDNEY	DAMAGE		5E-2 1000	IRIS	005857
	SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].							
	CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (09/20/90) BY THE RfD/RfC WORK GROUP.							
							IRIS	010878
BIS(2-CHLOROISOPROPYL) ETHER		039638-32-9						
	NOAEL 35.8 MG/KG/DAY ORAL: DIET	MOUSE 2 YEARS	ERYTHROCYTES	DECREASED HEMOGLOBIN		4E-2 1000	IRIS	010257
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							
BIS(2-ETHYLHEXYL) PHTHALATE / (DEHP)		000117-81-7						
							IRIS	010859
	SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.							
	SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.							
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							
BISPHENOL A		000080-05-7						
	NOAEL 750 PPM ORAL	RAT 13 WEEKS	WHOLE BODY	DECREASED WEIGHT		6E-1 100	IRIS	005268
								005266



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	UF	UF	UF	
BORON TRIFLUORIDE									
		007637-07-2							
NOAEL	6 MG/CU M	RAT							
	INHALATION:	13 WEEKS	KIDNEY	NECROSIS	7E-3		7E-4		010395
	INTERMITTENT				300		3000		
BORON, ELEMENTAL									
		007440-42-8							
NOAEL	8.8 MG/KG/DAY	DOG							
	ORAL: DIET	2 YEARS	TESTIS	LESIONS		9E-2		IRIS	005272
						100			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
LOAEL	4.5 MG/CU M	HUMAN							
	INHALATION:		RESPIRATORY	IRRITATION	2E-2		2E-2		005269
	INTERMITTENT		TRACT		100		100		
			BRONCHUS	BRONCHITIS					
SUBCHRONIC [RfC] COMMENT: THE SUBCHRONIC INHALATION [RfC] IS SPECIFICALLY FOR ANHYDROUS BORAX.									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS SPECIFICALLY FOR ANHYDROUS BORAX.									
BROMINATED DIBENZO-P-DIOXINS									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005858
BROMINATED DIBENZOFURANS									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005859
BROMOACETONE									
		000598-31-2							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005860
BROMOCHLOROETHANES									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005861

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day)	UF	(mg/kg/day)	
BROMODICHLOROMETHANE		000075-27-4							
LOAEL	17.9 MG/KG/DAY	MOUSE							
	ORAL: GAVAGE	102 WEEKS	KIDNEY	CYTOMEGALY		2E-2		IRIS	005715
						1000			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
BROMOETHENE / (VINYL BROMIDE)		000593-60-2							
LOAEL	9.7 PPM	RAT							
	INHALATION:	24 MONTHS	LIVER	HYPERTROPHY	3E-3		IRIS		010929
	INTERMITTENT		LIVER	BASOPHILIC FOCI	3000				
			LIVER	EOSINOPHILIC FOCI					
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
BROMOFORM		000075-25-2							
NOEL	17.9 MG/KG/DAY	RAT							
	ORAL: GAVAGE	13 WEEKS	LIVER	EFFECTS		2E-1		IRIS	005722
						100			
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (02/11/93) BY THE RfD/RfC WORK GROUP.									
BROMOMETHANE		000074-83-9							
							IRIS	IRIS	010861
							IRIS		010860
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
BROMOPHENYL PHENYL ETHER, 4-		000101-55-3							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
BROMOPHOS002104-96-3									
	NOAEL 5 MG/KG/DAY ORAL: DIET	RAT 3 GENERATIONS	BLOOD  LIVER	DECREASED CHOLINESTERASE ACTIVITY DECREASED CHOLINESTERASE ACTIVITY		5E-2 100		5E-3 1000	005865
SUBCHRONIC [RfD] COMMENT: BASED ON A REPRODUCTION STUDY. CHRONIC [RfD] COMMENT: BASED ON A REPRODUCTION STUDY.									
BROMOXYNIL001689-84-5									
	NOEL 5 MG/KG/DAY ORAL: DIET	RAT 2 YEARS		NONE OBSERVED		2E-2 300		IRIS	005866
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
BROMOXYNIL OCTANOATE001689-99-2									
	NOEL 7.3 MG/KG/DAY ORAL: DIET	RAT 2 YEARS		NONE OBSERVED		2E-2 300		IRIS	005867
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
BUSAN 77031512-74-0									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005868
BUSAN 90002491-38-5									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005869
BUTANOL, 1-000071-36-3									
	NOAEL 125 MG/KG/DAY ORAL: GAVAGE	RAT 13 WEEKS	CENTRAL NERVOUS SYSTEM CENTRAL NERVOUS SYSTEM	HYPOACTIVITY  ATAXIA		1E+0 100		IRIS	005870

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
BUTYL BENZYL PHTHALATE, N- 000085-68-7									
NOEL	159 MG/KG/DAY ORAL: DIET	RAT 26 WEEKS	LIVER	ALTERED WEIGHT		2E+0 100		IRIS	005616
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
BUTYLATE 002008-41-5									
NOEL	5 MG/KG/DAY ORAL: CAPSULE	DOG 12 MONTHS	LIVER	INCREASED RELATIVE WEIGHT		5E-2 100		IRIS	005871
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
BUTYLCHLORIDE, T- 000507-20-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005810
BUTYROLACTONE, GAMMA- 000096-48-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005872
CACODYLIC ACID 000075-60-5									
NOEL	9.2 MG/KG/DAY ORAL: DIET	RAT 90 DAYS		NONE OBSERVED		3E-2 300		3E-3 3000	005873
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ARSENIC BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO ARSENIC BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CADMIUM 007440-43-9									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								IRIS	005280

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
CALCIUM CYANIDE 000592-01-8									
NOAEL	19.1 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY THYROID NERVE	DECREASED WEIGHT EFFECTS MYELIN DEGENERATION		4E-2 500		IRIS	010258
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CAPROLACTAM 000105-60-2									
NOAEL	50 MG/KG/DAY ORAL: DIET	RAT 90 DAYS	KIDNEY	EFFECTS		5E-1 100		IRIS	005284
									005282
CAPTAFOL 002425-06-1									
LOAEL	2 MG/KG/DAY ORAL: CAPSULE	DOG 12 MONTHS	KIDNEY BLADDER	EFFECTS EFFECTS		2E-3 1000		IRIS	005874
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CAPTAN 000133-06-2									
NOEL	12.5 MG/KG/DAY ORAL: DIET	RAT	WHOLE BODY	DECREASED WEIGHT		1.3E-1 100		IRIS	005875
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (05/27/92) BY THE RfD/RfC WORK GROUP.									
CHRONIC [RfD] COMMENT: BASED ON A MULTI-GENERATION REPRODUCTION STUDY.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
CARBARYL		000063-25-2							
NOEL	9.6 MG/KG/DAY	RAT							
	ORAL: DIET	2 YEARS	KIDNEY LIVER	TOXICITY TOXICITY		1E-1 100		IRIS	005876
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (08/15/91) BY THE RfD/RfC WORK GROUP.									
CARBOFURAN		001563-66-2							
NOEL	0.5 MG/KG/DAY	DOG							
	ORAL: DIET	1 YEAR	BLOOD TESTIS UTERUS	CHOLINESTERASE INHIBITION EFFECTS EFFECTS		5E-3 100		IRIS	005877
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CARBON DISULFIDE		000075-15-0							
NOEL	11 MG/KG/DAY	RABBIT							
	INHALATION: INTERMITTENT		FETUS	TOXICITY		1E-1 100		IRIS	010259
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS DETERMINED FROM A TERATOLOGY STUDY WITH EXPOSURES BEFORE AND DURING THE ENTIRE GESTATION PERIOD.									
NOEL	10 MG/CU M	RAT							
	INHALATION: INTERMITTENT	GESTATION	FETUS	TOXICITY		1E-2 1000		1E-2 1000	010430
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
CARBON MONOXIDE		000630-05-0							
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									
									010493

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
CARBON TETRACHLORIDE		000056-23-5						IRIS	010862
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHLORAL		000075-87-6							
LOAEL	15.7 MG/KG/DAY	MOUSE							
	ORAL: DRINKING	90 DAYS	LIVER	EFFECTS		2E-2		IRIS	005290
	WATER					1000			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHLORDANE		000057-74-9							
NOEL	0.055 MG/KG/DAY	RAT							
	ORAL: DIET	130 WEEKS	LIVER	HYPERTROPHY		6E-5		IRIS	005296
						1000			
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHLORINE CYANIDE		000506-77-4							
NOAEL	25.3 MG/KG/DAY	RAT							
	ORAL: DIET	2 YEARS	WHOLE BODY	DECREASED WEIGHT		5E-2		IRIS	010261
			THYROID	EFFECTS		500			
			NERVE	MYELIN DEGENERATION					
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day)	UF	(mg/kg/day)	
CHLORO-1,3-BUTADIENE, 2- / (CHLOROPRENE) 000126-99-8									
NOAEL 32 PPM	INHALATION	RAT 90 DAYS	OLFACTORY EPITHELIUM	DEGENERATION	7E-2 30		7E-3 300		010515
SUBCHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) 010491									
CHLORO-M-CRESOL, P- 000059-50-7									
NOAEL 200 MG/KG/DAY	ORAL: GAVAGE	RAT 28 DAYS	WHOLE BODY	DECREASED WEIGHT GAIN		2E+0 100			005366
CHLOROACETALDEHYDE 000107-20-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT. 005342									
CHLOROACETIC ACID 000079-11-8									
LOAEL 30 MG/KG	ORAL: GAVAGE	RAT 13 WEEKS	HEART	MYOCARDITIS		2E-2 1000		2E-3 10000	005346
CHLOROANILINE, 2- 000095-51-2									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT 005347									
CHLOROANILINE, 3- 000108-42-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT 005348									
CHLOROANILINE, 4- 000106-47-8									
LOAEL 12.5 MG/KG/DAY	ORAL: DIET	RAT 78 WEEKS	SPLEEN	PROLIFERATIVE LESIONS		4E-3 3000		IRIS	005349
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	

## CHLOROBENZENE

000108-90-7

IRIS 010863

SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.

SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.

CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).

## CHLOROBENZILATE

000510-15-6

NOEL 5 MG/KG/DAY  
ORAL: GAVAGE

RABBIT  
13 DAYS

GASTRO-  
INTESTINAL SYSTEM  
WHOLE BODY  
WHOLE BODY  
NERVOUS SYSTEM  
DECREASED STOOL QUANTITY  
DECREASED FOOD CONSUMPTION  
DECREASED WEIGHT GAIN  
HYPERIRRITABILITY

2E-2  
300

IRIS 010260

SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. BASED ON A TERATOLOGY STUDY WITH EXPOSURES DURING DAYS 7-19 OF GESTATION.

CHRONIC [RfD] COMMENT: BASED ON A TERATOLOGY STUDY WITH EXPOSURES DURING DAYS 7-19 OF GESTATION.

010931

CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (02/11/93) BY THE RfD/RfC WORK GROUP.

## CHLOROBENZOIC ACID, P-

000074-11-3

NOEL 26 MG/DAY  
ORAL: DIET

RAT  
5 MONTHS

NONE OBSERVED

2E+0  
100

2E-1  
1000

005360

## CHLOROBENZOTRIFLUORIDE, 4-

000098-56-6

NOEL 15 MG/KG/DAY  
ORAL: GAVAGE

RAT

KIDNEY

TUBULAR DEGENERATION

2E-1  
100

2E-2  
1000

005364

SUBCHRONIC [RfD] COMMENT: BASED ON A 2-GENERATION REPRODUCTION STUDY WITH EXPOSURES 4 WEEKS PRIOR TO MATING, DURING GESTATION, AND FOR 90 DAYS POST-WEANING.

CHRONIC [RfD] COMMENT: BASED ON A 2-GENERATION REPRODUCTION STUDY WITH EXPOSURES 4 WEEKS PRIOR TO MATING, DURING GESTATION, AND FOR 90 DAYS POST-WEANING.

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
CHLOROBUTANE, 1- 000109-69-3									
	NOAEL 43 MG/KG/DAY ORAL: GAVAGE	RAT 103 WEEKS	WHOLE BODY CENTRAL NERVOUS SYSTEM BLOOD	INCREASED MORTALITY EFFECTS  HEMATOLOGIC EFFECTS				4E-1 100	005808
	NOAEL 86 MG/KG/DAY ORAL: GAVAGE	RAT 13 WEEKS	WHOLE BODY CENTRAL NERVOUS SYSTEM SPLEEN	DECREASED WEIGHT GAIN EFFECTS  HEMATOPOIESIS			9E-1 100		005806
CHLOROBUTANE, 2- 000078-86-4									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005809
CHLOROCYCLOPENTADIENE 041851-50-7									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005297
CHLOROFORM 000067-66-3									
	LOAEL 12.9 MG/KG/DAY ORAL: CAPSULE	DOG 7.5 YEARS	LIVER	LESIONS			1E-2 1000	IRIS	005372
	SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].								
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
	SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.								
CHLOROMETHANE / (METHYL CHLORIDE) 000074-87-3									
	SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.								010005
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								

**March 1994**

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# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	Chronic [RfD] (mg/kg/day) UF	REFERENCE
CHLORPYRIFOS 002921-88-2									
NOEL	0.03 MG/KG/DAY ORAL: CAPSULE	HUMAN 20 DAYS OR 9 DAYS	BLOOD	DECREASED CHOLINESTERASE ACTIVITY		3E-3 10		IRIS	005881
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHLORPYRIFOS METHYL 005598-13-0									
NOEL	1 MG/KG/DAY ORAL: DIET	RAT 3 GENERATIONS	REPRODUCTION	DECREASED FERTILITY		1E-2 100		1E-2 100	005882
		RAT 2 YEARS	LIVER	EFFECTS					
CHLOROTHALONIL 001897-45-6									
NOEL	1.5 MG/KG/DAY ORAL: DIET	DOG 2 YEARS	KIDNEY	EFFECTS		1.5E-2 100		IRIS	005883
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHLORTHIOPHOS 060238-56-4									
NOEL	0.08 MG/KG/DAY ORAL: DIET	RAT 2 YEARS		NONE OBSERVED		8E-4 100		8E-4 100	005884
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHROMIUM(III) 016065-83-1									
NOEL	5 % (CR2O3) ORAL: DIET	RAT 840 DAYS		NONE OBSERVED		1E+0 1000		IRIS	005731
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfC] COMMENT: INHALATION ISSUES ARE UNDER REVIEW BY THE RfD/RfC WORK GROUP. SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
CHROMIUM(VI) 018540-29-9									
NOAEL 2.4 MG/KG/DAY	RAT								
ORAL: DRINKING WATER	1 YEAR			NONE OBSERVED		2E-2 100		IRIS	005522
CHRONIC [RfC] COMMENT: INHALATION ISSUES ARE UNDER REVIEW BY THE RFD/RFC WORK GROUP.									
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
CHRYSENE 000218-01-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT. ALSO SEE HEAST TABLE 3: CARCINOGENICITY. 005885									
COPPER 007440-50-8									
LOAEL 5.3 MG	HUMAN								
ORAL	SINGLE DOSE	GASTRO- INTESTINAL SYSTEM		IRRITATION		1.3 MG/L		1.3 MG/L	005374
SUBCHRONIC [RfD] COMMENT: CURRENT DRINKING WATER STANDARD OF 1.3 MG/L. DWCD (1987) CONCLUDED TOXICITY DATA WERE INADEQUATE FOR CALCULATION OF AN RfD FOR COPPER.									
CHRONIC [RfD] COMMENT: CURRENT DRINKING WATER STANDARD OF 1.3 MG/L. DWCD (1987) CONCLUDED TOXICITY DATA WERE INADEQUATE FOR CALCULATION OF AN RfD FOR COPPER.									
COPPER CYANIDE 000544-92-3									
NOAEL 5 MG/KG/DAY	RAT								
ORAL: GAVAGE	90 DAYS	LIVER KIDNEY WHOLE BODY ORGANS		HISTOPATHOLOGY HISTOPATHOLOGY DECREASED WEIGHT DECREASED WEIGHT		5E-2 100		IRIS	010262

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic	Chronic	REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
CRESOL, M- / (3-METHYLPHENOL) 000108-39-4							
NOAEL	50 MG/KG/DAY	RAT					
	ORAL: GAVAGE	90 DAYS	WHOLE BODY NERVOUS SYSTEM	DECREASED WEIGHT GAIN NEUROTOXICITY		5E-1 100	IRIS 005380
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.							
IRIS 010888							
CRESOL, O- / (2-METHYLPHENOL) 000095-48-7							
NOAEL	50 MG/KG/DAY	RAT					
	ORAL: GAVAGE	90 DAYS	WHOLE BODY NERVOUS SYSTEM	DECREASED WEIGHT GAIN NEUROTOXICITY		5E-1 100	IRIS 005384
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.							
IRIS 010889							
CRESOL, P- / (4-METHYLPHENOL) 000106-44-5							
NOAEL	5 MG/(KG-DAY)	RABBIT					
	ORAL: GAVAGE	GESTATION DAYS 6-18	CENTRAL NERVOUS SYSTEM RESPIRATORY SYSTEM WHOLE BODY	HYPOACTIVITY  DISTRESS  MATERNAL DEATH		5E-3 1000	5E-3 1000 010516
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].							
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.							
IRIS 010890							

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	
CUMENE		000098-82-8						
NOAEL	154 MG/KG/DAY ORAL: GAVAGE	RAT 194 DAYS	KIDNEY	INCREASED WEIGHT		4E-1 300	IRIS	005392
NOAEL	105.1 PPM INHALATION: INTERMITTENT	RAT 4 WEEKS	CENTRAL NERVOUS SYSTEM NOSE	INVOLVEMENT  IRRITATION	9E-2 1000		9E-3 10000	005908
CYANAZINE		021725-46-2						
NOEL	0.625 MG/KG/DAY ORAL: DIET	DOG 1 YEAR	WHOLE BODY BLOOD BLOOD	DECREASED WEIGHT INCREASED PLATELET COUNT ALTERED CLINICAL CHEMISTRY PARAMETERS		2E-3 300	2E-3 300	010411
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS WITHDRAWN FROM IRIS (07/01/92). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
CYANIDE		000057-12-5						
NOAEL	10.8 MG/KG/DAY ORAL: DIET	RAT 104 WEEKS	WHOLE BODY THYROID NERVE	DECREASED WEIGHT EFFECTS MYELIN DEGENERATION		2E-2 500	IRIS	005396
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: THE CASRN FOR CN- IS 000057-12-5; THE CASRN FOR HCN IS 000074-90-8.								
CYANOGEN		000460-19-5						
NOAEL	21.6 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY THYROID NERVE	DECREASED WEIGHT EFFECTS MYELIN DEGENERATION		4E-2 500	IRIS	010263
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].								

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day)	UF	(mg/kg/day)	
CYANOGEN BROMIDE		000506-68-3							
NOAEL 44 MG/KG/DAY	RAT								
ORAL: DIET	2 YEARS	WHOLE BODY	DECREASED WEIGHT			9E-2		IRIS	010264
		THYROID	EFFECTS			500			
		NERVE	MYELIN DEGENERATION						
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CYCLOATE		001134-23-2							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									
005886									
CYCLOHEXANOL		000108-93-0							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									
005887									
CYCLOHEXYLAMINE		000108-91-8							
								IRIS	005400
NOAEL 30 MG/KG/DAY	RAT								
ORAL: DIET	90 DAYS	WHOLE BODY	DECREASED WEIGHT GAIN			3E-1			005398
		TESTIS	DECREASED WEIGHT			100			
CYCLOPENTADIENE		000542-92-7							
GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
010494									
DACTHAL		001861-32-1							
NOEL 50 MG/KG/DAY	RAT								
ORAL: DIET	2 YEARS	KIDNEY	INCREASED WEIGHT			5E-1		IRIS	005888
		ADRENAL	INCREASED RELATIVE WEIGHT			100			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									



**March 1994**

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# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
DIBENZOFURAN 000132-64-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005409
DIBROMOBENZENE, 1,4- 000106-37-6									
NOAEL 10 MG/KG/DAY	RAT								
ORAL: GAVAGE	45 OR 90 DAYS	LIVER LIVER		INCREASED RELATIVE WEIGHT ALTERED ENZYME ACTIVITIES		1E-1 100		IRIS	005893
DIBROMOCHLOROMETHANE 000124-48-1									
NOEL 21.4 MG/KG/DAY	RAT								
ORAL: GAVAGE	13 WEEKS	LIVER		LESIONS		2E-1 100		IRIS	005894
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DIBROMOETHANE, 1,2- 000106-93-4									
LOAEL 88 PPB	HUMAN								
INHALATION: INTERMITTENT		SPERM		EFFECTS	8E-4 300		2E-4 1000		010854
SUBCHRONIC [rfc] COMMENT: THE CHRONIC INHALATION [rfc] WAS MODIFIED TO ESTIMATE THE SUBCHRONIC INHALATION [rfc].									
CHRONIC [rfc] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DIBUTYL PHTHALATE 000084-74-2									
NOAEL 125 MG/KG/DAY	RAT								
ORAL: DIET	52 WEEKS	WHOLE BODY		INCREASED MORTALITY		1E+0 100		IRIS	005622
CHRONIC rfc COMMENT: THE CHRONIC INHALATION rfc IS CONSIDERED NOT VERIFIABLE (07/26/90) BY THE rfd/rfc WORK GROUP.									010892

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
DICAMBA		001918-00-9							
NOAEL 3	MG/KG/DAY	RABBIT							
	ORAL: GAVAGE	GESTATION	FETUS	DECREASED WEIGHT		3E-2		IRIS	010945
		DAYS 6-18	FETUS	INCREASED POST-IMPLANTATION LOSSES		100			
			FETUS	INCREASED MORTALITY					
			DAM	DECREASED WEIGHT GAIN					
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
DICHLOROBENZENE, 1,2-		000095-50-1							
								IRIS	010864
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
DICHLOROBENZENE, 1,3-		000541-73-1							
									005414
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (06/23/92) BY THE RfD/RfC WORK GROUP.									
DICHLOROBENZENE, 1,4-		000106-46-7							
NOAEL 75	MG/CU M	RAT							
	INHALATION:	MULTI-GENERA	LIVER	INCREASED WEIGHT IN MALE	2.5E+0		IRIS		010840
	INTERMITTENT	TION		PARENTS	30				
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS MODIFIED TO DERIVE THE SUBCHRONIC INHALATION [RfC].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DICHLOROBUTENES									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005415

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
DICHLORODIFLUOROMETHANE 000075-71-8									
NOAEL 90 MG/KG/DAY ORAL: DIET	DOG 90 DAYS			NONE OBSERVED		9E-1 100		IRIS	005498 005496
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
DICHLOROETHANE, 1,1- 000075-34-3									
NOEL 115 MG/KG/DAY INHALATION: INTERMITTENT	RAT 13 WEEKS			NONE OBSERVED		1E+0 100		1E-1 1000	005790
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DICHLOROETHANE, 1,2- 000107-06-2									
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300. SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DICHLOROETHYLENE, 1,1- 000075-35-4									
LOAEL 9 MG/KG/DAY ORAL: DRINKING WATER	RAT 2 YEARS	LIVER		LESIONS		9E-3 1000		IRIS	005419
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfD] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	UF	UF	UF	
DICHLOROETHYLENE, 1,2- (MIXED ISOMERS) 000540-59-0									
LOAEL 50 PPM		RAT							
ORAL: DRINKING WATER		2 YEARS	LIVER	LESIONS		9E-3 1000		9E-3 1000	010509
SUBCHRONIC [RfD] COMMENT: VALUES DERIVED FOR 1,1-DICHLOROETHYLENE WERE ADOPTED FOR 1,2- DICHLOROETHYLENE MIXED ISOMERS BASED ON ANALOGY									
CHRONIC [RfD] COMMENT: VALUES DERIVED FOR 1,1-DICHLOROETHYLENE (000075-35-4) WERE ADOPTED FOR 1,2-DICHLOROETHYLENE MIXED ISOMERS BASED ON ANALOGY.									
DICHLOROETHYLENE, 1,2-C- 000156-59-2									
NOAEL 32 MG/KG/DAY		RAT							
ORAL: GAVAGE		90 DAYS	BLOOD BLOOD	DECREASED HEMATOCRIT DECREASED HEMOGLOBIN		1E-1 300		1E-2 3000	005420
CHRONIC [RfD] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
DICHLOROETHYLENE, 1,2-T- 000156-60-5									
NOAEL 17 MG/KG/DAY		MOUSE							
ORAL: DRINKING WATER		90 DAYS	BLOOD	INCREASED ALKALINE PHOSPHATASE		2E-1 100		IRIS	005895
DICHLOROPHENOL, 2,3- 000576-24-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005315
DICHLOROPHENOL, 2,4- 000120-83-2									
NOEL 3 PPM		RAT							
ORAL: DRINKING WATER		2 GENERATIONS	IMMUNE SYSTEM	ALTERED IMMUNE FUNCTION		3E-3 100		IRIS	005314
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: BASED ON A 2-GENERATION REPRODUCTION STUDY WITH EXPOSURES BEFORE AND DURING GESTATION, PARTURITION, AND WEANING OF PUPS.									
DICHLOROPHENOL, 2,5- 000583-78-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005316

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [Rfd] (mg/kg/day) UF	Chronic [RfC] (mg/cu m) UF	Chronic [Rfd] (mg/kg/day) UF	REFERENCE
DICHLOROPHENOL, 2,6-		000087-65-0							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT							005317
DICHLOROPHENOL, 3,4-		000095-77-2							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT							005318
DICHLOROPHENOL, 3,5-		000591-35-5							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT							005319
DICHLOROPHENOXY ACETIC ACID, 2,4-		000094-75-7							
	NOAEL 1 MG/KG/DAY ORAL: DIET	RAT 91 DAYS	BLOOD LIVER KIDNEY	TOXICITY TOXICITY TOXICITY		1E-2 100		IRIS	010265
		SUBCHRONIC [Rfd] COMMENT: THE CHRONIC ORAL Rfd WAS ADOPTED AS THE SUBCHRONIC ORAL [Rfd].							
DICHLOROPHENOXY) BUTYRIC ACID, 4-(2,4- / (2,4-DB)		000094-82-6							
	NOAEL 8 MG/KG/DAY ORAL: DIET	DOG 90 DAYS	CARDIOVASCULAR SYSTEM WHOLE BODY	HEMORRHAGE  INCREASED MORTALITY		8E-2 100		IRIS	005890
DICHLOROPROPANE, 1,1-		000078-99-9							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.							005897
DICHLOROPROPANE, 1,2-		000078-87-5							
	NOAEL 69.3 MG/CU INHALATION: INTERMITTENT	MRAT 13 WEEKS	NASAL MUCOSA	HYPERPLASIA	1.3E-2 100			IRIS	005898
		GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.							

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic	[RfC] (mg/cu m) UF	Chronic	[RfD] (mg/kg/day) UF	REFERENCE
						[RfD] (mg/kg/day) UF		[RfC] (mg/cu m) UF		
DICHLOROPROPANE, 1,3-		000142-28-9								
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005899
DICHLOROPROPANE, 2,2-		000594-20-7								
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005900
DICHLOROPROPENE, 1,3- / (TELONE II)		000542-75-6								
NOEL 3	MG/KG/DAY	RAT								
	ORAL: DIET	90 DAYS	ORGANS	INCREASED WEIGHT			3E-3		IRIS	005901
							1000			
		GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
NOAEL 5	PPM	MOUSE								
	INHALATION:	2 YEARS	NASAL MUCOSA	HYPERTROPHY	2E-2			IRIS		010351
	INTERMITTENT		NASAL MUCOSA	HYPERPLASIA	30					
		SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].								
DICHLORPROP		000120-36-5								
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.								005896
DICYCLOPENTADIENE		000077-73-6								
NOEL 32	MG/KG/DAY	RAT								
	ORAL: DIET	3		NONE OBSERVED			3E-1		3E-2	005425
		GENERATIONS					100		1000	
		SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)								
		SUBCHRONIC [RfD] COMMENT: BASED ON A 3-GENERATION REPRODUCTION STUDY.								
		CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)								
		CHRONIC [RfD] COMMENT: BASED ON A 3-GENERATION REPRODUCTION STUDY.								

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	Chronic [RfD] (mg/kg/day) UF	REFERENCE
DIELDRIN 000060-57-1									
NOAEL	0.005 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	LIVER	LESIONS		5E-5 100		IRIS	005429
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DIETHYL PHTHALATE 000084-66-2									
NOAEL	750 MG/KG/DAY ORAL: DIET	RAT 16 WEEKS	WHOLE BODY ORGANS	DECREASED GROWTH DECREASED WEIGHT		8E+0 100		IRIS	005620
DIETHYL-P-NITROPHENYL PHOSPHATE 000311-45-5									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005922
DIETHYLANILINE, N,N- 000091-66-7									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005903
DIETHYLENE GLYCOL MONOBUTYL ETHER 000112-34-5									
NOAEL	18 PPM	RAT		NONE OBSERVED	2E-1 100		2E-2 1000		005482
CHRONIC [RfC] COMMENT: UNDER REVIEW.									
DIETHYLENE GLYCOL MONOETHYL ETHER 000111-90-0									
NOEL	200 MG/KG/DAY ORAL: DRINKING WATER	RAT	KIDNEY	HISTOPATHOLOGY				2E+0 100	005478
CHRONIC [RfD] COMMENT: BASED ON A 3-GENERATION REPRODUCTION STUDY.									
NOEL	500 MG/KG/DAY ORAL: DIET	RAT 90 DAYS	KIDNEY TESTIS	IMPAIRED FUNCTION INCREASED WEIGHT		5E+0 100			005476



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic [RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	Chronic [RfC] (mg/cu m) UF	Chronic [RfD] (mg/kg/day) UF	REFERENCE
DIETHYLFORMAMIDE		000617-84-5							
NOEL	0.546 MG/DAY, 5 DAYS/WEEK	RAT							
	ORAL: GAVAGE	73 WEEKS		NONE OBSERVED		1.1E-2 100		1.1E-2 100	010437
DIETHYLHYDRAZINE, 1,2-		001615-80-1							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT. ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									005921
DIMETHOATE		000060-51-5							
NOEL	0.05 MG/KG/DAY	RAT							
	ORAL: DIET	2 YEARS	BRAIN	DECREASED CHOLINESTERASE ACTIVITY		2E-4 300		IRIS	005923
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
DIMETHYLANILINE, N,N-		000121-69-7							
LOAEL	22.32 MG/KG/DAY	MOUSE							
	ORAL: GAVAGE	13 WEEKS	SPLEEN	EFFECTS		2E-2 1000		IRIS	005924
DIMETHYLFORMAMIDE, N,N-		000068-12-2							
NOAEL	96 MG/KG/DAY	RAT							
	ORAL: DIET	119 DAYS	LIVER	EFFECTS		1E+0 100		1E-1 1000	005925
LOAEL	22 MG/CU M	HUMAN							
	INHALATION: INTERMITTENT		LIVER GASTRO INTESTINAL SYSTEM	EFFECTS EFFECTS	3E-2 300		IRIS		010352
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
DIMETHYLPHENOL, 2,3-		000526-75-0							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005926

HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
DIMETHYLPHENOL, 2,4-									
NOAEL	50 MG/KG/DAY ORAL: GAVAGE	MOUSE 90 DAYS	NERVOUS SYSTEM BLOOD	EFFECTS ALTERATIONS		2E-1 300		IRIS	010266
DIMETHYLPHENOL, 2,5-									
	GENERAL COMMENT:	DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.							005928
DIMETHYLPHENOL, 2,6-									
NOEL	0.6 MG/KG/DAY ORAL	RAT 8 MONTHS	WHOLE BODY ORGANS, MAJOR	INCREASED WEIGHT LESIONS		6E-3 100		IRIS	005431
DIMETHYLPHENOL, 3,4-									
NOEL	1.4 MG/KG/DAY ORAL	RAT 8 MONTHS	WHOLE BODY ORGANS, MAJOR CARDIOVASCULAR SYSTEM	DECREASED WEIGHT LESIONS ALTERED BLOOD PRESSURE		1E-2 100		IRIS	005437
DIMETHYLPHTHALATE									
NOEL	1000 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	KIDNEY	EFFECTS		1E+1 100		1E+1 100	010267
								IRIS	010894
	CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (07/26/90) BY THE RfD/RfC WORK GROUP.								
DIMETHYLTEREPHTHALATE									
LOAEL	125 MG/KG/DAY ORAL: DIET	RAT 103 WEEKS	KIDNEY	INFLAMMATION		1E-1 1000		IRIS	005930
	SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].								

HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
DIMETHYLUREA, N,N-		000598-94-7							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT							005931
DINITRO-O-CRESOL, 4,6-		000534-52-1							
		CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (02/11/93) BY THE RfD/RfC WORK GROUP.							010470
DINITRO-P-CRESOL, 2,6-		000609-93-8							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT							005934
DINITROBENZENE, 1,2-		000528-29-0							
	NOAEL 0.4 MG/KG/DAY	RAT							
	ORAL: DRINKING	16 WEEKS	SPLEEN	INCREASED WEIGHT		4E-3		4E-4	010201
	WATER					100		1000	
		SUBCHRONIC [RfD] COMMENT: DERIVED BY ANALOGY TO 1,3-DINITROBENZENE.							
		CHRONIC [RfD] COMMENT: DERIVED BY ANALOGY TO 1,3-DINITROBENZENE.							
DINITROBENZENE, 1,3-		000099-65-0							
	NOAEL 0.4 MG/KG/DAY	RAT							
	ORAL: DRINKING		SPLEEN	INCREASED WEIGHT		1E-3		IRIS	010471
	WATER					100			
DINITROBENZENE, 1,4-		000100-25-4							
	NOAEL 0.4 MG/KG/DAY	RAT							
	ORAL: DRINKING	16 WEEKS	SPLEEN	INCREASED WEIGHT		4E-3		4E-4	010202
	WATER					100		1000	
		SUBCHRONIC [RfD] COMMENT: DERIVED BY ANALOGY TO 1,3-DINITROBENZENE.							
		CHRONIC [RfD] COMMENT: DERIVED BY ANALOGY TO 1,3-DINITROBENZENE.							
DINITROPHENOL, 2,3-		000066-56-8							
		GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT							005936

**March 1994**

IRIS, EPA'S INTEGRATED RISK INFORMATION SYSTEM, IS UPDATED MONTHLY. FURTHER INFORMATION: RISK INFORMATION HOTLINE: (513) 569-7254.

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
DINITROTOLUENE, 2,6-000606-20-2									
NOAEL 4	MG/KG/DAY	DOG							
	ORAL: DIET	13 WEEKS	WHOLE BODY	MORTALITY		1E-2		1E-3	005943
			CENTRAL NERVOUS	NEUROTOXICITY		300		3000	
			SYSTEM						
			BLOOD	HEINZ BODIES					
			BLOOD	METHEMOGLOBINEMIA					
			BILE DUCT	HYPERPLASIA					
			KIDNEY	HISTOPATHOLOGY					
CHRONIC [RfD] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
DINITROTOLUENE, 3,4-000610-39-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005944
DINOSEB000088-85-7									
LOAEL 1	MG/KG/DAY	RAT							
	ORAL: DIET	29 WEEKS	FETUS	DECREASED WEIGHT		1E-3		IRIS	005945
						1000			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS DETERMINED FROM A 3-GENERATION REPRODUCTION STUDY.									
DIPHENYLAMINE, N,N-000122-39-4									
NOEL 2.5	MG/KG/DAY	DOG							
	ORAL: DIET	2 YEARS	WHOLE BODY	DECREASED WEIGHT GAIN		2.5E-2		IRIS	005946
			LIVER	INCREASED WEIGHT		100			
			KIDNEY	INCREASED WEIGHT					
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
DIRECT LIGHTFAST BLUE004399-55-7									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005947

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day) UF	UF	(mg/kg/day) UF	
DISULFOTON									
LOAEL 0.04 MG/KG/DAY		RAT							
ORAL: DIET		2 YEARS	EYE BLOOD	DEGENERATION CHOLINESTERASE INHIBITION		4E-5 1000		IRIS	010412
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
ENDOSULFAN									
NOAEL 15 PPM		RAT							
ORAL: DIET		2 YEARS	WHOLE BODY KIDNEY BLOOD VESSEL	DECREASED WEIGHT GAIN GLOMERULONEPHROSIS ANEURYSMS		6E-3 100		6E-3 100	010926
NOAEL 10 PPM		DOG							
ORAL: DIET		1 YEAR	WHOLE BODY	DECREASED WEIGHT GAIN					010938
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: WITHDRAWN FROM IRIS (12/01/92). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE. BASED ON CO-CRITICAL RAT AND DOG STUDIES.									
ENDOTHALL									
NOEL 2 MG/KG/DAY		DOG							
ORAL: DIET		2 YEARS	STOMACH SMALL INTESTINE	INCREASED WEIGHT INCREASED WEIGHT		2E-2 100		IRIS	005948
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
ENDRIN									
NOEL 0.025 MG/KG/DAY		DOG							
ORAL: DIET		2 YEARS	CENTRAL NERVOUS SYSTEM LIVER	CONVULSIONS LESIONS		3E-4 100		IRIS	005445
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	Chronic [RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	REFERENCE
EPICHLOROHYDRIN 000106-89-8									
LOAEL	37.8 MG/CU M INHALATION: INTERMITTENT	RAT 136 WEEKS	KIDNEY	LESIONS		2E-3 1000		2E-3 1000	010440
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE-TO-ROUTE EXTRAPOLATION. THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfD] COMMENT: WITHDRAWN FROM IRIS (04/01/92). GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
NOAEL	19 MG/CU M INHALATION: INTERMITTENT	RAT 90 DAYS	NASAL EPITHELIUM	LESIONS	1E-2 100		IRIS		010492
EPTC 000759-94-4									
NOEL	2.5 MG/KG/DAY ORAL: DIET	RAT 2 GENERATIONS	HEART	DEGENERATIVE CARDIOMYOPATHY		2.5E-2 100		IRIS	005959
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS DETERMINED FROM A 2-GENERATION REPRODUCTION STUDY.									
ETHOPROP 013194-48-4									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005951
ETHOXYETHANOL ACETATE, 2- 000111-15-9									
									010507
SUBCHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) CHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
ETHOXYETHANOL ACRYLATE, 2- 000106-74-1									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005953
ETHOXYETHANOL DODECANOATE, 2- 000106-13-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005956

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
ETHOXYETHANOL PHOSPHATE, 2- 068554-00-7									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005955
ETHOXYETHANOL, 2- 000110-80-5									
LOAEL	357 MG/KG/DAY ORAL: GAVAGE	RAT 103 WEEKS	WHOLE BODY	DECREASED WEIGHT				4E-1 1000	005470
NOEL	50 UL/KG/DAY ORAL: GAVAGE	RAT 21 DAYS	FETUS	SKELETAL MALFORMATIONS		5E-1 100			005468
SUBCHRONIC [RfD] COMMENT: BASED ON A REPRODUCTION STUDY WITH EXPOSURES DURING DAYS 1-21 OF GESTATION.									
NOAEL	380 MG/CU M INHALATION: INTERMITTENT	RABBIT 13 WEEKS	BLOOD	ALTERED HEMATOLOGY	2E+0 30		IRIS		010441
ETHOXYETHYL METHACRYLATE, 2- 002370-63-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005954
ETHYL ACETATE 000141-78-6									
NOEL	900 MG/KG/DAY ORAL: GAVAGE	RAT 90 DAYS	WHOLE BODY WHOLE BODY	INCREASED MORTALITY DECREASED WEIGHT		9E+0 100	IRIS		005957
ETHYL BENZENE 000100-41-4									
							IRIS	IRIS	010867 010866
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	[RfD]	REFERENCE
					(mg/cu m)	(mg/kg/day)	(mg/cu m)	(mg/kg/day)		
					UF	UF	UF	UF		
ETHYL CHLORIDE 000075-00-3										
NOEL 1504 PPM	MOUSE									
INHALATION: INTERMITTENT	10 DAYS	FETUS	DEVELOPMENTAL TOXICITY	1E+1 300			IRIS		010371	
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].										
CHRONIC [RfC] COMMENT: BASED ON A DEVELOPMENTAL STUDY WITH EXPOSURES DURING DAYS 6-15 OF GESTATION.										
ETHYL ETHER 000060-29-7										
NOEL 500 MG/KG/DAY	RAT									
ORAL: GAVAGE	90 DAYS	LIVER	EFFECTS			2E+0 300		IRIS	010396	
ETHYL METHACRYLATE 000097-63-2										
NOEL 7.5 MG/KG/DAY	RAT									
ORAL: DRINKING WATER	2 YEARS	KIDNEY	INCREASED RELATIVE WEIGHT			9E-2 100		9E-2 100	005961	
CHRONIC [RfD] COMMENT: CALCULATED FROM METHYL METHACRYLATE DATA BY MULTIPLYING BY THE RATIO OF THE MOLECULAR WEIGHTS (114.5/100.13).										
ETHYL-O-XYLENE, 4- 000934-80-5										
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.										010472
ETHYLANILINE, N- 000103-69-5										
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT										005958
ETHYLENE CYANOHYDRIN 000109-78-4										
NOEL 30 MG/KG/DAY	RAT									
ORAL: DRINKING WATER	90 DAYS	HEART BRAIN	DECREASED WEIGHT DECREASED WEIGHT			3E-1 100		3E-1 100	005780	

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE	
					[RfC]	[RfD]	[RfC]	[RfD]		
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF		
ETHYLENE DIAMINE 000107-15-3										
NOAEL	22.6 MG/KG/DAY ORAL: DIET	RAT 3 MONTHS	HEART BLOOD	DECREASED WEIGHT HEMATOLOGIC CHANGES		2E-1 100		2E-2 1000	005796	
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (12/18/90) BY THE RfD/RfC WORK GROUP.									010898	
ETHYLENE GLYCOL 000107-21-1										
NOEL	200 MG/KG/DAY ORAL: DIET	RAT	FETUS	FETOTOXICITY		2E+0 100		IRIS	005454	
SUBCHRONIC [RfD] COMMENT: BASED ON A REPRODUCTION STUDY WITH EXPOSURES DURING DAYS 6-15 OF GESTATION.									005452	
ETHYLENE GLYCOL MONOBUTYL ETHER 000111-76-2										
NOAEL	121 MG/CU M INHALATION: INTERMITTENT	RAT 13 WEEKS	BLOOD	ALTERED HEMATOLOGY	2E-1 100		2E-2 1000		010353	
CHRONIC [RfC] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.										
ETHYLENE THIOUREA 000096-45-7										
LOAEL	0.25 MG/KG/DAY ORAL: DIET	RAT 24 MONTHS	THYROID	HYPERPLASIA		8E-5 3000		IRIS	010397	
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.										010899
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (08/12/92) BY THE RfD/RfC WORK GROUP.										
ETHYLTOLUENE, M- 000620-14-4										
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT										005963

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
ETHYLTOLUENE, O-000611-14-3									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005962
ETHYLTOLUENE, P-000622-96-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005964
FLUORANTHENE000206-44-0									
NOAEL 125 MG/KG/DAY ORAL: GAVAGE	MOUSE 90 DAYS	KIDNEY LIVER BLOOD	NEPHROPATHY WEIGHT CHANGES HEMATOLOGICAL CHANGES	4E-1 300	IRIS	010168			
FLUORENE000086-73-7									
NOAEL 125 MG/KG/DAY ORAL: GAVAGE	MOUSE 13 WEEKS	ERYTHROCYTES	DECREASED COUNTS	4E-1 300	IRIS	010169			
FLUORINE / (SOLUBLE FLUORIDE) 007782-41-4									
NOAEL 0.06 MG/KG/DAY ORAL: DRINKING WATER	HUMAN	TOOTH	FLUOROSIS	6E-2 1	IRIS	005965			
FLURIDONE059756-60-4									
NOEL 200 PPM ORAL: DIET	RAT 2 YEARS	KIDNEY TESTIS WHOLE BODY ORGANS	GLOMERULONEPHRITIS ATROPHY DECREASED WEIGHT DECREASED WEIGHT	8E-2 100	IRIS	005966			

SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
FOLPET 000133-07-3									
NOEL	10 MG/KG/DAY	DOG							
	ORAL: CAPSULE	1 YEAR	WHOLE BODY BLOOD	ALTERED WEIGHT GAIN ALTERED CHEMISTRY		1E-1 100		IRIS	005967
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
FORMALDEHYDE 000050-00-0									
NOEL	15 MG/KG/DAY	RAT							
	ORAL: WATER	2 YEARS	GASTRO- INTESTINAL TRACT	LESIONS		2E-1 100		IRIS	010398
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
FORMALDEHYDE CYANOHYDRIN 000107-16-4									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005782
FORMIC ACID 000064-18-6									
NOEL	200 MG/KG/DAY	RAT							
	ORAL: WATER	MULTI- GENERATION	WHOLE BODY	DECREASED GROWTH		2E+0 100		2E+0 100	010268
CHRONIC [RfD] COMMENT: BASED ON A MULTI-GENERATION STUDY. WITHDRAWN FROM IRIS (12/01/90). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
FURAN 000110-00-9									
NOEL	1.4 MG/KG/DAY	MOUSE							
	ORAL: GAVAGE	13 WEEKS	LIVER	LESIONS		1E-2 100		IRIS	005462

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
FURFURAL		000098-01-1							
	LOAEL 7.9 MG/KG/DAY ORAL: GAVAGE	RAT 13 WEEKS	LIVER	HEPATOTOXICITY		3E-2 300		IRIS	005466
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
GLYCIDALDEHYDE		000765-34-4							
	NOAEL 29 MG/CU M INHALATION: INTERMITTENT	RAT 12 WEEKS	WHOLE BODY KIDNEY	DECREASED WEIGHT EFFECTS	1E-2 300	4E-3 300	1E-3 3000	IRIS	005968
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5.									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
HEPTACHLOR		000076-44-8							
	NOEL 0.15 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	LIVER	INCREASED WEIGHT		5E-4 300		IRIS	005506
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY									
HEPTACHLOR EPOXIDE		001024-57-3							
	LOAEL 0.0125 MG/KG/DAY ORAL: DIET	DOG 60 WEEKS	LIVER	INCREASED RELATIVE WEIGHT		1.3E-5 1000		IRIS	010399
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
HEPTANE, N-		000142-82-5							
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005969

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	Chronic [RfD] (mg/kg/day) UF	REFERENCE
HEXABROMOBENZENE		000087-82-1							
	NOAEL 2 MG/KG/DAY ORAL: DIET	RAT 12 WEEKS	LIVER	INDUCED CARBOXYLESTERASE ACTIVITY		2E-2 100		IRIS	005970
HEXACHLOROBENZENE		000118-74-1							
								IRIS	010868
								IRIS	010900
								CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (11/15/90) BY THE RfD/RfC WORK GROUP.	
								SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.	
								SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.	
								GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.	
HEXACHLOROBUTADIENE		000087-68-3							
	LOAEL 0.5 MG/KG/DAY ORAL: DIET	MOUSE 13 WEEKS	RENAL TUBULES	REGENERATION				2E-4 1000	010927
								CHRONIC [RfD] COMMENT: WITHDRAWN FROM IRIS (05/01/93). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.	
								SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.	
								SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.	
HEXACHLOROCYCLOHEXANE, DELTA-		000319-86-8							
									010495
								GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT. ALSO SEE HEAST TABLE 3: CARCINOGENICITY.	
HEXACHLOROCYCLOHEXANE, EPSILON-		006108-10-7							
									010496
								GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT. ALSO SEE HEAST TABLE 3: CARCINOGENICITY.	

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
HEXACHLOROCYCLOHEXANE, GAMMA- 000058-89-9									
NOAEL	0.33 MG/KG/DAY ORAL: DIET	RAT 12 WEEKS	LIVER KIDNEY	TOXICITY TOXICITY		3E-3 100		IRIS	005537
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									010903
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (05/27/92) BY THE RfD/RfC WORK GROUP.									
HEXACHLOROCYCLOPENTADIENE 000077-47-4									
NOAEL	7.1 MG/KG/DAY ORAL	RAT 13 WEEKS	FORESTOMACH	LESIONS		7E-2 100		IRIS	005299
NOAEL	0.15 PPM INHALATION: INTERMITTENT	RAT 13 WEEKS	NASAL CAVITY	SQUAMOUS METAPLASIA	7E-4 100		7E-5 1000		010445
HEXACHLOROETHANE 000067-72-1									
NOAEL	1 MG/KG/DAY ORAL: DIET	RAT 16 WEEKS	KIDNEY	DEGENERATION		1E-2 100		IRIS	005518
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									010904
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (11/05/92), BY THE RfD/RfC WORK GROUP.									
HEXACHLOROPHENE 000070-30-4									
LOAEL	0.75 MG/KG/DAY ORAL: DIET	DOG 13 WEEKS	NERVOUS SYSTEM	EFFECTS		3E-3 300		IRIS	005972
HEXAMETHYLENE DIAMINE 000124-09-4									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005973

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
HEXANE, N-		000110-54-3							
	LOAEL 570 MG/KG/DAY ORAL	RAT	NERVOUS SYSTEM TESTIS	NEUROPATHY ATROPHY		6E-1 1000		6E-2 10000	005974
	LOAEL 73 MG/CU M INHALATION: INTERMITTENT	HUMAN	NERVOUS SYSTEM	NEUROTOXICITY	2E-1 300		IRIS		010273
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
HEXANONE, 2-		000591-78-6							
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005976
HYDROGEN SULFIDE		007783-06-4							
	NOAEL 3.1 MG/KG/DAY ORAL: FOOD	PIG 105 DAYS	GASTRO- INTESTINAL SYSTEM	DISTURBANCE		3E-2 100		IRIS	010269
	NOAEL 42 MG/CU M INHALATION: INTERMITTENT	MOUSE 13 WEEKS	NASAL MUCOSA	INFLAMMATION	9E-3 100		IRIS		010354
HYDROQUINONE		000123-31-9							
	NOAEL 4.29 MG/KG/DAY ORAL	HUMAN 3-5 MONTHS	BLOOD	HEMATOLOGICAL EFFECTS		4E-1 10		4E-2 100	005526
	CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (10/01/90) BY THE RfD/RfC WORK GROUP.								010905
IRON		007439-89-6							
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005527



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	(RfD)	(mg/cu m)	(RfD)	
					UF	UF	UF	UF	
ISOBUTYL ALCOHOL 000078-83-1									
NOEL	316 MG/KG/DAY	RAT							
	ORAL: GAVAGE	13 WEEKS	NERVOUS SYSTEM	HYPOACTIVITY		3E+0		IRIS	005977
			NERVOUS SYSTEM	ATAXIA		100			
ISOPHORONE 000078-59-1									
NOEL	150 MG/KG/DAY	DOG							
	ORAL: CAPSULE	90 DAYS	KIDNEY	LESIONS		2E+0		IRIS	005910
						100			
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (11/15/90) BY THE RfD/RfC WORK GROUP.									
IRIS 010906									
ISOPROPALIN 033820-53-0									
NOEL	15 MG/KG/DAY	RAT							
	ORAL: DIET	90 DAYS	BLOOD	HEMATOLOGICAL EFFECTS		1.5E-1		IRIS	005978
			ORGANS, UNSPECIFIED	ALTERED WEIGHTS		100			
LACTONITRILE 000078-97-7									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
005783									
LEAD 007439-92-1									
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									
CHRONIC [RfD] COMMENT: REFER TO IRIS									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
010447									
LEAD ALKYL									
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									
CHRONIC [RfD] COMMENT: REFER TO IRIS									
GENERAL COMMENT: DIMETHYLETHYL LEAD; METHYLTRIETHYL LEAD; TETRABUTYL LEAD; TETRAETHYL LEAD; TETRAMETHYL LEAD; TETRAPROPYL LEAD; TRIETHYL LEAD; TRIMETHYL LEAD; TRIMETHYLETHYL LEAD; TRIPROPYL LEAD									
010448									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
LINURON									
	LOAEL 0.625 MG/KG/DAY ORAL: DIET	DOG 2 YEARS	BLOOD	HEMATOLOGICAL EFFECTS			2E-3 300	IRIS	005990
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
MALATHION									
	NOEL 0.23 MG/KG/DAY ORAL: CAPSULE	HUMAN 47 DAYS	BLOOD	HEMATOLOGICAL EFFECTS			2E-2 10	IRIS	005991
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfC] COMMENT: UNDER REVIEW.									
MALEIC ANHYDRIDE									
	NOAEL 10 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	KIDNEY	LESIONS			1E-1 100	IRIS	005992
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
MALEIC HYDRAZIDE									
	LOAEL 500 MG/KG/DAY ORAL: DIET	RAT 28 MONTHS	KIDNEY	ALTERED FUNCTION			5E-1 1000	IRIS	005993
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
MALONONITRILE									
	LOAEL 0.21 MG/KG/DAY ORAL: GAVAGE	RAT 120 DAYS	LIVER SPLEEN	EFFECTS EFFECTS			2E-4 1000	2E-5 10000	005994

**HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
MANCOZEB		008018-01-7							
NOEL	2.9 MG/KG/DAY ORAL: DIET	RAT 90 WEEKS	THYROID	GOITROGENIC EFFECTS		3E-2 100		3E-2 100	005995
MANEB		012427-38-2							
NOEL	5 MG/KG/DAY ORAL: DIET	MONKEY 6 MONTHS	THYROID	INCREASED WEIGHT		5E-2 100		IRIS	005996
MANGANESE		007439-96-5							
NOEL	0.005 MG/KG/DAY ORAL: DRINKING WATER	HUMAN CHRONIC	CENTRAL NERVOUS SYSTEM	EFFECTS		5E-3 1		IRIS	010850
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL WATER RfD WAS ADOPTED AS THE SUBCHRONIC ORAL WATER [RfD]. SEE IRIS FOR SPECIFIC DIETARY INFORMATION.									
NOEL	0.14 MG/KG/DAY ORAL: DIET	HUMAN CHRONIC	CENTRAL NERVOUS SYSTEM	EFFECTS		1.4E-1 1		IRIS	010851
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL FOOD RfD WAS ADOPTED AS THE SUBCHRONIC ORAL FOOD [RfD]. SEE IRIS FOR SPECIFIC DIETARY INFORMATION.									
SUBCHRONIC [RfC] COMMENT: A SUBCHRONIC [RfC] HAS NOT BEEN DERIVED FOR MANGANESE.								IRIS	010959
MEPHOSFOLAN		000950-10-7							
NOEL	0.09 MG/KG/DAY ORAL: DIET	RAT 17 WEEKS	LIVER KIDNEY BLOOD	ALTERED WEIGHT ALTERED WEIGHT DECREASED CHOLINESTERASE ACTIVITY		9E-4 100		9E-5 1000	005997
			ERYTHROCYTES	DECREASED CHOLINESTERASE ACTIVITY					
			BRAIN	DECREASED CHOLINESTERASE ACTIVITY					

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
MERCURY, ELEMENTAL VAPOR 007439-97-6									
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
MERCURY, INORGANIC 007439-97-6									
		RAT							
	ORAL: PARENTERAL		KIDNEY	EFFECTS		3E-4 1000		3E-4 1000	005800
CHRONIC [RfD] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
NOAEL	0.009 MG/CU M INHALATION:	HUMAN	NERVOUS SYSTEM	NEUROTOXICITY	3E-4 30		3E-4 30		010270
SUBCHRONIC [RfC] COMMENT: THIS VALUE IS SPECIFICALLY FOR ELEMENTAL MERCURY.									
CHRONIC [RfC] COMMENT: THIS VALUE IS SPECIFICALLY FOR ELEMENTAL MERCURY. UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
MERPHOS 000150-50-5									
NOEL	0.1 MG/KG/DAY ORAL: CAPSULE	HEN 3 MONTHS	NERVOUS SYSTEM NERVOUS SYSTEM WHOLE BODY	ATAXIA DELAYED NEUROTOXICITY DECREASED WEIGHT		3E-4 300		IRIS	005998
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (06/25/92) BY THE RfD/RfC WORK GROUP.									
SUBCHRONIC [RfD] CPMMENT: THE CHRONIC ORAL RfD WAS MODIFIED TO ESTIMATE THE SUBCHRONIC ORAL [RfD].									
MERPHOS OXIDE 000078-48-8									
NOEL	0.1 MG/KG/DAY ORAL: CAPSULE	HEN 3 MONTHS	NERVOUS SYSTEM NERVOUS SYSTEM WHOLE BODY	ATAXIA DELAYED NEUROTOXICITY DECREASED WEIGHT		3E-4 300		IRIS	005999
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (06/25/92) BY THE RfD/RfC WORK GROUP.									
SUBCHRONIC [RfD] CPMMENT: THE CHRONIC ORAL RfD WAS MODIFIED TO ESTIMATE THE SUBCHRONIC ORAL [RfD].									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
METHACRYLONITRILE									
NOAEL 3.2 PPM		DOG							
INHALATION:		90 DAYS	LIVER	INCREASED SGOT		1E-3		IRIS	005812
INTERMITTENT			LIVER	INCREASED SGPT		300			
			CENTRAL NERVOUS	LOSS OF HINDLIMB MOTOR CONTROL					
			SYSTEM						
			BRAIN	LESIONS					
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
METHANOL									
NOEL 500 MG/KG/DAY		RAT							
ORAL: GAVAGE		90 DAYS	BLOOD	INCREASED ALKALINE PHOSPHATASE		5E+0		IRIS	010271
			BLOOD	INCREASED SGPT		100			
			BRAIN	DECREASED WEIGHT					
METHOMYL									
NOEL 2.5 MG/KG/DAY		DOG							
ORAL: DIET		24 MONTHS	KIDNEY	LESIONS		2.5E-2		IRIS	005802
						100			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
METHOXYCHLOR									
NOEL 5.01 MG/KG/DAY		RABBIT							
ORAL: GAVAGE		13 DAYS	REPRODUCTION	LOSS OF LITTERS		5E-3		IRIS	010357
						1000			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (11/07/91) BY THE RfD/RfC WORK GROUP.									
								IRIS	010909

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	

## METHOXYETHANOL ACETATE, 2- 000110-49-6

010497

CHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)  
SUBCHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

## METHOXYETHANOL, 2- 000109-86-4

NOAEL 93 MG/CU M	RABBIT							
INHALATION:	13 WEEKS	TESTICLE	EFFECTS	2E-1		IRIS		010372
INTERMITTENT				100				

SUBCHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).  
CHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).

## METHYL ACETATE 000079-20-9

NOEL 1156 MG/KG/DAY	RAT							
ORAL: GAVAGE	90 DAYS	LIVER	INCREASED ALKALINE PHOSPHATASE	1E+1		1E+0		010002
		LIVER	INCREASED SGPT	100		1000		

CHRONIC [RfD] COMMENT: CALCULATED FROM DATA OBTAINED WITH METHANOL BY MULTIPLYING BY THE MOLECULAR WEIGHT RATIO (74.08/32.04).

## METHYL ACRYLATE 000096-33-3

010498

CHRONIC [RfD] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)  
GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

## METHYL CHLOROCARBONATE 000079-22-1

CHRONIC [RfD] COMMENT: WITHDRAWN FROM IRIS (05/01/89).  
GENERAL COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
METHYL ETHYL KETONE 000078-93-3									
NOAEL 1711 MG/KG/DAY	RAT								
ORAL: DRINKING	MULTI-	FETUS	DECREASED BIRTH WEIGHT		2E+0		IRIS	010853	
WATER	GENERATION				1000				
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS MODIFIED TO ESTIMATE THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: MULTI-GENERATION DEVELOPMENTAL STUDY PERFORMED WHT THE SURROGATE 2-BUTANOL, A METABOLITE OF METHYL ETHYL KETONE.									
NOAEL 1010 PPM	MOUSE								
INHALATION:	10 DAYS	FETUS	DECREASED BIRTH WEIGHT		1E+0		IRIS	010845	
INTERMITTENT					3000				
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
METHYL ETHYL KETONE PEROXIDE 001338-23-4									
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/22/93) BY THE RfD/RfC WORK GROUP.									010948
METHYL ISOBUTYL KETONE 000108-10-1									
NOAEL 250 MG/(KG-DAY)	RAT								
ORAL: GAVAGE	13 WEEKS	WHOLE BODY	LETHARGY		8E-1		8E-2	010949	
		LIVER	INCREASED RELATIVE WEIGHT IN FEMALES		300		3000		
		LIVER	INCREASED ABSOLUTE WEIGHT IN FEMALES						
		KIDNEY	INCREASED RELATIVE WEIGHT IN FEMALES						
		KIDNEY	INCREASED ABSOLUTE WEIGHT IN FEMALES						
		KIDNEY	INCREASED URINARY PROTEIN LEVELS IN FEMALES						
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfD] COMMENT: WITHDRAWN FROM IRIS (03/01/91), UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
METHYL ISOCYANATE 000624-83-9									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (12/18/90) BY THE RfD/RfC WORK GROUP.									010013

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

<u>CHEMICAL</u> LEVEL	<u>DOSE</u> ROUTE	<u>SPECIES</u> EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	<u>[RfC]</u> <u>(mg/cu m)</u> UF	<u>Subchronic</u> <u>[RfD]</u> <u>(mg/kg/day)</u> UF	<u>[RfC]</u> <u>(mg/cu m)</u> UF	<u>Chronic</u> <u>[RfD]</u> <u>(mg/kg/day)</u> UF	REFERENCE
METHYL MERCURY 022967-92-6									
LOAEL	0.003 MG HG/KG/DAY ORAL	HUMAN		CENTRAL NERVOUS EFFECTS SYSTEM		3E-4 10		IRIS	005547
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfD] COMMENT: THE ADMINISTERED DOSE WAS CALCULATED FROM 200 NG HG/ML OF BLOOD.									
METHYL METHACRYLATE 000080-62-6									
NOEL	7.5 MG/KG/DAY ORAL: WATER	RAT 24 MONTHS	KIDNEY	INCREASED RELATIVE WEIGHT		8E-2 100		8E-2 100	010014
METHYL PARATHION 000298-00-0									
NOAEL	2.5 PPM ORAL: DIET	RAT 90 DAYS	ERYTHROCYTES	CHOLINESTERASE INHIBITION		2E-3 100		IRIS	010015 010846
METHYL STYRENE (MIXED ISOMERS) 025013-15-4									
CHRONIC [RfD] COMMENT: UNDER REVIEW. ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY) GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									010500
METHYL STYRENE, ALPHA 000098-83-9									
GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									010499



HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
METHYL-4-CHLOROPHENOXY) BUTYRIC ACID, 4-(2- 000094-81-5									
NOEL	12 MG/KG/DAY ORAL: DIET	RAT 13 WEEKS	LIVER KIDNEY	EFFECTS EFFECTS		1E-1 100		IRIS	010008
	ORAL: DIET	DOG 13 WEEKS	LIVER KIDNEY	EFFECTS EFFECTS					
METHYL-4-CHLOROPHENOXY) PROPIONIC ACID, 2-(2- 000093-65-2									
NOEL	3 MG/KG/DAY ORAL: DIET	RAT 90 DAYS	KIDNEY	ALTERED WEIGHT		1E-2 300		IRIS	010009
METHYL-4-CHLOROPHENOXYACETIC ACID, 2- 000094-74-6									
NOEL	0.15 MG/KG/DAY ORAL: DIET	DOG 52 WEEKS	KIDNEY LIVER	EFFECTS EFFECTS		5E-4 300		IRIS	010007
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
METHYLCYCLOHEXANE 000108-87-2									
NOEL	287 MG/CU M INHALATION: INTERMITTENT	RAT 1 YEAR	KIDNEY KIDNEY	MINERALIZATION PAPILLARY HYPERPLASIA	3E+0 100		3E+0 100		010431
METHYLENE BROMIDE 000074-95-3									
GENERAL COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
									010501

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	Chronic [RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	REFERENCE
METHYLENE CHLORIDE / (DICHLOROMETHANE)					000075-09-2				
NOAEL	5.85 MG/KG/DAY ORAL: DRINKING WATER	RAT 24 MONTHS	LIVER	TOXICITY		6E-2 100		IRIS	005553
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
NOAEL	694.8 MG/CU M INHALATION: INTERMITTENT	RAT 2 YEARS	LIVER	TOXICITY	3E+0 100		3E+0 100		005552
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
METHYLENE-BIS(2-CHLOROANILINE), 4,4'-					000101-14-4				
LOAEL	7.3 MG/KG/DAY ORAL	DOG 9 YEARS	LIVER BLADDER	EFFECTS EFFECTS		7E-4 10000		7E-4 10000	010413
010933									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE 02/10/93) BY THE RfD/RfC WORK GROUP.									
METHYLENEDIPHENYL ISOCYANATE, 4,4- / (DIPEHNYLMETHANE DIISOCYANATE)					000101-68-8				
NOAEL	0.2 MG/CU M INHALATION: INTERMITTENT	RAT 24 MONTHS	NASAL CAVITY	LESIONS	2E-5 300		2E-5 300		010449
CHRONIC [RfC] COMMENT: UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
METOLACHLOR		051218-45-2							
NOAEL	300 PPM ORAL: DIET	RAT 2 YEARS	WHOLE BODY	DECREASED WEIGHT GAIN		1.5E-1 100		1.5E-1 100	010950
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUCHRONIC ORAL [RfD].									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
METRIBUZIN									
		021087-64-9							
	NOEL 100 PPM	DOG							
	ORAL: DIET	2 YEARS	LIVER	EFFECTS		2.5E-2		IRIS	010928
			KIDNEY	EFFECTS		100			
			WHOLE BODY	MORTALITY					
			WHOLE BODY	DECREASED WEIGHT					
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
MIREX									
		002385-85-5							
	NOEL 0.07 MG/KG/DAY	RAT							
	ORAL: DIET	2 YEARS	LIVER	CYTOMEGALY		2E-4		IRIS	010841
			LIVER	FATTY METAMORPHOSIS		300			
			LIVER	ANGIECTASIS					
			THYROID	CYSTIC FOLLICLES					
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
MOLINATE									
		002212-67-1							
	NOEL 0.2 MG/KG/DAY	RAT							
	ORAL: GAVAGE		REPRODUCTIVE	TOXICITY		2E-3		IRIS	010017
			SYSTEM			100			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: BASED ON A REPRODUCTION STUDY.									
MOLYBDENUM									
		007439-98-7							
	LOEL 0.14 MG/KG/DAY	HUMAN							
	ORAL: WATER,		URINE	INCREASED URIC ACID		5E-3		IRIS	010489
	DIET		JOINTS	PAIN, SWELLING		30			
			BLOOD	DECREASED COPPER LEVELS					
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE	
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]		
					UF	(mg/kg/day)	UF	(mg/kg/day)		
MONOCHLORAMINE 010599-90-3										
NOAEL 9.5 MG/KG/DAY	RAT									
ORAL: DRINKING	2 YEARS		WHOLE BODY	WEIGHT CHANGES		1E-1		IRIS	010517	
WATER			LIVER	WEIGHT CHANGES		100				
			KIDNEY	WEIGHT CHANGES						
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].										
NAPHTHALENE 000091-20-3										
CHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.										
NAPHTHOQUINONE, 1,4- 000130-15-4										
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010020	
NICKEL (METALLIC) 007440-02-0										
NOAEL 100 PPM	RAT									
ORAL: DIET	2 YEARS		WHOLE BODY	DECREASED WEIGHT		2E-2		IRIS	005579	
			ORGANS, MAJOR	DECREASED WEIGHT		300				
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].										
NICKEL CYANIDE 000557-19-7										
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/20/93) BY THE RfD/RfC WORK GROUP.									010953	
NICOTINONITRILE 000100-54-9										
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005584	
NITRIC OXIDE 010102-43-9										
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.										010451

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
NITRITE		014797-65-0							
NOEL	10 PPM	HUMAN							
	ORAL: WATER		BLOOD	METHEMOGLOBINEMIA		1E-1 10		IRIS	010021
SUBCHRONIC [RfD] COMMENT: THIS VALUE IS BASED ON NITRATE (NITROGEN) DATA FROM THE MOST SENSITIVE HUMAN POPULATION (INFANTS). THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: THIS VALUE IS BASED ON NITRATE (NITROGEN) DATA FROM THE MOST SENSITIVE HUMAN POPULATION (INFANTS).									
NITROANILINE, 2-		000088-74-4							010936
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RFD] IS CONSIDERED NOT VERIFIABLE (06/23/92) BY THE RFD/RFC WORK GROUP.									
LOAEL	9.8 MG/CU M	RAT							
	INHALATION: INTERMITTENT	4 WEEKS	BLOOD	HEMATOLOGICAL EFFECTS	2E-3 1000		2E-4 10000		010935
NITROANILINE, M-		000099-09-2							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
									010400
NITROANILINE, P-		000100-01-6							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
									010024

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
NITROBENZENE		000098-95-3							
LOAEL 25 MG/CU M	MOUSE								
INHALATION: INTERMITTENT	90 DAYS	BLOOD ADRENAL KIDNEY LIVER	HEMATOLOGICAL EFFECTS LESIONS LESIONS LESIONS			5E-3 1000		IRIS	005589
	RAT								
INHALATION: INTERMITTENT	90 DAYS	BLOOD ADRENAL KIDNEY LIVER	HEMATOLOGICAL EFFECTS LESIONS LESIONS LESIONS						
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).									
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS SUBCHRONIC AND CHRONICTOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfD] COMMENT: THE ORAL RfD, WHILE STILL AVAILABLE ON IRIS, IS BEING RECONSIDERED BY THE RfD WORKGROUP. BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
NITROFURANTOIN		000067-20-9							
NOAEL 300 PPM	MOUSE								
ORAL: DIET	13 WEEKS	TESTIS	DAMAGE			7E-1 100		7E-2 1000	005593
NITROGEN DIOXIDE		010102-44-0							
NOEL 10 PPM	HUMAN								
ORAL: WATER		BLOOD	METHEMOGLOBINEMIA			1E+0 1		IRIS	010402
SUBCHRONIC [RfD] COMMENT: THIS VALUE IS BASED ON NITRATE (NITROGEN) DATA FROM THE MOST SENSITIVE HUMAN POPULATION (INFANTS). THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: THIS VALUE IS BASED ON NITRATE (NITROGEN) DATA FROM THE MOST SENSITIVE HUMAN POPULATION (INFANTS).									
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									
010912									
NITROGEN OXIDES									
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									
010170									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
NITROMETHANE 000075-52-5									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010026
NITROPHENOLS									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005594
NITROPROPANE, 2- 000079-46-9									
LOAEL 78 MG/CU M		RAT							
INHALATION:		22 MONTHS	LIVER	LESIONS	2E-2		IRIS		010374
INTERMITTENT					1000				
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
NITROSODIPHENYLAMINE, P- 000156-10-5									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010027
NITROTOLUENE, M- 000099-08-1									
LOAEL 200 MG/KG/DAY		RAT							
ORAL: GAVAGE		6 MONTHS	SPLEEN	LESIONS		1E-1		1E-2	010029
						1000		10000	
SUBCHRONIC [RfD] COMMENT: BASED ON DATA OBTAINED WITH O-NITROTOLUENE.									
CHRONIC [RfD] COMMENT: BASED ON DATA OBTAINED WITH O-NITROTOLUENE.									
NITROTOLUENE, O- 000088-72-2									
LOAEL 200 MG/KG/DAY		RAT							
ORAL: GAVAGE		6 MONTHS	SPLEEN	LESIONS		1E-1		1E-2	010028
						1000		10000	

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
NITROTOLUENE, P-		000099-99-0							
LOAEL	200 MG/KG/DAY ORAL: GAVAGE	RAT 6 MONTHS	SPLEEN	LESIONS		1E-1 1000		1E-2 10000	010030
SUBCHRONIC [RfD] COMMENT: BASED ON DATA OBTAINED WITH O-NITROTOLUENE. CHRONIC [RfD] COMMENT: BASED ON DATA OBTAINED WITH O-NITROTOLUENE.									
OCTABROMODIPHENYL ETHER		032536-52-0							
NOAEL	2.5 MG/KG/DAY ORAL: GAVAGE	RAT 90 DAYS	LIVER	HISTOLOGICAL CHANGES		3E-2 100		IRIS	010032
OCTAMETHYLPYROPHOSPHORAMIDE		000152-16-9							
NOAEL	0.02 MG/KG/DAY ORAL	HUMAN AT LEAST 30 DAYS	BLOOD	DECREASED CHOLINESTERASE ACTIVITY		2E-3 10		2E-3 10	010031
OSMIUM TETROXIDE		020816-12-0							
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/22/93) BY THE RfD/RfC WORK GROUP.									010954
OZONE		010028-15-6							
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									010171
PARALDEHYDE		000123-63-7							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									010033
PARATHION		000056-38-2							
NOAEL	0.064 MG/KG/DAY ORAL	HUMAN	CHOLINESTERASE	DECREASED CHOLINESTERASE ACTIVITY		6E-3 10		6E-3 10	005598
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
PARTICULATE MATTER									
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									010034
PEBULATE									
NOEL	5 MG/KG/DAY	RAT							
	ORAL: DIET	SUBCHRONIC	BLOOD	INCREASED CLOTTING TIME		5E-2 100		5E-2 100	010036
PENDIMETHALIN									
NOEL	12.5 MG/KG/DAY	DOG							
	ORAL: CAPSULE	2 YEARS	LIVER	EFFECTS		4E-2 300		IRIS	010037
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
PENTABROMODIPHENYL ETHER									
NOEL	1.8 MG/KG/DAY	RAT							
	ORAL: GAVAGE	90 DAYS	LIVER	ALTERED ENZYME ACTIVITIES		2E-2 100		IRIS	010038
PENTACHLOROBENZENE									
LOEL	8.3 MG/KG/DAY	RAT							
	ORAL: DIET	100 DAYS	LIVER KIDNEY	TOXICITY TOXICITY		8E-3 1000		IRIS	010039
PENTACHLOROCYCLOPENTADIENE									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									005302
PENTACHLORONITROBENZENE									
NOEL	0.75 MG/KG/DAY	DOG							
	ORAL: DIET	2 YEARS	LIVER	TOXICITY		3E-3 300		IRIS	010040
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
PENTACHLOROPHENOL 000087-86-5									
NOEL	3 MG/KG/DAY ORAL: GAVAGE	RAT 62 DAYS	FETUS	FETOTOXICITY		3E-2 100		IRIS	005600
SUBCHRONIC [RfD] COMMENT: BASED ON A TERATOLOGY STUDY WITH EXPOSURE 62 DAYS PRIOR TO MATING AND THROUGHOUT GESTATION AND LACTATION. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
PENTACHLOROPROPENE, 1,1,2,3,3,- 001600-37-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010041
PENTANE, N- 000109-66-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005603
PHENANTHRENE 000085-01-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005604
PHENOL 000108-95-2									
NOEL	60 MG/KG/DAY ORAL: GAVAGE	RAT	FETUS	DECREASED WEIGHT		6E-1 100		IRIS	005824
SUBCHRONIC [RfD] COMMENT: BASED ON A DEVELOPMENTAL STUDY WITH EXPOSURES DURING DAYS 6-15 OF GESTATION. THE ORAL CHRONIC RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CHRONIC [RfD] COMMENT: BASED ON A DEVELOPMENTAL STUDY WITH EXPOSURES DURING DAYS 6-15 OF GESTATION.									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (02/22/90) BY THE RfD/RfC WORK GROUP.								IRIS	010913
PHENYLENEDIAMINE, M- 000108-45-2									
NOEL	6 MG/KG/DAY ORAL	RAT 90 DAYS	LIVER	LESIONS		6E-2 100		IRIS	010044

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
PHENYLENEDIAMINE, O-		000095-54-5							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT. ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									010042
PHENYLENEDIAMINE, P-		000106-50-3							
NOAEL 18.7 MG/KG/DAY		RAT							
ORAL: DIET		2 YEARS	WHOLE BODY	EFFECTS				1.9E-1 100	010043
PHENYLMERCURIC ACETATE		000062-38-4							
NOAEL 0.0084 MG/KG/DAY		RAT							
ORAL: DIET		2 YEARS	KIDNEY	DAMAGE		8E-5 100		IRIS	010277
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. CALCULATED BY ANALOGY TO MERCURY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO MERCURY BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
PHORATE		000298-02-2							
NOAEL 0.033 MG/KG/DAY		RAT							
ORAL: DIET		13 WEEKS	CHOLINESTERASE	INHIBITION		2E-4 200		2E-4 200	010403
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
PHOSGENE		000075-44-5							
								IRIS	010045
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (10/01/90) BY THE RfD/RfC WORK GROUP.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
PHOSPHINE									
NOEL	0.026 MG/KG/DAY ORAL: DIET	RAT 2 YEARS				3E-4 100		IRIS	010174
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
NOAEL	1.4 MG/CU M INHALATION: INTERMITTENT	RAT 24 WKS	KIDNEY	RENAL EFFECTS	3E-4 1000		3E-5 10000		010173
PHOSPHORUS, WHITE									
								IRIS	010452
GENERAL COMMENT: FORMERLY LISTED AS PHOSPHORUS (INORGANIC COMPOUNDS).									
PHOTOCHEMICAL OXIDANTS									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									010172
PHTHALIC ACID, M-									
		000121-91-5							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010047
PHTHALIC ACID, O-									
		000088-99-3							
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010046
PHTHALIC ACID, P-									
NOEL	142 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	BLADDER	HYPERPLASIA		1E+0 100		1E+0 100	010048

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic	Subchronic	Chronic	Chronic	REFERENCE
					[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	[RfD] (mg/kg/day) UF	
PHTHALIC ANHYDRIDE 000085-44-9									
LOAEL	1562 MG/KG/DAY ORAL: DIET	MOUSE 104 WEEKS	LUNG KIDNEY	HISTOPATHOLOGY HISTOPATHOLOGY		2E+0 1000		IRIS	010049
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
LOAEL	0.1 MG/CU M INHALATION: INTERMITTENT	HUMAN 12 YEARS	NOSE LUNGS	RHINITIS BRONCHITIS	1.2E-1 300		1.2E-1 300		010847
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
POLYBROMINATED BIPHENYLS									
LOAEL	0.07 MG/KG/DAY ORAL: GAVAGE	RAT 25 WEEKS	LIVER LIVER	INCREASED WEIGHT LESIONS		7E-5 1000		7E-6 10000	010050
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
POTASSIUM CYANIDE 000151-50-8									
NOAEL	27 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY THYROID NERVE	DECREASED WEIGHT EFFECTS MYELIN DEGENERATION		5E-2 500		IRIS	010278
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE ORAL CHRONIC RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	UF	UF	UF	
POTASSIUM SILVER CYANIDE 000506-61-6									
NOAEL	82.7 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY THYROID NERVE	DECREASED WEIGHT EFFECTS MYELIN DEGENERATION		2E-1 500		IRIS	010279
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE ORAL CHRONIC RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
PROFLURALIN 026399-36-0									
NOEL	3 MG/KG/DAY ORAL: DIET	RAT SUBCHRONIC		NONE OBSERVED		6E-3 500		6E-3 500	010051
PRONAMIDE 023950-58-5									
NOEL	7.5 MG/KG/DAY ORAL: DIET	DOG 2 YEARS		NONE OBSERVED		7.5E-2 100		IRIS	010280
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
PROPACHLOR 001918-16-7									
NOEL	13.3 MG/KG/DAY ORAL: DIET	RAT 90 DAYS	WHOLE BODY	DECREASED WEIGHT GAIN		1.3E-1 100		IRIS	010175
PROPAZINE 000139-40-2									
NOEL	5 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY	DECREASED WEIGHT GAIN		2E-2 300		IRIS	010052
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
PROPIONITRILE 000107-12-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
									010053

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
PROPYL ALCOHOL, N- 000071-23-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005627
PROPYLENE GLYCOL 000057-55-6									
NOEL	50000 PPM ORAL: DIET	DOG 2 YEARS	ERYTHROCYTES BLOOD BLOOD	DECREASED COUNT DECREASED HEMATOCRIT DECREASED HEMOGLOBIN				2E+1 100	005631
NOEL	6 % ORAL: DIET	RAT 20 WEEKS	KIDNEY	LESIONS		3E+1 100			005629
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (04/25/91) BY THE RfD/RfC WORK GROUP.									010914
PROPYLENE GLYCOL MONOETHYL ETHER 001569-02-4									
NOEL	680 MG/KG/DAY ORAL: DRINKING WATER	RAT 30 DAYS	WHOLE BODY	DECREASED WEIGHT GAIN		7E+0 100		7E-1 1000	005488
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (04/25/91) BY THE RfD/RfC WORK GROUP.									010915
PROPYLENE GLYCOL MONOMETHYL ETHER 000107-98-2									
NOEL	947 MG/KG/DAY ORAL: GAVAGE	RAT 35 DAYS	LIVER KIDNEY	HISTOPATHOLOGY HISTOPATHOLOGY		7E+0 100		7E-1 1000	005486
NOAEL	1000 PPM INHALATION: INTERMITTENT	RAT, RABBIT 13 WEEKS	CENTRAL NERVOUS SYSTEM	EFFECTS	2E+1 30		IRIS		010276

**HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)**

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	UF	UF	UF	
PROPYLENE OXIDE									
	LOAEL 71 MG/CU M	RAT							
	INHALATION:	2 YEARS	EPITHELIUM	UNSPECIFIED					
	INTERMITTENT				3E-2		IRIS		010375
					100				
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
PYRENE									
	NOAEL 75 MG/KG/DAY	MOUSE							
	ORAL: GAVAGE	13 WKS	KIDNEY	EFFECTS					
						3E-1	IRIS		010176
						300			
PYRIDINE									
	NOAEL 1 MG/KG/DAY	RAT							
	ORAL: GAVAGE	90 DAYS	LIVER	INCREASED WEIGHT					
			LIVER	INCREASED RELATIVE WEIGHT		1E-2	IRIS		010055
						100			
RDX / (CYCLONITE)									
	NOEL 0.3 MG/KG/DAY	RAT							
	ORAL	105 WEEKS	PROSTATE	INFLAMMATION					
			PROSTATE	HEMOSIDEROSIS		3E-3	IRIS		010056
						100			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
RONNEL									
	NOAEL 5 MG/KG/DAY	RAT							
	ORAL: DIET	2 YEARS	LIVER	EFFECTS					
						5E-2	5E-2		010057
						100	100		



HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

<u>CHEMICAL</u> LEVEL	<u>DOSE</u> ROUTE	<u>SPECIES</u> EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC] (mg/cu m) UF	Subchronic [RfD] (mg/kg/day) UF	[RfC] (mg/cu m) UF	Chronic [RfD] (mg/kg/day) UF	REFERENCE
SELENIOS ACID 007783-00-8									
NOAEL 0.046 MG/KG/DAY ORAL: DIET	HUMAN	WHOLE BODY	SELENOSIS, CLINICAL			5E-3 3		IRIS	010504
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
SELENIUM 007782-49-2									
NOAEL 0.853 MG/DAY ORAL: DIET	HUMAN	WHOLE BODY	SELENOSIS, CLINICAL			5E-3 3		IRIS	010404
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
SELENOUREA 000630-10-4									
NOAEL 0.072 MG/KG/DAY ORAL: DIET	HUMAN	WHOLE BODY	SELENOSIS			5E-3 15		5E-3 15	010473
CHRONIC [RfD] COMMENT: WITHDRAWN FROM IRIS (05/01/91). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
SILVER 007440-22-4									
LOAEL 0.014 MG/KG/DAY IV	HUMAN 2-9 YEARS	SKIN	ARGYRIA			5E-3 3		IRIS	010453
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: BASED ON A TOTAL IV DOSE OF 1 GRAM.									

HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
SILVER CYANIDE		000506-64-9							
NOAEL	55.7 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY THYROID NERVE	DECREASED WEIGHT EFFECTS MYELIN DEGENERATION		1E-1 500		IRIS	010283
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE ORAL CHRONIC RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
SIMAZINE		000122-34-9							
NOAEL	0.52 MG/(KG-DAY) ORAL: DIET	RAT 2 YEARS	WHOLE BODY BLOOD	DECREASED WEIGHT GAIN HEMATOLOGICAL EFFECTS		5E-3 100		IRIS	010955
SUBCHRONIC [RfD] COMMENT: THE ORAL CHRONIC RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY									
SODIUM CYANIDE		000143-33-9							
NOAEL	20.4 MG/KG/DAY ORAL: DIET	RAT	CENTRAL NERVOUS SYSTEM	EFFECTS		4E-2 500		IRIS	005640
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT. THE ORAL CHRONIC RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
SODIUM DIETHYLDITHIOCARBAMATE		000148-18-5							
NOEL	30 MG/KG/DAY ORAL	RAT 90 DAYS	EYE WHOLE BODY	CATARACTS DECREASED WEIGHT		3E-1 100		IRIS	005644
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
SODIUM METAVANADATE		013718-26-8							
NOAEL	10 PPM ORAL: DRINKING WATER	RAT 3 MONTHS	KIDNEY	IMPAIRED FUNCTION		1E-2 100		1E-3 1000	005735

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE	
					[RfD]	[RfC]	[RfD]		
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF		(mg/kg/day) UF
STRONTIUM, STABLE									
	NOAEL 190 MG/KG/DAY	RAT, YOUNG							
	ORAL: DRINKING	20 DAYS	BONE	RACHITIC CHANGES		6E-1	IRIS	010842	
	WATER					300			
	SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].								
STRYCHNINE									
	LOAEL 2.5 MG/KG/DAY	RAT							
	ORAL: GAVAGE	28 DAYS	UNSPECIFIED	TOXICITY		3E-3	IRIS	010285	
			UNSPECIFIED	HISTOPATHOLOGY		1000			
	GENERAL COMMENT: THE LOAEL IS ALSO THE FEL.								
STYRENE									
							IRIS	010059	
	SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.								
	NOAEL 22 PPM	HUMAN							
	INHALATION:		CENTRAL	EFFECTS	3E+0		IRIS	010511	
	OCCUPATIONAL		NERVOUS SYSTEM		10				
	CHRONIC [RfC] COMMENT: THE MEAN DURATION OF EXPOSURE FOR 50 WORKERS WAS 8.6 YEARS. AIR EXPOSURE CONCENTRATIONS WERE ESTIMATED FROM THE SUMMATION OF THE PRINCIPLE URINARY METABOLITES OF STYRENE, MANDELIC ACID AND PHENYLGLYOXYLIC ACID. SEE IRIS FOR MORE INFORMATION.								
	GENERAL COMMENT: ALSO SEE TABLE 3: CARCINOGENICITY.								
SUCCINONITRILE									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005585
SULFUR DIOXIDE									
	CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.								010505

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
SULFUR OXIDES									
CHRONIC [RfC] COMMENT: REFER TO APPENDIX A: TECHNICAL INFORMATION, SECTION V ON NATIONAL AMBIENT AIR QUALITY STANDARDS.									010035
SULFURIC ACID 007664-93-9									
NOAEL 0.066-0.098 MG/CU M HUMAN INHALATION			RESPIRATORY SYSTEM	RESPIRATORY EFFECTS					005647
CHRONIC [RfC] COMMENT: REPORTED EFFECTS OCCURRED AT PORTAL OF ENTRY. ESTIMATES OF MG/DAY REFERENCE DOSES ARE INAPPROPRIATE BECAUSE EFFECTS AT PORTAL OF ENTRY DEPEND ON CONCENTRATION IN AIR. AN ACCEPTABLE AIR CONCENTRATION OF 0.07 MG/CU M WAS ESTIMATED BY CARSON ET AL (1981) FROM AVAILABLE DATA.									
TEMEPHOS 003383-96-8									
NOAEL 200 PPM ORAL: DIET		RAT 99 DAYS				2E-1 100	2E-2 1000		010060
TERBUFOS 013071-79-9									
NOAEL 0.0025 MG/KG/DAY ORAL: DIET		DOG 6 MONTHS	CHOLINESTERASE	INHIBITION		2.5E-5 100	2.5E-5 100		010408
TEREPHTHALIC ACID 000100-21-0									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT.									010474
TETRACHLOROAZOXYBENZENE 021232-47-3									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010064
TETRACHLOROBENZENE, 1,2,4,5- 000095-94-3									
NOAEL 0.34 MG/KG/DAY ORAL: DIET		RAT 13 WEEKS	KIDNEY	LESIONS		3E-3 100	IRIS		010286

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE	
					(mg/cu m)	(RfD)	(RfC)		(RfD)
					UF	(mg/kg/day)	(mg/cu m)		(mg/kg/day)
					UF	UF	UF	UF	
TETRACHLOROCYCLOPENTADIENE 000695-77-2									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005303
TETRACHLOROETHANE, 1,1,1,2- 000630-20-6									
LOAEL	89.3 MG/KG/DAY	RAT							
	ORAL: GAVAGE	103 WEEKS	LIVER	LESIONS		3E-2		IRIS	010407
			KIDNEY	LESIONS		3000			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
TETRACHLOROETHYLENE 000127-18-4									
NOAEL	14 MG/KG/DAY	MOUSE							
	ORAL	6 WEEKS	LIVER	HEPATOTOXICITY		1E-1		IRIS	005650
						100			
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
TETRACHLOROHYDRAZOBENZENE 071753-42-9									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010065
TETRACHLOROPHENOL, 2,3,4,5- 004901-51-3									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005324
TETRACHLOROPHENOL, 2,3,4,6- 000058-90-2									
NOAEL	25 MG/KG/DAY	RAT							
	ORAL: GAVAGE	90 DAYS	LIVER	INCREASED WEIGHT		3E-1		IRIS	005323
			LIVER	CENTRIOBULAR HYPERTROPHY		100			
TETRACHLOROPHENOL, 2,3,5,6- 000935-95-5									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005325
TETRACHLOROPROPENE, 1,1,2,3- 010436-39-2									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010066

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE	
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF		
TETRACHLOROVINPHOS / (STIROPHOS)				000961-11-5						
NOEL	3.1 MG/KG/DAY ORAL: DIET	DOG 2 YEARS	LIVER KIDNEY WHOLE BODY	INCREASED WEIGHT INCREASED WEIGHT		3E-2 100		IRIS	010067	
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.										
TETRAETHYL DITHIOPYROPHOSPHATE				003689-24-5						
NOEL	0.5 MG/KG/DAY ORAL: DIET	RAT 3 MONTHS	ERYTHROCYTES BLOOD	DECREASED CHOLINESTERASE ACTIVITY DECREASED CHOLINESTERASE ACTIVITY		5E-3 100		IRIS	010287	
THALLIC OXIDE				001314-32-5						
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/22/93) BY THE RfD/RfC WORK GROUP.										010956
THALLIUM (I) ACETATE				000563-68-8						
NOEL	0.26 MG/KG/DAY ORAL	RAT 90 DAYS	LIVER BLOOD HAIR	INCREASED SGOT INCREASED SERUM LDH ALOPECIA		9E-4 300		IRIS	005664	
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES. CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES.										
THALLIUM (I) CARBONATE				006533-73-9						
NOEL	0.23 MG/KG/DAY ORAL	RAT 90 DAYS	LIVER BLOOD HAIR	INCREASED SGOT INCREASED SERUM LDH ALOPECIA		8E-4 300		IRIS	005668	
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES. CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES.										

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
THALLIUM (I) CHLORIDE 007791-12-0									
NOAEL	0.23 MG/KG/DAY ORAL	RAT 90 DAYS	LIVER BLOOD HAIR	INCREASED SGOT INCREASED SERUM LDH ALOPECIA		8E-4 300		IRIS	005672
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES. CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES.									
THALLIUM (I) NITRATE 010102-45-1									
NOAEL	0.26 MG/KG/DAY ORAL	RAT 90 DAYS	LIVER BLOOD HAIR	INCREASED SGOT INCREASED SERUM LDH ALOPECIA		9E-4 300		IRIS	005676
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES. CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO THALLIUM (I) SULFATE BY CORRECTING FOR MOLECULAR WEIGHT DIFFERENCES.									
THALLIUM (I) SULFATE 007446-18-6									
NOAEL	0.25 MG/KG/DAY ORAL	RAT 90 DAYS	LIVER BLOOD HAIR	INCREASED SGOT INCREASED SERUM LDH ALOPECIA		8E-4 300		IRIS	005682
THALLIUM (IN SOLUBLE SALTS)									
CHRONIC [RfD] COMMENT: REFER TO IRIS FOR OTHER THALLIUM SALTS.									010458
THALLIUM SELENITE 012039-52-0									
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS WITHDRAWN FROM IRIS (08/01/93). THE CHRONIC ORAL [RfD] IS CONSIDERED NOT VERIFIABLE (07/22/93) BY THE RfD/RfC WORK GROUP.									010957

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	UF	UF	UF	
THIOCYANOMETHYLTHIO)BENZOTHAZOLE, 2-( 021564-17-0									
NOEL	25 MG/KG/DAY ORAL: DIET	RAT SUBCHRONIC	STOMACH	LESIONS		3E-1 100		3E-2 1000	010068
SUBCHRONIC [RfD] COMMENT: BASED ON CONFIDENTIAL BUSINESS INFORMATION DATA									
CHRONIC [RfD] COMMENT: BASED ON CONFIDENTIAL BUSINESS INFORMATION DATA									
THIOFANOX 013196-18-4									
NOEL	0.025 MG/KG/DAY ORAL	DOG 8 DAYS	CHOLINESTERASE	DECREASED CHOLINESTERASE ACTIVITY		3E-4 100		3E-4 100	010069
SUBCHRONIC [RfD] COMMENT: BASED ON CONFIDENTIAL BUSINESS INFORMATION DATA.									
CHRONIC [RfD] COMMENT: BASED ON CONFIDENTIAL BUSINESS INFORMATION DATA.									
THIRAM 000137-26-8									
NOEL	0.61 MG/KG/DAY ORAL	FERRET 24 WEEKS	REPRODUCTION	IMPAIRED		6E-3 100		IRIS	010450
									010070
TIN AND COMPOUNDS									
NOEL	2000 PPM ORAL: DIET	RAT 2 YEARS	LIVER KIDNEY	LESIONS LESIONS		6E-1 100		6E-1 100	005688
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO STANNOUS CHLORIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO STANNOUS CHLORIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
TOLUENE									
	NOAEL 223 MG/KG/DAY ORAL: GAVAGE	RAT 13 WEEKS	LIVER KIDNEY	ALTERED WEIGHT ALTERED WEIGHT		2E+0 100		IRIS	010469
								IRIS	010844
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
TOLUENE-2,5-DIAMINE									
	NOAEL 56 MG/KG/DAY ORAL: DIET	RAT 78 WEEKS				6E-1 100		6E-1 100	010073
SUBCHRONIC [RfD] COMMENT: DETERMINED FROM DATA OBTAINED WITH THE SULFATE SALT.									
CHRONIC [RfD] COMMENT: DETERMINED FROM DATA OBTAINED WITH THE SULFATE SALT.									
TOLUENE-2,6-DIAMINE									
	NOAEL 16 MG/KG/DAY ORAL: DIET	RAT 2 YEARS				2E-1 100		2E-1 100	010074
SUBCHRONIC [RfD] COMMENT: DETERMINED FROM DATA OBTAINED WITH THE DIHYDROCHLORIDE.									
CHRONIC [RfD] COMMENT: DETERMINED FROM DATA OBTAINED WITH THE DIHYDROCHLORIDE.									
TOLUENEDIAMINE, 2,3-									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								010071
TOLUENEDIAMINE, 3,4-									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								010072
TOLUIDINE, M-									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								010075

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day) UF	(mg/kg/day) UF	UF	
TRIALATE		002303-17-5							
	NOAEL 1.275 MG/KG/DAY ORAL: DIET	DOG 24 MONTHS	SPLEEN LIVER	EFFECTS EFFECTS		1.3E-2 100		IRIS	010076
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
TRIBROMOBENZENE, 1,2,4-		000615-54-3							
	NOAEL 5 MG/KG/DAY ORAL: DIET	RAT 45 OR 90 DAYS	LIVER LIVER	ALTERED WEIGHT ENZYME INDUCTION		5E-2 100		IRIS	010077
TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-		000076-13-1							
	NOEL 2000 PPM INHALATION: INTERMITTENT	RAT 24 MONTHS	WHOLE BODY	DECREASED WEIGHT	3E+1 100	3E+0 100	3E+1 100	IRIS	010460 010376
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.2.									
TRICHLORO-2'-HYDROXYDIPHENYLETHER, 2,2,4'-		003380-34-5							
	NOEL 500 MG/KG/DAY ORAL	RAT 4 WEEKS	WHOLE BODY	DECREASED WEIGHT		4E+0 100			005492
TRICHLOROBENZENE, 1,2,4-		000120-82-1							
	NOAEL 100 PPM ORAL: DRINKING WATER	RAT	ADRENAL	INCREASED WEIGHT		1E-2 1000		IRIS	010506
SUBCHRONIC [RfD] COMMENT: BASED ON A MULTIGENERATION REPRODUCTION STUDY.									
	NOAEL 104 PPM INHALATION	RAT, RABBIT, DOG, MONKEY 6 AND 26 WEEKS	LIVER	NON-ADVERSE WEIGHT CHANGES	2E+0 100		2E-1 1000		010958

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
TRICHLOROCYCLOPENTADIENE									
									005304
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
TRICHLOROETHANE, 1,1,1-									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
TRICHLOROETHANE, 1,1,2-									
NOAEL 3.9 MG/KG/DAY		MOUSE							
ORAL: DRINKING		90 DAYS	BLOOD	CLINICAL CHEMISTRY ALTERATIONS		4E-2		IRIS	005702
WATER						100			
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
TRICHLOROFLUOROMETHANE									
								IRIS	005502
LOAEL 1000 MG/KG/DAY		RAT							
ORAL		6 WEEKS	WHOLE BODY	INCREASED MORTALITY		7E-1			005500
						1000			
SUBCHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
CHRONIC [RfC] COMMENT: ALSO SEE HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)									
TRICHLOROPHENOL, 2,3,4-									
									005330
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
TRICHLOROPHENOL, 2,3,5-									
									005331
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									
TRICHLOROPHENOL, 2,3,6-									
									005332
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
TRICHLOROPHENOL, 2,4,5- 000095-95-4									
NOEL	1000 PPM	RAT							
	ORAL: DIET	98 DAYS	LIVER KIDNEY	HEPATOTOXICITY EFFECTS		1E+0 100		IRIS	005329
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (04/24/91) BY THE RfD/RfC WORK GROUP.									IRIS 010919
TRICHLOROPHENOL, 2,4,6- 000088-06-2									
CHRONIC RfC COMMENT: THE CHRONIC INHALATION RfC IS CONSIDERED NOT VERIFIABLE (04/24/91) BY THE RfD/RfC WORK GROUP.									IRIS 010461
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
TRICHLOROPHENOL, 3,4,5- 000609-19-8									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005333
TRICHLOROPHENOXY) PROPIONIC ACID, 2(2,4,5- 000093-72-1									
NOEL	0.75 MG/KG/DAY	DOG							
	ORAL: DIET	2 YEARS	LIVER	HISTOPATHOLOGY		8E-3 100		IRIS	010284
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
TRICHLOROPHENOXYACETIC ACID, 2,4,5- 000093-76-5									
NOEL	10 MG/KG/DAY	RAT						IRIS	010178
	ORAL: DIET	90 DAYS	KIDNEY LIVER	WEIGHT EFFECTS WEIGHT EFFECTS		1E-1 100			010179
TRICHLOROPROPANE, 1,1,1- 007789-89-1									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									005705

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
TRICHLOROPROPANE, 1,1,2- 000598-77-6									
NOEL	100 MG/L	RAT							
	ORAL: DRINKING	13 WEEKS	LIVER	HISTOPATHOLOGY		5E-2		IRIS	005708
	WATER		KIDNEY	HISTOPATHOLOGY		300			
			THYROID	HISTOPATHOLOGY					
TRICHLOROPROPANE, 1,2,2- 003175-23-3									
	GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005706
TRICHLOROPROPANE, 1,2,3- 000096-18-4									
NOAEL	8 MG/KG/DAY	RAT							
	ORAL	120 DAYS	WHOLE BODY	TOXICITY		6E-2		IRIS	005714
			LIVER	LESIONS		100			
			KIDNEY	LESIONS					
			ERYTHROCYTES	DECREASED COUNT					
			BLOOD	DECREASED HEMATOCRIT					
			BLOOD	DECREASED HEMOGLOBIN					
	GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.								
TRICHLOROPROPENE, 1,2,3- 000096-19-5									
NOEL	18 MG/CU M	DOG							
	INHALATION:	66 WEEKS	EYE	IRRITATION		5E-3		5E-3	010078
	INTERMITTENT					100		100	
	SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5.								
	CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5.								
TRICHLOROTOLUENE, 2,3,6- 002077-46-5									
LOAEL	0.5 PPM	RAT							
	ORAL: DIET	28 DAYS	LIVER	LESIONS		5E-5			005335
			KIDNEY	LESIONS		1000			
			THYROID	LESIONS					

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE	
					(mg/cu m)	[RfD]	[RfC]		[RfD]
					UF	(mg/kg/day) UF	(mg/cu m) UF		(mg/kg/day) UF
TRICHLOROTOLUENE, ALPHA,2,6- 002014-83-7									
LOAEL 0.5 PPM		RAT							
ORAL: DIET		28 DAYS	LIVER	LESIONS		5E-5		005339	
			KIDNEY	LESIONS		1000			
			THYROID	LESIONS					
TRIFLURALIN 001582-09-8									
NOEL 0.75 MG/KG/DAY		DOG							
ORAL: DIET		12 MONTHS	LIVER	INCREASED WEIGHT		7.5E-3	IRIS	010080	
			BLOOD	METHEMOGLOBINEMIA		100			
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
TRIMETHYLBENZENES									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								005727	
TRINITROBENZENE, 1,3,5- 000099-35-4									
NOAEL 0.51 MG/KG/DAY		RAT							
ORAL: WATER		16 WEEKS	SPLEEN	INCREASED WEIGHT		5E-4	IRIS	010081	
						1000			
SUBCHRONIC [RfD] COMMENT: CALCULATED FROM DATA OBTAINED WITH 1,3-DINITROBENZENE.									
CHRONIC [RfD] COMMENT: CALCULATED FROM DATA OBTAINED WITH 1,3-DINITROBENZENE.									
TRINITROPHENOLS									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT								010082	
TRINITROPHENYLMETHYLNITRAMINE 000479-45-8									
LOAEL 125 MG/KG/DAY		RABBIT							
ORAL: GAVAGE		9 MONTHS	LIVER	HISTOPATHOLOGICAL EFFECTS		1E-1	1E-2	010377	
			KIDNEY	HISTOPATHOLOGICAL EFFECTS		1000	10000		
			SPLEEN	HISTOPATHOLOGICAL EFFECTS					

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	UF	UF	UF	
TRINITROTOLUENE, 2,4,6-									
	LOAEL 0.5 MG/KG/DAY ORAL: GAVAGE	DOG	LIVER	EFFECTS		5E-4 1000		IRIS	010416
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD]. GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
URANIUM, SOLUBLE SALTS									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
VANADIUM									
	NOAEL 5 PPM ORAL: DRINKING WATER	RAT LIFETIME				7E-3 100		7E-3 100	005739
VANADIUM PENTOXIDE									
	NOAEL 17.85 PPM ORAL: DIET	RAT LIFETIME				9E-3 100		IRIS	005743
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
VANADIUM SULFATE									
	NOAEL 2.24 MG/KG/DAY ORAL: DRINKING WATER	RAT LIFETIME				2E-2 100		2E-2 100	005747
VERNAM / (VERNOLATE)									
	NOEL 1 MG/KG/DAY ORAL: DIET	RAT	WHOLE BODY	DECREASED WEIGHT		1E-2 100		IRIS	010083

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
VINYL ACETATE 000108-05-4									
NOAEL 100 MG/KG/DAY ORAL: WATER	RAT 2 YEARS	WHOLE BODY KIDNEY	ALTERED WEIGHT ALTERED WEIGHT		1E+0 100		1E+0 100	010417	
NOAEL 176 MG/CU M INHALATION: INTERMITTENT	MOUSE 104 WEEKS	NASAL CAVITY	LESIONS	2E-1 30		IRIS		010418	
SUBCHRONIC [RfC] COMMENT: THE CHRONIC INHALATION RfC WAS ADOPTED AS THE SUBCHRONIC INHALATION [RfC].									
VINYL CHLORIDE 000075-01-4									
SUBCHRONIC [RfC] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
GENERAL COMMENT: ALSO SEE HEAST TABLE 3: CARCINOGENICITY.									
VINYL-1-CYCLOHEXENE, 4- 000100-40-3									
GENERAL COMMENT: DATA INADEQUATE FOR QUANTITATIVE RISK ASSESSMENT									010084
WARFARIN 000081-81-2									
LOAEL 2 MG/DAY ORAL	HUMAN	BLOOD	INCREASED PROTHROMBIN TIME		3E-4 100	IRIS		010409	
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									



# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m)	[RfD]	(mg/cu m)	[RfD]	
					UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
XYLENE, M-000108-38-3									
	NOEL 250 MG/KG	RAT							
	ORAL: GAVAGE	103 WEEKS	CENTRAL NERVOUS SYSTEM	HYPERACTIVITY				2E+0	005755
			WHOLE BODY	DECREASED WEIGHT				100	
			WHOLE BODY						
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.									010920
XYLENE, MIXTURE001330-20-7									
								IRIS	010872
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.									010921
XYLENE, O-000095-47-6									
	NOEL 250 MG/KG	RAT							
	ORAL: GAVAGE	103 WEEKS	CENTRAL NERVOUS SYSTEM	HYPERACTIVITY				2E+0	005751
			WHOLE BODY	DECREASED WEIGHT				100	
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.									010922
XYLENE, P-000106-42-3									
SUBCHRONIC [RfD] COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.									
CHRONIC [RfC] COMMENT: THE CHRONIC INHALATION [RfC] IS CONSIDERED NOT VERIFIABLE (12/11/91) BY THE RfD/RfC WORK GROUP.									010923

# HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	[RfC]	Chronic	REFERENCE
					(mg/cu m) UF	[RfD] (mg/kg/day) UF	(mg/cu m) UF	[RfD] (mg/kg/day) UF	
ZINC (METALLIC)		007440-66-6							
	LOAEL 1.0 MG/KG/DAY ORAL: DIET SUPPLEMENT	HUMAN 10 WEEKS	BLOOD	DECREASED BLOOD ENZYME		3E-1 3		IRIS	010937
CHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									
ZINC CYANIDE		000557-21-1							
	NOAEL 24.3 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	WHOLE BODY THYROID	DECREASED WEIGHT EFFECTS		5E-2 500		IRIS	010289
			NERVE	MYELIN DEGENERATION					
SUBCHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
CHRONIC [RfD] COMMENT: CALCULATED BY ANALOGY TO FREE CYANIDE BY CORRECTING FOR DIFFERENCES IN MOLECULAR WEIGHT.									
ZINC PHOSPHIDE		001314-84-7							
	LOAEL 3.48 MG/KG/DAY ORAL: DIET	RAT 13 WEEKS	WHOLE BODY WHOLE BODY	DECREASED WEIGHT DECREASED FOOD INTAKE		3E-3 1000		IRIS	010290
ZINEB		012122-67-7							
	LOAEL 25 MG/KG/DAY ORAL: DIET	RAT 2 YEARS	THYROID	HYPERPLASIA		5E-2 500		IRIS	010085
SUBCHRONIC [RfD] COMMENT: THE CHRONIC ORAL RfD WAS ADOPTED AS THE SUBCHRONIC ORAL [RfD].									

REFERENCES FOR HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

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REFERENCES FOR HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

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REFERENCES FOR HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

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March 1994

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March 1994

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CYANAZINE

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CYCLOPENTADIENE

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DICHLOROETHYLENE, 1,1-

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DICHLOROETHYLENE, 1,2- (MIXED ISOMERS)

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March 1994

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NICKEL CYANIDE

000557-19-7

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NITRIC OXIDE

010102-43-9

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NITROANILINE, M-

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NITROANILINE, P-

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NITROGEN DIOXIDE

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REFERENCES FOR HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

ZINEB

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US EPA. 1986. RfD/RfC WORK GROUP.

## HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
ACETONE CYANOHYDRIN					000075-86-5				
NOEL	4.0 MG/KG/DAY	RAT							
	INHALATION:	14 WEEKS	CENTRAL NERVOUS	EFFECTS	1E-1		1E-2		010432
	INTERMITTENT		SYSTEM		100		1000		
SUBCHRONIC [RfC] COMMENT: 4E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). AN ERROR IN THE UNCERTAINTY FACTOR THAT WAS REPORTED IN HEED (1988) WAS CORRECTED.									
CHRONIC [RfC] COMMENT: 4E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
ACETONITRILE					000075-05-8				
NOEL	100 PPM	MOUSE							
	INHALATION:	92 DAYS	LIVER	INCREASED RELATIVE WEIGHT	5E-1		5E-2		005208
	INTERMITTENT				300		3000		
SUBCHRONIC [RfC] COMMENT: 1E-1 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
CHRONIC [RfC] COMMENT: 1E-2 MG/KG/DAY. (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
BARIUM					007440-39-3				
NOEL	0.8 MG/CU M	RAT							
	INHALATION:	4 MONTHS	FETUS	FETOTOXICITY	5E-3		5E-4		005249
	INTERMITTENT				100		1000		
SUBCHRONIC [RfC] COMMENT: 1E-3 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). BASED ON A REPRODUCTION STUDY.									
CHRONIC [RfC] COMMENT: 1E-4 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). BASED ON A REPRODUCTION STUDY.									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
CHLORO-1,3-BUTADIENE / (CHLOROPRENE)					000126-99-8				
NOEL	10 PPM	RAT							
	INHALATION:	2 YEARS	HAIR	ALOPECIA		2E-2		2E-2	005878
	INTERMITTENT		WHOLE BODY	DECREASED WEIGHT GAIN		100		100	
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION ASSUMING AN INHALATION ABSORPTION FACTOR OF 0.5.									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION ASSUMING AN INHALATION ABSORPTION FACTOR OF 0.5.									
GENERAL COMMENT: SEE ALSO HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).									



## HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
CHLOROBENZENE 000108-90-7									
LOAEL 75 PPM		RAT							
INHALATION:		120 DAYS	LIVER	EFFECTS			2E-2		005353
INTERMITTENT			KIDNEY	EFFECTS			10000		
CHRONIC [RfC] COMMENT: 5E-3 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). UNDER REVIEW, CURRENT NUMBER SUBJECT TO CHANGE.									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
CYCLOPENTADIENE 000542-92-7									
NOEL 87.3 MG/KG/DAY		RAT							
INHALATION:		194 DAYS	LIVER	LESIONS	3E+0				005401
INTERMITTENT			KIDNEY	LESIONS	100				
SUBCHRONIC [RfC] COMMENT: 9E-1 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC INHALATION [RfC] VALUE WAS DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP.									
DICHLOROBENZENE, 1,2- 000095-50-1									
NOEL 49 PPM		RAT							
INHALATION:		UP TO 7	WHOLE BODY	DECREASED WEIGHT GAIN	2E+0		2E-1		005412
INTERMITTENT		MONTHS			100		1000		
CHRONIC [RfC] COMMENT: 4E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
DICHLORODIFLUOROMETHANE 000075-71-8									
LOAEL 482.3 MG/KG/DAY		GUINEA PIG							
INHALATION:		6 WEEKS	LIVER	LESIONS	2E+0		2E-1		005497
INTERMITTENT					1000		10000		
SUBCHRONIC [RfC] COMMENT: 5E-1 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
CHRONIC [RfC] COMMENT: 5E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									

## HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic	Chronic	REFERENCE		
					[RfC]	[RfD]		[RfC]	[RfD]
					(mg/cu m) UF	(mg/kg/day) UF		(mg/cu m) UF	(mg/kg/day) UF
DICHLOROETHANE, 1,1- 000075-34-3									
NOEL	138 MG/KG/DAY INHALATION: INTERMITTENT	CAT 13 WEEKS	KIDNEY	DAMAGE	5E+0 100	5E-1 1000	005789		
SUBCHRONIC [RfC] COMMENT: 1E+0 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
CHRONIC [RfC] COMMENT: 1E-1 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE HEAST TABLE 1: CHRONIC AND SUBCHRONIC TOXICITY AND									
DICYCLOPENTADIENE 000077-73-6									
LOAEL 1 PPM	INHALATION: INTERMITTENT	RAT 90 DAYS	LIVER	DYSFUNCTION	2E-3 1000	2E-4 10000	005424		
SUBCHRONIC [RfC] COMMENT: 6E-4 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
CHRONIC [RfC] COMMENT: 6E-5 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
ETHOXYETHANOL ACETATE, 2- 000111-15-9									
NOEL	30.1 MG/KG/DAY INHALATION: INTERMITTENT	RAT DAY 6-18 OF GESTATION	FETUS	DECREASED OSSIFICATION	3E-1 100	3E-1 100	005952		
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. THE SUBCHRONIC ORAL [RfD] WAS BASED ON A REPRODUCTION STUDY WITH EXPOSURES DURING DAYS 6-18 OF GESTATION.									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. THE CHRONIC ORAL [RfD] WAS BASED ON A REPRODUCTION STUDY WITH EXPOSURES DURING DAYS 6-18 OF GESTATION.									
GENERAL COMMENT: NO PHARMACOKINETIC DATA WERE PROVIDED TO JUSTIFY ROUTE TO ROUTE EXTRAPOLATION FOR THE ORAL [RfD] VALUES. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY VALUES.									

## HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	Subchronic		Chronic		REFERENCE
					[RfC]	[RfD]	[RfC]	[RfD]	
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
FURFURAL									
NOAEL 20 PPM		000098-01-1							
INHALATION: INTERMITTENT		HAMSTER 13 WEEKS	NASAL CAVITY	OLFACTORY DEGENERATION	5E-1 100		5E-2 1000		005465
SUBCHRONIC [RfC] COMMENT: 1E-1 MG/KG/DAY (SEE APPENDIX A-11, DOSE CONVERSIONS ON HEAST).									
CHRONIC [RfC] COMMENT: 1E-2 MG/KG/DAY (SEE APPENDIX A-11, DOSE CONVERSIONS ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
METHACRYLONITRILE									
NOEL 3.2 PPM		000126-98-7							
INHALATION: INTERMITTENT		DOG 90 DAYS	LIVER LIVER	INCREASED SGOT INCREASED SGPT	7E-3 300		7E-4 3000		005811
SUBCHRONIC [RfC] COMMENT: 2E-3 MG/KG/DAY (SEE APPENDIX A-11, DOSE CONVERSIONS ON HEAST). THESE VALUES DIFFER FROM THOSE IN THE 1987 NEED.									
CHRONIC [RfC] COMMENT: 2E-4 MG/KG/DAY (SEE APPENDIX A-11, DOSE CONVERSIONS ON HEAST). THESE VALUES DIFFER FROM THOSE IN THE 1987 NEED.									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									
METHOXYETHANOL ACETATE, 2-									
NOAEL 10 PPM		000110-49-6							
INHALATION: INTERMITTENT		RABBIT 13 WEEKS	TESTIS	DEGENERATION		2E-2 100	2E-3 1000		010001
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5. CALCULATED FROM DATA OBTAINED WITH METHOXYETHANOL CONVERTED BY MULTIPLYING BY THE MOLECULAR WEIGHT RATIO (118.13/76.09).									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5. CALCULATED FROM DATA OBTAINED WITH METHOXYETHANOL CONVERTED BY MULTIPLYING BY THE MOLECULAR WEIGHT RATIO (118.13/76.09).									
GENERAL COMMENT: NO PHARMACOKINETIC DATA WERE PROVIDED TO JUSTIFY ROUTE TO ROUTE EXTRAPOLATION FOR THE ORAL [RfD] VALUES.									

## HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE	
					(mg/cu m)	[RfD]	[RfC]		[RfD]
					UF	(mg/kg/day) UF	(mg/cu m) UF		(mg/kg/day) UF
METHOXYETHANOL, 2-000109-86-4									
NOEL	31 MG/CU M	RABBIT							
	INHALATION:	13 WEEKS	TESTICLE	EFFECTS		1E-2	1E-3	010910	
	INTERMITTENT					100	1000		
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
GENERAL COMMENT: ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).									
METHYL ACRYLATE000096-33-3									
NOEL	15 PPM	RAT							
	INHALATION:	2 YEARS		NONE OBSERVED		3E-2	3E-2	010003	
	INTERMITTENT					100	100		
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.									
GENERAL COMMENT: NO PHARMACOKINETIC DATA WERE PROVIDED TO JUSTIFY ROUTE TO ROUTE EXTRAPOLATION FOR THE ORAL [RfD] VALUES.									
METHYL ISOBUTYL KETONE000108-10-1									
NOEL	50 PPM	RAT							
	INHALATION:	90 DAYS	LIVER	INCREASED WEIGHT	8E-1	8E-2		005562	
	INTERMITTENT		KIDNEY	EFFECTS	100	1000			
SUBCHRONIC [RfC] COMMENT: 2E-1 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSION ON HEAST).									
CHRONIC [RfC] COMMENT: 2E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSION ON HEAST).									
GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.									

## HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	[RfD]	REFERENCE
					(mg/cu m) UF	(mg/kg/day) UF	(mg/cu m) UF	(mg/kg/day) UF	
METHYL STYRENE (MIXED ISOMERS) 025013-15-4									
LOAEL	5.6 MG/KG/DAY INHALATION: INTERMITTENT	MOUSE 103 WEEKS	NASAL CAVITY	LESIONS		6E-3 1000		6E-3 1000	005567
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION WITH AN ABSORPTION FACTOR OF 0.5. CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION WITH AN ABSORPTION FACTOR OF 0.5. GENERAL COMMENT: NO PHARMACOKINETIC DATA WERE PROVIDED TO JUSTIFY ROUTE TO ROUTE EXTRAPOLATION FOR THE ORAL [RfD] VALUES.									
LOAEL	11.2 MG/KG/DAY INHALATION: INTERMITTENT	MOUSE 103 WEEKS	NASAL CAVITY	LESIONS	4E-2 1000		4E-2 1000		005566
SUBCHRONIC [RfC] COMMENT: 1E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). CHRONIC [RfC] COMMENT: 1E-2 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST). GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP.									
METHYL STYRENE, ALPHA 000098-83-9									
NOEL	970 MG/CU M INHALATION: INTERMITTENT	RAT 197 DAYS	LIVER KIDNEY	INCREASED WEIGHT INCREASED WEIGHT		7E-1 100		7E-2 1000	010016
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5. CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION USING AN ABSORPTION FACTOR OF 0.5. GENERAL COMMENT: NO PHARMACOKINETIC DATA WERE PROVIDED TO JUSTIFY ROUTE TO ROUTE EXTRAPOLATION FOR THE ORAL [RfD] VALUES.									
METHYLENE BROMIDE 000074-95-3									
NOAEL	11 MG/KG/DAY INHALATION: INTERMITTENT	RAT 90 DAYS	BLOOD	INCREASED CARBOXYHEMOGLOBIN		1E-1 100		1E-2 1000	010011
SUBCHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION, INCLUDING AN ABSORPTION FACTOR OF 0.5. CHRONIC [RfD] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION, INCLUDING AN ABSORPTION FACTOR OF 0.5. GENERAL COMMENT: NO PHARMACOKINETIC DATA WERE PROVIDED TO JUSTIFY ROUTE TO ROUTE EXTRAPOLATION FOR THE ORAL [RfD] VALUES.									

# HEAST TABLE 2: ALTERNATE METHODS - SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)

March 1994

CHEMICAL LEVEL	DOSE ROUTE	SPECIES EXPERIMENT LENGTH	TARGET	CRITICAL EFFECT	[RfC]	Subchronic	Chronic	REFERENCE	
					(mg/cu m)	[RfD]	[RfC]		[RfD]
					UF	(mg/kg/day) UF	(mg/cu m) UF		(mg/kg/day) UF
NITROBENZENE		000098-95-3							
LOAEL 25 MG/CU M	INHALATION: INTERMITTENT	MOUSE 90 DAYS	BLOOD ADRENAL KIDNEY LIVER	HEMATOLOGICAL EFFECTS LESIONS LESIONS LESIONS	2E-2 1000		2E-3 10000	010518	
	INHALATION: INTERMITTENT	RAT 90 DAYS	BLOOD ADRENAL KIDNEY LIVER	HEMATOLOGICAL EFFECTS LESIONS LESIONS LESIONS					

SUBCHRONIC [RfC] COMMENT: 6E-4 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).

CHRONIC [RfC] COMMENT: 6E-4 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).

GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.

## TRICHLOROBENZENE, 1,2,4- 000120-82-1

GENERAL COMMENT: INFORMATION REMOVED FROM THIS TABLE. SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).

## TRICHLOROFLUOROMETHANE 000075-69-4

LOAEL 1940 MG/KG/DAY	INHALATION: CONTINUOUS	DOG 90 DAYS	KIDNEY LUNG	INCREASED BUN INFLAMMATION	7E+0 1000		7E-1 10000		005501

SUBCHRONIC [RfC] COMMENT: 2E+0 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).

CHRONIC [RfC] COMMENT: 2E-1 MG/KG/DAY (SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST).

GENERAL COMMENT: THE SUBCHRONIC AND CHRONIC INHALATION [RfC] VALUES WERE DERIVED FROM METHODOLOGY THAT IS NOT CURRENT WITH THE INTERIM INHALATION METHODOLOGY USED BY THE RfD/RfC WORK GROUP. ALSO SEE TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.

REFERENCES FOR HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

ACETONE CYANOHYDRIN

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(OTHER THAN CARCINOGENICITY)

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(OTHER THAN CARCINOGENICITY)

March 1994

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REFERENCES FOR HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

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REFERENCES FOR HEAST TABLE 2: ALTERNATE METHODS -- SUBCHRONIC AND CHRONIC TOXICITY  
(OTHER THAN CARCINOGENICITY)

March 1994

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### HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
ACEPHATE		030560-19-1									
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).						IRIS	IRIS		IRIS		010086
ACROLEIN		000107-02-8									
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).						IRIS					005001
ACRYLAMIDE		000079-06-1									
ORAL: DRINKING WATER	2 YEARS RAT		MAMMARY THYROID UTERUS ORAL CAVITY CENTRAL NERVOUS SYSTEM	TUMORS TUMORS TUMORS TUMORS TUMORS		IRIS	IRIS	4.5E+0	IRIS	IRIS	010087
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
ACRYLONITRILE		000107-13-1									
						IRIS	IRIS		IRIS		005004
INHALATION: OCCUPATIONAL	HUMAN		LUNG	TUMORS		IRIS		2.4E-1		IRIS	005003
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
ALACHLOR		015972-60-8									
ORAL: DIET	MULTIPLE SITES		TUMORS			B2	8E-2		2.3E-6		010180
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
ALDRIN		000309-00-2									
	ORAL: DIET					IRIS	IRIS	1.7E+1	IRIS	IRIS	005006
		MOUSE		LIVER	CARCINOMA						
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
INHALATION [UNIT RISK] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
ALLYL CHLORIDE		000107-05-1									
						IRIS					010181
GENERAL COMMENT: FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 260-4761 FOR RCRA APPROVED NUMERIC ASSESSMENT OF THIS COMPOUND.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
ANILINE		000062-53-3									
						IRIS	IRIS		IRIS		010088
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
ARAMITE		000140-57-8									
	ORAL: DIET	104 WKS RAT		LIVER	TUMORS	IRIS	IRIS	2.5E-2	IRIS	IRIS	010206
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
ARSENIC, INORGANIC		007440-38-2									
									IRIS		010925
	INHALATION: OCCUPATIONAL	HUMAN		RESPIRATORY SYSTEM	TUMORS	IRIS		5.0E+1		IRIS	005007
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
ASBESTOS		001332-21-4				IRIS IRIS				IRIS	005010 005919
ATRAZINE	ORAL: DIET	001912-24-9 2 YEARS RAT	MAMMARY GLAND MAMMARY GLAND MAMMARY GLAND MAMMARY GLAND	ADENOMA FIBROADENOMA ADENOCARCINOMA CARCINOSARCOMA	C		2.22E-1		6.3E-6		010380
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
AZOBENZENE	ORAL: DIET	000103-33-3 2 YEARS RAT	ABDOMINAL CAVITY	SARCOMA	IRIS	IRIS		1.1E-1	IRIS	IRIS	010089
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
BENZENE	INHALATION: OCCUPATIONAL	000071-43-2 HUMAN	BLOOD	LEUKEMIA	IRIS	IRIS		2.9E-2	IRIS	IRIS	005011
ORAL [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
BENZIDINE		000092-87-5			IRIS	IRIS	IRIS		IRIS	IRIS	005014
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
BENZOTRICHLORIDE		000098-07-7			IRIS	IRIS			IRIS		010092

### HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH SPECIES	TARGET	CANCER	[DEPA GROUP]	[SLOPE FACTOR] ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	[UNIT RISK] ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	REFERENCE
BENZO[A]ANTHRACENE		000056-55-3			IRIS					010182
BENZO[A]PYRENE		000050-32-8			IRIS	IRIS		IRIS		010508
BENZO[B]FLUORANTHENE		000205-99-2			IRIS					010183
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										
BENZO[K]FLUORANTHENE		000207-08-9			IRIS					010090
GENERAL COMMENT: FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 260-4761 FOR RCRA APPROVED NUMERIC ASSESSMENT OF THIS COMPOUND.										
BENZYL CHLORIDE		000100-44-7			IRIS	IRIS		IRIS		010093
BERYLLIUM		007440-41-7			IRIS	IRIS		IRIS		005018
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										
INHALATION: OCCUPATIONAL		HUMAN	LUNG	TUMORS	IRIS		8.4E+0		IRIS	005017
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.										
BIS(2-CHLOROETHYL) ETHER		000111-44-4								
ORAL		560 DAYS MOUSE	LIVER	TUMORS	IRIS	IRIS	1.1E+0	IRIS	IRIS	005076
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.										

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
BIS(2-CHLOROISOPROPYL) ETHER 039638-32-9											
	ORAL: GAVAGE	2 YEARS MOUSE		LIVER LUNG	TUMORS TUMORS	C	7E-2	3.5E-2	2E-6	1E-5	005079
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION (50% RESPIRATORY ABSORPTION). SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: FORMERLY LISTED AS BIS(2-CHLORO-1-METHYL(ETHYL)ETHER). ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
BIS(2-ETHYLHEXYL) PHTHALATE / (DEHP) 000117-81-7											
	GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).					IRIS	IRIS		IRIS		005120
BIS(CHLOROMETHYL) ETHER 000542-88-1											
	INHALATION: INTERMITTENT	10-100 DAYS RAT		RESPIRATORY SYSTEM	TUMORS	IRIS	IRIS	2.2E+2	IRIS	IRIS	005077
ORAL [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
BROMODICHLOROMETHANE 000075-27-4											
	GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).					IRIS	IRIS		IRIS		005148
BROMOETHENE / (VINYL BROMIDE) 000593-60-2											
	INHALATION: INTERMITTENT	2 YEARS RAT		LIVER	TUMORS	B2		1.1E-1		3.2E-5	010094
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											



# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
BROMOFORM		000075-25-2									
	ORAL: GAVAGE	2 YEARS				IRIS	IRIS	3.9E-3	IRIS	IRIS	005150
		RAT		INTESTINE, LARGE	ADENOMATOUS POLYP ADENOCARCINOMA						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
BUTADIENE, 1,3-		000106-99-0									
	INHALATION: INTERMITTENT	MOUSE		MULTIPLE SITES	TUMORS	IRIS		1.8E+0		IRIS	010477
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
BUTYL BENZYL PHTHALATE, N-		000085-68-7									
						IRIS					005122
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
CADMIUM		007440-43-9									
						IRIS				IRIS	005019
ORAL [SLOPE] COMMENT: THERE IS INADEQUATE EVIDENCE FOR THE CARCINOGENICITY OF THIS COMPOUND BY THE ORAL ROUTE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CAPTAFOL		002425-06-1									
	ORAL: DIET					C	8.6E-3		2.4E-7		010095
		MOUSE		LYMPHATIC SYSTEM	LYMPHOSARCOMA						
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CAPTAN		000133-06-2									
						B2	3.5E-3		1.0E-7		010184
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
CARBAZOLE											
	ORAL: DIET	96 WEEKS MOUSE		LIVER	TUMORS	B2	2E-2		5.7E-7		010096
CARBON TETRACHLORIDE											
	ORAL: DIET			LIVER	TUMORS	IRIS	IRIS	5.3E-2	IRIS	IRIS	005022
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. INHALATION [UNIT RISK] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. INCORPORATES AN ABSORPTION FACTOR OF 0.4. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CHLORANIL											
	ORAL: DIET	82 WEEKS MOUSE		LIVER LUNG	TUMORS TUMORS	C	4.03E-1		1.2E-5		010097
CHLORDANE											
	ORAL: DIET			LIVER	CARCINOMA	IRIS	IRIS	1.3E+0	IRIS	IRIS	005024
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CHLORO-2-METHYLANILINE HYDROCHLORIDE, 4-											
	ORAL: DIET	18 MONTHS MOUSE		CARDIOVASCULAR SYSTEM CARDIOVASCULAR SYSTEM	HEMANGIOMA  HEMANGIOSARCOMA	B2	4.6E-1		1.3E-5		010419

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH SPECIES	TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
						ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
CHLORO-2-METHYLANILINE, 4-		000095-69-2								
	ORAL: DIET	18 MONTHS MOUSE	CARDIOVASCULAR SYSTEM	HEMANGIOMA	B2	5.8E-1		1.6E-5		010098
			CARDIOVASCULAR SYSTEM	HEMANGIOSARCOMA						

ORAL [SLOPE] COMMENT: BASED ON VASCULAR TUMORS IN MICE TREATED WITH 4- CHLORO-2-METHYLANILINE HYDROCHLORIDE.

CHLOROBENZILATE		000510-15-6								
	ORAL: GAVAGE, DIET	82 WEEKS MOUSE	LIVER	HEPATOMA	B2	2.7E-1	2.7E-1	7.8E-6	7.8E-5	010848

INHALATION [SLOPE] COMMENT: ABSORBANCE BY THE INHALATION ROUTE WAS ASSUMED TO EQUAL ORAL ABSORPTION SINCE THERE WERE NO PHARMACOKINETIC DATA TO THE CONTRARY. SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST.  
 INHALATION [UNIT RISK] COMMENT: ABSORBANCE BY THE INHALATION ROUTE WAS ASSUMED TO EQUAL ORAL ABSORPTION SINCE THERE WERE NO PHARMACOKINETIC DATA TO THE CONTRARY.  
 GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).

CHLOROFORM		000067-66-3								
				IRIS		IRIS		IRIS		005036
	ORAL: GAVAGE	78 WEEKS MOUSE	LIVER	CARCINOMA	IRIS	8.1E-2		IRIS		005035

INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.  
 GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).

CHLOROMETHANE		000074-87-3								
	INHALATION: INTERMITTENT	24 MONTHS MOUSE	KIDNEY	TUMORS	C	1.3E-2	6.3E-3	3.7E-7	1.8E-6	005038

ORAL [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.  
 GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).

**March 1994**

**IRIS, EPA'S INTEGRATED RISK INFORMATION SYSTEM, IS UPDATED MONTHLY. FURTHER INFORMATION: RISK INFORMATION HOTLINE: (513) 569-7254.**

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
COKE OVEN EMISSIONS		008007-45-2									
	INHALATION: OCCUPATIONAL	HUMAN		LUNG	TUMORS	IRIS		2.2E+0		IRIS	005039
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: FORMERLY LISTED UNDER COAL TARS.											
CREOSOTE, COAL TAR		008001-58-9									
						IRIS					005042
CRESOL, M- / (3-METHYLPHENOL)		000108-39-4									
						IRIS					010187
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CRESOL, O- / (2-METHYLPHENOL)		000095-48-7									
						IRIS					010186
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CRESOL, P- / (4-METHYLPHENOL)		000106-44-5									
						IRIS					010188
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
CROTONALDEHYDE		000123-73-9									
	ORAL: DRINKING WATER	113 WKS RAT		LIVER	TUMOR	IRIS	1.9E+0		5.4E-5		010190
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
CYANAZINE		021725-46-2									
	ORAL: DIET	2 YEARS RAT		MAMMARY GLAND	ADENOMA/ CARCINOMA, COMBINED	C	8.4E-1		2.4E-5		010944
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
DDD		000072-54-8				IRIS	IRIS		IRIS		010291
DDE		000072-55-9				IRIS	IRIS		IRIS		010292
DDT		000050-29-3				IRIS	IRIS	3.4E-1	IRIS	IRIS	005044
	ORAL: DIET	HOUSE, RAT		LIVER	TUMORS						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
DECABROMODIPHENYL ETHER		001163-19-5				IRIS					010102
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
DIALATE		002303-16-4				B2	6.1E-2		1.7E-6		010103
	ORAL	19 MONTHS HOUSE		LIVER	TUMORS						
DIBENZO[A,H]ANTHRACENE		000053-70-3				IRIS					010191
GENERAL COMMENT: FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 260-4761 FOR RCRA APPROVED NUMERIC ASSESSMENT OF THIS COMPOUND.											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES				[EPA GROUP]	ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	
DIBROMO-3-CHLOROPROPANE, 1,2 000096-12-8										
	ORAL: DIET			STOMACH KIDNEY LIVER	TUMORS TUMORS TUMORS	B2	1.4E+0		4E-5	010484
[EPA GROUP] COMMENT: UNDER REVIEW, CLASSIFICATION SUBJECT TO CHANGE. INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST.										
	INHALATION: INTERMITTENT	RAT, MOUSE		NASAL CAVITY	TUMORS	B2		2.4E-3		6.9E-7 010519
DIBROMOCHLOROMETHANE 000124-48-1										
	GENERAL COMMENT: FORMERLY LISTED AS CHLORODIBROMOMETHANE. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).									010891
DIBROMOETHANE, 1,2- 000106-93-4										
	GENERAL COMMENT: FORMERLY LISTED UNDER ETHYLENE DIBROMIDE									005818
	INHALATION: INTERMITTENT	88-103 WEEKS RAT		NASAL CAVITY	TUMORS	IRIS		7.6E-1	IRIS	005071
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										
DICHLORO-2-BUTENE, 1,4- 000764-41-0										
	INHALATION: INTERMITTENT	90 DAYS RAT		NASAL PASSAGES	TUMORS	B2		9.3E+0	2.6E-3	005053
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: FORMERLY LISTED UNDER DICHLOROBUTENES										

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
DICHLOROBENZENE, 1,4-		000106-46-7									
	ORAL: GAVAGE	103 WEEKS MOUSE		LIVER	TUMORS	B2	2.4E-2		6.8E-7		005050
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
DICHLOROBENZIDINE, 3,3'-		000091-94-1									
						IRIS	IRIS		IRIS		005815
DICHLOROETHANE, 1,1-		000075-34-3									
						IRIS					005055
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
DICHLOROETHANE, 1,2-		000107-06-2									
	ORAL: GAVAGE	78 WEEKS. RAT		CIRCULATORY SYSTEM	SARCOMA	IRIS	IRIS	9.1E-2	IRIS	IRIS	005058
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
DICHLOROETHYLENE, 1,1-		000075-35-4									
						IRIS	IRIS		IRIS		005060
	INHALATION	12 MONTHS MOUSE		KIDNEY	ADENOCARCINOMA	IRIS		1.2E+0		IRIS	005059
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											



# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
DICHLOROPROPANE, 1,2- 000078-87-5											
	ORAL: GAVAGE	MOUSE		LIVER	TUMORS	B2	6.8E-2		1.9E-6		005062
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
DICHLOROPROPENE, 1,3- / (TELONE II) 000542-75-6											
	ORAL: GAVAGE	104 WEEKS MOUSE		BLADDER RESPIRATORY SYSTEM  FORESTOMACH	CARCINOMA ALVEOLAR/ BRONCHIOLAR ADENOMA PAPILLOMA/ CARCINOMA	IRIS	1.8E-1		5E-6		010946
	ORAL: GAVAGE	104 WEEKS RAT		LIVER  FORESTOMACH	NEOPLASTIC MODULE/CARCINOMA PAPILLOMA/ CARCINOMA						
ORAL [SLOPE] COMMENT: THE [SLOPE] IS THE GEOMETRIC MEAN OF SLOPE FACTORS OF COMBINED TUMORS LISTED. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
	INHALATION: INTERMITTENT	2 YEARS MOUSE		LUNG	ADENOMA	IRIS		1.3E-1		3.7E-5	010104
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
DIELDRIN 000060-57-1											
	ORAL: DIET	MOUSE		LIVER	CARCINOMA	IRIS	IRIS	1.6E+1	IRIS	IRIS	005816
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. INHALATION [UNIT RISK] COMMENT: BASED ON ROUTE-TO-ROUTE EXTRAPOLATION. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
DIETHYLSTILBESTROL		000056-53-1									
	ORAL: DIET	MOUSE		MAMMARY GLAND	CARCINOMA	A	4.7E+3		1.3E-1		010485
DIMETHOXYBENZIDINE, 3,3'-		000119-90-4									
	ORAL: DIET	LIFETIME HAMSTER		FORESTOMACH	PAPILLOMA	B2	1.4E-2		4E-7		010106
DIMETHYLANILINE HYDROCHLORIDE, 2,4-		021436-96-4									
	ORAL: DIET	18 MONTHS MOUSE		LUNG	TUMORS	C	5.8E-1		1.7E-5		010108
DIMETHYLANILINE, 2,4-		000095-68-1									
	ORAL: DIET	18 MONTHS MOUSE		LUNG	TUMORS	C	7.5E-1		2.1E-5		010107
DIMETHYLBENZIDINE, 3,3'-		000119-93-7									
	ORAL: GAVAGE	30 DAYS RAT		MAMMARY	TUMORS	B2	9.2E+0		2.6E-4		010109
DIMETHYLBENZ[A]ANTHRACENE, 7,12-		000057-97-6									
GENERAL COMMENT: FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 260-4761 FOR RCRA APPROVED NUMERIC ASSESSMENT OF THIS COMPOUND.											010297
DIMETHYLHYDRAZINE, 1,1-		000057-14-7									
GENERAL COMMENT: NO EPA GROUP CLASSIFICATION WAS PROVIDED IN THE REFERENCE DOCUMENT, THEREFORE THIS COMPOUND WAS REMOVED FROM TABLE 3.											
DIMETHYLHYDRAZINE, 1,2-		000540-73-8									
GENERAL COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.											010962
DIMETHYLSULFATE		000077-78-1									
IRIS											010112

IRIS, EPA'S INTEGRATED RISK INFORMATION SYSTEM, IS UPDATED MONTHLY. FURTHER INFORMATION: RISK INFORMATION HOTLINE: (513) 569-7254.

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH	TARGET	CANCER	[SLOPE FACTOR]			[UNIT RISK]		REFERENCE
		SPECIES			[EPA GROUP]	ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
DINITROTOLUENE, 2,4-		000121-14-2								
GENERAL COMMENT: LISTED AS "DINITROTOLUENE MIXTURE, 2,4-/2,6-" ON CARCINOGENICITY).					IRIS	IRIS		IRIS		005066
IRIS. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN										
DINITROTOLUENE, 2,6-		000606-20-2								
GENERAL COMMENT: LISTED AS "DINITROTOLUENE MIXTURE, 2,4-/2,6-" ON CARCINOGENICITY).					IRIS	IRIS		IRIS		005068
IRIS. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN										
DIOXANE, 1,4-		000123-91-1								
					IRIS	IRIS		IRIS		010298
DIPHENYLHYDRAZINE, 1,2-		000122-66-7								
ORAL: DIET		2 YEARS RAT	LIVER	TUMORS	IRIS	IRIS	8.0E-1	IRIS	IRIS	005070
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.										
DIRECT BLACK 38		001937-37-7								
ORAL: DIET		93 DAYS RAT	LIVER	TUMORS	A	8.6E+0		2.4E-4		010113
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.										
DIRECT BLUE 6		002602-46-2								
ORAL: DIET		91 DAYS RAT	LIVER	TUMORS	A	8.1E+0		2.3E-4		010114
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.										

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES				[EPA GROUP]	ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	
DIRECT BROWN 95		016071-86-6								
	ORAL: DIET	91 DAYS				A	9.3E+0		2.6E-4	010115
		RAT		LIVER	TUMORS					
	ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.									
DIRECT SKY BLUE 6B		002610-05-1								
						B2				010116
	[EPA GROUP] COMMENT: BASED ON THE FACT THAT 3,3-DIMETHOXYBENZIDINE, A KNOWN EPA GROUP B2 CARCINOGEN, IS A METABOLITE OF DIRECT SKY BLUE 6B.									
EPICHLOROHYDRIN		000106-89-8								
						IRIS	IRIS		IRIS	010198
	INHALATION: INTERMITTENT	30 DAYS, OBSERVED LIFETIME				IRIS		4.2E-3		010117
		RAT		NASAL CAVITY	TUMORS				IRIS	
	INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).									
ETHYL ACRYLATE		000140-88-5								
	ORAL: GAVAGE	104 WEEKS				B2	4.8E-2		1.4E-6	010118
		RAT		FORESTOMACH	TUMORS					
ETHYLENE OXIDE		000075-21-8								
	ORAL: GAVAGE	LIFETIME, TWICE WEEKLY				B1	1.02E+0		2.9E-5	010421
		RAT		STOMACH	TUMORS					
	ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.									
	INHALATION: INTERMITTENT	2 YEARS				B1		3.5E-1		010422
		RAT		BLOOD BRAIN	LEUKEMIA GLIOMA				1E-4	
	INHALATION [UNIT RISK] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.									

### HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
ETHYLENE THIOUREA											
	ORAL: GAVAGE	2 YEARS				B2	1.1E-1		3.4E-6		010947
		MOUSE		LIVER	ADENOMA/ CARCINOMA, COMBINED						
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
FOLPET											
						IRIS	IRIS		IRIS		010120
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
FORMALDEHYDE											
	INHALATION	24 MONTHS				IRIS		4.5E-2		IRIS	010121
		RAT		NASAL CAVITY	TUMORS						
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
FURAZOLIDONE											
	ORAL: DIET	45 WEEKS				B2	3.8E+0		1E-4		005106
		RAT		MAMMARY	TUMORS						
GENERAL COMMENT: FORMERLY LISTED UNDER NITROFURANS											
FURIUM											
	ORAL: DIET	28 WEEKS				B2	5.0E+1		1.4E-3		005108
		MOUSE		BLOOD	LEUKEMIA						
GENERAL COMMENT: FORMERLY LISTED UNDER NITROFURANS											
GLYCIDALDEHYDE											
						IRIS					010122
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
<b>HEPTACHLOR</b> <b>000076-44-8</b>											
	ORAL: DIET					IRIS	IRIS	4.5E+0	IRIS	IRIS	005820
		MOUSE		LIVER	CARCINOMA						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
<b>HEPTACHLOR EPOXIDE</b> <b>001024-57-3</b>											
	ORAL: DIET	18-24 MONTHS				IRIS	IRIS	9.1E+0	IRIS	IRIS	010424
		MOUSE		LIVER	CARCINOMA						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
<b>HEXACHLOROBENZENE</b> <b>000118-74-1</b>											
	ORAL: DIET					IRIS	IRIS	1.6E+0	IRIS	IRIS	010365
		RAT		LIVER	TUMORS						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
<b>HEXACHLOROBUTADIENE</b> <b>000087-68-3</b>											
	ORAL: DIET	22-24 MONTHS				IRIS	IRIS	7.8E-2	IRIS	IRIS	005088
		RAT		KIDNEY	TUMORS						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
<b>HEXACHLOROCYCLOHEXANE, ALPHA-</b> <b>000319-84-6</b>											
	ORAL: DIET	24 WEEKS				IRIS	IRIS	6.3E+0	IRIS	IRIS	010123
		MOUSE		LIVER	TUMORS						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
HEXACHLOROCYCLOHEXANE, BETA- 000319-85-7											
	ORAL: DIET	110 WEEKS MOUSE		LIVER	TUMORS	IRIS	IRIS	1.8E+0	IRIS	IRIS	010124
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
HEXACHLOROCYCLOHEXANE, DELTA- 000319-86-8											
						IRIS					010125
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
HEXACHLOROCYCLOHEXANE, EPSILON- 006108-10-7											
						IRIS					010126
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
HEXACHLOROCYCLOHEXANE, GAMMA- 000058-89-9											
	ORAL: DIET	110 WEEKS MOUSE		LIVER	TUMORS	B2-C	1.3E+0		3.7E-5		005098
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
HEXACHLOROCYCLOHEXANE-TECHNICAL 000608-73-1											
	ORAL: DIET	6-20 MONTHS MOUSE		LIVER	TUMORS	IRIS	IRIS	1.8E+0	IRIS	IRIS	010127
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
HEXACHLOROETHANE 000067-72-1											
	ORAL: GAVAGE	78 WEEKS MOUSE		LIVER	CARCINOMA	IRIS	IRIS	1.4E-2	IRIS	IRIS	005090
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
HYDRAZINE		000302-01-2				IRIS	IRIS		IRIS		010129
	INHALATION: INTERMITTENT	1 YEAR RAT		NASAL CAVITY	TUMORS	IRIS		1.7E+1		IRIS	010128
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
HYDRAZINE SULFATE		010034-93-2				IRIS	IRIS		IRIS		010131
	INHALATION: INTERMITTENT	1 YEAR RAT		NASAL CAVITY	TUMORS	IRIS		1.7E+1		IRIS	010130
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: LISTED UNDER "HYDRAZINE" ON IRIS.											
INDENO[1,2,3-CD]PYRENE		000193-39-5				IRIS					010192
ISOPHORONE		000078-59-1				IRIS	IRIS		IRIS		005094
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
LEAD		007439-92-1				IRIS					005096
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
LINURON		000330-55-2				IRIS					010383
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											



HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES	WEEKS				ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
METHOXY-5-NITROANILINE, 2- 000099-59-2											
	ORAL: DIET	104 WEEKS RAT		SKIN	CARCINOMA	B2	4.6E-2		1.3E-6		010132
METHYL HYDRAZINE 000060-34-4											
GENERAL COMMENT: NO EPA GROUP CLASSIFICATION WAS PROVIDED IN THE REFERENCE DOCUMENT, THEREFORE THIS COMPOUND WAS REMOVED FROM TABLE 3.											
METHYL-5-NITROANILINE, 2- 000099-55-8											
	ORAL: DIET	98 WEEKS HOUSE		LIVER	CARCINOMA	C	3.3E-2		9.4E-7		010140
METHYLANILINE HYDROCHLORIDE, 2- 000636-21-5											
	ORAL: DIET	93 WEEKS RAT		SKIN	FIBROMA	B2	1.8E-1		5.1E-6		010134
METHYLANILINE, 2- 000095-53-4											
	ORAL: DIET	93 WEEKS RAT		SKIN	FIBROMA	B2	2.4E-1		6.9E-6		010133
GENERAL COMMENT: THE 1984 HEEP CALLED THIS COMPOUND O-TOLUIDINE, THE 1987 HEEP CALLED IT 2-METHYLANILINE.											
METHYLCHOLANTHRACENE, 3- 000056-49-5											
GENERAL COMMENT: FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 260-4761 FOR RCRA APPROVED NUMERIC ASSESSMENT OF THIS COMPOUND.											
METHYLENE CHLORIDE / (DICHLOROMETHANE) 000075-09-2											
						IRIS IRIS	IRIS		IRIS	IRIS	005100 005904
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
METHYLENE-BIS(BENZENEAMINE), 4,4- / (4,4'-METHYLENEDIANILINE) 000101-77-9											
GENERAL COMMENT: NO EPA GROUP CLASSIFICATION WAS PROVIDED IN THE REFERENCE DOCUMENT, THEREFORE THIS COMPOUND WAS REMOVED FROM TABLE 3.											
METHYLENE-BIS(2-CHLOROANILINE), 4,4'- 000101-14-4											
	ORAL: DIET	2 YEARS		LUNG	TUMORS	B2	1.3E-1	1.3E-1	3.7E-6	3.7E-5	010425
		RAT									
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. BASED ON ROUTE TO ROUTE EXTRAPOLATION.											
METHYLENE-BIS(N,N'-DIMETHYL)ANILINE, 4,4'- 000101-61-1											
						IRIS	IRIS		IRIS		010137
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
METOLACHLOR 051218-45-2											
						IRIS					010951
MIREX 002385-85-5											
	ORAL: DIET	2 YEARS		LIVER	ADENOMA	B2					010952
		RAT		LIVER	CARCINOMA						
[EPA GROUP] COMMENT: UNDER REVIEW, CLASSIFICATION SUBJECT TO CHANGE.											
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
NIAGARA BLUE 4B 002429-74-5											
						B2					010141
[EPA GROUP] COMMENT: BASED ON THE FACT THAT 3,3-DIMETHOXYBENZIDINE, A KNOWN EPA GROUP B2 CARCINOGEN, IS A METABOLITE OF NIAGARA BLUE 4B.											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
NICKEL REFINERY DUST											
	INHALATION: OCCUPATIONAL	HUMAN		RESPIRATORY SYSTEM	TUMORS	IRIS		8.4E-1		IRIS	005103
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: FORMERLY LISTED AS NICKEL. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (UNDER NICKEL).											
NICKEL SUBSULFIDE 012035-72-2											
	INHALATION: OCCUPATIONAL	HUMAN		RESPIRATORY SYSTEM	TUMORS	IRIS		1.7E+0		IRIS	005768
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: FORMERLY LISTED AS NICKEL. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (UNDER NICKEL).											
NITROFURAZONE 000059-87-0											
	ORAL: DIET	46 WEEKS RAT		MAMMARY	TUMORS	B2	1.5E+0		4.3E-5		005110
NITROPROPANE, 2- 000079-46-9											
	INHALATION: INTERMITTENT	22 MONTHS RAT		LIVER	TUMORS	B2		9.4E+0		2.7E-3	010142
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST.											
NITROSO-DI-N-BUTYLAMINE, N- 000924-16-3											
	ORAL: DRINKING WATER	LIFETIME MOUSE		BLADDER ESOPHAGUS	TUMORS TUMORS	IRIS	IRIS	5.4E+0	IRIS	IRIS	010143
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE	
		SPECIES				[EPA GROUP]	ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>		INHALATION (ug/cu m) <sup>-1</sup>
NITROSO-DI-N-PROPYLAMINE, N- 000621-64-7											
						IRIS	IRIS		IRIS	010147	
NITROSO-N-ETHYLUREA, N- 000759-73-9											
	ORAL: DRINKING WATER	203 DAYS RAT		INTESTINE	GASTROINTESTINAL TUMORS	B2	1.4E+2			010426	
[EPA GROUP] COMMENT: UNDER REVIEW, CLASSIFICATION SUBJECT TO CHANGE. GENERAL COMMENT: FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 382-4761 FOR RCRA-APPROVED NUMERIC ASSESSMENT FOR THIS COMPOUND. UNDER REVIEW.											
NITROSO-N-METHYLUREA, N- 000684-93-5											
	ORAL: GAVAGE	308 DAYS GUINEA PIG		PANCREAS	ADENOCARCINOMA	B2				010427	
[EPA GROUP] COMMENT: UNDER REVIEW, CLASSIFICATION SUBJECT TO CHANGE. GENERAL COMMENT: THE CRAVE WORK GROUP (04/01/92) STATES THERE IS NO ACCEPTABLE QUANTITATION FOR NITROSO-N-METHYLUREA, N-.											
NITROSODIETHANOLAMINE, N- 001116-54-7											
						IRIS	IRIS		IRIS	010144	
NITROSODIETHYLAMINE, N- 000055-18-5											
	ORAL: DRINKING WATER	6 OR 12 MONTHS RAT		LIVER	TUMORS	IRIS	IRIS	1.5E+2	IRIS	IRIS	010145
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											
NITROSODIMETHYLAMINE, N- 000062-75-9											
	ORAL: DRINKING WATER	RAT		LIVER	TUMORS	IRIS	IRIS	5.1E+1	IRIS	IRIS	010146
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cm <sup>3</sup> ) <sup>-1</sup>	
NITROSODIPHENYLAMINE, N-				000086-30-6							
					IRIS		IRIS		IRIS		005112
NITROSOMETHYLETHYLAMINE, N-				010595-95-6							
					IRIS		IRIS		IRIS		010148
NITROSOMETHYLVINYLAMINE, N				004549-40-0							
	INHALATION	RAT		UPPER RESPIRATORY TRACT	CARCINOMAS	B2					010149
	ORAL: DRINKING WATER			UPPER DIGESTIVE TRACT	CARCINOMAS						
NITROSOPYRROLIDINE, N-				000930-55-2							
	ORAL: DIET	LIFETIME RAT		LIVER	TUMORS	IRIS	IRIS	2.1E+0	IRIS	IRIS	010300
	INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-11, DOSE CONVERSIONS ON HEAST.										
PARATHION				000056-38-2							
					IRIS						005116
	GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										
PENTABROMO-6-CHLOROCYCLOHEXANE, 1,2,3,4,5-				000087-84-3							
	ORAL: DIET	2 YEARS RAT		INTESTINE, LARGE	TUMORS	C	2.3E-2		6.6E-7		010150
	ORAL [SLOPE] COMMENT: BASED ON RESULTS WITH THE ALPHA ISOMER.										

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
PENTACHLORONITROBENZENE		000082-68-8									
	ORAL	72 WEEKS MOUSE		LIVER	TUMORS	C	2.6E-1		7.4E-6		010151
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
PENTACHLOROPHENOL		000087-86-5									
						IRIS	IRIS		IRIS		010381
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
PHENYLENEDIAMINE, O-		000095-54-5									
	ORAL: DIET	548 DAYS RAT		LIVER	TUMORS	B2	4.7E-2		1.3E-6		010152
ORAL [SLOPE] COMMENT: BASED ON LIVER TUMORS IN RATS TREATED WITH O-PHENYLENEDIAMINE DIHYDROCHLORIDE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY.											
PHENYLPHENOL, 2-		000090-43-7									
	ORAL: DIET	637 DAYS RAT		URINARY BLADDER	TUMORS	C	1.94E-3		5.5E-8		010153
POLYBROMINATED BIPHENYLS											
	ORAL: GAVAGE	25 WEEKS RAT		LIVER LIVER	CARCINOMA NEOPLASTIC MODULE	B2	8.9E+0		2.5E-4		010154
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY)											
POLYCHLORINATED BIPHENYLS		001336-36-3									
						IRIS	IRIS		IRIS		005118

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
PROPYLENE OXIDE		000075-56-9									
						IRIS	IRIS		IRIS		010156
	INHALATION: INTERMITTENT	2 YEARS MOUSE		NASAL CAVITY	TUMORS	IRIS		1.3E-2		IRIS	010155
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
QUINOLINE		000091-22-5									
	ORAL: DIET	20-40 WEEKS RAT		LIVER	TUMORS	C	1.2E+1		3.5E-4		010158
RDX / (CYCLONITE)		000121-82-4									
						IRIS	IRIS		IRIS		010157
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
SELENIUM SULFIDE		007446-34-6									
						IRIS					010194
ORAL [SLOPE] COMMENT: STUDY RESULTS WERE CONSIDERED INCONCLUSIVE FOR QUANTITATIVE RISK ASSESSMENT.											
SIMAZINE		000122-34-9									
	ORAL: DIET	2 YEARS RAT		MAMMARY	CARCINOMA	C	1.2E-1		3.4E-6		010195
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
SODIUM DIETHYLDITHIOCARBAMATE		000148-18-5									
	ORAL: DIET	77 WEEKS MOUSE		LIVER	TUMORS	C	2.7E-1		7.7E-6		005126
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH	TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES				ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
STYRENE		000100-42-5								010480
GENERAL COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										
TCDD, 2,3,7,8-		001746-01-6								
	ORAL: DIET	720 DAYS			B2	1.5E+5	1.5E+5	4.5E+0	3.3E-5 (PG/CU M)-1	005128
		RAT	RESPIRATORY SYSTEM LIVER	TUMORS  TUMORS						
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST. INHALATION [UNIT RISK] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE. BASED ON ROUTE TO ROUTE EXTRAPOLATION. AN ABSORPTION FACTOR OF 75% USED TO CALCULATE THE UNIT RISK FROM THE SLOPE FACTOR.										
TETRACHLOROETHANE, 1,1,1,2-		000630-20-6								
	ORAL: GAVAGE	103 WEEKS			IRIS	IRIS	2.6E-2	IRIS	IRIS	010302
			LIVER	TUMOR						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.										
TETRACHLOROETHANE, 1,1,2,2-		000079-34-5								
	ORAL: GAVAGE	75 WEEKS MOUSE			IRIS	IRIS	2.0E-1	IRIS	IRIS	005130
			LIVER	CARCINOMA						
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST.										
TETRACHLOROETHYLENE		000127-18-4								010482
GENERAL COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300. ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										



# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
TETRACHLOROTOLUENE, PARA, ALPHA, ALPHA, ALPHA- 005216-25-1											
	ORAL: GAVAGE	17.5 WEEKS MOUSE		LUNG	ADENOCARCINOMA	B2	2.0E+1		5.7E-4		005028
TETRACHLOROVINPHOS / (STIROFOS) 000961-11-5											
	ORAL: DIET	560 DAYS MOUSE		LIVER	TUMORS	C	2.4E-2		6.9E-7		010159
[EPA GROUP] COMMENT: UNDER REVIEW, CLASSIFICATION SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
TOLUENE-2,4-DIAMINE 000095-80-7											
	ORAL: DIET	84-103 WEEKS RAT		MAMMARY	TUMORS	B2	3.2E+0		9.1E-5		010160
TOLUIDINE, P- 000106-49-0											
	ORAL: DIET	18 MONTHS MOUSE		LIVER	TUMORS	C	1.9E-1		5.4E-6		010162
TOXAPHENE 008001-35-2											
	ORAL: DIET	18 MONTHS MOUSE		LIVER	TUMORS	IRIS	IRIS	1.1E+0	IRIS	IRIS	005134
INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. INHALATION [UNIT RISK] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION.											
TRICHLOROANILINE HYDROCHLORIDE, 2,4,6- 033663-50-2											
	ORAL: DIET	18 MONTHS MOUSE		VASCULAR SYSTEM	TUMORS	C	2.9E-2		8.2E-7		005142
TRICHLOROANILINE, 2,4,6- 000634-93-5											
	ORAL: DIET	18 MONTHS MOUSE		VASCULAR SYSTEM	TUMORS	C	3.4E-2		1E-6		010487

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH		TARGET	CANCER	[DEPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES					ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
TRICHLOROETHANE, 1,1,2- 000079-00-5											
	ORAL: GAVAGE	78 WEEKS MOUSE		LIVER	CARCINOMA	IRIS	IRIS	5.7E-2	IRIS	IRIS	005144
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
TRICHLOROETHYLENE 000079-01-6											
	GENERAL COMMENT: CONTACT THE SUPERFUND HEALTH RISK TECHNICAL SUPPORT CENTER: (513) 569-7300.										010483
TRICHLOROPHENOL, 2,4,6- 000088-06-2											
	ORAL: DIET	107 WEEKS MOUSE		BLOOD	LEUKEMIA	IRIS	IRIS	1E-2	IRIS	IRIS	010428
INHALATION [SLOPE] COMMENT: BASED ON ROUTE TO ROUTE EXTRAPOLATION. SEE APPENDIX A-II, DOSE CONVERSIONS ON HEAST. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
TRICHLOROPROPANE, 1,2,3- 000096-18-4											
	ORAL: GAVAGE	RAT		MULTIPLE SITES	TUMORS, BENIGN/MALIGNANT, COMBINED	B2	7E+0		2E-4		010849
[EPA GROUP] COMMENT: UNDER REVIEW, CLASSIFICATION SUBJECT TO CHANGE. GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
TRIFLURALIN 001582-09-8											
						IRIS	IRIS		IRIS		010163
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).											
TRIMETHYL PHOSPHATE 000512-56-1											
	ORAL: GAVAGE	103 WEEKS MOUSE		UTERUS	TUMORS	B2	3.7E-2		1.1E-6		010164

# HEAST TABLE 3: CARCINOGENICITY

March 1994

CHEMICAL	ROUTE	EXPERIMENT LENGTH	TARGET	CANCER	[EPA GROUP]	[SLOPE FACTOR]		[UNIT RISK]		REFERENCE
		SPECIES				ORAL (mg/kg/day) <sup>-1</sup>	INHALATION (mg/kg/day) <sup>-1</sup>	ORAL (ug/L) <sup>-1</sup>	INHALATION (ug/cu m) <sup>-1</sup>	
TRINITROTOLUENE, 2,4,6-		000118-96-7								
					IRIS	IRIS		IRIS		010476
GENERAL COMMENT: ALSO SEE HEAST TABLE 1: SUBCHRONIC AND CHRONIC TOXICITY (OTHER THAN CARCINOGENICITY).										
VINYL CHLORIDE		000075-01-4								
ORAL: DIET		1001 DAYS			A	1.9E+0		5.4E-5		010368
		RAT	LUNG LIVER	TUMORS TUMORS						
ORAL [SLOPE] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.										
INHALATION: INTERMITTENT		1 YEAR RAT	LIVER	TUMORS	A		3.0E-1		8.4E-5	010367

INHALATION [SLOPE] COMMENT: SEE APPENDIX A-II: DOSE CONVERSIONS ON HEAST.

INHALATION [UNIT RISK] COMMENT: UNDER REVIEW, NUMBER SUBJECT TO CHANGE.

GENERAL COMMENT: THE MOST RECENTLY REVIEWED QUANTITATIVE TOXICITY VALUES LISTED HERE APPEAR IN EPA DOCUMENTS PUBLISHED IN 1984 AND 1985. THE AGENCY IS AWARE THAT THESE VALUES DO NOT INCORPORATE CONSIDERABLE INFORMATION THAT IS NOW AVAILABLE. THE OFFICE OF HEALTH AND ENVIRONMENTAL ASSESSMENT'S POSITION IS THAT THESE TOXICITY VALUES DO NOT REFLECT STATE-OF-THE-ART SCIENCE FOR VINYL CHLORIDE. EPA NOW HAS INDIVIDUAL ANIMAL DATA, NOT AVAILABLE WHEN THE ORAL UNIT RISK WAS CALCULATED, THAT MAY INFLUENCE THIS VALUE. ADDITIONAL INFORMATION THAT MAY BE FACTORED INTO A REVISED QUANTITATIVE TOXICITY VALUE INCLUDES DATA ON INCREASED SENSITIVITY OBSERVED IN YOUNG ANIMALS AND DATA ON METABOLISM/PHARMACOKINETICS. A UNIT RISK FOR AIR THAT CONSIDERS INFORMATION ON YOUNG AGE EXPOSURE INCREASES THE RISK (I.E., LOWERS THE RISK SPECIFIC DOSE) BY AT LEAST 3-FOLD. THE CONSIDERATION OF METABOLISM PHARMACOKINETICS WILL FURTHER INCREASE THE RISK. ONE UNPUBLISHED PHYSIOLOGICALLY-BASED PHARMACOKINETIC MODEL PREDICTION RESULTS IN A 100-FOLD INCREASED RISK.

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## METHYLCHOLANTHRACENE, 3-

000056-49-5

010299 FOR RCRA ACTIVITIES ONLY, CONTACT THE HEALTH ASSESSMENT SECTION (202) 260-4761 FOR RCRA APPROVED NUMERIC ASSESSMENT OF THIS COMPOUND.

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**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Actinium (89)	Ac-225 <sup>†</sup>	014265-85-1	1.000E+01 D		Y	1.0E-03	1.7E-11	2.4E-09	7.6E-09
	Ac-227 <sup>†</sup>	014952-40-0	2.180E+01 Y		Y	1.0E-03	2.8E-10	8.0E-08	2.6E-11
	Ac-227 + D	014952-40-0(+D)	2.180E+01 Y		Y	1.0E-03	3.5E-10	8.8E-08	8.5E-07
	Ac-228 <sup>†</sup>	014331-83-0	6.130E+00 H		Y	1.0E-03	5.0E-13	2.6E-11	2.9E-06
Americium (95)	Am-241 <sup>†</sup>	014596-10-2	4.320E+02 Y		W	1.0E-03	2.4E-10	3.2E-08	4.9E-09
	Am-242	013981-54-9	1.600E+01 H		W	1.0E-03	3.6E-13	1.2E-11	5.8E-09
	Am-242m	013981-54-9(m)	1.520E+02 Y		W	1.0E-03	2.3E-10	2.8E-08	1.2E-10
	Am-243 <sup>†</sup>	014993-75-0	7.380E+03 Y		W	1.0E-03	2.4E-10	3.2E-08	2.4E-08
	Am-243 + D	014993-75-0(+D)	7.380E+03 Y		W	1.0E-03	2.4E-10	3.2E-08	2.5E-07
Antimony (51)	Sb-122	014374-79-9	2.700E+00 D		W	1.0E-01	2.0E-12	3.4E-12	1.4E-06
	Sb-124	014683-10-4	6.020E+01 D		W	1.0E-01	2.9E-12	2.2E-11	6.5E-06
	Sb-125	014234-35-6	2.770E+00 Y		W	1.0E-01	8.4E-13	1.1E-11	1.2E-06
	Sb-126	015756-32-8	1.240E+01 D		W	1.0E-01	2.8E-12	8.8E-12	9.1E-06
	Sb-126m	015756-32-8(m)	1.900E+01 M		W	1.0E-01	7.2E-14	2.6E-14	5.1E-06
	Sb-127	013968-50-8	3.850E+00 D		W	1.0E-01	2.0E-12	4.1E-12	2.1E-06
	Sb-129	014331-88-5	4.400E+00 H		W	1.0E-01	5.9E-13	5.1E-13	4.9E-06
Argon (18)	Ar-41	014163-25-8	1.830E+00 H		*	1.0E+00	-----	5.8E-16	4.4E-06
Astatine (85)	At-217 <sup>†</sup>	017239-90-6	3.230E-02 S		D	1.0E+00	4.5E-18	5.6E-17	7.7E-10

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Barium (56)	Ba-131	014914-75-1	1.180E+01 D	D	1.0E-01	4.8E-13	3.6E-13	1.2E-06
	Ba-133	013981-41-4	1.050E+01 Y	D	1.0E-01	1.2E-12	3.6E-12	8.4E-07
	Ba-133m	013981-41-4(m)	3.890E+01 H	D	1.0E-01	6.2E-13	3.5E-13	9.5E-08
	Ba-137m <sup>†</sup>	013981-97-0(m)	2.550E+00 M	D	1.0E-01	2.4E-15	6.0E-16	2.0E-06
	Ba-139	014378-25-7	8.310E+01 M	D	1.0E-01	2.1E-13	1.5E-13	7.7E-08
	Ba-140	014798-08-4	1.280E+01 D	D	1.0E-01	2.7E-12	2.0E-12	5.4E-07
Beryllium (4)	Be-7	013966-02-4	5.340E+01 D	Y	5.0E-03	3.0E-14	2.7E-13	1.5E-07
Bismuth (83)	Bi-206	015776-19-9	6.240E+00 D	W	5.0E-02	2.2E-12	4.3E-12	1.1E-05
	Bi-207	013982-38-2	3.340E+01 Y	W	5.0E-02	1.4E-12	1.8E-11	4.9E-06
	Bi-210 <sup>†</sup>	014331-79-4	5.010E+00 D	W	5.0E-02	1.6E-12	8.0E-11	0.0E+00
	Bi-211 <sup>†</sup>	015229-37-5	2.130E+00 M	W	5.0E-02	1.2E-14	1.9E-13	1.3E-07
	Bi-212 <sup>†</sup>	014913-49-6	6.055E+01 M	W	5.0E-02	3.1E-13	6.6E-12	5.9E-07
	Bi-213 <sup>†</sup>	015776-20-2	4.570E+01 M	W	5.0E-02	2.3E-13	3.0E-13	4.1E-07
	Bi-214 <sup>†</sup>	014733-03-0	1.990E+01 M	W	5.0E-02	1.3E-13	2.1E-12	5.3E-06
Bromine (35)	Br-82	014686-69-2	3.530E+01 H	D	1.0E+00	1.1E-12	8.7E-13	8.9E-06
Cadmium (20)	Cd-109	014109-32-1	4.640E+02 D	Y	5.0E-02	7.9E-12	6.5E-11	7.3E-10
	Cd-115	014336-68-6	5.350E+01 H	Y	5.0E-02	1.7E-12	2.6E-12	6.3E-07
	Cd-115m	014336-68-6(m)	4.460E+01 D	Y	5.0E-02	5.2E-12	3.9E-11	7.5E-08

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Calcium (20)	Ca-45	013966-05-7	1.630E+02 D	W	3.0E-01	9.9E-13	5.1E-12	5.8E-18
	Ca-47	001439-99-2	4.540E+00 D	W	3.0E-01	2.0E-12	4.6E-12	3.6E-06
Carbon (6)	C-11	014333-33-6	2.050E+01 M	D	1.0E+00	4.9E-14	2.1E-14	3.2E-06
	C-14	014762-75-5	5.730E+03 Y	*	1.0E+00	9.0E-13	6.4E-15	0.0E+00
	C-15	015929-23-4	2.450E+00 S	D	1.0E+00	8.1E-16	2.1E-16	-----
Cerium (58)	Ce-141	013967-74-3	3.250E+01 D	Y	3.0E-04	8.3E-13	8.4E-12	1.3E-07
	Ce-143	014119-19-8	3.300E+01 H	Y	3.0E-04	1.3E-12	2.2E-12	6.7E-07
	Ce-144	014762-78-8	2.840E+02 D	Y	3.0E-04	6.1E-12	3.4E-10	2.5E-08
Cesium (55)	Cs-131	014914-76-2	9.690E+00 D	D	1.0E+00	1.4E-13	1.0E-13	2.8E-09
	Cs-134	013967-70-9	2.060E+00 Y	D	1.0E+00	4.1E-11	2.8E-11	5.2E-06
	Cs-134m	013967-70-9(m)	2.900E+00 H	D	1.0E+00	4.1E-14	3.9E-14	2.0E-08
	Cs-135	015726-30-4	2.300E+06 Y	D	1.0E+00	4.0E-12	2.7E-12	0.0E+00
	Cs-136	014234-29-8	1.320E+01 D	D	1.0E+00	6.7E-12	4.6E-12	7.2E-06
	Cs-137 <sup>†</sup>	010045-97-3	3.020E+01 Y	D	1.0E+00	2.8E-11	1.9E-11	0.0E+00
	Cs-137 + D	010045-97-3(+D)	3.020E+01 Y	D	1.0E+00	2.8E-11	1.9E-11	2.0E-06
	Cs-138	015758-29-9	3.220E+01 M	D	1.0E+00	1.9E-13	9.6E-14	8.3E-06
Chlorine (17)	Cl-36	013981-43-6	3.010E+05 Y	D	1.0E+00	1.8E-12	1.4E-12	0.0E+00
	Cl-38	014158-34-0	3.720E+01 M	D	1.0E+00	2.3E-13	1.3E-13	5.7E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Chromium (24)	Cr-51	014392-02-0	2.770E+01 D	Y	1.0E-01	4.3E-14	3.0E-13	9.2E-08
Cobalt (27)	Co-57	013981-50-5	2.710E+02 D	Y	3.0E-01	5.8E-13	8.2E-12	1.9E-07
	Co-58	01381-38-9	7.080E+01 D	Y	3.0E-01	1.6E-12	9.8E-12	3.3E-06
	Co-58m	01381-38-9(m)	9.150E+00 H	Y	3.0E-01	3.2E-14	7.3E-14	4.8E-11
	Co-60	010198-40-0	5.270E+00 Y	Y	3.0E-01	1.5E-11	1.5E-10	8.6E-06
Copper (29)	Cu-64	013981-25-4	1.270E+01 H	Y	5.0E-01	1.7E-13	2.0E-13	6.0E-07
Curium (96)	Cm-242	015510-73-3	1.630E+02 D	W	1.0E-03	1.3E-11	3.9E-09	3.4E-11
	Cm-243	015757-87-6	2.850E+01 Y	W	1.0E-03	1.9E-10	2.6E-08	1.6E-07
	Cm-244	013981-15-2	1.810E+01 Y	W	1.0E-03	1.6E-10	2.2E-08	3.0E-11
	Cm-245	015621-76-8	8.500E+03 Y	W	1.0E-03	2.4E-10	3.2E-08	5.3E-08
	Cm-246	015757-90-1	4.750E+03 Y	W	1.0E-03	2.4E-10	3.2E-08	2.7E-11
	Cm-247	015758-32-4	1.560E+07 Y	W	1.0E-03	2.2E-10	3.0E-08	9.2E-07
	Cm-248	015758-33-5	3.390E+05 Y	W	1.0E-03	9.1E-10	1.2E-07	2.2E-11
Dysprosium (66)	Dy-165	013967-64-1	2.330E+00 H	W	3.0E-04	1.5E-13	1.1E-13	5.7E-08
	Dy-166	015840-01-4	8.160E+01 H	W	3.0E-04	1.9E-12	5.0E-12	2.7E-08
Erbium (63)	Er-169	015840-13-8	9.400E+00 D	W	3.0E-04	4.4E-13	1.5E-12	8.4E-12
	Er-171	014391-45-8	7.520E+00 H	W	3.0E-04	4.6E-13	3.9E-13	9.4E-07
Europium (63)	Eu-152	014683-23-9	1.360E+01 Y	W	1.0E-03	2.1E-12	1.1E-10	3.6E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
	Eu-154	015585-10-1	8.800E+00	Y	W	1.0E-03	3.0E-12	1.4E-10	4.1E-06
	Eu-155	014391-16-3	4.960E+00	Y	W	1.0E-03	4.5E-13	1.8E-11	5.9E-08
	Eu-156	014280-35-4	1.520E+01	D	W	1.0E-03	2.5E-12	1.1E-11	4.8E-06
Fluorine (9)	F-18	013981-56-1	1.100E+02	M	D	1.0E+00	9.8E-14	7.1E-14	3.1E-06
Francium (87)	Fr-221 <sup>†</sup>	015756-41-9	4.800E+00	M	D	1.0E+00	5.9E-14	9.2E-13	6.2E-08
	Fr-223 <sup>†</sup>	015756-98-6	2.180E+00	M	D	1.0E+00	1.7E-13	4.2E-13	4.1E-08
Gadolinium (64)	Gd-153	014276-65-4	2.420E+02	D	W	3.0E-04	3.1E-13	5.8E-12	7.3E-08
	Gd-159	014041-42-0	1.860E+01	H	W	3.0E-04	5.9E-13	6.3E-13	8.9E-08
Gallium (31)	Ga-67	014119-09-6	3.260E+00	D	W	1.0E-03	2.1E-13	3.6E-13	3.3E-07
	Ga-72	013982-22-4	1.410E+01	H	W	1.0E-03	1.3E-12	1.2E-12	9.8E-06
Germanium (32)	Ge-71	014374-81-3	1.180E+01	D	W	1.0E+00	6.8E-15	1.3E-13	2.3E-11
Gold (79)	Au-196	014914-16-0	6.180E+00	D	Y	1.0E-01	3.9E-13	8.7E-13	1.3E-06
	Au-198	010043-49-0	2.700E+00	D	Y	1.0E-01	1.2E-12	2.1E-12	1.2E-06
Holmium (67)	Ho-166	013967-65-2	2.680E+01	H	W	3.0E-04	1.7E-12	2.2E-12	6.5E-08
Hydrogen (1)	H-3	010028-17-8	1.230E+01	Y	*	1.0E+00	5.4E-14	7.8E-14	0.0E+00
Indium (49)	In-113m	014885-78-0(m)	1.660E+00	H	W	2.0E-02	4.9E-14	2.9E-14	7.0E-07
	In-114	013981-55-0	7.190E+01	S	W	2.0E-02	5.5E-15	1.5E-15	1.0E-07
	In-114m	013981-55-0(m)	4.950E+01	D	W	2.0E-02	5.4E-12	4.2E-11	1.8E-07

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Iodine (53)	In-115	014191-71-0	4.600E+15 Y	W	2.0E-02	3.2E-11	2.2E-10	0.0E+00
	In-115m	014191-71-0(m)	4.360E+00 H	W	2.0E-02	1.2E-13	9.4E-14	3.9E-07
	I-122	018287-75-7	3.620E+00 M	D	1.0E+00	2.5E-14	7.9E-15	3.0E-06
	I-123	015715-08-9	1.310E+01 H	D	1.0E+00	1.0E-12	5.7E-13	2.4E-07
	I-125	014158-31-7	6.010E+01 D	D	1.0E+00	7.9E-12	5.3E-12	2.9E-09
	I-126	014158-32-8	1.290E+01 D	D	1.0E+00	1.5E-11	9.8E-12	1.3E-06
	I-129	015046-84-1	1.570E+07 Y	D	1.0E+00	1.9E-10	1.2E-10	4.1E-09
	I-130	014914-02-4	1.240E+01 H	D	1.0E+00	9.1E-12	5.1E-12	7.0E-06
	I-131	010043-66-0	8.040E+00 D	D	1.0E+00	3.6E-11	2.4E-11	1.5E-06
	I-132	014683-16-0	2.300E+00 H	D	1.0E+00	1.0E-12	5.8E-13	7.7E-06
	I-133	014834-67-4	2.080E+01 H	D	1.0E+00	2.1E-11	1.2E-11	2.0E-06
	I-134	014914-27-3	5.260E+01 M	D	1.0E+00	2.8E-13	1.6E-13	9.0E-06
	I-135	014834-68-5	6.610E+00 H	D	1.0E+00	4.2E-12	2.4E-12	5.5E-06
	Ir-190	014981-91-0	1.180E+01 D	Y	1.0E-02	1.4E-12	4.8E-12	4.2E-06
Iridium (77)	Ir-192	014694-69-0	7.400E+01 D	Y	1.0E-02	1.7E-12	2.7E-11	2.4E-06
	Ir-194	014158-35-1	1.920E+01 H	Y	1.0E-02	1.6E-12	1.8E-12	2.8E-07
Iron (26)	Fe-55	014681-59-5	2.700E+00 Y	W	1.0E-01	2.7E-13	8.4E-13	0.0E+00
	Fe-59	014596-12-4	4.460E+01 D	W	1.0E-01	2.8E-12	9.7E-12	4.1E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Krypton (36)	Kr-83m	013965-98-5(m)	1.830E+00 H	*	1.0E+00	-----	6.2E-17	3.4E-11
	Kr-85	013983-27-2	1.070E+01 Y	*	1.0E+00	-----	4.7E-17	7.0E-09
	Kr-85m	013983-27-2(m)	4.480E+00 H	*	1.0E+00	-----	4.9E-16	3.4E-07
	Kr-87	014809-68-8	7.630E+01 M	*	1.0E+00	-----	2.2E-15	2.8E-06
	Kr-88	014995-61-0	2.840E+00 H	*	1.0E+00	-----	4.7E-15	7.3E-06
	Kr-89	016316-03-3	3.160E+00 M	*	1.0E+00	-----	2.6E-15	6.5E-06
	Kr-90	015741-13-6	3.230E+01 S	*	1.0E+00	-----	2.4E-15	4.2E-06
Lanthanum (57)	La-140	013981-28-7	4.020E+01 H	W	1.0E-03	2.3E-12	3.0E-12	8.0E-06
Lead (82)	Pb-203	014687-25-3	5.200E+01 H	D	2.0E-01	3.2E-13	2.6E-13	5.9E-07
	Pb-209 <sup>†</sup>	014119-30-3	3.250E+00 H	D	2.0E-01	8.5E-14	7.0E-14	0.0E+00
	Pb-210 <sup>†</sup>	014255-04-0	2.230E+01 Y	D	2.0E-01	5.1E-10	1.3E-09	1.3E-10
	Pb-210+D	014255-04-0(+D)	2.230E+01 Y	D	2.0E-01	6.6E-10	4.0E-09	1.6E-10
	Pb-211 <sup>†</sup>	015816-77-0	3.610E+01 M	D	2.0E-01	1.8E-13	2.8E-12	1.6E-07
	Pb-212 <sup>†</sup>	015092-94-1	1.060E+01 H	D	2.0E-01	5.5E-12	4.3E-11	2.8E-07
	Pb-214 <sup>†</sup>	015067-28-4	2.680E+01 M	D	2.0E-01	1.7E-13	2.9E-12	6.4E-07
Lutetium (71)	Lu-177	014265-75-9	6.710E+00 D	Y	3.0E-04	6.2E-13	1.9E-12	6.7E-08
Manganese (25)	Mn-52	014092-99-0	5.590E+00 D	W	1.0E-01	2.2E-12	3.7E-12	1.2E-05
	Mn-54	013966-31-9	3.130E+02 D	W	1.0E-01	1.1E-12	5.3E-12	2.9E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	H	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Mercury (80)	Mn-56	014681-52-8	2.580E+00	H	W	1.0E-01	4.0E-13	2.8E-13	6.1E-06
	Hg-197	013981-51-6	6.410E+01	H	W	2.0E-02	2.7E-13	4.5E-13	5.5E-08
	Hg-203	013982-78-0	4.660E+01	D	W	2.0E-02	6.6E-13	4.8E-12	5.7E-07
Molybdenum (42)	Mo-99	014119-15-4	6.600E+01	H	Y	8.0E-01	1.5E-12	2.6E-12	4.9E-07
Neodymium (60)	Nd-147	014269-74-0	1.100E+01	D	Y	3.0E-04	1.3E-12	5.5E-12	3.0E-07
	Nd-149	015749-81-2	1.730E+00	H	Y	3.0E-04	1.9E-13	1.6E-13	9.8E-07
Neptunium (93)	Np-236	015700-36-4	1.150E+05	Y	W	1.0E-03	2.3E-13	3.9E-12	8.9E-08
	Np-237 <sup>†</sup>	013994-20-2	2.140E+06	Y	W	1.0E-03	2.2E-10	2.9E-08	7.8E-09
	Np-237 + D	013994-20-2(+D)	2.140E+06	Y	W	1.0E-03	2.2E-10	2.9E-08	4.3E-07
	Np-238	015766-25-3	2.120E+00	D	W	1.0E-03	1.1E-12	3.3E-12	1.7E-06
	Np-239 <sup>†</sup>	013968-59-7	2.360E+00	D	W	1.0E-03	9.4E-13	1.5E-12	2.3E-07
	Np-240	015690-84-3	6.500E+01	M	W	1.0E-03	1.3E-13	6.5E-14	3.2E-06
	Np-240m	015690-84-3(m)	7.400E+00	M	W	1.0E-03	2.9E-14	9.0E-15	9.3E-07
	Ni-59	014336-70-0	7.500E+04	Y	W	5.0E-02	9.1E-14	7.0E-13	0.0E+00
Nickel (28)	Ni-63	013981-37-8	1.000E+02	Y	W	5.0E-02	2.4E-13	1.8E-12	0.0E+00
	Ni-65	014833-49-9	2.520E+00	H	W	5.0E-02	2.6E-13	1.9E-13	1.9E-06
Niobium (41)	Nb-93m	007440-03-1(m)	1.460E+01	Y	Y	1.0E-02	1.5E-13	1.9E-11	5.3E-11
	Nb-94	014681-63-1	2.030E+04	Y	Y	1.0E-02	2.1E-12	2.1E-10	5.4E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]



**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>**  
(In Units of Picocuries<sup>b</sup>)

MARCH 1994

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>a</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Osmium (76)	Nb-95	013967-76-5	3.510E+01 D	Y	1.0E-02	6.5E-13	5.1E-12	2.6E-06
	Nb-95m	013967-76-5(m)	8.660E+01 H	Y	1.0E-02	6.6E-13	1.6E-12	8.1E-08
	Nb-97	018496-04-3	7.210E+01 M	Y	1.0E-02	1.2E-13	6.9E-14	2.2E-06
	Nb-97m	018496-04-3(m)	6.000E+01 S	Y	1.0E-02	2.4E-15	1.1E-15	2.5E-06
	Os-185	015766-50-4	9.360E+01 D	Y	1.0E-02	6.3E-13	8.9E-12	2.2E-06
	Os-191	014119-24-5	1.540E+01 D	Y	1.0E-02	6.7E-13	3.6E-12	8.5E-08
	Os-191m	014119-24-5(m)	1.300E+01 H	Y	1.0E-02	1.2E-13	2.1E-13	3.4E-09
Palladium (46)	Os-193	016057-77-5	3.000E+01 H	Y	1.0E-02	9.6E-13	1.2E-12	1.7E-07
	Pd-100	015690-69-4	3.640E+00 D	Y	5.0E-03	1.0E-12	2.3E-12	-----
	Pd-101	015749-54-9	8.480E+00 H	Y	5.0E-03	1.2E-13	1.1E-13	-----
	Pd-103	014967-68-1	1.700E+01 D	Y	5.0E-03	2.2E-13	1.4E-12	7.3E-10
	Pd-107	017637-99-9	6.500E+06 Y	Y	5.0E-03	4.4E-14	6.4E-12	0.0E+00
Phosphorus (15)	Pd-109	014981-64-7	1.350E+01 H	Y	5.0E-03	7.9E-13	8.1E-13	2.2E-09
	P-32	014596-37-3	1.430E+01 D	D	8.0E-01	3.5E-12	3.0E-12	0.0E+00
	P-33	015749-66-3	2.540E+01 D	D	8.0E-01	5.6E-13	4.6E-13	0.0E+00
Platinum (78)	Pt-191	015706-36-2	2.710E+00 D	D	1.0E-02	3.8E-13	3.0E-13	6.3E-07
	Pt-193	015735-70-3	5.000E+01 Y	D	1.0E-02	3.5E-14	8.2E-14	0.0E+00
	Pt-193m	015735-70-3(m)	4.330E+00 D	D	1.0E-02	5.3E-13	4.0E-13	7.6E-09

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Plutonium (94)	Pt-197	015735-74-7	1.830E+01 H	D	1.0E-02	4.9E-13	3.2E-13	3.1E-08
	Pt-197m	015735-74-7(m)	9.440E+01 M	D	1.0E-02	1.2E-13	8.7E-14	1.6E-07
	Pu-236	015411-92-4	2.850E+00 Y	Y	1.0E-03	5.0E-11	2.4E-08	3.4E-11
	Pu-238	013981-16-3	8.780E+01 Y	Y	1.0E-03	2.2E-10	3.9E-08	2.8E-11
	Pu-239	015117-48-3	2.410E+04 Y	Y	1.0E-03	2.3E-10	3.8E-08	1.7E-11
	Pu-240	014119-33-6	6.570E+03 Y	Y	1.0E-03	2.3E-10	3.8E-08	2.7E-11
	Pu-241	014119-32-5	1.440E+01 Y	Y	1.0E-03	3.6E-12	2.3E-10	0.0E+00
	Pu-242	013982-10-0	3.760E+05 Y	Y	1.0E-03	2.2E-10	3.6E-08	2.3E-11
	Pu-243	015706-37-3	4.960E+00 H	Y	1.0E-03	1.1E-13	1.0E-13	1.8E-08
Polonium (84)	Pu-244	014119-34-7	8.260E+07 Y	Y	1.0E-03	2.2E-10	3.6E-08	1.9E-11
	Po-210 <sup>†</sup>	013981-52-7	1.380E+02 D	W	1.0E-01	1.5E-10	2.6E-09	2.9E-11
	Po-212 <sup>†</sup>	015389-34-1	2.980E-07 S	W	1.0E-01	2.2E-23	6.1E-22	0.0E+00
	Po-213 <sup>†</sup>	015756-57-7	4.200E-06 S	W	1.0E-01	3.2E-22	8.0E-21	1.0E-10
	Po-214 <sup>†</sup>	015735-67-8	1.640E-04 S	W	1.0E-01	1.0E-20	2.8E-19	2.8E-10
	Po-215 <sup>†</sup>	015706-52-2	1.780E-03 S	W	1.0E-01	2.8E-19	5.7E-18	4.6E-10
	Po-216 <sup>†</sup>	015756-58-8	1.460E-01 S	W	1.0E-01	3.0E-17	4.8E-16	5.0E-11
	Po-218 <sup>†</sup>	015422-24-9	3.050E+00 M	W	1.0E-01	2.8E-14	5.8E-13	0.0E+00
Potassium (19)	K-40	013966-00-2	1.280E+09 Y	D	1.0E+00	1.1E-11	7.6E-12	5.4E-07

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Praseodymium (59)	K-42	014378-21-3	1.240E+01 H	D	1.0E+00	8.9E-13	1.2E-12	9.6E-07
	Pr-142	014191-64-1	1.910E+01 H	Y	3.0E-04	1.6E-12	1.8E-12	2.1E-07
	Pr-143	014981-79-4	1.360E+01 D	Y	3.0E-04	1.4E-12	7.0E-12	3.0E-14
	Pr-144	014119-05-2	1.730E+01 M	Y	3.0E-04	9.5E-14	3.6E-14	1.2E-07
	Pr-144m	014119-05-2(m)	7.200E+00 M	Y	3.0E-04	3.7E-14	1.6E-14	2.1E-09
Promethium (61)	Pm-147	014380-75-7	2.620E+00 Y	Y	3.0E-04	3.1E-13	3.0E-11	6.0E-12
	Pm-148	014683-19-3	5.370E+00 D	Y	3.0E-04	3.1E-12	7.9E-12	1.9E-06
	Pm-148m	014683-19-3(m)	4.130E+01 D	Y	3.0E-04	2.5E-12	4.8E-11	6.5E-06
	Pm-149	015765-31-8	5.310E+01 H	Y	3.0E-04	1.2E-12	1.9E-12	3.3E-08
Protactinium (91)	Pa-231 <sup>†</sup>	014331-85-2	3.730E+04 Y	Y	1.0E-03	9.2E-11	3.6E-08	2.6E-08
	Pa-233 <sup>†</sup>	013981-14-1	2.700E+01 D	Y	1.0E-03	1.0E-12	8.6E-12	4.2E-07
	Pa-234	015100-28-4	6.700E+00 H	Y	1.0E-03	6.8E-13	5.4E-13	5.9E-06
	Pa-234m <sup>†</sup>	015100-28-4(m)	1.170E+00 M	Y	1.0E-03	5.8E-15	1.6E-15	3.6E-08
Radium (88)	Ra-223 <sup>†</sup>	015623-45-7	1.140E+01 D	W	2.0E-01	6.4E-11	3.1E-09	2.3E-07
	Ra-224 <sup>†</sup>	013233-32-4	3.620E+00 D	W	2.0E-01	3.8E-11	1.2E-09	2.3E-08
	Ra-225 <sup>†</sup>	013981-53-8	1.480E+01 D	W	2.0E-01	5.1E-11	1.5E-09	1.9E-09
	Ra-226 <sup>†</sup>	013982-63-3	1.600E+03 Y	W	2.0E-01	1.2E-10	3.0E-09	1.2E-08
	Ra-226 + D	013982-63-3(+D)	1.600E+03 Y	W	2.0E-01	1.2E-10	3.0E-09	6.0E-06

[Table 4A continues on the following page; Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Radon (86)	Ra-228 <sup>i</sup>	015262-20-1	5.750E+00	Y	W	2.0E-01	1.0E-10	6.6E-10	0.0E+00
	Ra-228 + D	015262-20-1(+D)	5.750E+00	Y	W	2.0E-01	1.0E-10	6.9E-10	2.9E-06
	Rn-219 <sup>i</sup>	014835-02-0	3.960E+00	S	*	1.0E+00	-----	4.6E-14	1.6E-07
	Rn-220 <sup>i</sup>	022481-48-7	5.560E+01	S	*	1.0E+00	-----	1.2E-13	1.7E-09
	Rn-222 <sup>i</sup>	014859-67-7	3.820E+00	D	*	1.0E+00	1.4E-12	7.3E-13	1.2E-09
Rhodium (45)	Rn-222 + D	014859-67-7(+D)	3.820E+00	D	*	1.0E+00	1.7E-12	7.7E-12	5.9E-06
	Rh-103m	007440-16-6(m)	5.610E+01	M	Y	5.0E-02	6.9E-15	3.9E-15	7.9E-11
	Rh-105	014913-89-4	3.540E+01	H	Y	5.0E-02	4.3E-13	5.9E-13	2.2E-07
	Rh-105m	014913-89-4(m)	4.500E+01	S	Y	5.0E-02	6.2E-16	3.4E-16	2.2E-08
	Rh-106	014234-34-5	2.990E+01	S	Y	5.0E-02	4.4E-15	1.2E-15	6.7E-07
Rubidium (37)	Rb-82	014391-63-0	1.250E+00	M	D	1.0E+00	1.2E-14	3.5E-15	3.5E-06
	Rb-86	014932-53-7	1.870E+01	D	D	1.0E+00	5.9E-12	4.5E-12	3.3E-07
	Rb-87	013982-13-3	4.730E+10	Y	D	1.0E+00	3.4E-12	2.4E-12	0.0E+00
	Rb-88	014928-36-0	1.780E+01	M	D	1.0E+00	1.7E-13	7.9E-14	2.4E-06
	Rb-89	014191-65-2	1.540E+01	M	D	1.0E+00	9.3E-14	3.9E-14	7.4E-06
Ruthenium (44)	Ru-97	015758-35-7	2.900E+00	D	Y	5.0E-02	1.7E-13	2.6E-13	4.2E-07
	Ru-103	013968-53-1	3.940E+01	D	Y	5.0E-02	9.0E-13	8.4E-12	1.5E-06
	Ru-105	014331-95-4	4.440E+00	H	Y	5.0E-02	3.7E-13	3.3E-13	2.6E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Samarium (62)	Ru-106	013967-48-1	3.680E+02 D	Y	Y	5.0E-02	9.5E-12	4.4E-10	0.0E+00
	Sm-147	014392-33-7	1.060E+11 Y	W	W	3.0E-04	1.6E-11	7.2E-09	0.0E+00
	Sm-151	015715-94-3	9.000E+01 Y	W	W	3.0E-04	1.1E-13	8.7E-12	4.0E-13
Scandium (21)	Sm-153	015766-00-4	4.670E+01 H	W	W	3.0E-04	8.7E-13	1.3E-12	4.6E-08
	Sc-46	013967-63-0	8.380E+01 D	Y	Y	1.0E-04	1.6E-12	2.7E-11	6.9E-06
	Sc-47	014391-96-9	3.420E+00 D	Y	Y	1.0E-04	6.4E-13	1.2E-12	2.3E-07
Selenium (34)	Sc-48	014391-86-7	4.370E+01 H	Y	Y	1.0E-04	1.9E-12	2.3E-12	1.2E-05
	Se-75	014265-71-5	1.200E+02 D	W	W	8.0E-01	5.8E-12	6.0E-12	8.1E-07
Silicon (14)	Si-31	014276-49-4	1.570E+02 M	W	W	1.0E-02	2.2E-13	1.7E-13	3.0E-09
Silver (47)	Ag-105	014928-14-4	4.130E+01 D	Y	Y	5.0E-02	7.3E-13	4.0E-12	-----
	Ag-108	014391-65-2	2.370E+00 M	Y	Y	5.0E-02	8.5E-15	2.4E-15	5.1E-08
	Ag-108m	014391-65-2(m)	1.270E+02 Y	Y	Y	5.0E-02	3.5E-12	1.5E-10	5.0E-06
Sodium (11)	Ag-109m	014378-38-2(m)	3.960E+01 S	Y	Y	5.0E-02	3.3E-16	8.9E-17	1.3E-09
	Ag-110	014391-76-5	2.460E+01 S	Y	Y	5.0E-02	3.0E-15	8.1E-16	1.0E-07
	Ag-110m	014391-76-5(m)	2.500E+02 D	Y	Y	5.0E-02	4.7E-12	6.9E-11	9.3E-06
	Ag-111	157690-04-0	7.460E+00 D	Y	Y	5.0E-02	1.6E-12	4.8E-12	7.7E-08
	Na-22	013966-32-0	2.600E+00 Y	D	D	1.0E+00	6.8E-12	4.8E-12	7.2E-06
	Na-24	013982-04-2	1.500E+01 H	D	D	1.0E+00	1.0E-12	9.6E-13	1.6E-05

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Strontium (38)	Sr-82	014809-50-8	2.500E+01	D	D	3.0E-01	7.5E-12	6.9E-12	1.3E-10
	Sr-85	013967-73-2	6.480E+01	D	D	3.0E-01	7.7E-13	1.0E-12	1.4E-06
	Sr-85m	013967-73-2(m)	6.770E+01	M	D	3.0E-01	1.2E-14	6.1E-15	4.8E-07
	Sr-89	014158-27-1	5.060E+01	D	D	3.0E-01	3.0E-12	2.9E-12	4.7E-10
	Sr-90 <sup>†</sup>	010098-97-2	2.860E+01	Y	D	3.0E-01	3.3E-11	5.6E-11	0.0E+00
	Sr-90 + D	010098-97-2(+D)	2.860E+01	Y	D	3.0E-01	3.6E-11	6.2E-11	0.0E+00
	Sr-91	014331-91-0	9.500E+00	H	D	3.0E-01	8.5E-13	6.9E-13	2.4E-06
	Sr-92	014928-29-1	2.710E+00	H	D	3.0E-01	5.7E-13	4.5E-13	4.6E-06
Sulfur (16)	S-35	015117-53-0	8.740E+01	D	D	8.0E-01	2.2E-13	1.9E-13	0.0E+00
Tantalum (73)	Ta-182	013982-00-8	1.150E+02	D	Y	1.0E-03	1.7E-12	4.3E-11	4.1E-06
Technetium (43)	Tc-95	014809-56-4	2.000E+01	H	W	8.0E-01	5.6E-14	2.3E-14	2.4E-06
	Tc-95m	014809-56-4(m)	6.100E+01	D	W	8.0E-01	1.8E-12	4.0E-12	1.9E-06
	Tc-96	014808-44-7	4.280E+00	D	W	8.0E-01	1.8E-12	2.1E-12	8.3E-06
	Tc-96m	014808-44-7(m)	5.150E+01	M	W	8.0E-01	2.3E-14	2.1E-14	7.0E-08
	Tc-97	015759-35-0	2.600E+06	Y	W	8.0E-01	1.5E-13	9.8E-13	3.5E-10
	Tc-97m	015759-35-0(m)	8.900E+01	D	W	8.0E-01	1.1E-12	5.0E-12	3.7E-10
	Tc-99	014133-76-7	2.130E+05	Y	W	8.0E-01	1.3E-12	8.3E-12	6.0E-13
	Tc-99m	014133-76-7(m)	6.020E+00	H	W	8.0E-01	5.0E-14	2.7E-14	2.3E-07

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Tellurium (52)	Te-125m	014390-73-9(m)	5.800E+01 D	W	2.0E-01	8.5E-13	5.4E-12	2.6E-09
	Te-127	013981-49-2	9.350E+00 H	W	2.0E-01	2.3E-13	2.3E-13	1.4E-08
	Te-127m	013981-49-2(m)	1.090E+02 D	W	2.0E-01	2.2E-12	1.6E-11	8.4E-10
	Te-129	014269-71-7	6.960E+01 M	W	2.0E-01	1.1E-13	6.8E-14	1.3E-07
	Te-129m	014269-71-7(m)	3.360E+01 D	W	2.0E-01	3.2E-12	2.0E-11	6.3E-08
	Te-131	014683-12-6	2.500E+01 M	W	2.0E-01	2.8E-13	1.4E-13	1.2E-06
	Te-131m	014683-12-6(m)	3.000E+01 H	W	2.0E-01	3.8E-12	5.4E-12	4.7E-06
	Te-132	014234-28-7	7.820E+01 H	W	2.0E-01	3.0E-12	5.3E-12	4.0E-07
Terbium (65)	Tb-158	015759-55-4	1.500E+02 Y	W	3.0E-04	1.2E-12	9.4E-11	-----
	Tb-160	013981-29-8	7.230E+01 D	W	3.0E-04	1.8E-12	1.9E-11	3.6E-06
Thallium (81)	Tl-202	015720-57-7	1.220E+01 D	D	1.0E+00	8.4E-13	6.0E-13	1.3E-06
	Tl-204	013968-51-9	3.780E+00 Y	D	1.0E+00	1.7E-12	1.3E-12	8.7E-10
	Tl-207 <sup>†</sup>	014133-67-6	4.770E+00 M	D	1.0E+00	1.3E-14	4.5E-15	7.5E-09
	Tl-208 <sup>†</sup>	014913-50-9	3.050E+00 M	D	1.0E+00	1.8E-14	5.0E-15	1.3E-05
	Tl-209 <sup>†</sup>	015690-73-0	2.200E+00 M	D	1.0E+00	1.4E-14	4.3E-15	6.9E-06
Thorium (90)	Th-227 <sup>†</sup>	015623-47-9	1.870E+01 D	Y	2.0E-04	4.5E-12	4.9E-09	1.6E-07
	Th-228 <sup>†</sup>	014274-82-9	1.910E+00 Y	Y	2.0E-04	1.1E-11	7.7E-08	5.5E-10
	Th-228 + D	014274-82-9(+D)	1.910E+00 Y	Y	2.0E-04	5.5E-11	7.8E-08	5.6E-06

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

MARCH 1994

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Thulium (69)	Th-229 <sup>†</sup>	015594-54-4	7.340E+03	Y	Y	2.0E-04	2.1E-11	7.3E-08	5.8E-08
	Th-229 + D	015594-54-4(+D)	7.340E+03	Y	Y	2.0E-04	8.9E-11	7.7E-08	6.8E-07
	Th-230 <sup>†</sup>	014269-63-7	7.700E+04	Y	Y	2.0E-04	1.3E-11	2.9E-08	5.4E-11
	Th-231 <sup>†</sup>	014932-40-2	2.550E+01	H	Y	2.0E-04	4.0E-13	4.9E-13	2.3E-09
	Th-232 <sup>†</sup>	007440-29-1	1.410E+10	Y	Y	2.0E-04	1.2E-11	2.8E-08	2.6E-11
	Th-234 <sup>†</sup>	015065-10-8	2.410E+01	D	Y	2.0E-04	4.0E-12	3.2E-11	3.5E-09
Tin (50)	Tm-170	013981-30-1	1.290E+02	D	W	3.0E-04	1.5E-12	2.1E-11	3.8E-09
	Tm-171	014333-45-0	1.920E+00	Y	W	3.0E-04	1.2E-13	3.1E-12	3.3E-10
	Sn-113	013966-06-8	1.150E+02	D	W	2.0E-02	8.7E-13	9.4E-12	3.3E-09
Tungsten (74)	Sn-121	014683-06-8	2.710E+01	H	W	2.0E-02	2.7E-13	3.2E-13	-----
	Sn-121m	014683-06-8(m)	5.550E+01	Y	W	2.0E-02	5.4E-13	9.3E-12	-----
	Sn-125	014683-08-0	9.640E+00	D	W	2.0E-02	3.6E-12	1.2E-11	1.1E-06
	Sn-126	015832-50-5	1.000E+05	Y	W	2.0E-02	5.6E-12	7.7E-11	3.3E-08
	W-181	015749-46-9	1.210E+02	D	D	3.0E-01	8.3E-14	6.4E-14	2.2E-08
Uranium (92)	W-185	014932-41-3	7.510E+01	D	D	3.0E-01	4.7E-13	3.0E-13	4.7E-11
	W-187	014983-48-3	2.380E+01	H	D	3.0E-01	6.3E-13	3.9E-13	1.5E-06
	U-232	014158-29-3	7.200E+01	Y	Y	5.0E-02	3.7E-11	6.0E-08	4.6E-11
	U-233	013968-55-3	1.590E+05	Y	Y	5.0E-02	1.6E-11	2.7E-08	4.2E-11

[Table 4A continues on the following page: Refer to Endnotes on the last page.]



**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Vanadium (23)	U-234 <sup>i</sup>	013966-29-5	2.450E+05	Y	Y	5.0E-02	1.6E-11	2.6E-08	3.0E-11
	U-235 <sup>i</sup>	015117-96-1	7.040E+08	Y	Y	5.0E-02	1.6E-11	2.5E-08	2.4E-07
	U-235 + D	015117-96-1(+D)	7.040E+08	Y	Y	5.0E-02	1.6E-11	2.5E-08	2.4E-07
	U-236	013982-70-2	2.340E+07	Y	Y	5.0E-02	1.5E-11	2.5E-08	2.4E-11
	U-237	014269-75-1	6.750E+00	D	Y	5.0E-02	8.9E-13	2.6E-12	1.3E-07
	U-238 <sup>i</sup>	007440-61-1	4.470E+09	Y	Y	5.0E-02	1.6E-11	2.4E-08	2.1E-11
	U-238 + D	007440-61-1(+D)	4.470E+09	Y	Y	5.0E-02	2.0E-11	2.4E-08	5.1E-08
	U-240	015687-53-3	1.410E+01	H	Y	5.0E-02	1.2E-12	1.2E-12	1.5E-10
	V-48	014331-97-6	1.600E+01	D	W	1.0E-02	2.2E-12	7.6E-12	9.9E-06
	Xe-122	015151-09-4	2.010E+01	H	*	1.0E+00	-----	3.3E-15	8.4E-08
Xenon (54)	Xe-123	015700-10-4	2.140E+00	H	*	1.0E+00	-----	7.4E-16	1.7E-06
	Xe-125	013994-18-8	1.680E+01	H	*	1.0E+00	-----	4.2E-16	4.7E-07
	Xe-127	013994-19-9	3.640E+01	D	*	1.0E+00	-----	4.0E-16	5.0E-07
	Xe-129m	013965-99-6(m)	8.890E+00	D	*	1.0E+00	-----	6.0E-16	1.3E-08
	Xe-131m	014683-11-5(m)	1.180E+01	D	*	1.0E+00	-----	4.3E-16	4.5E-09
	Xe-133	014932-42-4	5.250E+00	D	*	1.0E+00	-----	4.3E-16	2.3E-08
	Xe-133m	014932-42-4(m)	2.190E+00	D	*	1.0E+00	-----	5.4E-16	3.3E-08
	Xe-135	014995-62-1	9.110E+00	H	*	1.0E+00	-----	8.0E-16	6.2E-07

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>**  
(In Units of Picocuries<sup>b</sup>)

MARCH 1994

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>a</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)
Yttrium (39)	Xe-135m	014995-62-1(m)	1.540E+01 M	*	1.0E+00	-----	2.1E-16	1.3E-06
	Xe-137	014835-21-3	3.830E+00 M	*	1.0E+00	-----	1.8E-15	6.0E-07
	Xe-138	015751-81-2	1.410E+01 M	*	1.0E+00	-----	2.8E-15	4.0E-06
	Y-90 <sup>†</sup>	010098-91-6	6.410E+01 H	Y	1.0E-04	3.2E-12	5.5E-12	0.0E+00
	Y-91	014234-24-3	5.850E+01 D	Y	1.0E-04	2.8E-12	4.3E-11	1.2E-08
	Y-91m	014234-24-3(m)	4.970E+01 M	Y	1.0E-04	2.2E-14	3.5E-14	1.7E-06
	Y-92	015751-59-4	3.540E+00 H	Y	1.0E-04	7.1E-13	5.3E-13	8.6E-07
Zinc (30)	Y-93	014981-70-5	1.010E+01 H	Y	1.0E-04	1.4E-12	1.4E-12	3.0E-07
	Zn-65	013982-39-3	2.440E+02 D	Y	5.0E-01	8.5E-12	1.6E-11	2.0E-06
	Zn-69	013982-23-5	5.560E+01 M	Y	5.0E-01	5.6E-14	3.2E-14	1.8E-11
Zirconium (40)	Zn-69m	013982-23-5(m)	1.380E+01 H	Y	5.0E-01	4.3E-13	5.7E-13	1.3E-06
	Zr-93	015751-77-6	1.530E+06 Y	W	2.0E-03	1.7E-13	6.5E-12	0.0E+00
	Zr-95	013967-71-0	6.400E+01 D	W	2.0E-03	9.9E-13	1.0E-11	2.5E-06
	Zr-97	014928-30-4	1.690E+01 H	W	2.0E-03	2.4E-12	2.5E-12	6.1E-07

[Table 4A continues on the following page: Refer to Endnotes on the last page.]

**Table 4A: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Picocuries<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/pCi)	Inhalation (Risk/pCi)	External Exposure (Risk/yr per pCi/g soil)

**ENDNOTES:**

<sup>a</sup> EPA classifies all radionuclides as Group A (known human) carcinogens. Radionuclide slope factors are calculated by EPA's Office of Radiation and Indoor Air (ORIA) to assist HEAST users with risk-related evaluations and decision-making at various stages of the remediation process. Ingestion and inhalation slope factors are best estimates (i.e., median or 50th percentile values) of the age-averaged, lifetime excess cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk/picocurie (pCi) in Table 4A or as risk/becquerel (Bq) in Table 4B. External exposure slope factors are best estimates of the lifetime excess cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, and are expressed as risk/yr per pCi/gram of soil (Table 4A) or as risk/yr per Bq/gram of soil (Table 4B). For a discussion on the derivation of radionuclide slope factors and guidance on their use, refer to the User's Guide section on radionuclide carcinogenicity.

<sup>b</sup> A curie (Ci), the customary unit of activity, is equal to  $3.7 \times 10^{10}$  nuclear transformations per second. 1 picocurie (pCi) =  $10^{-12}$  Ci.

<sup>c</sup> For each radionuclide listed, slope factors correspond to the risks per unit intake or exposure for that radionuclide only, except when marked with a "+D" to indicate that the risks from radioactive decay chain products are also included. Radionuclides designated with a "+" are members of a decay chain. Refer to Exhibit 1 in the User's Guide section on radionuclide carcinogenicity for guidance on determining slope factors for partial or complete radioactive decay chains.

<sup>d</sup> Chemical Abstract Service Reference Number (CASRN). For risk calculations involving decay chains, a CASRN should be reported for the parent radionuclide and each chain member.

<sup>e</sup> Radioactive half-life: S = Second, M = Minute, D = Day, Y = Year. For those radionuclides with decay products (+D), half-lives are listed for the parent radionuclide.

<sup>f</sup> Lung clearance classification recommended by the International Commission on Radiological Protection (ICRP): Y = Year, W = Week, D = Day, \* = Gas.

<sup>g</sup> Gastrointestinal (GI) absorption factors are the fractional amounts of each radionuclide absorbed across the GI tract into the bloodstream. Lung clearance classifications and GI absorption factors are provided for reference only. Do not use these factors to adjust (i.e., multiply or divide) inhalation or ingestion slope factors. See the User's Guide for instructions.

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Actinium (89)	Ac-225 <sup>†</sup>	014265-85-1	1.000E+01 D		Y	1.0E-03	4.6E-10	6.5E-08	2.1E-07
	Ac-227 <sup>†</sup>	014952-40-0	2.180E+01 Y		Y	1.0E-03	7.6E-09	2.2E-06	7.0E-10
	Ac-227 + D	014952-40-0(+D)	2.180E+01 Y		Y	1.0E-03	9.5E-09	2.4E-06	2.3E-05
	Ac-228	014331-83-0	6.130E+00 H		Y	1.0E-03	1.4E-11	7.0E-10	7.8E-05
Americium (95)	Am-241 <sup>†</sup>	014596-10-2	4.320E+02 Y		W	1.0E-03	6.5E-09	8.6E-07	1.3E-07
	Am-242	013981-54-9	1.600E+01 H		W	1.0E-03	9.7E-12	3.2E-10	1.6E-07
	Am-242m	013981-54-9(m)	1.520E+02 Y		W	1.0E-03	6.2E-09	7.6E-07	3.2E-09
	Am-243 <sup>†</sup>	014993-75-0	7.380E+03 Y		W	1.0E-03	6.5E-09	8.6E-07	6.5E-07
	Am-243 + D	014993-75-0(+D)	7.380E+03 Y		W	1.0E-03	6.5E-09	8.6E-07	6.8E-06
Antimony (51)	Sb-122	014374-79-9	2.700E+00 D		W	1.0E-01	5.4E-11	9.2E-11	3.8E-05
	Sb-124	014683-10-4	6.020E+01 D		W	1.0E-01	7.8E-11	5.9E-10	1.8E-04
	Sb-125	014234-35-6	2.770E+00 Y		W	1.0E-01	2.3E-11	3.0E-10	3.2E-05
	Sb-126	015756-32-8	1.240E+01 D		W	1.0E-01	7.6E-11	2.4E-10	2.5E-04
	Sb-126m	015756-32-8(m)	1.900E+01 M		W	1.0E-01	1.9E-12	7.0E-13	1.4E-04
	Sb-127	013968-50-8	3.850E+00 D		W	1.0E-01	5.4E-11	1.1E-10	5.7E-05
	Sb-129	014331-88-5	4.400E+00 H		W	1.0E-01	1.6E-11	1.4E-11	1.3E-04
Argon (18)	Ar-41	014163-25-8	1.830E+00 H		*	1.0E+00	-----	1.6E-14	1.2E-04
Astatine (85)	At-217 <sup>†</sup>	017239-90-6	3.230E-02 S		D	1.0E+00	1.2E-16	1.5E-15	2.1E-08

[Table 4B continues on the following page; Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Barium (56)	Ba-131	014914-75-1	1.180E+01	D	D	1.0E-01	1.3E-11	9.7E-12	3.2E-05
	Ba-133	013981-41-4	1.050E+01	Y	D	1.0E-01	3.2E-11	9.7E-11	2.3E-05
	Ba-133m	013981-41-4(m)	3.890E+01	H	D	1.0E-01	1.7E-11	9.5E-12	2.6E-06
	Ba-137m <sup>†</sup>	013981-97-0(m)	2.550E+00	M	D	1.0E-01	6.5E-14	1.6E-14	5.4E-05
	Ba-139	014378-25-7	8.310E+01	M	D	1.0E-01	5.7E-12	4.1E-12	2.1E-06
	Ba-140	014798-08-4	1.280E+01	D	D	1.0E-01	7.3E-11	5.4E-11	1.5E-05
Beryllium (4)	Be-7	013966-02-4	5.340E+01	D	Y	5.0E-03	8.1E-13	7.3E-12	4.1E-06
Bismuth (83)	Bi-206	015776-19-9	6.240E+00	D	W	5.0E-02	5.9E-11	1.2E-10	3.0E-04
	Bi-207	013982-38-2	3.340E+01	Y	W	5.0E-02	3.8E-11	4.9E-10	1.3E-04
	Bi-210 <sup>†</sup>	014331-79-4	5.010E+00	D	W	5.0E-02	4.3E-11	2.2E-09	0.0E+00
	Bi-211 <sup>†</sup>	015229-37-5	2.130E+00	M	W	5.0E-02	3.3E-13	5.2E-12	3.6E-06
	Bi-212 <sup>†</sup>	014913-49-6	6.055E+01	M	W	5.0E-02	8.4E-12	1.8E-10	1.6E-05
	Bi-213 <sup>†</sup>	015776-20-2	4.570E+01	M	W	5.0E-02	6.2E-12	8.1E-12	1.1E-05
	Bi-214 <sup>†</sup>	014733-03-0	1.990E+01	M	W	5.0E-02	3.5E-12	5.7E-11	1.4E-04
Bromine (35)	Br-82	014686-69-2	3.530E+01	H	D	1.0E+00	3.0E-11	2.4E-11	2.4E-04
Cadmium (20)	Cd-109	014109-32-1	4.640E+02	D	Y	5.0E-02	2.1E-10	1.8E-09	2.0E-08
	Cd-115	014336-68-6	5.350E+01	H	Y	5.0E-02	4.6E-11	7.0E-11	1.7E-05
	Cd-115m	014336-68-6(m)	4.460E+01	D	Y	5.0E-02	1.4E-10	1.1E-09	2.0E-06

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Calcium (20)	Ca-45	013966-05-7	1.630E+02	D	W	3.0E-01	2.7E-11	1.4E-10	1.6E-16
	Ca-47	001439-99-2	4.540E+00	D	W	3.0E-01	5.4E-11	1.2E-10	9.7E-05
Carbon (6)	C-11	014333-33-6	2.050E+01	M	D	1.0E+00	1.3E-12	5.7E-13	8.6E-05
	C-14	014762-75-5	5.730E+03	Y	*	1.0E+00	2.4E-11	1.7E-13	0.0E+00
	C-15	015929-23-4	2.450E+00	S	D	1.0E+00	2.2E-14	5.7E-15	-----
Cerium (58)	Ce-141	013967-74-3	3.250E+01	D	Y	3.0E-04	2.2E-11	2.3E-10	3.5E-06
	Ce-143	014119-19-8	3.300E+01	H	Y	3.0E-04	3.5E-11	5.9E-11	1.8E-05
	Ce-144	014762-78-8	2.840E+02	D	Y	3.0E-04	1.6E-10	9.2E-09	6.8E-07
Cesium (55)	Cs-131	014914-76-2	9.690E+00	D	D	1.0E+00	3.8E-12	2.7E-12	7.6E-08
	Cs-134	013967-70-9	2.060E+00	Y	D	1.0E+00	1.1E-09	7.6E-10	1.4E-04
	Cs-134m	013967-70-9(m)	2.900E+00	H	D	1.0E+00	1.1E-12	1.1E-12	5.4E-07
	Cs-135	015726-30-4	2.300E+06	Y	D	1.0E+00	1.1E-10	7.3E-11	0.0E+00
	Cs-136	014234-29-8	1.320E+01	D	D	1.0E+00	1.8E-10	1.2E-10	1.9E-04
	Cs-137 <sup>†</sup>	010045-97-3	3.020E+01	Y	D	1.0E+00	7.6E-10	5.1E-10	0.0E+00
	Cs-137 + D	010045-97-3(+D)	3.020E+01	Y	D	1.0E+00	7.6E-10	5.1E-10	5.4E-05
	Cs-138	015758-29-9	3.220E+01	M	D	1.0E+00	5.1E-12	2.6E-12	2.2E-04
Chlorine (17)	Cl-36	013981-43-6	3.010E+05	Y	D	1.0E+00	4.9E-11	3.8E-11	0.0E+00
	Cl-38	014158-34-0	3.720E+01	M	D	1.0E+00	6.2E-12	3.5E-12	1.5E-04

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Chromium (24)	Cr-51	014392-02-0	2.770E+01 D	Y	1.0E-01	1.2E-12	8.1E-12	2.5E-06
Cobalt (27)	Co-57	013981-50-5	2.710E+02 D	Y	3.0E-01	1.6E-11	2.2E-10	5.1E-06
	Co-58	01381-38-9	7.080E+01 D	Y	3.0E-01	4.3E-11	2.6E-10	8.9E-05
	Co-58m	01381-38-9(m)	9.150E+00 H	Y	3.0E-01	8.6E-13	2.0E-12	1.3E-09
	Co-60	010198-40-0	5.270E+00 Y	Y	3.0E-01	4.1E-10	4.1E-09	2.3E-04
Copper (29)	Cu-64	013981-25-4	1.270E+01 H	Y	5.0E-01	4.6E-12	5.4E-12	1.6E-05
Curium (96)	Cm-242	015510-73-3	1.630E+02 D	W	1.0E-03	3.5E-10	1.1E-07	9.2E-10
	Cm-243	015757-87-6	2.850E+01 Y	W	1.0E-03	5.1E-09	7.0E-07	4.3E-06
	Cm-244	013981-15-2	1.810E+01 Y	W	1.0E-03	4.3E-09	5.9E-07	8.1E-10
	Cm-245	015621-76-8	8.500E+03 Y	W	1.0E-03	6.5E-09	8.6E-07	1.4E-06
	Cm-246	015757-90-1	4.750E+03 Y	W	1.0E-03	6.5E-09	8.6E-07	7.3E-10
	Cm-247	015758-32-4	1.560E+07 Y	W	1.0E-03	5.9E-09	8.1E-07	2.5E-05
	Cm-248	015758-33-5	3.390E+05 Y	W	1.0E-03	2.5E-08	3.2E-06	5.9E-10
	Cm-249	015758-34-6	1.260E+06 Y	W	1.0E-03	2.5E-08	3.2E-06	5.9E-10
Dysprosium (66)	Dy-165	013967-64-1	2.330E+00 H	W	3.0E-04	4.1E-12	3.0E-12	1.5E-06
	Dy-166	015840-01-4	8.160E+01 H	W	3.0E-04	5.1E-11	1.4E-10	7.3E-07
Erbium (63)	Er-169	015840-13-8	9.400E+00 D	W	3.0E-04	1.2E-11	4.1E-11	2.3E-10
	Er-171	014391-45-8	7.520E+00 H	W	3.0E-04	1.2E-11	1.1E-11	2.5E-05
Europium (63)	Eu-152	014683-23-9	1.360E+01 Y	W	1.0E-03	5.7E-11	3.0E-09	9.7E-05

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

MARCH 1994

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
	Eu-154	015585-10-1	8.800E+00	Y	W	1.0E-03	8.1E-11	3.8E-09	1.1E-04
	Eu-155	014391-16-3	4.960E+00	Y	W	1.0E-03	1.2E-11	4.9E-10	1.6E-06
	Eu-156	014280-35-4	1.520E+01	D	W	1.0E-03	6.8E-11	3.0E-10	1.3E-04
Florin (9)	F-18	013981-56-1	1.100E+02	M	D	1.0E+00	2.6E-12	1.9E-12	8.4E-05
Francium (87)	Fr-221 <sup>†</sup>	015756-41-9	4.800E+00	M	D	1.0E+00	1.6E-12	2.5E-11	1.7E-06
	Fr-223 <sup>†</sup>	015756-98-6	2.180E+00	M	D	1.0E+00	4.6E-12	1.1E-11	1.1E-06
Gadolinium (64)	Gd-153	014276-65-4	2.420E+02	D	W	3.0E-04	8.4E-12	1.6E-10	2.0E-06
	Gd-159	014041-42-0	1.860E+01	H	W	3.0E-04	1.6E-11	1.7E-11	2.4E-06
Gallium (31)	Ga-67	014119-09-6	3.260E+00	D	W	1.0E-03	5.7E-12	9.7E-12	8.9E-06
	Ga-72	013982-22-4	1.410E+01	H	W	1.0E-03	3.5E-11	3.2E-11	2.6E-04
Germanium (32)	Ge-71	014374-81-3	1.180E+01	D	W	1.0E+00	1.8E-13	3.5E-12	6.2E-10
Gold (79)	Au-196	014914-16-0	6.180E+00	D	Y	1.0E-01	1.1E-11	2.4E-11	3.5E-05
	Au-198	010043-49-0	2.700E+00	D	Y	1.0E-01	3.2E-11	5.7E-11	3.2E-05
Holmium (67)	Ho-166	013967-65-2	2.680E+01	H	W	3.0E-04	4.6E-11	5.9E-11	1.8E-06
Hydrogen (1)	H-3	010028-17-8	1.230E+01	Y	*	1.0E+00	1.5E-12	2.1E-12	0.0E+00
Indium (49)	In-113m	014885-78-0(m)	1.660E+00	H	W	2.0E-02	1.3E-12	7.8E-13	1.9E-05
	In-114	013981-55-0	7.190E+01	S	W	2.0E-02	1.5E-13	4.1E-14	2.7E-06
	In-114m	013981-55-0(m)	4.950E+01	D	W	2.0E-02	1.5E-10	1.1E-09	4.9E-06

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

4B-5



**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Iodine (53)	127I	014191-71-0	4.600E+15 Y	W	2.0E-02	8.6E-10	5.9E-09	0.0E+00
	129I	014191-71-0(m)	4.360E+00 H	W	2.0E-02	3.2E-12	2.5E-12	1.1E-05
	131I	018287-75-7	3.620E+00 M	D	1.0E+00	6.8E-13	2.1E-13	8.1E-05
	132I	015715-08-9	1.310E+01 H	D	1.0E+00	2.7E-11	1.5E-11	6.5E-06
	133I	014158-31-7	6.010E+01 D	D	1.0E+00	2.1E-10	1.4E-10	7.8E-08
	134I	014158-32-8	1.290E+01 D	D	1.0E+00	4.1E-10	2.6E-10	3.5E-05
	135I	015046-84-1	1.570E+07 Y	D	1.0E+00	5.1E-09	3.2E-09	1.1E-07
	136I	014914-02-4	1.240E+01 H	D	1.0E+00	2.5E-10	1.4E-10	1.9E-04
	137I	010043-66-0	8.040E+00 D	D	1.0E+00	9.7E-10	6.5E-10	4.1E-05
	138I	014683-16-0	2.300E+00 H	D	1.0E+00	2.7E-11	1.6E-11	2.1E-04
	139I	014834-67-4	2.080E+01 H	D	1.0E+00	5.7E-10	3.2E-10	5.4E-05
	140I	014914-27-3	5.260E+01 M	D	1.0E+00	7.6E-12	4.3E-12	2.4E-04
	141I	014834-68-5	6.610E+00 H	D	1.0E+00	1.1E-10	6.5E-11	1.5E-04
	192Ir	014981-91-0	1.180E+01 D	Y	1.0E-02	3.8E-11	1.3E-10	1.1E-04
Iridium (77)	194Ir	014694-69-0	7.400E+01 D	Y	1.0E-02	4.6E-11	7.3E-10	6.5E-05
	196Ir	014158-35-1	1.920E+01 H	Y	1.0E-02	4.3E-11	4.9E-11	7.6E-06
Iron (26)	55Fe	014681-59-5	2.700E+00 Y	W	1.0E-01	7.3E-12	2.3E-11	0.0E+00
	59Fe	014596-12-4	4.460E+01 D	W	1.0E-01	7.6E-11	2.6E-10	1.1E-04

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	H	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Krypton (36)	Kr-83m	013965-98-5(m)	1.830E+00	H	*	1.0E+00	-----	1.7E-15	9.2E-10
	Kr-85	013983-27-2	1.070E+01	Y	*	1.0E+00	-----	1.3E-15	1.9E-07
	Kr-85m	013983-27-2(m)	4.480E+00	H	*	1.0E+00	-----	1.3E-14	9.2E-06
	Kr-87	014809-68-8	7.630E+01	M	*	1.0E+00	-----	5.9E-14	7.6E-05
	Kr-88	014995-61-0	2.840E+00	H	*	1.0E+00	-----	1.3E-13	2.0E-04
	Kr-89	016316-03-3	3.160E+00	M	*	1.0E+00	-----	7.0E-14	1.8E-04
	Kr-90	015741-13-6	3.230E+01	S	*	1.0E+00	-----	6.5E-14	1.1E-04
Lanthanum (57)	La-140	013981-28-7	4.020E+01	H	W	1.0E-03	6.2E-11	8.1E-11	2.2E-04
Lead (82)	Pb-203	014687-25-3	5.200E+01	H	D	2.0E-01	8.6E-12	7.0E-12	1.6E-05
	Pb-209 <sup>†</sup>	014119-30-3	3.250E+00	H	D	2.0E-01	2.3E-12	1.9E-12	0.0E+00
	Pb-210 <sup>†</sup>	014255-04-0	2.230E+01	Y	D	2.0E-01	1.4E-08	3.5E-08	3.5E-09
	Pb-210 + D	014255-04-0(+D)	2.230E+01	Y	D	2.0E-01	1.8E-08	1.1E-07	4.3E-09
	Pb-211 <sup>†</sup>	015816-77-0	3.610E+01	M	D	2.0E-01	4.9E-12	7.6E-11	4.3E-06
	Pb-212 <sup>†</sup>	015092-94-1	1.060E+01	H	D	2.0E-01	1.5E-10	1.2E-09	7.6E-06
	Pb-214 <sup>†</sup>	015067-28-4	2.680E+01	M	D	2.0E-01	4.6E-12	7.8E-11	1.7E-05
Lutetium (71)	Lu-177	014265-75-9	6.710E+00	D	Y	3.0E-04	1.7E-11	5.1E-11	1.8E-06
Manganese (25)	Mn-52	014092-99-0	5.590E+00	D	W	1.0E-01	5.9E-11	1.0E-10	3.2E-04
	Mn-54	013966-31-9	3.130E+02	D	W	1.0E-01	3.0E-11	1.4E-10	7.8E-05

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>**  
(In Units of Becquerels<sup>b</sup>)

MARCH 1994

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	H	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
	Mn-56	014681-52-8	2.580E+00	H	W	1.0E-01	1.1E-11	7.6E-12	1.6E-04
Mercury (80)	Hg-197	013981-51-6	6.410E+01	H	W	2.0E-02	7.3E-12	1.2E-11	1.5E-06
	Hg-203	013982-78-0	4.660E+01	D	W	2.0E-02	1.8E-11	1.3E-10	1.5E-05
Molybdenum (42)	Mo-99	014119-15-4	6.600E+01	H	Y	8.0E-01	4.1E-11	7.0E-11	1.3E-05
Neodymium (60)	Nd-147	014269-74-0	1.100E+01	D	Y	3.0E-04	3.5E-11	1.5E-10	8.1E-06
	Nd-149	015749-81-2	1.730E+00	H	Y	3.0E-04	5.1E-12	4.3E-12	2.6E-05
Neptunium (93)	Np-236	015700-36-4	1.150E+05	Y	W	1.0E-03	6.2E-12	1.1E-10	2.4E-06
	Np-237 <sup>i</sup>	013994-20-2	2.140E+06	Y	W	1.0E-03	5.9E-09	7.8E-07	2.1E-07
	Np-237 + D	013994-20-2(+D)	2.140E+06	Y	W	1.0E-03	5.9E-09	7.8E-07	1.2E-05
	Np-238	015766-25-3	2.120E+00	D	W	1.0E-03	3.0E-11	8.9E-11	4.6E-05
	Np-239 <sup>i</sup>	013968-59-7	2.360E+00	D	W	1.0E-03	2.5E-11	4.1E-11	6.2E-06
	Np-240	015690-84-3	6.500E+01	M	W	1.0E-03	3.5E-12	1.8E-12	8.6E-05
	Np-240m	015690-84-3(m)	7.400E+00	M	W	1.0E-03	7.8E-13	2.4E-13	2.5E-05
	Ni-59	014336-70-0	7.500E+04	Y	W	5.0E-02	2.5E-12	1.9E-11	0.0E+00
Nickel (28)	Ni-63	013981-37-8	1.000E+02	Y	W	5.0E-02	6.5E-12	4.9E-11	0.0E+00
	Ni-65	014833-49-9	2.520E+00	H	W	5.0E-02	7.0E-12	5.1E-12	5.1E-05
Niobium (41)	Nb-93m	007440-03-1(m)	1.460E+01	Y	Y	1.0E-02	4.1E-12	5.1E-10	1.4E-09
	Nb-94	014681-63-1	2.030E+04	Y	Y	1.0E-02	5.7E-11	5.7E-09	1.5E-04

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Osmium (76)	Nb-95	013967-76-5	3.510E+01 D	Y	1.0E-02	1.8E-11	1.4E-10	7.0E-05
	Nb-95m	013967-76-5(m)	8.660E+01 H	Y	1.0E-02	1.8E-11	4.3E-11	2.2E-06
	Nb-97	018496-04-3	7.210E+01 M	Y	1.0E-02	3.2E-12	1.9E-12	5.9E-05
	Nb-97m	018496-04-3(m)	6.000E+01 S	Y	1.0E-02	6.5E-14	3.0E-14	6.8E-05
	Os-185	015766-50-4	9.360E+01 D	Y	1.0E-02	1.7E-11	2.4E-10	5.9E-05
	Os-191	014119-24-5	1.540E+01 D	Y	1.0E-02	1.8E-11	9.7E-11	2.3E-06
	Os-191m	014119-24-5(m)	1.300E+01 H	Y	1.0E-02	3.2E-12	5.7E-12	9.2E-08
Palladium (46)	Os-193	016057-77-5	3.000E+01 H	Y	1.0E-02	2.6E-11	3.2E-11	4.6E-06
	Pd-100	015690-69-4	3.640E+00 D	Y	5.0E-03	2.7E-11	6.2E-11	-----
	Pd-101	015749-54-9	8.480E+00 H	Y	5.0E-03	3.2E-12	3.0E-12	-----
	Pd-103	014967-68-1	1.700E+01 D	Y	5.0E-03	5.9E-12	3.8E-11	2.0E-08
	Pd-107	017637-99-9	6.500E+06 Y	Y	5.0E-03	1.2E-12	1.7E-10	0.0E+00
Phosphorus (15)	Pd-109	014981-64-7	1.350E+01 H	Y	5.0E-03	2.1E-11	2.2E-11	5.9E-08
	P-32	014596-37-3	1.430E+01 D	D	8.0E-01	9.5E-11	8.1E-11	0.0E+00
	P-33	015749-66-3	2.540E+01 D	D	8.0E-01	1.5E-11	1.2E-11	0.0E+00
Platinum (78)	Pt-191	015706-36-2	2.710E+00 D	D	1.0E-02	1.0E-11	8.1E-12	1.7E-05
	Pt-193	015735-70-3	5.000E+01 Y	D	1.0E-02	9.5E-13	2.2E-12	0.0E+00
	Pt-193m	015735-70-3(m)	4.330E+00 D	D	1.0E-02	1.4E-11	1.1E-11	2.1E-07

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Plutonium (94)	Pt-197	015735-74-7	1.830E+01 H	D	1.0E-02	1.3E-11	8.6E-12	8.4E-07
	Pt-197m	015735-74-7(m)	9.440E+01 M	D	1.0E-02	3.2E-12	2.4E-12	4.3E-06
	Pu-236	015411-92-4	2.850E+00 Y	Y	1.0E-03	1.4E-09	6.5E-07	9.2E-10
	Pu-238	013981-16-3	8.780E+01 Y	Y	1.0E-03	5.9E-09	1.1E-06	7.6E-10
	Pu-239	015117-48-3	2.410E+04 Y	Y	1.0E-03	6.2E-09	1.0E-06	4.6E-10
	Pu-240	014119-33-6	6.570E+03 Y	Y	1.0E-03	6.2E-09	1.0E-06	7.3E-10
	Pu-241	014119-32-5	1.440E+01 Y	Y	1.0E-03	9.7E-11	6.2E-09	0.0E+00
	Pu-242	013982-10-0	3.760E+05 Y	Y	1.0E-03	5.9E-09	9.7E-07	6.2E-10
	Pu-243	015706-37-3	4.960E+00 H	Y	1.0E-03	3.0E-12	2.7E-12	4.9E-07
Polonium (84)	Pu-244	014119-34-7	8.260E+07 Y	Y	1.0E-03	5.9E-09	9.7E-07	5.1E-10
	Po-210 <sup>†</sup>	013981-52-7	1.380E+02 D	W	1.0E-01	4.1E-09	7.0E-08	7.8E-10
	Po-212 <sup>†</sup>	015389-34-1	2.980E-07 S	W	1.0E-01	5.9E-22	1.6E-20	0.0E+00
	Po-213 <sup>†</sup>	015756-57-7	4.200E-06 S	W	1.0E-01	8.6E-21	2.2E-19	2.7E-09
	Po-214 <sup>†</sup>	015735-67-8	1.640E-04 S	W	1.0E-01	2.7E-19	7.6E-18	7.6E-09
	Po-215 <sup>†</sup>	015706-52-2	1.780E-03 S	W	1.0E-01	7.6E-18	1.5E-16	1.2E-08
	Po-216 <sup>†</sup>	015756-58-8	1.460E-01 S	W	1.0E-01	8.1E-16	1.3E-14	1.4E-09
	Po-218 <sup>†</sup>	015422-24-9	3.050E+00 M	W	1.0E-01	7.6E-13	1.6E-11	0.0E+00
Potassium (19)	K-40	013966-00-2	1.280E+09 Y	D	1.0E+00	3.0E-10	2.1E-10	1.5E-05

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	H	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
	K-42	014378-21-3	1.240E+01	H	D	1.0E+00	2.4E-11	3.2E-11	2.6E-05
Praseodymium (59)	Pr-142	014191-64-1	1.910E+01	H	Y	3.0E-04	4.3E-11	4.9E-11	5.7E-06
	Pr-143	014981-79-4	1.360E+01	D	Y	3.0E-04	3.8E-11	1.9E-10	8.1E-13
	Pr-144	014119-05-2	1.730E+01	M	Y	3.0E-04	2.6E-12	9.7E-13	3.2E-06
	Pr-144m	014119-05-2(m)	7.200E+00	M	Y	3.0E-04	1.0E-12	4.3E-13	5.7E-08
Promethium (61)	Pm-147	014380-75-7	2.620E+00	Y	Y	3.0E-04	8.4E-12	8.1E-10	1.6E-10
	Pm-148	014683-19-3	5.370E+00	D	Y	3.0E-04	8.4E-11	2.1E-10	5.1E-05
	Pm-148m	014683-19-3(m)	4.130E+01	D	Y	3.0E-04	6.8E-11	1.3E-09	1.8E-04
	Pm-149	015765-31-8	5.310E+01	H	Y	3.0E-04	3.2E-11	5.1E-11	8.9E-07
Protactinium (91)	Pa-231 <sup>†</sup>	014331-85-2	3.730E+04	Y	Y	1.0E-03	2.5E-09	9.7E-07	7.0E-07
	Pa-233 <sup>†</sup>	013981-14-1	2.700E+01	D	Y	1.0E-03	2.7E-11	2.3E-10	1.1E-05
	Pa-234	015100-28-4	6.700E+00	H	Y	1.0E-03	1.8E-11	1.5E-11	1.6E-04
	Pa-234m <sup>†</sup>	015100-28-4(m)	1.170E+00	M	Y	1.0E-03	1.6E-13	4.3E-14	9.7E-07
Radium (88)	Ra-223 <sup>†</sup>	015623-45-7	1.140E+01	D	W	2.0E-01	1.7E-09	8.4E-08	6.2E-06
	Ra-224 <sup>†</sup>	013233-32-4	3.620E+00	D	W	2.0E-01	1.0E-09	3.2E-08	6.2E-07
	Ra-225 <sup>†</sup>	013981-53-8	1.480E+01	D	W	2.0E-01	1.4E-09	4.1E-08	5.1E-08
	Ra-226 <sup>†</sup>	013982-63-3	1.600E+03	Y	W	2.0E-01	3.2E-09	8.1E-08	3.2E-07
	Ra-226 + D	013982-63-3(+D)	1.600E+03	Y	W	2.0E-01	3.2E-09	8.1E-08	1.6E-04

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f, <sup>g</sup> )	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Radon (86)	Ra-228 <sup>†</sup>	015262-20-1	5.750E+00	Y	W	2.0E-01	2.7E-09	1.8E-08	0.0E+00
	Ra-228 + D	015262-20-1(+D)	5.750E+00	Y	W	2.0E-01	2.7E-09	1.9E-08	7.8E-05
	Rn-219 <sup>†</sup>	014835-02-0	3.960E+00	S	*	1.0E+00	-----	1.2E-12	4.3E-06
	Rn-220 <sup>†</sup>	022481-48-7	5.560E+01	S	*	1.0E+00	-----	3.2E-12	4.6E-08
	Rn-222 <sup>†</sup>	014859-67-7	3.820E+00	D	*	1.0E+00	3.8E-11	2.0E-11	3.2E-08
Rhodium (45)	Rn-222 + D	014859-67-7(+D)	3.820E+00	D	*	1.0E+00	4.6E-11	2.1E-10	1.6E-04
	Rh-103m	007440-16-6(m)	5.610E+01	M	Y	5.0E-02	1.9E-13	1.1E-13	2.1E-09
	Rh-105	014913-89-4	3.540E+01	H	Y	5.0E-02	1.2E-11	1.6E-11	5.9E-06
	Rh-105m	014913-89-4(m)	4.500E+01	S	Y	5.0E-02	1.7E-14	9.2E-15	5.9E-07
	Rh-106	014234-34-5	2.990E+01	S	Y	5.0E-02	1.2E-13	3.2E-14	1.8E-05
Rubidium (37)	Rb-82	014391-63-0	1.250E+00	M	D	1.0E+00	3.2E-13	9.5E-14	9.5E-05
	Rb-86	014932-53-7	1.870E+01	D	D	1.0E+00	1.6E-10	1.2E-10	8.9E-06
	Rb-87	013982-13-3	4.730E+10	Y	D	1.0E+00	9.2E-11	6.5E-11	0.0E+00
	Rb-88	014928-36-0	1.780E+01	M	D	1.0E+00	4.6E-12	2.1E-12	6.5E-05
	Rb-89	014191-65-2	1.540E+01	M	D	1.0E+00	2.5E-12	1.1E-12	2.0E-04
Ruthenium (44)	Ru-97	015758-35-7	2.900E+00	D	Y	5.0E-02	4.6E-12	7.0E-12	1.1E-05
	Ru-103	013968-53-1	3.940E+01	D	Y	5.0E-02	2.4E-11	2.3E-10	4.1E-05
	Ru-105	014331-95-4	4.440E+00	H	Y	5.0E-02	1.0E-11	8.9E-12	7.0E-05

[Table 4B continues on the following page; Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>**  
**(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>		ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor		
							Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Samarium (62)	Ru-106	013967-48-1	3.680E + 02 D		Y	5.0E-02	2.6E-10	1.2E 08	0.0E + 00
	Sm-147	014392-33-7	1.060E + 11 Y		W	3.0E-04	4.3E-10	1.9E-07	0.0E + 00
	Sm-151	015715-94-3	9.000E + 01 Y		W	3.0E-04	3.0E-12	2.4E-10	1.1E-11
Scandium (21)	Sm-153	015766-00-4	4.670E + 01 H		W	3.0E-04	2.4E-11	3.5E-11	1.2E-06
	Sc-46	013967-63-0	8.380E + 01 D		Y	1.0E-04	4.3E-11	7.3E-10	1.9E-04
	Sc-47	014391-96-9	3.420E + 00 D		Y	1.0E-04	1.7E-11	3.2E-11	6.2E-06
Selenium (34)	Sc-48	014391-86-7	4.370E + 01 H		Y	1.0E-04	5.1E-11	6.2E-11	3.2E-04
	Se-75	014265-71-5	1.200E + 02 D		W	8.0E-01	1.6E-10	1.6E-10	2.2E-05
	Silicon (14)	Si-31	014276-49-4	1.570E + 02 M		W	1.0E-02	5.9E-12	4.6E-12
Silver (47)	Ag-105	014928-14-4	4.130E + 01 D		Y	5.0E-02	2.0E-11	1.1E-10	-----
	Ag-108	014391-65-2	2.370E + 00 M		Y	5.0E-02	2.3E-13	6.5E-14	1.4E-06
	Ag-108m	014391-65-2(m)	1.270E + 02 Y		Y	5.0E-02	9.5E-11	4.1E-09	1.4E-04
	Ag-109m	014378-38-2(m)	3.960E + 01 S		Y	5.0E-02	8.9E-15	2.4E-15	3.5E-08
	Ag-110	014391-76-5	2.460E + 01 S		Y	5.0E-02	8.1E-14	2.2E-14	2.7E-06
	Ag-110m	014391-76-5(m)	2.500E + 02 D		Y	5.0E-02	1.3E-10	1.9E-09	2.5E-04
Sodium (11)	Ag-111	157690-04-0	7.460E + 00 D		Y	5.0E-02	4.3E-11	1.3E 10	2.1E-06
	Na-22	013966-32-0	2.600E + 00 Y		D	1.0E + 00	1.8E-10	1.3E-10	1.9E-04
	Na-24	013982-04-2	1.500E + 01 H		D	1.0E + 00	2.7E-11	2.6E-11	4.3E-04

[Table 4B continues on the following page: Refer to Endnotes on the last page.]



**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Strontium (38)	Sr-82	014809-50-8	2.500E+01 D	D	3.0E-01	2.0E-10	1.9E-10	3.5E-09
	Sr-85	013967-73-2	6.480E+01 D	D	3.0E-01	2.1E-11	2.7E-11	3.8E-05
	Sr-85m	013967-73-2(m)	6.770E+01 M	D	3.0E-01	3.2E-13	1.6E-13	1.3E-05
	Sr-89	014158-27-1	5.060E+01 D	D	3.0E-01	8.1E-11	7.8E-11	1.3E-08
	Sr-90 <sup>i</sup>	010098-97-2	2.860E+01 Y	D	3.0E-01	8.9E-10	1.5E-09	0.0E+00
	Sr-90+D	010098-97-2(+D)	2.860E+01 Y	D	3.0E-01	9.7E-10	1.7E-09	0.0E+00
	Sr-91	014331-91-0	9.500E+00 H	D	3.0E-01	2.3E-11	1.9E-11	6.5E-05
	Sr-92	014928-29-1	2.710E+00 H	D	3.0E-01	1.5E-11	1.2E-11	1.2E-04
Sulfur (16)	S-35	015117-53-0	8.740E+01 D	D	8.0E-01	5.9E-12	5.1E-12	0.0E+00
Tantalum (73)	Ta-182	013982-00-8	1.150E+02 D	Y	1.0E-03	4.6E-11	1.2E-09	1.1E-04
Technetium (43)	Tc-95	014809-56-4	2.000E+01 H	W	8.0E-01	1.5E-12	6.2E-13	6.5E-05
	Tc-95m	014809-56-4(m)	6.100E+01 D	W	8.0E-01	4.9E-11	1.1E-10	5.1E-05
	Tc-96	014808-44-7	4.280E+00 D	W	8.0E-01	4.9E-11	5.7E-11	2.2E-04
	Tc-96m	014808-44-7(m)	5.150E+01 M	W	8.0E-01	6.2E-13	5.7E-13	1.9E-06
	Tc-97	015759-35-0	2.600E+06 Y	W	8.0E-01	4.1E-12	2.6E-11	9.5E-09
	Tc-97m	015759-35-0(m)	8.900E+01 D	W	8.0E-01	3.0E-11	1.4E-10	1.0E-08
	Tc-99	014133-76-7	2.130E+05 Y	W	8.0E-01	3.5E-11	2.2E-10	1.6E-11
	Tc-99m	014133-76-7(m)	6.020E+00 H	W	8.0E-01	1.4E-12	7.3E-13	6.2E-06

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Tellurium (52)	Te-125m	014390-73-9(m)	5.800E+01 D	W	2.0E-01	2.3E-11	1.5E-10	7.0E-08
	Te-127	013981-49-2	9.350E+00 H	W	2.0E-01	6.2E-12	6.2E-12	3.8E-07
	Te-127m	013981-49-2(m)	1.090E+02 D	W	2.0E-01	5.9E-11	4.3E-10	2.3E-08
	Te-129	014269-71-7	6.960E+01 M	W	2.0E-01	3.0E-12	1.8E-12	3.5E-06
	Te-129m	014269-71-7(m)	3.360E+01 D	W	2.0E-01	8.6E-11	5.4E-10	1.7E-06
	Te-131	014683-12-6	2.500E+01 M	W	2.0E-01	7.6E-12	3.8E-12	3.2E-05
	Te-131m	014683-12-6(m)	3.000E+01 H	W	2.0E-01	1.0E-10	1.5E-10	1.3E-04
	Te-132	014234-28-7	7.820E+01 H	W	2.0E-01	8.1E-11	1.4E-10	1.1E-05
Terbium (65)	Tb-158	015759-55-4	1.500E+02 Y	W	3.0E-04	3.2E-11	2.5E-09	-----
	Tb-160	013981-29-8	7.230E+01 D	W	3.0E-04	4.9E-11	5.1E-10	9.7E-05
Thallium (81)	Tl-202	015720-57-7	1.220E+01 D	D	1.0E+00	2.3E-11	1.6E-11	3.5E-05
	Tl-204	013968-51-9	3.780E+00 Y	D	1.0E+00	4.6E-11	3.5E-11	2.4E-08
	Tl-207 <sup>†</sup>	014133-67-6	4.770E+00 M	D	1.0E+00	3.5E-13	1.2E-13	2.0E-07
	Tl-208 <sup>†</sup>	014913-50-9	3.050E+00 M	D	1.0E+00	4.9E-13	1.4E-13	3.5E-04
	Tl-209 <sup>†</sup>	015690-73-0	2.200E+00 M	D	1.0E+00	3.8E-13	1.2E-13	1.9E-04
Thorium (90)	Th-227 <sup>†</sup>	015623-47-9	1.870E+01 D	Y	2.0E-04	1.2E-10	1.3E-07	4.3E-06
	Th-228 <sup>†</sup>	014274-82-9	1.910E+00 Y	Y	2.0E-04	3.0E-10	2.1E-06	1.5E-08
	Th-228 + D	014274-82-9(+D)	1.910E+00 Y	Y	2.0E-04	1.5E-09	2.1E-06	1.5E-04

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>i</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Thulium (69)	Th-229 <sup>†</sup>	015594-54-4	7.340E+03	Y	Y	2.0E-04	5.7E-10	2.0E-06	-----
	Th-229 + D	015594-54-4( + D)	7.340E+03	Y	Y	2.0E-04	2.4E-09	2.1E-06	1.8E-05
	Th-230 <sup>†</sup>	014269-63-7	7.700E+04	Y	Y	2.0E-04	3.5E-10	7.8E-07	1.5E-09
	Th-231 <sup>†</sup>	014932-40-2	2.550E+01	H	Y	2.0E-04	1.1E-11	1.3E-11	6.2E-08
	Th-232 <sup>†</sup>	007440-29-1	1.410E+10	Y	Y	2.0E-04	3.2E-10	7.6E-07	7.0E-10
	Th-234 <sup>†</sup>	015065-10-8	2.410E+01	D	Y	2.0E-04	1.1E-10	8.6E-10	9.5E-08
Tin (50)	Tm-170	013981-30-1	1.290E+02	D	W	3.0E-04	4.1E-11	5.7E-10	1.0E-07
	Tm-171	014333-45-0	1.920E+00	Y	W	3.0E-04	3.2E-12	8.4E-11	8.9E-09
Tungsten (74)	Sn-113	013966-06-8	1.150E+02	D	W	2.0E-02	2.4E-11	2.5E-10	8.9E-08
	Sn-121	014683-06-8	2.710E+01	H	W	2.0E-02	7.3E-12	8.6E-12	-----
	Sn-121m	014683-06-8(m)	5.550E+01	Y	W	2.0E-02	1.5E-11	2.5E-10	-----
	Sn-125	014683-08-0	9.640E+00	D	W	2.0E-02	9.7E-11	3.2E-10	3.0E-05
	Sn-126	015832-50-5	1.000E+05	Y	W	2.0E-02	1.5E-10	2.1E-09	8.9E-07
Uranium (92)	W-181	015749-46-9	1.210E+02	D	D	3.0E-01	2.2E-12	1.7E-12	5.9E-07
	W-185	014932-41-3	7.510E+01	D	D	3.0E-01	1.3E-11	8.1E-12	1.3E-09
	W-187	014983-48-3	2.380E+01	H	D	3.0E-01	1.7E-11	1.1E-11	4.1E-05
Uranium (92)	U-232	014158-29-3	7.200E+01	Y	Y	5.0E-02	1.0E-09	1.6E-06	1.2E-09
	U-233	013968-55-3	1.590E+05	Y	Y	5.0E-02	4.3E-10	7.3E-07	1.1E-09

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	Y	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Vanadium (23)	U-234 <sup>†</sup>	013966-29-5	2.450E+05	Y	Y	5.0E-02	4.3E-10	7.0E-07	8.1E-10
	U-235 <sup>†</sup>	015117-96-1	7.040E+08	Y	Y	5.0E-02	4.3E-10	6.8E-07	6.5E-06
	U-235 + D	015117-96-1(+D)	7.040E+08	Y	Y	5.0E-02	4.3E-10	6.8E-07	6.5E-06
	U-236	013982-70-2	2.340E+07	Y	Y	5.0E-02	4.1E-10	6.8E-07	6.5E-10
	U-237	014269-75-1	6.750E+00	D	Y	5.0E-02	2.4E-11	7.0E-11	3.5E-06
	U-238 <sup>†</sup>	007440-61-1	4.470E+09	Y	Y	5.0E-02	4.3E-10	6.5E-07	5.7E-10
	U-238 + D	007440-61-1(+D)	4.470E+09	Y	Y	5.0E-02	5.4E-10	6.5E-07	1.4E-06
	U-240	015687-53-3	1.410E+01	H	Y	5.0E-02	3.2E-11	3.2E-11	4.1E-09
	V-48	014331-97-6	1.600E+01	D	W	1.0E-02	5.9E-11	2.1E-10	2.7E-04
	Xe-122	015151-09-4	2.010E+01	H	*	1.0E+00	-----	8.9E-14	2.3E-06
Xenon (54)	Xe-123	015700-10-4	2.140E+00	H	*	1.0E+00	-----	2.0E-14	4.6E-05
	Xe-125	013994-18-8	1.680E+01	H	*	1.0E+00	-----	1.1E-14	1.3E-05
	Xe-127	013994-19-9	3.640E+01	D	*	1.0E+00	-----	1.1E-14	1.4E-05
	Xe-129m	013965-99-6(m)	8.890E+00	D	*	1.0E+00	-----	1.6E-14	3.5E-07
	Xe-131m	014683-11-5(m)	1.180E+01	D	*	1.0E+00	-----	1.2E-14	1.2E-07
	Xe-133	014932-42-4	5.250E+00	D	*	1.0E+00	-----	1.2E-14	6.2E-07
	Xe-133m	014932-42-4(m)	2.190E+00	D	*	1.0E+00	-----	1.5E-14	8.9E-07
	Xe-135	014995-62-1	9.110E+00	H	*	1.0E+00	-----	2.2E-14	1.7E-05

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>**  
(In Units of Becquerels<sup>b</sup>)

MARCH 1994

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	M	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
							Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)
Yttrium (39)	Xe-135m	014995-62-1(m)	1.540E+01	M	*	1.0E+00	-----	5.7E-15	3.5E-05
	Xe-137	014835-21-3	3.830E+00	M	*	1.0E+00	-----	4.9E-14	1.6E-05
	Xe-138	015751-81-2	1.410E+01	M	*	1.0E+00	-----	7.6E-14	1.1E-04
	Y-90 <sup>†</sup>	010098-91-6	6.410E+01	H	Y	1.0E-04	8.6E-11	1.5E-10	0.0E+00
	Y-91	014234-24-3	5.850E+01	D	Y	1.0E-04	7.6E-11	1.3E-09	3.2E-07
	Y-91m	014234-24-3(m)	4.970E+01	M	Y	1.0E-04	5.9E-13	9.5E-13	4.6E-05
	Y-92	015751-59-4	3.540E+00	H	Y	1.0E-04	1.9E-11	1.6E-11	2.3E-05
Zinc (30)	Y-93	014981-70-5	1.010E+01	H	Y	1.0E-04	3.8E-11	3.8E-11	8.1E-06
	Zn-65	013982-39-3	2.440E+02	D	Y	5.0E-01	2.3E-10	4.3E-10	5.4E-05
	Zn-69	013982-23-5	5.560E+01	M	Y	5.0E-01	1.5E-12	8.6E-13	4.9E-10
Zirconium (40)	Zn-69m	013982-23-5(m)	1.380E+01	H	Y	5.0E-01	1.2E-11	1.5E-11	3.5E-05
	Zr-93	015751-77-6	1.530E+06	Y	W	2.0E-03	4.6E-12	1.8E-10	0.0E+00
	Zr-95	013967-71-0	6.400E+01	D	W	2.0E-03	2.7E-11	2.7E-10	6.8E-05
	Zr-97	014928-30-4	1.690E+01	H	W	2.0E-03	6.5E-11	6.8E-11	1.6E-05

[Table 4B continues on the following page: Refer to Endnotes on the last page.]

**Table 4B: Radionuclide Carcinogenicity -- Slope Factors<sup>a</sup>  
(In Units of Becquerels<sup>b</sup>)**

**MARCH 1994**

Element (Atomic Number)	Isotope <sup>c</sup>	CASRN <sup>d</sup>	Radioactive Half-life <sup>e</sup>	ICRP Lung Class <sup>f</sup>	GI Absorption Factor (f <sub>1</sub> ) <sup>g</sup>	Slope Factor		
						Lifetime Excess Total Cancer Risk Per Unit Intake or Exposure		
						Ingestion (Risk/Bq)	Inhalation (Risk/Bq)	External Exposure (Risk/yr per Bq/g soil)

#### ENDNOTES:

<sup>a</sup> EPA classifies all radionuclides as Group A (known human) carcinogens. Radionuclide slope factors are calculated by EPA's Office of Radiation and Indoor Air (ORIA) to assist HEAST users with risk-related evaluations and decision-making at various stages of the remediation process. Ingestion and inhalation slope factors are best estimates (i.e., median or 50th percentile values) of the age-averaged, lifetime excess cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk/picocurie (pCi) in Table 4A or as risk/becquerel (Bq) in Table 4B. External exposure slope factors are best estimates of the lifetime excess cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, and are expressed as risk/yr per pCi/gram of soil (Table 4A) or as risk/yr per Bq/gram of soil (Table 4B). For a discussion on the derivation of radionuclide slope factors and guidance on their use, refer to the User's Guide section on radionuclide carcinogenicity.

<sup>b</sup> A becquerel (Bq), the International System (SI) unit of activity, is equal to one nuclear transformations per second. 1 Bq  $\approx$  27 picocuries (pCi).

<sup>c</sup> For each radionuclide listed, slope factors correspond to the risks per unit intake or exposure for that radionuclide only, except when marked with a "+D" to indicate that the risks from radioactive decay chain products are also included. Radionuclides designated with a "+" are members of a decay chain. Refer to Exhibit 1 in the User's Guide section on radionuclide carcinogenicity for guidance on determining slope factors for partial or complete radioactive decay chains.

<sup>d</sup> Chemical Abstract Service Reference Number (CASRN). For risk calculations involving decay chains, a CASRN should be reported for the parent radionuclide and each chain member.

<sup>e</sup> Radioactive half-life: S = Second, M = Minute, D = Day, Y = Year. For those radionuclides with decay products (+D), half-lives are listed for the parent radionuclide.

<sup>f</sup> Lung clearance classification recommended by the International Commission on Radiological Protection (ICRP): Y = Year, W = Week, D = Day, \* = Gas.

<sup>g</sup> Gastrointestinal (GI) absorption factors are the fractional amounts of each radionuclide absorbed across the GI tract into the bloodstream. Lung clearance classifications and GI absorption factors are provided for reference only. Do not use these factors to adjust (i.e., multiply or divide) inhalation or ingestion slope factors. See the User's Guide for instructions.

## APPENDIX A: TECHNICAL INFORMATION

- I. DATA SOURCES AND SELECTION CRITERIA USED IN HEAST
- II. DOSE CONVERSIONS ON HEAST
- III. CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE  
REGISTRY NUMBERS CROSS REFERENCE
- IV. EFFECT LEVEL DEFINITIONS
- V. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)





## **APPENDIX A-I**

### **I. DATA SOURCES AND SELECTION CRITERIA USED IN HEAST**

#### **A. Description of Sources and Documents Cited in HEAST**

##### **1. The Integrated Risk Information System (IRIS)**

IRIS is an on-line data base developed by the EPA for compilation of risk assessment and regulatory information on chemicals and physical agents. IRIS is the primary communications mechanism for distribution of health hazard assessment information derived by the various intra-Agency Work Groups. The primary intent of IRIS is to provide guidance to EPA personnel in making risk management decisions. An IRIS chemical file contains a Work Group verified summary of the available information on hazard and dose-response assessment for noncarcinogenic and/or carcinogenic effects for that chemical and is not an extensive toxicologic data base. Risk assessment values placed on IRIS are considered Agency consensus and take precedence over differing risk assessment values from other EPA sources. Each file includes referenced citations and EPA contacts for obtaining further information on any specific chemical or agent. The IRIS data base was made available to State and local governments, as well as to the public, in April 1988.

\* Questions concerning IRIS: Call RISK INFORMATION HOTLINE at (513) 569-7254

##### **2. EPA Work Groups:**

Risk assessment values for chemicals currently being considered by EPA Work Groups, but not yet on IRIS, are included in HEAST. The EPA Reference Dose/Reference Concentration (RfD/RfC) Work Group and the Carcinogen Risk Assessment Verification Endeavor (CRAVE) Work Group validates Agency systemic toxicity and carcinogen risk assessments, respectively. These Work Groups are also responsible for resolving any conflicts regarding toxicity values developed by various Program Offices. Work Group members represent many different EPA offices and are scientists experienced in issues related to both the qualitative and quantitative risk assessment of carcinogenic and toxic agents. Values verified by these Work Groups have undergone extensive peer review and represent an Agency consensus. Verified risk assessment values are entered into the IRIS data base monthly.

\* Questions concerning RfD/RfC Work Group: Call Mike Dourson (ECAO-Cincinnati) at (513) 569-7533 or Annie Jarabek (ECAO-Research Triangle Park) at (919) 541-4847

\* Questions concerning CRAVE Work Group: Call Jim Cogliano at (202) 260-3814 (OHEA-Washington, DC)

3. Office of Research and Development (ORD/Office of Health and Environmental Assessment (OHEA) OSWER-OAQPS (Office of Solid Waste and Emergency Response-Office of Air Quality Planning and Standards) Documents:

A listing of most ORD/OHEA OSWER-OAQPS documents can be found in the Chemical Assessments and Related Activities (CARA) list (available through NTIS) or in the CERI (Center for Environmental Research Information) Office of Research and Development publications list. The CARA is produced by the Office of Health and Environmental Assessment (OHEA). All OSWER-OAQPS documents are subject to a minimum of internal EPA peer review or a maximum of EPA/Peer Review Workshop/Science Advisory Board and public comments prior to finalization.

\* Information on the availability of OSWER-OAQPS documents can be obtained from the following sources:

All Documents:

Technical Information Staff  
Office of Health and Environmental Assessment (RD-689)  
U.S. Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460  
(202) 260-7345

Published Documents:

Center for Environmental Research Information (CERI)  
Office of Research and Development  
U.S. Environmental Protection Agency  
26 W. Martin Luther King Drive  
Cincinnati, OH 45268  
(513) 569-7562

Documents Available Through RCRA/Superfund:

Hotline Number 1-800-424-9346

Documents Available from NTIS:

National Technical Information Service (NTIS)  
5285 Port Royal Road  
Springfield, VA 22161  
(703) 487-4650

Health Effects Assessments (HEAs): This document series was prepared by the Environmental Criteria and Assessment Office (ECAO-Cincinnati) for the Office of Emergency and Remedial Response (Superfund). HEAs are intended for use by the OERR in evaluating risk for its preliminary assessment process at uncontrolled sites, and for appraising clean-up alternatives in its remedial investigation/feasibility studies. HEAs are brief, quantitatively oriented, preliminary assessment of relevant health effects data. HEAs are subject to internal EPA review by staff within the Office of Health and Environmental Assessment. Final drafts of HEAs become part of the RCRA and Superfund dockets and are available through NTIS. This series has recently been incorporated into the following HEED series.

Health and Environmental Effects Documents (HEEDs): This document series is prepared by the Environmental Criteria and Assessment Office (ECAO-Cincinnati) for the Office of Solid Waste and Emergency Response (OSWER). HEEDs are intended to support listings under the Resource Conservation and Recovery Act (RCRA) as well as to provide health-related limits and goals for emergency and remedial actions under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Within a HEED, both published literature and information within Agency Program Offices are evaluated as they pertain to potential human health, aquatic life and environmental effects of hazardous waste constituents. Quantitative estimates, including reference doses for chronic and subchronic duration for both inhalation and oral exposures, carcinogenic potency factors, unit risk estimates for air and drinking water, and reportable quantities (RQs) based on chronic toxicity and carcinogenicity are determined when sufficient data are available. HEEDs are subject to internal EPA review by staff within the Office of Health and Environmental Assessment and the Office of Pesticides and Toxic Substances. Final drafts of HEEDs become part of the RCRA and Superfund public dockets and are available through NTIS.

Health and Environmental Effects Profiles (HEEPs): This document series was prepared by the Environmental Criteria and Assessment Office (ECAO-Cincinnati) for the Office of Solid Waste and Emergency Response (OSWER). HEEP's have been superseded by HEEDs since mid-FY87. HEEP's are intended to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA), as well as to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). HEEP's are summaries of the

literature concerning health hazards associated with environmental exposures to chemicals or compounds and are very similar to HEEDs as described above. HEEPs were subject to internal EPA review by staff within the Office of Health and Environmental Assessment. HEEPs are part of the RCRA and CERCLA public dockets. Final drafts are available through NTIS.

Air Quality Criteria Documents (AQCDs): This document series is prepared by the Environmental Criteria and Assessment Office (ECAO-Research Triangle Park) for the Office of Air and Radiation (OAR). AQCDs are intended to support National Ambient Air Quality Standards (NAAQS) set under Sections 108-110 of the Clean Air Act. These documents are evaluations of the available scientific literature on the potential health effects of air pollutants. AQCDs are subject to internal EPA review by staff within the Office of Health and Environmental Assessment and the Office of Air and Radiation. Further review is conducted by the Science Advisory Board/Clean Air Scientific Advisory Committee, and then, these documents are subject to peer review workshops and public comments. The AQCDs are mandated by the Clean Air Act and are revised at 5-year intervals. AQCDs become part of the OAR public docket and final drafts are available through NTIS.

Health Assessment Documents (HADs): This document series is prepared by the Environmental Criteria and Assessment Office (ECAO-Research Triangle Park and ECAO-Cincinnati) for the Office of Air and Radiation (OAR). HADs are intended for use by the Office of Air Quality Planning and Standards (OAQPS) to determine possible listing of hazardous air pollutants (HAP) under sections 111 and 112 of the Clean Air Act. These documents are evaluations of the available scientific literature on the potential health effects of air pollutants and serve as the scientific data base for establishing relationships between exposure concentrations and potential health risks. HADs are subject to internal EPA review by staff within the Office of Health and Environmental Assessment and the Office of Air and Radiation. Further review is conducted by the Science Advisory Board/Clean Air Scientific Advisory Committee, and then, these documents are subject to peer review workshops and public comments. HADs become part of the OAR public docket and final drafts are available through NTIS.

#### 4. Miscellaneous Documents:

Drinking Water Criteria Documents (DWCDs): The Environmental Criteria and Assessment Office (ECAO-Cin) prepares a portion of this document series for the Office of Water (OW). DWCDs are intended to assist the OW in deriving criteria standards for chemicals in drinking water, as required under Section 412(b)(3)(A) of the Safe Drinking Water Act, as amended in 1986. The DWCDs are comprehensive evaluations of potential health effects, including mechanisms of toxicity, with specific emphasis on data providing dose-response information. DWCDs contain Health

Advisories (Has) for 1-day, 10-day and longer-term exposures and drinking water equivalent levels for lifetime exposures. DWCDs are subject to internal EPA review by staff within the Office of Health and Environmental Assessment and the Office of Water. Selected documents are reviewed by the Science Advisory Board and are subject to peer review workshops and public comments. DWCDs become part of the Safe Drinking Water (SDW) public docket and final drafts are available through NTIS.

## B. Selection Criteria and Sources of HEAST Values

Chemicals with derived noncarcinogenic and/or carcinogen risk assessment values that have had some level of peer review (i.e., those in peer reviewed EPA documents or under review by EPA Work Groups) are included in HEAST; this does not include many interim values (values not found in final EPA documents or not being considered by Work Groups) derived for various purposes within Superfund and other Program Offices. In updating the HEAST, the first source that is checked is the Integrated Risk Information System (IRIS) for revised or newly added risk assessment values. Secondly, the status of chemicals under discussion by the RfD/RfC and CRAVE Work Groups is reviewed. The Office of Health and Environmental Assessment's Chemical Assessments and Related Activities (CARA) list is also reviewed for new Office of Water, Office of Air Quality Planning and Standards, and Office of Solid Waste and Emergency Response risk assessment documents (HEEDs, HEEPs, HEAs, HADs, AQCDs, DWCDs).

The HEAST also contains chemicals commonly found at RCRA (Resource Conservation and Recovery Act) sites as identified by the Office of Solid Waste's Technical Assessment Branch. Questions about RCRA chemicals may be addressed by calling the Health Assessment Section (Office of Solid Waste) at (202) 260-4761. Finally, the Office of Radiation Programs provides data on radionuclides for Table 4A and 4B of the HEAST. Radionuclides included are those thought to be most commonly encountered at Superfund sites. Questions concerning radionuclides carcinogenicity should first be addressed by contacting the appropriate Regional Radiation Program Manager. A listing of these managers and several contacts in the Office of Radiation Programs can be found in Exhibit 2 of the User's Guide -Radionuclide Carcinogenicity.



## APPENDIX A-II

### II. DOSE CONVERSIONS ON HEAST

In January 1991, the decision was made to replace inhalation Reference Doses (RfDi) for noncancer toxicity and inhalation slope factors for carcinogenicity, previously available on the IRIS data base, with Reference Concentrations (RFC) and inhalation unit risks, respectively. RfCs and unit risks are expressed in terms of concentration in air ( $\text{mg}/\text{m}^3$ ), not in terms of "dose" ( $\text{mg}/\text{kg}\text{-day}$ ) like the RfDs and the oral and inhalation slope factors. This presents a problem for the Superfund program, since the current Hazard Ranking System (HRS) and the Risk Assessment Guidance for superfund (RAGS): Human Health Evaluation manual, Parts A and B were developed using chronic daily intakes and health criteria expressed in units of  $\text{mg}/\text{kg}\text{-day}$ .

The decision to replace inhalation slope factors and RfDi values expressed in  $\text{mg}/\text{kg}\text{-day}$  with unit risk and RfC values expressed in  $\text{mg}/\text{m}^3$  was based on two major factors: 1) the workgroups felt that it was technically more accurate to base toxicity values directly on measured air concentrations instead of making the metabolic pharmacokinetic and/or surface area adjustments required to estimate an "internal dose"; and 2) there are compounds that elicit route-of-entry effects (e.g., sensitizers and irritants) where the toxic effect is to the respiratory system or exchange boundary where a measure of "internal dose" might inappropriately imply effects to other organ systems or effects from other exposure routes.

Superfund recognizes the importance of these issues and is actively working with EPA's Office of Research and Development to evaluate the impact of these changes on its program regulations and guidance. In the short term, however, modification of program regulations and guidance is not a viable option. Therefore, the chairs of the RfD/RfC and CRAVE Work Groups were consulted regarding Superfund's need to make the conversion from a concentration in air to dose. There was agreement that, in many cases, converting the air concentration data to a dose (in  $\text{mg}/\text{kg}\text{-day}$ ) may not add significant uncertainty to the Superfund risk assessment process, and therefore may be a reasonable use of the data given appropriate circumstances and Superfund program objectives. These Work Groups will continue to work with the Superfund program to identify specific instances where it is not appropriate to make the conversion from unit risk/RfC to inhalation slope factor/RfD due to the large uncertainty introduced by the assumptions used in the conversion.

Generally, the Superfund Health Risk Technical Support Center will be responsible for making all appropriate conversions and the values will be identified with appropriate highlights or footnotes in the Health Effects Assessment Summary Tables (HEAST). Therefore, HEAST users are strongly advised against making such conversions themselves. However, it is a critical responsibility of the risk assessor to

consult the original reports cited in the HEAST and to appropriately characterize or caveat the resulting risk estimates derived from these values so that managers are fully informed of their origin and related uncertainties.



## **APPENDIX A-III**

### **II. CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE**

This section lists chemicals and their respective Chemical Abstracts Service Registry Number (CASRN) for cross referencing on the HEAST. Chemicals may be searched either alphabetically by chemical name or numerically by the CASRN.

# CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE (LISTED BY NAME)

March 1994

A-10

ACENAPHTHENE	000083-32-9	BENZIDINE	000092-87-5	CARBON TETRACHLORIDE	000056-23-5
ACENAPHTHYLENE	000208-96-8	BENZOIC ACID	000065-85-0	CHLORAL	000075-87-6
ACEPHATE	030560-19-1	BENZOTRICHLORIDE	000098-07-7	CHLORANIL	000118-75-2
ACETONE	000067-64-1	BENZO[A]ANTHRACENE	000056-55-3	CHLORDANE	000057-74-9
ACETONE CYANOHYDRIN	000075-86-5	BENZO[A]PYRENE	000050-32-8	CHLORINE CYANIDE	000506-77-4
ACETONITRILE	000075-05-8	BENZO[B]FLUORANTHENE	000205-99-2	CHLORO-1,3-BUTADIENE, 2- / (CHLOROPRENE)	000126-99-8
ACETOPHENONE	000098-86-2	BENZO[K]FLUORANTHENE	000207-08-9	CHLORO-2-METHYLANILINE, 4-	000095-69-2
ACROLEIN	000107-02-8	BENZYL ALCOHOL	000100-51-6	CHLORO-2-METHYLANILINE HYDROCHLORIDE, 4-	003165-93-3
ACRYLAMIDE	000079-06-1	BENZYL CHLORIDE	000100-44-7	CHLORO-M-CRESOL, P-	000059-50-7
ACRYLIC ACID	000079-10-7	BERYLLIUM	007440-41-7	CHLOROACETALDEHYDE	000107-20-0
ACRYLONITRILE	000107-13-1	BIPHENYL, 1,1'	000092-52-4	CHLOROACETIC ACID	000079-11-8
ADIPONITRILE	000111-69-3	BIS(2-CHLOROETHYL) ETHER	000111-44-4	CHLOROANILINE, 2-	000095-51-2
ALACHLOR	015972-60-8	BIS(2-CHLOROISOPROPYL) ETHER	039638-32-9	CHLOROANILINE, 3-	000108-42-9
ALDICARB	000116-06-3	BIS(2-ETHYLHEXYL) PHTHALATE / (DEHP)	000117-81-7	CHLOROANILINE, 4-	000106-47-8
ALDRIN	000309-00-2	BIS(CHLOROMETHYL) ETHER	000542-88-1	CHLOROBENZENE	000108-90-7
ALLIDIOCHLOR	000093-71-0	BISPHENOL A	000080-05-7	CHLOROBENZILATE	000510-15-6
ALLYL ALCOHOL	000107-18-6	BORON, ELEMENTAL	007440-42-8	CHLOROBENZOIC ACID, P-	000074-11-3
ALLYL CHLORIDE	000107-05-1	BORON TRIFLUORIDE	007637-07-2	CHLOROBENZOTRIFLUORIDE, 4-	000098-56-6
ALUMINUM	007429-90-5	BROMINATED DIBENZO-P-DIOXINS	NO CASRN	CHLOROBUTANE, 1-	000109-69-3
ALUMINUM PHOSPHIDE	020859-73-8	BROMINATED DIBENZOFURANS	NO CASRN	CHLOROBUTANE, 2-	000078-86-4
AMETRYN	000834-12-8	BROMOACETONE	000598-31-2	CHLOROCYCLOPENTADIENE	041851-50-7
AMINO-2-NAPHTHOL, 1-	002834-92-6	BROMOCHLOROETHANES	NO CASRN	CHLOROFORM	000067-66-3
AMINO-2-NAPHTOL HYDROCHLORIDE, 1-	001198-27-2	BROMODICHLOROMETHANE	000075-27-4	CHLOROMETHANE / (METHYL CHLORIDE)	000074-87-3
AMINOPHENOL, M-	000591-27-5	BROMOETHENE / (VINYL BROMIDE)	000593-60-2	CHLOROMETHYL METHYL ETHER	000107-30-2
AMINOPHENOL, O-	000095-55-6	BROMOFORM	000075-25-2	CHLORONITROBENZENE, M-	000121-73-3
AMINOPHENOL, P-	000123-30-8	BROMOMETHANE	000074-83-9	CHLORONITROBENZENE, O-	000088-73-3
AMINOPYRIDINE, 4-	000504-24-5	BROMOPHENYL PHENYL ETHER, 4-	000101-55-3	CHLORONITROBENZENE, P-	000100-00-5
AMMONIA	007664-41-7	BROMOPHOS	002104-96-3	CHLOROPHENOL, 2-	000095-57-8
ANILINE	000062-53-3	BROMOXNYL	001689-84-5	CHLOROPHENOL, 3-	000108-43-0
ANTHRACENE	000120-12-7	BROMOXNYL OCTANOATE	001689-99-2	CHLOROPHENOL, 4-	000106-48-9
ANTIMONY, METALLIC	007440-36-0	BUSAN 77	031512-74-0	CHLOROPROPANE, 2-	000075-29-6
ANTIMONY PENTOXIDE	001314-60-9	BUSAN 90	002491-38-5	CHLOROTHALONIL	001897-45-6
ANTIMONY POTASSIUM TARTRATE	000304-61-0	BUTADIENE, 1,3-	000106-99-0	CHLOROTOLUENE, M-	000108-41-8
ANTIMONY TETROXIDE	001332-81-6	BUTANOL, 1-	000071-36-3	CHLOROTOLUENE, O-	000095-49-8
ANTIMONY TRIOXIDE	001309-64-4	BUTYL BENZYL PHTHALATE, N-	000085-68-7	CHLOROTOLUENE, P-	000106-43-4
ARAMITE	000140-57-8	BUTYLATE	002008-41-5	CHLORPYRIFOS	002921-88-2
AROCHLOR 1248	012672-29-6	BUTYLCHLORIDE, T-	000507-20-0	CHLORPYRIFOS METHYL	005598-13-0
ARSENIC, INORGANIC	007440-38-2	BUTYROLACTONE, GAMMA-	000096-48-0	CHLORTHIOPHOS	060238-56-4
ASBESTOS	001332-21-4	CACODYLIC ACID	000075-60-5	CHROMIUM(III)	016065-83-1
ATRAZINE	001912-24-9	CADMIUM	007440-43-9	CHROMIUM(VI)	018540-29-9
AZOBENZENE	000103-33-3	CALCIUM CYANIDE	000592-01-8	CHRYSENE	000218-01-9
BARIUM	007440-39-3	CAPROLACTAM	000105-60-2	COKE OVEN EMISSIONS	008007-45-2
BARIUM CYANIDE	000542-62-1	CAPTAFOL	002425-06-1	COPPER	007440-50-8
BENEFIN	001861-40-1	CAPTAN	000133-06-2	COPPER CYANIDE	000544-92-3
BENZAL CHLORIDE	000098-87-3	CARBARYL	000063-25-2	CREOSOTE, COAL TAR	008001-58-9
BENZALDEHYDE	000100-52-7	CARBAZOLE	000086-74-8	CRESOL, M- / (3-METHYLPHENOL)	000108-39-4
BENZALDEHYDE CYANOHYDRIN	000532-28-5	CARBOFURAN	001563-66-2	CRESOL, O- / (2-METHYLPHENOL)	000095-48-7
BENZENE	000071-43-2	CARBON DISULFIDE	000075-15-0		
BENZENETHIOL / (THIOPHENOL)	000108-98-5	CARBON MONOXIDE	000630-05-0		

CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY NAME) Continued

March 1994

A-11	CRESOL, P- / (4-METHYLPHENOL)	000106-44-5	DICHLOROPHENOXY ACETIC ACID, 2,4-	000094-75-7	DINITROTOLUENE, 2,3-	000602-01-7
	CROTONALDEHYDE	000123-73-9	DICHLOROPHENOXY) BUTYRIC ACID, 4-(2,4-	000094-82-6	DINITROTOLUENE, 2,4	000121-14-2
	CUMENE	000098-82-8	(2,4-DB)	000094-82-6	DINITROTOLUENE, 2,5-	000619-15-8
	CYAMAZINE	021725-46-2	DICHLOROPROPANE, 1,1-	000078-99-9	DINITROTOLUENE, 2,6-	000606-20-2
	CYANIDE	000057-12-5	DICHLOROPROPANE, 1,2-	000078-87-5	DINITROTOLUENE, 3,4-	000610-39-9
	CYANOGEN	000460-19-5	DICHLOROPROPANE, 1,3-	000142-28-9	DINOSEB	000088-85-7
	CYANOGEN BROMIDE	000506-68-3	DICHLOROPROPANE, 2,2-	000594-20-7	DIOXANE, 1,4-	000123-91-1
	CYCLOATE	001134-23-2	DICHLOROPROPENE, 1,3- / (TELONE II)	000542-75-6	DIPHENYLAMINE, N,N-	000122-39-4
	CYCLOHEXANOL	000108-93-0	DICHLORPROP	000120-36-5	DIPHENYLHYDRAZINE, 1,2-	000122-66-7
	CYCLOHEXYLAMINE	000108-91-8	DICYCLOPENTADIENE	000077-73-6	DIRECT BLACK 38	001937-37-7
	CYCLOPENTADIENE	000542-92-7	DIELDRIN	000060-57-1	DIRECT BLUE 6	002602-46-2
	DACTHAL	001861-32-1	DIETHYL-P-NITROPHENYL PHOSPHATE	000311-45-5	DIRECT BROWN 95	016071-86-6
	DALAPON	000075-99-0	DIETHYL PHTHALATE	000084-66-2	DIRECT LIGHTFAST BLUE	004399-55-7
	DDD	000072-54-8	DIETHYLANILINE, N,N-	000091-66-7	DIRECT SKY BLUE 68	002610-05-1
	DDE	000072-55-9	DIETHYLENE GLYCOL MONOBUTYL ETHER	000112-34-5	DISULFOTON	000298-04-4
	DDT	000050-29-3	DIETHYLENE GLYCOL MONOETHYL ETHER	000111-90-0	ENDOSULFAN	000115-29-7
	DECABROMODIPHENYL ETHER	001163-19-5	DIETHYLFORMAMIDE	000617-84-5	ENDOTHALL	000145-73-3
	DI-N-OCTYL PHTHALATE	000117-84-0	DIETHYLHYDRAZINE, 1,2-	001615-80-1	ENDRIN	000072-20-8
	DIALATE	002303-16-4	DIETHYLSTILBESTROL	000056-53-1	EPICHLOROHYDRIN	000106-89-8
	DIAZINON	000333-41-5	DIMETHOATE	000060-51-5	EPTC	000759-94-4
	DIBENZOFURAN	000132-64-9	DIMETHOXYBENZIDINE, 3,3'-	000119-90-4	ETHOPROP	013194-48-4
	DIBENZO[A,H]ANTHRACENE	000053-70-3	DIMETHYLANILINE, 2,4-	000095-68-1	ETHOXYETHANOL, 2-	000110-80-5
	DIBROMO-3-CHLOROPROPANE, 1,2	000096-12-8	DIMETHYLANILINE HYDROCHLORIDE, 2,4-	021436-96-4	ETHOXYETHANOL ACETATE, 2-	000111-15-9
	DIBROMOBENZENE, 1,4-	000106-37-6	DIMETHYLANILINE, N,N-	000121-69-7	ETHOXYETHANOL ACRYLATE, 2-	000106-74-1
	DIBROMOCHLOROMETHANE	000124-48-1	DIMETHYLBENZIDINE, 3,3'-	000119-93-7	ETHOXYETHANOL DODECANOATE, 2-	000106-13-8
	DIBROMOETHANE, 1,2-	000106-93-4	DIMETHYLBENZ[A]ANTHRACENE, 7,12-	000057-97-6	ETHOXYETHANOL PHOSPHATE, 2-	068554-00-7
	DIBUTYL PHTHALATE	000084-74-2	DIMETHYLFORMAMIDE, N,N-	000068-12-2	ETHOXYETHYL METHACRYLATE, 2-	002370-63-0
	DICAMBA	001918-00-9	DIMETHYLHYDRAZINE, 1,1-	000057-14-7	ETHYL ACETATE	000141-78-6
	DICHLORO-2-BUTENE, 1,4-	000764-41-0	DIMETHYLHYDRAZINE, 1,2-	000540-73-8	ETHYL ACRYLATE	000140-88-5
	DICHLOROBENZENE, 1,2-	000095-50-1	DIMETHYLPHENOL, 2,3-	000526-75-0	ETHYL BENZENE	000100-41-4
	DICHLOROBENZENE, 1,3-	000541-73-1	DIMETHYLPHENOL, 2,4-	000105-67-9	ETHYL CHLORIDE	000075-00-3
	DICHLOROBENZENE, 1,4-	000106-46-7	DIMETHYLPHENOL, 2,5-	000095-87-4	ETHYL ETHER	000060-29-7
	DICHLOROBENZIDINE, 3,3'-	000091-94-1	DIMETHYLPHENOL, 2,6-	000576-26-1	ETHYL METHACRYLATE	000097-63-2
	DICHLOROBUTENES	NO CASRN	DIMETHYLPHENOL, 3,4-	000095-65-8	ETHYL-O-XYLENE, 4-	000934-80-5
	DICHLORODIFLUOROMETHANE	000075-71-8	DIMETHYLPHTHALATE	000131-11-3	ETHYLANILINE, N-	000103-69-5
	DICHLOROETHANE, 1,1-	000075-34-3	DIMETHYLSULFATE	000077-78-1	ETHYLENE CYANOHYDRIN	000109-78-4
	DICHLOROETHANE, 1,2-	000107-06-2	DIMETHYLTETREPHTHALATE	000120-61-6	ETHYLENE DIAMINE	000107-15-3
	DICHLOROETHYLENE, 1,1-	000075-35-4	DIMETHYLUREA, N,N-	000598-94-7	ETHYLENE GLYCOL	000107-21-1
	DICHLOROETHYLENE, 1,2- (MIXED ISOMERS)	000540-59-0	DINITRO-O-CRESOL, 4,6-	000534-52-1	ETHYLENE GLYCOL MONOBUTYL ETHER	000111-76-2
	DICHLOROETHYLENE, 1,2-C-	000156-59-2	DINITRO-P-CRESOL, 2,6-	000609-93-8	ETHYLENE OXIDE	000075-21-8
	DICHLOROETHYLENE, 1,2-T-	000156-60-5	DINITROBENZENE, 1,2-	000528-29-0	ETHYLENE THIOUREA	000096-45-7
	DICHLOROPHENOL, 2,3-	000576-24-9	DINITROBENZENE, 1,3-	000099-65-0	ETHYLTOLUENE, M-	000620-14-4
	DICHLOROPHENOL, 2,4-	000120-83-2	DINITROBENZENE, 1,4-	000100-25-4	ETHYLTOLUENE, O-	000611-14-3
	DICHLOROPHENOL, 2,5-	000583-78-8	DINITROPHENOL, 2,3-	000066-56-8	ETHYLTOLUENE, P-	000622-96-8
	DICHLOROPHENOL, 2,6-	000087-65-0	DINITROPHENOL, 2,4-	000051-28-5	FLUORANTHENE	000206-44-0
	DICHLOROPHENOL, 3,4-	000095-77-2	DINITROPHENOL, 2,5-	000329-71-5	FLUORENE	000086-73-7
	DICHLOROPHENOL, 3,5-	000591-35-5	DINITROPHENOL, 2,6-	000573-56-8	FLUORINE / (SOLUBLE FLUORIDE)	007782-41-4
			DINITROPHENOL, 3,5-	000586-11-8	FLURIDONE	059756-60-4

CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY NAME) Continued

March 1994

A-12	FOLPET	000133-07-3	MERCURY, ELEMENTAL VAPOR	007439-97-6	MOLINATE	002212-67-1
	FORMALDEHYDE	000050-00-0	MERCURY, INORGANIC	007439-97-6	MOLYBDENUM	007439-98-7
	FORMALDEHYDE CYANOHYDRIN	000107-16-4	MERPHOS	000150-50-5	MONOCHLORAMINE	010599-90-3
	FORMIC ACID	000064-18-6	MERPHOS OXIDE	000078-48-8	NAPHTHALENE	000091-20-3
	FURAN	000110-00-9	METHACRYLONITRILE	000126-98-7	NAPHTHOQUINONE, 1,4-	000130-15-4
	FURAZOLIDONE	000067-45-8	METHOMYL	016752-77-5	NIAGARA BLUE 4B	002429-74-5
	FURFURAL	000098-01-1	METHOXY-5-NITROANILINE, 2-	000099-59-2	NICKEL (METALLIC)	007440-02-0
	FURUM	000531-82-8	METHOXYCHLOR	000072-43-5	NICKEL CYANIDE	000557-19-7
	GLYCIDALDEHYDE	000765-34-4	METHOXYETHANOL, 2-	000109-86-4	NICKEL REFINERY DUST	NO CASRN
	HEPTACHLOR	000076-44-8	METHOXYETHANOL ACETATE, 2-	000110-49-6	NICKEL SUBSULFIDE	012035-72-2
	HEPTACHLOR EPOXIDE	001024-57-3	METHYL-4-CHLOROPHENOXY) BUTYRIC ACID, 4-(2-		NICOTINONITRILE	000100-54-9
	HEPTANE, N-	000142-82-5		000094-81-5	NITRIC OXIDE	010102-43-9
	HEXABROMOBENZENE	000087-82-1	METHYL-4-CHLOROPHENOXY) PROPIONIC ACID, 2-(2-		NITRITE	014797-65-0
	HEXACHLOROBENZENE	000118-74-1		000093-65-2	NITROANILINE, 2-	000088-74-4
	HEXACHLOROBUTADIENE	000087-68-3	METHYL-4-CHLOROPHENOXY ACETIC ACID, 2-		NITROANILINE, M-	000099-09-2
	HEXACHLOROCYCLOHEXANE, ALPHA-	000319-84-6		000094-74-6	NITROANILINE, P-	000100-01-6
	HEXACHLOROCYCLOHEXANE, BETA-	000319-85-7	METHYL-5-NITROANILINE, 2-	000099-55-8	NITROBENZENE	000098-95-3
	HEXACHLOROCYCLOHEXANE, DELTA-	000319-86-8	METHYL ACETATE	000079-20-9	NITROFURANTOIN	000067-20-9
	HEXACHLOROCYCLOHEXANE, EPSILON-	006108-10-7	METHYL ACRYLATE	000096-33-3	NITROFURAZONE	000059-87-0
	HEXACHLOROCYCLOHEXANE, GAMMA-	000058-89-9	METHYL CHLOROCARBONATE	000079-22-1	NITROGEN DIOXIDE	010102-44-0
	HEXACHLOROCYCLOHEXANE-TECHNICAL	000608-73-1	METHYL ETHYL KETONE	000078-93-3	NITROGEN OXIDES	NO CASRN
	HEXACHLOROCYCLOPENTADIENE	000077-47-4	METHYL ETHYL KETONE PEROXIDE	001338-23-4	NITROMETHANE	000075-52-5
	HEXACHLOROETHANE	000067-72-1	METHYL HYDRAZINE	000060-34-4	NITROPHENOLS	NO CASRN
	HEXACHLOROPHENE	000070-30-4	METHYL ISOBUTYL KETONE	000108-10-1	NITROPROPANE, 2-	000079-46-9
	HEXAMETHYLENE DIAMINE	000124-09-4	METHYL ISOCYANATE	000624-83-9	NITROSO-DI-N-BUTYLAMINE, N-	000924-16-3
	HEXANE, N-	000110-54-3	METHYL MERCURY	022967-92-6	NITROSO-DI-N-PROPYLAMINE, N-	000621-64-7
	HEXANONE, 2-	000591-78-6	METHYL METHACRYLATE	000080-62-6	NITROSO-N-ETHYLUREA, N-	000759-73-9
	HYDRAZINE	000302-01-2	METHYL PARATHION	000298-00-0	NITROSO-N-METHYLUREA, N-	000684-93-5
	HYDRAZINE SULFATE	010034-93-2	METHYL STYRENE (MIXED ISOMERS)	025013-15-4	NITROSODIETHANOLAMINE, N-	001116-54-7
	HYDROGEN SULFIDE	007783-06-4	METHYL STYRENE, ALPHA	000098-83-9	NITROSODIETHYLAMINE, N-	000055-18-5
	HYDROQUINONE	000123-31-9	METHYLANILINE, 2-	000095-53-4	NITROSODIMETHYLAMINE, N-	000062-75-9
	INDENO[1,2,3-CD]PYRENE	000193-39-5	METHYLANILINE HYDROCHLORIDE, 2-	000636-21-5	NITROSODIPHENYLAMINE, P-	000156-10-5
	IRON	007439-89-6	METHYLCHOLANTHRACENE, 3-	000056-49-5	NITROSODIPHENYLAMINE, N-	000086-30-6
	ISOBUTYL ALCOHOL	000078-83-1	METHYLCYCLOHEXANE	000108-87-2	NITROSOMETHYLETHYLAMINE, N-	010595-95-6
	ISOPHORONE	000078-59-1	METHYLENE-BIS(2-CHLOROANILINE), 4,4'-		NITROSOMETHYLVINYLAMINE, N	004549-40-0
	ISOPROPALIN	033820-53-0		000101-14-4	NITROSPYRROLIDINE, N-	000930-55-2
	LACTONITRILE	000078-97-7	METHYLENE-BIS(N,N'-DIMETHYL)ANILINE, 4,4'-		NITROTOLUENE, M-	000099-08-1
	LEAD	007439-92-1		000101-61-1	NITROTOLUENE, O-	000088-72-2
	LEAD ALKYLs	NO CASRN	METHYLENE BROMIDE	000074-95-3	NITROTOLUENE, P-	000099-99-0
	LINURON	000330-55-2	METHYLENE CHLORIDE / (DICHLOROMETHANE)		OCTABROMODIPHENYL ETHER	032536-52-0
	MALATHION	000121-75-5		000075-09-2	OCTAMETHYLPYROPHOSPHORAMIDE	000152-16-9
	MALEIC ANHYDRIDE	000108-31-6	METHYLENE-BIS(BENZENEAMINE), 4,4- /		OSMIUM TETROXIDE	020816-12-0
	MALEIC HYDRAZIDE	000123-33-1	(METHYLENE DIANILINE, 4,4-)	000101-77-9	OZONE	010028-15-6
	MALONONITRILE	000109-77-3	METHYLEDIPHENYL ISOCYANATE, 4,4- /		PARALDEHYDE	000123-63-7
	MANCOZEB	008018-01-7	(DIPHENYLMETHANE DIISOCYANATE)	000101-68-8	PARATHION	000056-38-2
	MANEB	012427-38-2	METOLACHLOR	051218-45-2	PARTICULATE MATTER	NO CASRN
	MANGANESE	007439-96-5	METRIBUZIN	021087-64-9	PEBULATE	001114-71-2
	MEPHOSFOLAN	000950-10-7	MIREX	002385-85-5	PENDIMETHALIN	040487-42-1

CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY NAME) Continued

March 1994

A-13	PENTABROMO-6-CHLOROCYCLOHEXANE, 1,2,3,4,5-	000087-84-3	SILVER CYANIDE	000506-64-9	TOLUENEDIAMINE, 2,3-	002687-25-4
	PENTABROMODIPHENYL ETHER	032534-81-9	SIMAZINE	000122-34-9	TOLUENEDIAMINE, 3,4-	000496-72-0
	PENTACHLOROBENZENE	000608-93-5	SODIUM CYANIDE	000143-33-9	TOLUIDINE, M-	000108-44-1
	PENTACHLOROCYCLOPENTADIENE	025329-35-5	SODIUM DIETHYLDITHIOCARBAMATE	000148-18-5	TOLUIDINE, P-	000106-49-0
	PENTACHLORONITROBENZENE	000082-68-8	SODIUM METAVANADATE	013718-26-8	TOXAPHENE	008001-35-2
	PENTACHLOROPHENOL	000087-86-5	STRONTIUM, STABLE	007440-24-6	TRIALLATE	002303-17-5
	PENTACHLOROPROPENE, 1,1,2,3,3,-	001600-37-9	STRYCHNINE	000057-24-9	TRIBROMOBENZENE, 1,2,4-	000615-54-3
	PENTANE, N-	000109-66-0	STYRENE	000100-42-5	TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-	000076-13-1
	PHENANTHRENE	000085-01-8	SUCCINONITRILE	000110-61-2	TRICHLORO-2'-HYDROXYDIPHENYLETHER, 2,2,4'-	003380-34-5
	PHENOL	000108-95-2	SULFUR DIOXIDE	007446-09-5	TRICHLOROANILINE, 2,4,6-	000634-93-5
	PHENYLENEDIAMINE, M-	000108-45-2	SULFUR OXIDES	NO CASRN	TRICHLOROANILINE HYDROCHLORIDE, 2,4,6-	033663-50-2
	PHENYLENEDIAMINE, O-	000095-54-5	SULFURIC ACID	007664-93-9	TRICHLOROBENZENE, 1,2,4-	000120-82-1
	PHENYLENEDIAMINE, P-	000106-50-3	TCDD, 2,3,7,8-	001746-01-6	TRICHLOROCYCLOPENTADIENE	077323-84-3
	PHENYLMERCURIC ACETATE	000062-38-4	TEMEPHOS	003383-96-8	TRICHLOROETHANE, 1,1,1-	000071-55-6
	PHENYLPHENOL, 2-	000090-43-7	TERBUFOS	013071-79-9	TRICHLOROETHANE, 1,1,2-	000079-00-5
	PHORATE	000298-02-2	TEREPHTHALIC ACID	000100-21-0	TRICHLOROETHYLENE	000079-01-6
	PHOSGENE	000075-44-5	TETRACHLOROAZOXYBENZENE	021232-47-3	TRICHLOROFLUOROMETHANE	000075-69-4
	PHOSPHINE	0007803-51-2	TETRACHLOROBENZENE, 1,2,4,5-	000095-94-3	TRICHLOROPHENOL, 2,3,4-	015950-66-0
	PHOSPHORUS, WHITE	007723-14-0	TETRACHLOROCYCLOPENTADIENE	000695-77-2	TRICHLOROPHENOL, 2,3,5-	000933-78-8
	PHOTOCHEMICAL OXIDANTS	NO CASRN	TETRACHLOROETHANE, 1,1,1,2-	000630-20-6	TRICHLOROPHENOL, 2,3,6-	000933-75-5
	PHTHALIC ACID, M-	000121-91-5	TETRACHLOROETHYLENE	000079-34-5	TRICHLOROPHENOL, 2,4,5-	000095-95-4
	PHTHALIC ACID, O-	000088-99-3	TETRACHLOROETHYLENE	000127-18-4	TRICHLOROPHENOL, 2,4,6-	000088-06-2
	PHTHALIC ACID, P-	000100-21-0	TETRACHLOROHYDRAZOBENZENE	071753-42-9	TRICHLOROPHENOL, 3,4,5-	000609-19-8
	PHTHALIC ANHYDRIDE	000085-44-9	TETRACHLOROPHENOL, 2,3,4,5-	004901-51-3	TRICHLOROPHENOXY) PROPIONIC ACID, 2(2,4,5-	000093-72-1
	POLYBROMINATED BIPHENYLS	NO CASRN	TETRACHLOROPHENOL, 2,3,4,6-	000058-90-2	TRICHLOROPHENOXY ACETIC ACID, 2,4,5-	000093-76-5
	POLYCHLORINATED BIPHENYLS	001336-36-3	TETRACHLOROPHENOL, 2,3,5,6-	000935-95-5	TRICHLOROPROPANE, 1,1,1-	007789-89-1
	POTASSIUM CYANIDE	000151-50-8	TETRACHLOROPROPENE, 1,1,2,3-	010436-39-2	TRICHLOROPROPANE, 1,1,2-	000598-77-6
	POTASSIUM SILVER CYANIDE	000506-61-6	TETRACHLOROTOLUENE, PARA, ALPHA, ALPHA-	005216-25-1	TRICHLOROPROPANE, 1,2,2-	003175-23-3
	PROFLURALIN	026399-36-0	TETRACHLOROVINPHOS / (STIOPHOS)	000961-11-5	TRICHLOROPROPANE, 1,2,3-	000096-18-4
	PRONAMIDE	023950-58-5	TETRAETHYL DITHIOPYROPHOSPHATE	003689-24-5	TRICHLOROPROPENE, 1,2,3-	000096-19-5
	PROPACHLOR	001918-16-7	THALLIC OXIDE	001314-32-5	TRICHLOROTOLUENE, 2,3,6-	002077-46-5
	PROPAZINE	000139-40-2	THALLIUM (I) ACETATE	000563-68-8	TRICHLOROTOLUENE, ALPHA,2,6-	002014-83-7
	PROPIONITRILE	000107-12-0	THALLIUM (I) CARBONATE	006533-73-9	TRIFLURALIN	001582-09-8
	PROPYL ALCOHOL, N-	000071-23-8	THALLIUM (I) CHLORIDE	007791-12-0	TRIMETHYL PHOSPHATE	000512-56-1
	PROPYLENE GLYCOL	000057-55-6	THALLIUM (I) NITRATE	010102-45-1	TRIMETHYLBENZENES	NO CASRN
	PROPYLENE GLYCOL MONOMETHYL ETHER	000107-98-2	THALLIUM (I) SULFATE	007446-18-6	TRINITROBENZENE, 1,3,5-	000099-35-4
	PROPYLENE OXIDE	000075-56-9	THALLIUM (IN SOLUBLE SALTS)	NO CASRN	TRINITROPHENOLS	NO CASRN
	PYRENE	000129-00-0	THALLIUM SELENITE	012039-52-0	TRINITROPHENYLMETHYLNITRAMINE	000479-45-8
	PYRIDINE	000110-86-1	THIOCYANOMETHYLTHTIO)BENZOTHAZOLE, 2-(	021564-17-0	TRINITROTOLUENE, 2,4,6-	000118-96-7
	QUINOLINE	000091-22-5	THIOFANOX	013196-18-4	URANIUM, SOLUBLE SALTS	NO CASRN
	RDX / (CYCLONITE)	000121-82-4	THIRAM	000137-26-8	VANADIUM	007440-62-2
	RONNEL	000299-84-3	TIN AND COMPOUNDS	NO CASRN	VANADIUM PENTOXIDE	001314-62-1
	SELENIOUS ACID	007783-00-8	TOLUENE	000108-88-3	VANADIUM SULFATE	036907-42-3
	SELENIUM	007782-49-2	TOLUENE-2,4-DIAMINE	000095-80-7		
	SELENIUM SULFIDE	007446-34-6	TOLUENE-2,5-DIAMINE	000095-70-5		
	SELENOUREA	000630-10-4	TOLUENE-2,6-DIAMINE	000823-40-5		
	SILVER	007440-22-4				

CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY NAME) Continued

March 1994

VERNAM / (VERNOLATE)	001929-77-7
VINYL-1-CYCLOHEXENE, 4-	000100-40-3
VINYL ACETATE	000108-05-4
VINYL CHLORIDE	000075-01-4
WARFARIN	000081-81-2
XYLENE, M-	000108-38-3
XYLENE, MIXTURE	001330-20-7
XYLENE, O-	000095-47-6
XYLENE, P-	000106-42-3
ZINC (METALLIC)	007440-66-6
ZINC CYANIDE	000557-21-1
ZINC PHOSPHIDE	001314-84-7
ZINEB	012122-67-7

# CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE (LISTED BY CAS REGISTRY NUMBER)

March 1994

A-15

000050-32-8	BENZO[A]PYRENE	000074-83-9	BROMOMETHANE	000079-22-1	METHYL CHLOROCARBONATE
000050-00-0	FORMALDEHYDE	000074-87-3	CHLOROMETHANE / (METHYL CHLORIDE)	000080-62-6	METHYL METHACRYLATE
000050-29-3	DDT	000074-95-3	METHYLENE BROMIDE	000080-05-7	BISPHENOL A
000051-28-5	DINITROPHENOL, 2,4-	000074-11-3	CHLOROBENZOIC ACID, P-	000081-81-2	WARFARIN
000053-70-3	DIBENZO[A,H]ANTHRACENE	000075-35-4	DICHLOROETHYLENE, 1,1-	000082-68-8	PENTACHLORONITROBENZENE
000055-18-5	NITROSODIETHYLAMINE, N-	000075-60-5	CACODYLIC ACID	000083-32-9	ACENAPHTHENE
000056-53-1	DIETHYLSTILBESTROL	000075-01-4	VINYL CHLORIDE	000084-66-2	DIETHYL PHTHALATE
000056-38-2	PARATHION	000075-21-8	ETHYLENE OXIDE	000084-74-2	DIBUTYL PHTHALATE
000056-55-3	BENZO[A]ANTHRACENE	000075-15-0	CARBON DISULFIDE	000085-01-8	PHENANTHRENE
000056-23-5	CARBON TETRACHLORIDE	000075-86-5	ACETONE CYANOHYDRIN	000085-68-7	BUTYL BENZYL PHTHALATE, N-
000056-49-5	METHYLCHOLANTHRACENE, 3-	000075-09-2	METHYLENE CHLORIDE / (DICHLOROMETHANE)	000085-44-9	PHTHALIC ANHYDRIDE
000057-74-9	CHLORDANE	000075-27-4	BROMODICHLOROMETHANE	000086-73-7	FLUORENE
000057-12-5	CYANIDE	000075-00-3	ETHYL CHLORIDE	000086-30-6	NITROSODIPHENYLAMINE, N-
000057-14-7	DIMETHYLHYDRAZINE, 1,1-	000075-69-4	TRICHLOROFLUOROMETHANE	000086-74-8	CARBAZOLE
000057-55-6	PROPYLENE GLYCOL	000075-25-2	BROMOFORM	000087-68-3	HEXACHLOROBUTADIENE
000057-97-6	DIMETHYLBENZ[A]ANTHRACENE, 7,12-	000075-87-6	CHLORAL	000087-84-3	PENTABROMO-6-CHLOROCYCLOHEXANE, 1,2,3,4,5-
000057-24-9	STRYCHNINE	000075-71-8	DICHLORODIFLUOROMETHANE	000087-65-0	DICHLOROPHENOL, 2,6-
000058-89-9	HEXACHLOROCYCLOHEXANE, GAMMA-	000075-99-0	DALAPON	000087-86-5	PENTACHLOROPHENOL
000058-90-2	TETRACHLOROPHENOL, 2,3,4,6-	000075-05-8	ACETONITRILE	000087-82-1	HEXABROMOBENZENE
000059-87-0	NITROFURAZONE	000075-29-6	CHLOROPROPANE, 2-	000088-99-3	PHTHALIC ACID, O-
000059-50-7	CHLORO-M-CRESOL, P-	000075-44-5	PHOSGENE	000088-72-2	NITROTOLUENE, O-
000060-34-4	METHYL HYDRAZINE	000075-52-5	NITROMETHANE	000088-06-2	TRICHLOROPHENOL, 2,4,6-
000060-57-1	DIELDRIN	000075-34-3	DICHLOROETHANE, 1,1-	000088-74-4	NITROANILINE, 2-
000060-29-7	ETHYL ETHER	000075-56-9	PROPYLENE OXIDE	000088-73-3	CHLORONITROBENZENE, O-
000060-51-5	DIMETHOATE	000076-13-1	TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-	000088-85-7	DINOSEB
000062-38-4	PHENYLMERCURIC ACETATE	000076-44-8	HEPTACHLOR	000090-43-7	PHENYLPHENOL, 2-
000062-53-3	ANILINE	000077-78-1	DIMETHYLSULFATE	000091-66-7	DIETHYLANILINE, N,N-
000062-75-9	NITROSODIMETHYLAMINE, N-	000077-47-4	HEXACHLOROCYCLOPENTADIENE	000091-94-1	DICHLOROBENZIDINE, 3,3'-
000063-25-2	CARBARYL	000077-73-6	DICYCLOPENTADIENE	000091-22-5	QUINOLINE
000064-18-6	FORMIC ACID	000078-99-9	DICHLOROPROPANE, 1,1-	000091-20-3	NAPHTHALENE
000065-85-0	BENZOIC ACID	000078-87-5	DICHLOROPROPANE, 1,2-	000092-52-4	BIPHENYL, 1,1'
000066-56-8	DINITROPHENOL, 2,3-	000078-86-4	CHLOROBUTANE, 2-	000092-87-5	BENZIDINE
000067-45-8	FURAZOLIDONE	000078-48-8	MERPHOS OXIDE	000093-76-5	TRICHLOROPHENOXY ACETIC ACID, 2,4,5-
000067-72-1	HEXACHLOROETHANE	000078-97-7	LACTONITRILE	000093-71-0	ALLIDOCHELR
000067-66-3	CHLOROFORM	000078-83-1	ISOBUTYL ALCOHOL	000093-72-1	TRICHLOROPHENOXY) PROPIONIC ACID, 2(2,4,5-
000067-20-9	NITROFURANTOIN	000078-93-3	METHYL ETHYL KETONE	000093-65-2	METHYL-4-CHLOROPHENOXY) PROPIONIC ACID, 2-(2-
000067-64-1	ACETONE	000078-59-1	ISOPHORONE	000094-82-6	DICHLOROPHENOXY) BUTYRIC ACID, 4- (2,4- / (2,4-DB)
000068-12-2	DIMETHYLFORMAMIDE, N,N-	000079-06-1	ACRYLAMIDE	000094-75-7	DICHLOROPHENOXY ACETIC ACID, 2,4-
000070-30-4	HEXACHLOROPHENE	000079-20-9	METHYL ACETATE	000094-74-6	METHYL-4-CHLOROPHENOXY ACETIC ACID, 2-
000071-23-8	PROPYL ALCOHOL, N-	000079-34-5	TETRACHLOROETHANE, 1,1,2,2-		
000071-36-3	BUTANOL, 1-	000079-46-9	NITROPROPANE, 2-		
000071-55-6	TRICHLOROETHANE, 1,1,1-	000079-01-6	TRICHLOROETHYLENE		
000071-43-2	BENZENE	000079-00-5	TRICHLOROETHANE, 1,1,2-		
000072-20-8	ENDRIN	000079-11-8	CHLOROACETIC ACID		
000072-55-9	DDE	000079-10-7	ACRYLIC ACID		
000072-43-5	METHOXYCHLOR				
000072-54-8	DDD				

CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY CAS REGISTRY NUMBER) Continued

March 1994

A-16

000094-81-5	METHYL-4-CHLOROPHENOXY) BUTYRIC ACID, 4-(2-	000100-40-3	VINYL-1-CYCLOHEXENE, 4-	000108-95-2	PHENOL
000095-53-4	METHYLANILINE, 2-	000100-25-4	DINITROBENZENE, 1,4-	000108-88-3	TOLUENE
000095-51-2	CHLOROANILINE, 2-	000100-44-7	BENZYL CHLORIDE	000108-98-5	BENZENETHIOL / (THIOPHENOL)
000095-70-5	TOLUENE-2,5-DIAMINE	000100-41-4	ETHYL BENZENE	000108-42-9	CHLOROANILINE, 3-
000095-95-4	TRICHLOROPHENOL, 2,4,5-	000100-54-9	NICOTINONITRILE	000108-93-0	CYCLOHEXANOL
000095-50-1	DICHLOROBENZENE, 1,2-	000100-21-0	PHTHALIC ACID, P-	000108-45-2	PHENYLENEDIAMINE, M-
000095-48-7	CRESOL, O- / (2-METHYLPHENOL)	000100-01-6	NITROANILINE, P-	000108-91-8	CYCLOHEXYLAMINE
000095-80-7	TOLUENE-2,4-DIAMINE	000101-55-3	BROMOPHENYL PHENYL ETHER, 4-	000108-39-4	CRESOL, M- / (3-METHYLPHENOL)
000095-69-2	CHLORO-2-METHYLANILINE, 4-	000101-14-4	METHYLENE-BIS(2-CHLOROANILINE), 4,4'-	000108-41-8	CHLOROTOLUENE, M-
000095-87-4	DIMETHYLPHENOL, 2,5-	000101-68-8	METHYLENEDIPHENYL ISOCYANATE, 4,4- / (DIPHENYLMETHANE DIISOCYANATE)	000108-05-4	VINYL ACETATE
000095-49-8	CHLOROTOLUENE, O-	000101-61-1	METHYLENE-BIS(N,N'-DIMETHYL)ANILIN E, 4,4'-	000108-31-6	MALEIC ANHYDRIDE
000095-47-6	XYLENE, O-	000103-33-3	AZOBENZENE	000108-44-1	TOLUIDINE, M-
000095-94-3	TETRACHLOROBENZENE, 1,2,4,5-	000103-69-5	ETHYLANILINE, N-	000108-43-0	CHLOROPHENOL, 3-
000095-57-8	CHLOROPHENOL, 2-	000105-60-2	CAPROLACTAM	000108-90-7	CHLOROBENZENE
000095-54-5	PHENYLENEDIAMINE, O-	000105-67-9	DIMETHYLPHENOL, 2,4-	000109-86-4	METHOXYETHANOL, 2-
000095-77-2	DICHLOROPHENOL, 3,4-	000106-48-9	CHLOROPHENOL, 4-	000109-69-3	CHLOROBUTANE, 1-
000095-65-8	DIMETHYLPHENOL, 3,4-	000106-37-6	DIBROMOBENZENE, 1,4-	000109-78-4	ETHYLENE CYANOHYDRIN
000095-68-1	DIMETHYLANILINE, 2,4-	000106-93-4	DIBROMOETHANE, 1,2-	000109-66-0	PENTANE, M-
000095-55-6	AMINOPHENOL, O-	000106-47-8	CHLOROANILINE, 4-	000109-77-3	MALONONITRILE
000096-45-7	ETHYLENE THIOUREA	000106-43-4	CHLOROTOLUENE, P-	000110-54-3	HEXANE, M-
000096-48-0	BUTYROLACTONE, GAMMA-	000106-44-5	CRESOL, P- / (4-METHYLPHENOL)	000110-86-1	PYRIDINE
000096-12-8	DIBROMO-3-CHLOROPROPANE, 1,2	000106-89-8	EPICHLOROXYDRIN	000110-61-2	SUCCINONITRILE
000096-19-5	TRICHLOROPROPENE, 1,2,3-	000106-46-7	DICHLOROBENZENE, 1,4-	000110-49-6	METHOXYETHANOL ACETATE, 2-
000096-33-3	METHYL ACRYLATE	000106-99-0	BUTADIENE, 1,3-	000110-80-5	ETHOXYETHANOL, 2-
000096-18-4	TRICHLOROPROPANE, 1,2,3-	000106-13-8	ETHOXYETHANOL DODECANOATE, 2-	000110-00-9	FURAN
000097-63-2	ETHYL METHACRYLATE	000106-42-3	XYLENE, P-	000111-15-9	ETHOXYETHANOL ACETATE, 2-
000098-87-3	BENZAL CHLORIDE	000106-50-3	PHENYLENEDIAMINE, P-	000111-90-0	DIETHYLENE GLYCOL MONOETHYL ETHER
000098-01-1	FURFURAL	000106-49-0	TOLUIDINE, P-	000111-76-2	ETHYLENE GLYCOL MONOBUTYL ETHER
000098-83-9	METHYL STYRENE, ALPHA	000106-74-1	ETHOXYETHANOL ACRYLATE, 2-	000111-44-4	BIS(2-CHLOROETHYL) ETHER
000098-95-3	NITROBENZENE	000107-02-8	ACROLEIN	000111-69-3	ADIPONITRILE
000098-82-8	CUMENE	000107-30-2	CHLOROMETHYL METHYL ETHER	000112-34-5	DIETHYLENE GLYCOL MONOBUTYL ETHER
000098-86-2	ACETOPHENONE	000107-13-1	ACRYLONITRILE	000115-29-7	ENDOSULFAN
000098-56-6	CHLOROBENZOTRIFLUORIDE, 4-	000107-05-1	ALLYL CHLORIDE	000116-06-3	ALDICARB
000098-07-7	BENZOTRICHLORIDE	000107-06-2	DICHLOROETHANE, 1,2-	000117-84-0	DI-N-OCTYL PHTHALATE
000099-55-8	METHYL-5-NITROANILINE, 2-	000107-18-6	ALLYL ALCOHOL	000117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE / (DEHP)
000099-59-2	METHOXY-5-NITROANILINE, 2-	000107-21-1	ETHYLENE GLYCOL	000118-75-2	CHLORANIL
000099-35-4	TRINITROBENZENE, 1,3,5-	000107-15-3	ETHYLENE DIAMINE	000118-96-7	TRINITROTOLUENE, 2,4,6-
000099-65-0	DINITROBENZENE, 1,3-	000107-12-0	PROPIONITRILE	000118-74-1	HEXACHLOROBENZENE
000099-08-1	NITROTOLUENE, M-	000107-98-2	PROPYLENE GLYCOL MONOMETHYL ETHER	000119-90-4	DIMETHOXYBENZIDINE, 3,3'-
000099-99-0	NITROTOLUENE, P-	000107-16-4	FORMALDEHYDE CYANOHYDRIN	000119-93-7	DIMETHYLBENZIDINE, 3,3'-
000099-09-2	NITROANILINE, M-	000107-20-0	CHLOROACETALDEHYDE	000120-12-7	ANTHRACENE
000100-52-7	BENZALDEHYDE	000108-10-1	METHYL ISOBUTYL KETONE	000120-36-5	DICHLOROPROP
000100-51-6	BENZYL ALCOHOL	000108-38-3	XYLENE, M-	000120-83-2	DICHLOROPHENOL, 2,4-
000100-42-5	STYRENE	000108-87-2	METHYLCYCLOHEXANE	000120-82-1	TRICHLOROBENZENE, 1,2,4-
000100-00-5	CHLORONITROBENZENE, P-			000120-61-6	DIMETHYLTEREPHTHALATE
000100-21-0	TEREPHTHALIC ACID			000121-75-5	MALATHION



CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY CAS REGISTRY NUMBER) Continued

March 1994

A-17

000121-69-7 DIMETHYLANILINE, N,N-  
000121-82-4 RDX / (CYCLONITE)  
000121-73-3 CHLORONITROBENZENE, M-  
000121-91-5 PHTHALIC ACID, M-  
000121-14-2 DINITROTOLUENE, 2,4  
000122-34-9 SIMAZINE  
000122-39-4 DIPHENYLAMINE, N,N-  
000122-66-7 DIPHENYLHYDRAZINE, 1,2-  
000123-30-8 AMINOPHENOL, P-  
000123-73-9 CROTONALDEHYDE  
000123-31-9 HYDROQUINONE  
000123-33-1 MALEIC HYDRAZIDE  
000123-91-1 DIOXANE, 1,4-  
000123-63-7 PARALDEHYDE  
000124-48-1 DIBROMOCHLOROMETHANE  
000124-09-4 HEXAMETHYLENE DIAMINE  
000126-99-8 CHLORO-1,3-BUTADIENE, 2- /  
(CHLOROPRENE)  
000126-98-7 METHACRYLONITRILE  
000127-18-4 TETRACHLOROETHYLENE  
000129-00-0 PYRENE  
000130-15-4 NAPHTHOQUINONE, 1,4-  
000131-11-3 DIMETHYLPHTHALATE  
000132-64-9 DIBENZOFURAN  
000133-06-2 CAPTAN  
000133-07-3 FOLPET  
000137-26-8 THIRAM  
000139-40-2 PROPAGINE  
000140-57-8 ARAMITE  
000140-88-5 ETHYL ACRYLATE  
000141-78-6 ETHYL ACETATE  
000142-82-5 HEPTANE, N-  
000142-28-9 DICHLOROPROPANE, 1,3-  
000143-33-9 SODIUM CYANIDE  
000145-73-3 ENDOTHALL  
000148-18-5 SODIUM DIETHYLDITHIOCARBAMATE  
000150-50-5 MERPHOS  
000151-50-8 POTASSIUM CYANIDE  
000152-16-9 OCTAMETHYLPYROPHOSPHORAMIDE  
000156-59-2 DICHLOROETHYLENE, 1,2-C-  
000156-10-5 NITROSODIPHENYLAMINE, P-  
000156-60-5 DICHLOROETHYLENE, 1,2-T-  
000193-39-5 INDENO[1,2,3-CD]PYRENE  
000205-99-2 BENZO[B]FLUORANTHENE  
000206-44-0 FLUORANTHENE  
000207-08-9 BENZO[K]FLUORANTHENE  
000208-96-8 ACENAPHTHYLENE

000218-01-9 CHRYSENE  
000298-02-2 PHORATE  
000298-04-4 DISULFOTON  
000298-00-0 METHYL PARATHION  
000299-84-3 RONNEL  
000302-01-2 HYDRAZINE  
000304-61-0 ANTIMONY POTASSIUM TARTRATE  
000309-00-2 ALDRIN  
000311-45-5 DIETHYL-P-NITROPHENYL PHOSPHATE  
000319-84-6 HEXACHLOROCYCLOHEXANE, ALPHA-  
000319-85-7 HEXACHLOROCYCLOHEXANE, BETA-  
000319-86-8 HEXACHLOROCYCLOHEXANE, DELTA-  
000329-71-5 DINITROPHENOL, 2,5-  
000330-55-2 LINURON  
000333-41-5 DIAZINON  
000460-19-5 CYANOGEN  
000479-45-8 TRINITROPHENYLMETHYLNITRAMINE  
000496-72-0 TOLUENEDIAMINE, 3,4-  
000504-24-5 AMINOPYRIDINE, 4-  
000506-68-3 CYANOGEN BROMIDE  
000506-64-9 SILVER CYANIDE  
000506-61-6 POTASSIUM SILVER CYANIDE  
000506-77-4 CHLORINE CYANIDE  
000507-20-0 BUTYLCHLORIDE, T-  
000510-15-6 CHLOROBENZILATE  
000512-56-1 TRIMETHYL PHOSPHATE  
000526-75-0 DIMETHYLPHENOL, 2,3-  
000528-29-0 DINITROBENZENE, 1,2-  
000531-82-8 FURUM  
000532-28-5 BENZALDEHYDE CYANOHYDRIN  
000534-52-1 DINITRO-O-CRESOL, 4,6-  
000540-73-8 DIMETHYLHYDRAZINE, 1,2-  
000540-59-0 DICHLOROETHYLENE, 1,2- (MIXED  
ISOMERS)  
000541-73-1 DICHLOROBENZENE, 1,3-  
000542-92-7 CYCLOPENTADIENE  
000542-62-1 BARIUM CYANIDE  
000542-88-1 BIS(CHLOROMETHYL) ETHER  
000542-75-6 DICHLOROPROPENE, 1,3- / (TELONE  
II)  
000544-92-3 COPPER CYANIDE  
000557-19-7 NICKEL CYANIDE  
000557-21-1 ZINC CYANIDE  
000563-68-8 THALLIUM (I) ACETATE  
000573-56-8 DINITROPHENOL, 2,6-  
000576-24-9 DICHLOROPHENOL, 2,3-  
000576-26-1 DIMETHYLPHENOL, 2,6-

000583-78-8 DICHLOROPHENOL, 2,5-  
000586-11-8 DINITROPHENOL, 3,5-  
000591-27-5 AMINOPHENOL, M-  
000591-35-5 DICHLOROPHENOL, 3,5-  
000591-78-6 HEXANONE, 2-  
000592-01-8 CALCIUM CYANIDE  
000593-60-2 BROMOETHENE / (VINYL BROMIDE)  
000594-20-7 DICHLOROPROPANE, 2,2-  
000598-94-7 DIMETHYLUREA, N,N-  
000598-31-2 BROMOACETONE  
000598-77-6 TRICHLOROPROPANE, 1,1,2-  
000602-01-7 DINITROTOLUENE, 2,3-  
000606-20-2 DINITROTOLUENE, 2,6-  
000608-93-5 PENTACHLOROBENZENE  
000608-73-1 HEXACHLOROCYCLOHEXANE-TECHNICAL  
000609-19-8 TRICHLOROPHENOL, 3,4,5-  
000609-93-8 DINITRO-P-CRESOL, 2,6-  
000610-39-9 DINITROTOLUENE, 3,4-  
000611-14-3 ETHYLTOLUENE, O-  
000615-54-3 TRIBROMOBENZENE, 1,2,4-  
000617-84-5 DIETHYLFORMAMIDE  
000619-15-8 DINITROTOLUENE, 2,5-  
000620-14-4 ETHYLTOLUENE, M-  
000621-64-7 NITROSO-DI-N-PROPYLAMINE, N-  
000622-96-8 ETHYLTOLUENE, P-  
000624-83-9 METHYL ISOCYANATE  
000630-05-0 CARBON MONOXIDE  
000630-10-4 SELENOUREA  
000630-20-6 TETRACHLOROETHANE, 1,1,1,2-  
000634-93-5 TRICHLOROANILINE, 2,4,6-  
000636-21-5 METHYLANILINE HYDROCHLORIDE, 2-  
000684-93-5 NITROSO-N-METHYLUREA, N-  
000695-77-2 TETRACHLOROCYCLOPENTADIENE  
000759-73-9 NITROSO-N-ETHYLUREA, N-  
000759-94-4 EPTC  
000764-41-0 DICHLORO-2-BUTENE, 1,4-  
000765-34-4 GLYCIDALDEHYDE  
000823-40-5 TOLUENE-2,6-DIAMINE  
000834-12-8 AMETRYN  
000924-16-3 NITROSO-DI-N-BUTYLAMINE, N-  
000930-55-2 NITROSOPYRROLIDINE, N-  
000933-78-8 TRICHLOROPHENOL, 2,3,5-  
000933-75-5 TRICHLOROPHENOL, 2,3,6-  
000934-80-5 ETHYL-O-XYLENE, 4-  
000935-95-5 TETRACHLOROPHENOL, 2,3,5,6-  
000950-10-7 MEPHOSFOLAN  
000961-11-5 TETRACHLOROVINPHOS / (STIROPHOS)

# CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE (LISTED BY CAS REGISTRY NUMBER) Continued

March 1994

A-18

001024-57-3	HEPTACHLOR EPOXIDE	002921-88-2	CHLORPYRIFOS	007791-12-0	THALLIUM (I) CHLORIDE
001114-71-2	PEBULATE	003165-93-3	CHLORO-2-METHYLANILINE HYDROCHLORIDE, 4-	007803-51-2	PHOSPHINE
001116-54-7	NITROSODIETHANOLAMINE, N-	003175-23-3	TRICHLOROPROPANE, 1,2,2-	008001-35-2	TOXAPHENE
001134-23-2	CYCLOATE	003380-34-5	TRICHLORO-2'-HYDROXYDIPHENYLETHER, 2,2,4'-	008001-58-9	CREOSOTE, COAL TAR
001163-19-5	DECABROMODIPHENYL ETHER	003383-96-8	TEMEPHOS	008007-45-2	COKE OVEN EMISSIONS
001198-27-2	AMINO-2-NAPHTOL HYDROCHLORIDE, 1-	003689-24-5	TETRAETHYL DITHIOPYROPHOSPHATE	008018-01-7	MANCOZEB
001309-64-4	ANTIMONY TRIOXIDE	004399-55-7	DIRECT LIGHTFAST BLUE	010028-15-6	OZONE
001314-84-7	ZINC PHOSPHIDE	004549-40-0	NITROSOMETHYLVINYLAMINE, N	010034-93-2	HYDRAZINE SULFATE
001314-62-1	VANADIUM PENTOXIDE	004901-51-3	TETRACHLOROPHENOL, 2,3,4,5-	000101-77-9	METHYLENE-BIS(BENZENEAMINE), 4,4- / (METHYLENE DIANILINE, 4,4-)
001314-60-9	ANTIMONY PENTOXIDE	005216-25-1	TETRACHLOROTOLUENE, PARA, ALPHA, ALPHA, ALPHA-	010102-43-9	NITRIC OXIDE
001314-32-5	THALLIC OXIDE	005598-13-0	CHLORPYRIFOS METHYL	010102-44-0	NITROGEN DIOXIDE
001330-20-7	XYLENE, MIXTURE	006108-10-7	HEXACHLOROCYCLOHEXANE, EPSILON-	010102-45-1	THALLIUM (I) NITRATE
001332-81-6	ANTIMONY TETROXIDE	006533-73-9	THALLIUM (I) CARBONATE	010436-39-2	TETRACHLOROPROPENE, 1,1,2,3-
001332-21-4	ASBESTOS	007429-90-5	ALUMINUM	010595-95-6	NITROSOMETHYLETHYLAMINE, N-
001336-36-3	POLYCHLORINATED BIPHENYLS	007439-97-6	MERCURY, INORGANIC	010599-90-3	MONOCHLORAMINE
001338-23-4	METHYL ETHYL KETONE PEROXIDE	007439-98-7	MOLYBDENUM	012035-72-2	NICKEL SUBSULFIDE
001563-66-2	CARBOFURAN	007439-89-6	IRON	012039-52-0	THALLIUM SELENITE
001582-09-8	TRIFLURALIN	007439-92-1	LEAD	012122-67-7	ZINEB
001600-37-9	PENTACHLOROPROPENE, 1,1,2,3,3,-	007439-97-6	MERCURY, ELEMENTAL VAPOR	012427-38-2	MANEB
001615-80-1	DIETHYLHYDRAZINE, 1,2-	007439-96-5	MANGANESE	012672-29-6	AROCHLOR 1248
001689-84-5	BROMOXYNIL	007440-39-3	BARIUM	013071-79-9	TERBUFOS
001689-99-2	BROMOXYNIL OCTANOATE	007440-38-2	ARSENIC, INORGANIC	013194-48-4	ETHOPROP
001746-01-6	TCDD, 2,3,7,8-	007440-43-9	CADMIUM	013196-18-4	THIOFANOX
001861-40-1	BENEFIN	007440-66-6	ZINC (METALLIC)	013718-26-8	SODIUM METAVANADATE
001861-32-1	DACTHAL	007440-50-8	COPPER	014797-65-0	NITRITE
001897-45-6	CHLOROTHALONIL	007440-42-8	BORON, ELEMENTAL	015950-66-0	TRICHLOROPHENOL, 2,3,4-
001912-24-9	ATRAZINE	007440-22-4	SILVER	015972-60-8	ALACHLOR
001918-00-9	DICAMBA	007440-41-7	BERYLLIUM	016065-83-1	CHROMIUM(III)
001918-16-7	PROPACHLOR	007440-62-2	VANADIUM	016071-86-6	DIRECT BROWN 95
001929-77-7	VERNAM / (VERNOLATE)	007440-02-0	NICKEL (METALLIC)	016752-77-5	METHONYL
001937-37-7	DIRECT BLACK 38	007440-36-0	ANTIMONY, METALLIC	018540-29-9	CHROMIUM(VI)
002008-41-5	BUTYLATE	007440-24-6	STRONTIUM, STABLE	020816-12-0	OSMIUM TETROXIDE
002014-83-7	TRICHLOROTOLUENE, ALPHA,2,6-	007446-34-6	SELENIUM SULFIDE	020859-73-8	ALUMINUM PHOSPHIDE
002077-46-5	TRICHLOROTOLUENE, 2,3,6-	007446-09-5	SULFUR DIOXIDE	021087-64-9	METRIBUZIN
002104-96-3	BROMOPHOS	007446-18-6	THALLIUM (I) SULFATE	021232-47-3	TETRACHLOROAZOXYBENZENE
002212-67-1	MOLINATE	007637-07-2	BORON TRIFLUORIDE	021436-96-4	DIMETHYLANILINE HYDROCHLORIDE, 2,4-
002303-16-4	DIALATE	007664-41-7	AMMONIA	021564-17-0	THIOCYANOMETHYLTHIO)BENZOTHAZOLE, 2-(
002303-17-5	TRIALATE	007664-93-9	SULFURIC ACID	021725-46-2	CYANAZINE
002370-63-0	ETHOXYETHYL METHACRYLATE, 2-	007723-14-0	PHOSPHORUS, WHITE	022967-92-6	METHYL MERCURY
002385-85-5	MIREX	007782-41-4	FLUORINE / (SOLUBLE FLUORIDE)	023950-58-5	PROMAMIDE
002425-06-1	CAPTAFOF	007782-49-2	SELENIUM	025013-15-4	METHYL STYRENE (MIXED ISOMERS)
002429-74-5	NIAGARA BLUE 48	007783-00-8	SELENIOS ACID	025329-35-5	PENTACHLOROCYCLOPENTADIENE
002491-38-5	BUSAN 90	007783-06-4	HYDROGEN SULFIDE	026399-36-0	PROFLURALIN
002602-46-2	DIRECT BLUE 6	007789-89-1	TRICHLOROPROPANE, 1,1,1-	030560-19-1	ACEPHATE
002610-05-1	DIRECT SKY BLUE 6B				
002687-25-4	TOLUENEDIAMINE, 2,3-				
002834-92-6	AMINO-2-NAPHTHOL, 1-				

CHEMICAL NAME AND CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER CROSS REFERENCE  
(LISTED BY CAS REGISTRY NUMBER) *Continued*

March 1994

A-19

031512-74-0	BUSAN 77
032534-81-9	PENTABROMODIPHENYL ETHER
032536-52-0	OCTABROMODIPHENYL ETHER
033663-50-2	TRICHLOROANILINE HYDROCHLORIDE, 2,4,6-
033820-53-0	ISOPROPALIN
036907-42-3	VANADIUM SULFATE
039638-32-9	BIS(2-CHLOROISOPROPYL) ETHER
040487-42-1	PENDIMETHALIN
041851-50-7	CHLOROCYCLOPENTADIENE
051218-45-2	METOLACHLOR
059756-60-4	FLURIDONE
060238-56-4	CHLORTHIPHOS
068554-00-7	ETHOXYETHANOL PHOSPHATE, 2-
071753-42-9	TETRACHLOROHYDRAZOBENZENE
077323-84-3	TRICHLOROCYCLOPENTADIENE
NO CASRN	SULFUR OXIDES
NO CASRN	BROMINATED DIBENZO-P-DIOXINS
NO CASRN	BROMOCHLOROETHANES
NO CASRN	BROMINATED DIBENZOFURANS
NO CASRN	TRIMETHYLBENZENES
NO CASRN	PARTICULATE MATTER
NO CASRN	TIN AND COMPOUNDS
NO CASRN	LEAD ALKYLs
NO CASRN	NITROPHENOLS
NO CASRN	NITROGEN OXIDES
NO CASRN	NICKEL REFINERY DUST
NO CASRN	DICHLOROBUTENES
NO CASRN	PHOTOCHEMICAL OXIDANTS
NO CASRN	THALLIUM (IN SOLUBLE SALTS)
NO CASRN	URANIUM, SOLUBLE SALTS
NO CASRN	TRINITROPHENOLS
NO CASRN	POLYBROMINATED BIPHENYLS

## APPENDIX A-IV

### IV. EFFECT LEVEL DEFINITIONS

Adverse effect. A biochemical change, functional impairment, or pathologic lesion that either singly or in combination adversely affects the performance of the whole organism, or reduces an organism's ability to respond to an additional environmental challenge.

Frank-effect-level (FEL). The exposure level at which there are statistically or biologically significant increases in frequency or severity of severe effects between the exposed population and its appropriate control group. These severe effects produce an unmistakable adverse health effect (such as severe convulsions or death).

Lowest-observed-adverse-effect level (LOAEL). The lowest exposure level at which there are statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group.

Lowest-observed-effect level (LOEL). The lowest exposure level at which there are statistically or biologically significant increases in frequency or severity of any effects between the exposed population and its appropriate control group. The effects that are seen at this level may or may not be considered as adverse.

No-observed-adverse-effect level (NOAEL). An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered to be adverse.

No-observed-effect level (NOEL). An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of any effect between the exposed population and its appropriate control.

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Adapted from: U.S. EPA. 1991. Integrated Risk Information System (IRIS). Online. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.



## APPENDIX A-V

### V. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

The Clean Air Act requires that National Ambient Air Quality Standards (NAAQS) be set and ultimately met for any air pollutant which, if present in air, may reasonably be anticipated to endanger public health or welfare and whose presence in the air results from numerous or diverse mobile and/or stationary sources. Since the primary NAAQS and the inhalation RfC serve essentially the same function, and the primary NAAQS have extensive data bases rigorously reviewed, the primary NAAQS with annual averaging times should be used *in lieu* of an inhalation RfC, except for lead. In deriving a risk assessment number for lead (Pb), the Integrated Exposure Uptake Biokinetics (IEUBK) model should be used instead of the RfC. Primary standards are designed to protect public health and secondary standards are designed to protect public welfare. Each primary NAAQS has either one or two averaging times depending on the health effects of the chemical. To date, six NAAQS have been established: Carbon Monoxide (CO), Lead (Pb), Nitrogen Dioxide (NO<sub>2</sub>), Particulate Matter, less than 10  $\mu$ m in size, (PM<sub>10</sub>), Ozone (O<sub>3</sub>) and Sulfur Dioxide (SO<sub>2</sub>). A table of the most recent NAAQS is provided as Table A-V-1.

The process of establishing and revising the NAAQS is detailed by Padgett and Richmond (Journal of the Air Pollution Control Association, 33:13-16, 1983). The primary NAAQS are solely health based and designed to protect the most sensitive group of individuals (but not necessarily the most sensitive members of that group) against adverse health effects. Thus, by definition, the NAAQS primary standards define allowable pollutant concentrations which can be present in the atmosphere without causing adverse effects, and essentially serve the same function as an inhalation RfC in a risk assessment/risk management decision, except for lead. The data bases supporting each of the NAAQS are extensive. More importantly, the NAAQS are set by the USEPA Administrator as mandated by Congress after numerous reviews and a public comment process.

**TABLE A-V-1**  
**NATIONAL AMBIENT AIR QUALITY STANDARDS<sup>a</sup>**  
**(as of December 2, 1991)**

Pollutant	Primary Standards <sup>b</sup>	Averaging Time	Secondary Standards <sup>b</sup>
Carbon monoxide (CO)	9 ppm (10 mg/m <sup>3</sup> ) 35 ppm (40 mg/m <sup>3</sup> )	8 hour <sup>c</sup> 1 hour <sup>c</sup>	None
Lead (Pb) (and Lead compounds)	1.5 µg/m <sup>3</sup>	Quarterly	Same as primary
Nitrogen dioxide (NO <sub>2</sub> ) (Nitrogen oxide) (Nitric oxide)	0.053 ppm (100 µg/m <sup>3</sup> )	Annual	Same as primary
Particulate Matter (PM <sub>10</sub> )	50 µg/m <sup>3</sup> 150 µg/m <sup>3</sup>	Annual <sup>d</sup> 24 hours <sup>e</sup>	Same as primary
Ozone (O <sub>3</sub> )	0.12 ppm (235 µg/m <sup>3</sup> )	1 hour <sup>f</sup>	Same as primary
Sulfur dioxide (SO <sub>2</sub> ) (Sulfur oxide)	0.03 ppm (80 µg/m <sup>3</sup> )	Annual	---
	0.14 ppm (365 µg/m <sup>3</sup> )	24 hours <sup>c</sup>	---
	---	3 hours <sup>c</sup>	0.5 ppm (1300 µg/m <sup>3</sup> )

<sup>a</sup>Source: U.S. EPA 1991. Subchapter C - Air Programs. Part 50 -National Primary and Secondary Ambient Air Quality Standards. Code of Federal Regulations 50: 693-697. Revised 7/1/91.

<sup>b</sup>Primary standards are designed to protect public health; Secondary standards are designed to protect public welfare.

<sup>c</sup>Not to be exceeded more than once per year.

<sup>d</sup>The standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 µg/m<sup>3</sup>.

<sup>e</sup>The standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m<sup>3</sup> is equal to or less than 1.

<sup>f</sup>The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than 1

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March 1994

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