State of California
California Environmental Protection Agency

Air Resources Board
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USER MANUAL
FOR THE
HOTSPOTS ANALYSIS AND REPORTING PROGRAM
HEALTH RISK ASSESSMENT STANDALONE TOOL
VERSION 2

Last Revised: March 17, 2015

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REFERENCES

OEHHA (2015). The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. Available online at http://www.oehha.ca.gov.

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HotSpots Analysis and Reporting Program User Guide
Health Risk Assessment Standalone Tool
Version 2
March 2015

1. OVERVIEW

The Hotspots Analysis and Reporting Program Version 2 (HARP 2) is a software suite used to assist with the programmatic requirements of the Air Toxics "Hot Spots" Program. This version replaces the previous version (HARP 1 series) and incorporates the information presented in the 2015 Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. HARP combines the tools of emission inventory database, facility prioritization, air dispersion modeling, and health risk assessment analysis. In this version, HARP 2, the modules have been separated into three individual programs which will allow users to access any of the modules independently or to share information between each program. The three programs are referred to as the Emission Inventory Module (EIM), Air Dispersion Modeling and Risk Assessment Tool (ADMRT), and the Health Risk Assessment Standalone Tool (RAST).

EIM creates and manages facility emission inventory databases and calculates facility prioritization scores. ADMRT performs air dispersion analysis in order to calculate ground level concentrations (GLCs) of pollutants to evaluate potential cancer and noncancer health impacts. RAST is a standalone tool used solely to calculate potential cancer and noncancer health impacts. Each software has its own user document, and this user guide will focus on RAST.

HARP was created for the purpose of assisting and supporting the local California Air Pollution Control and Air Quality Management Districts (districts) with implementing the requirements of Assembly Bill 2588 (AB 2588). AB 2588, known as the Air Toxics "Hot Spots" Information and Assessment Act, was enacted in September 1987. Under this Act, stationary source facilities are required to report the types and quantities of certain substances their facilities routinely release into the air. Emissions of interest are those that result from the routine operation of a facility or that are predictable, including but not limited to continuous and intermittent releases and process upsets.

The goals of the Air Toxics "Hot Spots" Act are to collect emissions data, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residents of significant risks. In September 1992, the "Hot Spots" Act was amended by Senate Bill (SB) 1731 to address the reduction of significant risks. The bill requires that owners of significant-risk facilities reduce their risks below the level of significance.

The Act requires that toxic air emissions from stationary source facilities be quantified and compiled into an inventory according to criteria and guidelines developed by the Air Resources Board (ARB), that each facility be prioritized to determine whether a risk assessment must be conducted, that the risk assessments be conducted according to methods developed by the Office of Environmental Health Hazard Assessment

(OEHHA), that the public be notified of significant risks posed by nearby facilities, and that emissions which result in a significant risk be reduced. Owners of facilities found to pose significant risks by a district must prepare and implement risk reduction audits and plans within six months of the determination. Legislation states that these plans to reduce airborne toxic risk reduction measures from a facility should be completed within five years of the date a plan is submitted to the district. The period to implement a plan may be shortened by the district if it finds that it is technically feasible and economically practicable to implement a plan more quickly. The district may also lengthen the time period needed to implement the plan, up to an additional five years. This may occur when it is determined that the facility 1) cannot meet the initial five year deadline due to unreasonable economic burden, 2) the risk reduction plan is not technically feasible, or 3) a time period of longer than five years will not result in unreasonable risk to the public.

For more information on the Air Toxics "Hot Spots" Program, please visit ARB's website at http://www.arb.ca.gov/ab2588/ab2588.htm.

Users of HARP 2 should have a working knowledge of air dispersion modeling, ARB's Emission Inventory Criteria and Guidelines, and the risk assessment methods and procedures outlined in OEHHA's 2015 *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (OEHHA Guidance Manual).

HARP 2 can be used by districts, facility operators, and other parties to manage and evaluate emissions inventory data and the potential health impacts associated with these emissions. The use of HARP 2 promotes statewide consistency, increases the efficiency of evaluating potential health impacts, and provides a cost-effective tool for developing facility health risk assessments.

HARP 2 may be used to assess the potential health impacts from a single facility or multiple facilities in proximity to each other, where a single meteorological data set is appropriate for all the included facilities. However, other applications may be appropriate depending on the user's expertise and presence of adequate data.

Although designed to meet the programmatic requirements of the Air Toxics "Hot Spots" Program, HARP 2 modules have been used for preparing risk assessments for other air related programs (e.g., air toxic control measure development, facility permitting applications, roads, ambient monitoring evaluations, CEQA reviews). Therefore, each user of the HARP 2 software should know the requirements of the regulation or program they are addressing before using the HARP 2 software and reporting results.

a. How is this User Guide Organized?

This document pertains only to information about HARP 2 RAST. The HARP 2 RAST User Guide is organized into three steps, sequentially in the order that one would conduct a health risk assessment. The first three chapters contain an overview of HARP 2, hardware and software requirements to run HARP 2 RAST, and a user

interface overview for HARP 2 RAST. The remaining chapters detail the three steps that are needed to run HARP 2 RAST, summarized below.

- Step 1 walks through entering new facility pollutant concentrations, as well as how to create a comma separated values (CSV) file to import previously existing pollutant data.
- Step 2 explains how to define the health risk scenario, and include data for various pathways of pollutant exposure. It also includes how to calculate risk and export risk files.
- Step 3 provides an overview of viewing and understanding the risk results, as well as exporting or importing risk results files.

b. What can the Risk Assessment Standalone Tool (RAST) do?

HARP 2 RAST allows the user to estimate the single or multipathway health impacts at multiple receptor locations from one or more pollutants released from one or more emission points. Both carcinogenic and non-carcinogenic impacts may be evaluated. The user may conduct a point-estimate analysis or utilize the data distributions available to conduct a stochastic analysis. Users may also supply their own adequately supported point-estimates or data distributions by editing the network of default health and exposure values in RAST.

- Note: *Stochastic analyses (Tiers 3 and 4) are currently not employed* but will be added in subsequent versions of HARP 2.

The risk analysis algorithms and default values used in HARP 2 are based on the OEHHA guidelines set forth in the revised *Technical Support Document for Exposure Assessment and Stochastic Analysis*. All equations, default parameter values, and variable distributions encoded into HARP 2 are from the OEHHA Guidance Manual (OEHHA, 2015).

Table 1-1 below describes RAST in relation to the other two programs: Emissions Inventory Module and Air Dispersion Modeling and Risk Assessment Tool.

- Note: *HARP 2 RAST does not calculate noncancer health risk for lead exposure.* To evaluate noncancer health risk from lead exposure, refer to *Appendix F: Overview of the Lead Risk Assessment Procedures* of the OEHHA Guidance Manual, or contact your local air district.

Table 1-1. Summary of Functions of the Three Programs in HARP 2[1,2]

Emissions Inventory Module (EIM)	Air Dispersion Modeling & Risk Assessment Tool (ADMRT)	Risk Assessment Standalone Tool (RAST)
• Creates and manages facility emission inventory databases. These databases can be transmitted to local air districts and ARB for use in their emissions inventory programs; • Calculates facility prioritization scores, which are used by local air districts to prioritize facilities based on sources of emissions, proximity to receptors, and risk.	• Performs air dispersion analysis using EPA's AERMOD modeling system; • Calculates potential health impacts for one or multiple facilities and multiple pollutants; • Calculates cancer and noncancer (acute, 8-hour, and chronic) health impacts using the new risk assessment guidelines in the OEHHA Guidance Manual (OEHHA, 2015); • Uses point estimates to calculate inhalation and multipathway risks; • Performs stochastic health risk analyses • Calculates population exposures and uses spatial averaging methods to determine exposure concentrations or potential cancer risk; • Presents the results as tabular reports that can be printed, added to word processing documents, or off-ramped to a Geographic information Systems (GIS) program.	• Calculates potential health impacts using a ground level concentration; • Evaluates one or multiple pollutants for one or multiple receptor points; • Calculates cancer and noncancer (acute, 8-hour, and chronic) health impacts using the new risk assessment guidelines in the OEHHA Guidance Manual (OEHHA, 2015); • Uses point estimates to calculate inhalation and multipathway risks; • Performs stochastic health risk analyses.

[1]Note: *Stochastic analyses (Tiers 3 and 4) are currently not employed* and will be added in subsequent versions of HARP 2.

[2] Note: *HARP 2 RAST does not calculate noncancer health risk for lead exposure.* To evaluate noncancer health risk from lead exposure, refer to *Appendix F: Overview of the Lead Risk Assessment Procedures* of the OEHHA Guidance Manual, or contact your local air district.

HARP 2 calculates risk for pollutants with health values approved for use in AB 2588, listed in Table 1-2. For current approved health values, visit the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values website at http://www.arb.ca.gov/toxics/healthval/healthval.htm.

Table 1-2. Pollutants with OEHHA/ARB Approved Risk Assessment Health Values[1]

- Acetaldehyde
- Acetamide
- Acrolein
- Acrylamide
- Acrylic Acid
- Acrylonitrile
- Allyl Chloride
- 2-Aminoanthraquinone
- Ammonia
- Aniline
- Arsenic and compounds (inorganic) TAC
- Asbestos TAC
- Benzene TAC
- Benzidine (and its salts)
- Benzyl Chloride
- Beryllium and compounds
- Bis(2-chloroethyl)ether (Dichloroethyl ether)
- Bis(chloromethyl)ether
- Bromine and compounds
- 1,3-Butadiene TAC
- Cadmium and compounds TAC
- Caprolactam
- Carbon Disulfide
- Carbon Monoxide
- Carbon Tetrachloride TAC (Tetrachloromethane)
- Chlorinated Paraffins
- Chlorine
- Chlorine Dioxide
- 4-Chloro-o-phenylenediamine
- Chlorobenzene
- Chloroform TAC
- Chlorophenols
- Chloropicrin
- p-Chloro-o-toluidine
- Chromium 6+ TAC
- Chromium Trioxide (as chromic acid mist)
- Copper and compounds
- p-Cresidine
- Cresols (mixtures of)
- Cupferron
- Cyanide compounds (inorganic)
- 2,4-Diaminoanisole
- 2,4-Diaminotoluene
- 1,2-Dibromo-3-chloropropane (DBCP)
- p-Dichlorobenzene
- Isophorone
- Isopropyl Alcohol (Isopropanol)
- Lead and compounds (inorganic)
- Lindane
- Maleic Anhydride
- Manganese and compounds
- Mercury and compounds (inorganic)
- Methanol
- Methyl Bromide (Bromomethane)
- Methyl Tertiary-Butyl Ether
- 1,2-Epoxybutane
- Chloroaniline) (MOCA)
- Methylene Chloride TAC (Dichloromethane)
- 4,4'-Methylene Dianiline (and its Dichloride)
- Methylene Diphenyl Isocyanate
- 4,4'-Bis(dimethylamino)benzophenone (Michler's Ketone)
- N-Nitrosodi-n-butylamine
- N-Nitrosodi-n-propylamine
- N-Nitrosodiethylamine
- N-Nitrosodimethylamine
- N-Nitrosodiphenylamine
- N-Nitroso-n-methylethylamine
- N-Nitrosomorpholine
- 4,4'-Methylene Bis (2-
- N-Nitrosopiperidine
- Naphthalene
- Nickel and compounds
- Nitrogen Dioxide
- Methyl Chloroform (1,1,1-Trichloroethane)
- Methyl Isocyanate
- Nitric Acid
- p-Nitrosodiphenylamine
- Ozone
- Particulate Emissions from Diesel-fueled Engines TAC
- Pentachlorophenol
- Perchloroethylene TAC (Tetrachloroethylene)
- Phenol
- Phosgene
- Phosphine
- Phosphoric Acid
- Phthalic Anhydride
- PCB (Polychlorinated Biphenyls) (unspeciated mixture)

Table 1-2. Pollutants with OEHHA/ARB Approved Risk Assessment Health Values[1]	
• Di(1-ethylhexyl)phthalate (DEHP)Diesel Exhaust • Diethanolamine • p-Dimethylaminoazobenzene • N,N-Dimethyl Formamide • 2,4-Dinitrotoluene • 1,4-Dioxane (1,4-Diethylene dioxide) • Epichlorohydrin (1-Chloro-2,3-epoxypropane) • 3,3-Dichlorobenzidine • 1,1-Dichloroethane (Ethylidene dichloride) • 1,1-Dichloroethylene • Ethyl Benzene • Ethyl Chloride (Chloroethane) • Ethylene Dibromide[TAC] (1,2-Dibromoethane) • Ethylene Dichloride[TAC] • Ethylene Glycol • Ethylene Glycol Butyl Ether • Ethylene Oxide [TAC] • Ethylene Thiourea • Fluorides • Formaldehyde [TAC] • Glutaraldehyde • Glycol Ethers • Hexachlorobenzene • Hexachlorocyclohexanes (mixed or technical grade) • n-Hexane • Hydrazine • Hydrochloric Acid (Hydrogen Chloride) • Hydrogen Bromide • Hydrogen Cyanide • Hydrogen Fluoride Hydrogen Sulfide	• PCB (Polychlorinated Biphenyls) (speciated) • Polychlorinated Dibenzo-p-dioxins (PCDD) (Treated as 2,3,7,8-TCDD for HRA) [TAC] • Polychlorinated Dibenzofurans (PCDF)[TAC] (Treated as 2,3,7,8-TCDD for HRA) • Polycyclic Aromatic Hydrocarbon (PAH) (Treated as B(a)P for HRA) • Potassium Bromate • 1,3-Propane Sultone • Propylene (Propene) • Propylene Glycol Monomethyl Ether • Propylene Oxide • Selenium and compounds • Silica (crystalline, respirable) • Sodium Hydroxide • Styrene • Sulfates • Sulfur Dioxide • Sulfuric Acid • 1,1,2,2-Tetrachloroethane • Tetrachlorophenols • 2,4,5-Trichlorophenol • 2,4,6-Trichlorophenol • Thioacetamide • Toluene • Toluene diisocyantates • 1,1,2-Trichloroethane (Vinyl Trichloride) • Trichloroethylene[TAC] • Triethylamine • Urethane (Ethyl Carbamate) • Vanadium Compounds • Vinyl Acetate • Vinyl Chloride[TAC] (Chloroethylene) • Vinylidene Chloride (1,1-Dichloroethylene) • Xylenes (mixed isomers)

[1]Substances with [TAC] are characterized as Toxic Air Contaminants (TACs) pursuant to AB 1807 and AB 2728.

i. Pollutant Exceptions: Asbestos, Diesel PM, & Inorganic Lead

Table 1-2 contains pollutants for which there are exceptions when calculating risk in RAST. These include asbestos, inorganic lead, and particulate emissions from diesel-fueled engines. The explanations below are also listed in footnotes *f* (asbestos), *h* (inorganic lead) and *i* (diesel) of the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values*. The table lists the pollutants for which risk can be calculated by HARP. The latest copy may be found at http://www.arb.ca.gov/toxics/healthval/contable.pdf.

Asbestos

Units for the Inhalation Cancer Potency factor for asbestos are (100 PCM fibers/m^3)$^{-1}$. A conversion factor of 100 fibers/0.003 µg can be multiplied by a receptor concentration of asbestos expressed in µg/m^3. Unless other information necessary to estimate the concentration (fibers/m^3) of asbestos at receptors of interest is available, a unit risk factor of 1.9 E 10-4 (µg/m^3)$^{-1}$ and an inhalation cancer potency factor of 2.2 E 10^{+2} (mg/kg BW * day)$^{-1}$ are available. For more information on asbestos quantity conversion factors, see Appendix F of OEHHA's *The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part II; Technical Support Document for Cancer Potency Factors (May 2009)*, and Appendix C of the OEHHA Guidance Manual.

Particulate Emissions from Diesel-Fueled Engines

The inhalation cancer potency factor was derived from whole diesel exhaust. It should be used only for impacts from the inhalation pathway, based on diesel particulate matter (PM) measurements. The inhalation impacts from speciated emissions from diesel-fueled engines are already accounted for in the inhalation cancer potency factor. However, at the discretion of the risk assessor, speciated emissions from diesel-fueled engines may be used to estimate acute noncancer health impacts or the contribution to cancer risk or chronic noncancer health impacts for the non-inhalation exposure pathway. See Appendix D of the Guidance Manual for more information. The noncancer chronic reference exposure level (REL) for diesel exhaust is based on assumptions of contributions of diesel PM to ambient PM and should be used with diesel PM measurements.

Inorganic Lead

Inorganic Lead was identified by ARB as a Toxic Air Contaminant in April 1997. Since information on noncancer health effects shows no identified threshold, no REL has been developed. See Appendix F of the OEHHA Guidance Manual for an overview of how to evaluate noncancer impacts from exposure to lead using these risk management guidelines.

- Note: *HARP 2 RAST does not calculate noncancer health risk for lead exposure.* To evaluate noncancer health risk from lead exposure, refer to *2001 Risk Management Guidelines for New, Modified, and Existing Sources of Lead* for more information or contact your local air district.

2. GETTING STARTED & PROCESS OVERVIEW

This section provides information for installing and running the program.

a. System Requirements

Before installing the HARP 2 RAST on your computer, please review the system requirements. If you need technical support, please contact ARB's Transportation and Toxics Division (TTD), Emissions Assessment Branch at (916) 323-4327 or send an email to harp@arb.ca.gov.

The current version of HARP is a Microsoft Windows based program and can be installed on any Windows operating system that supports the Microsoft .NET Framework 4.0 or later. Additional system requirements include:

- 2 GM of RAM
- 20 MB RAM of free hard drive space for HARP 2 RAST program files
- At least 1 GB of storage space for project files

b. Installing HARP 2 RAST

HARP 2 installation files are available on the Internet at http://www.arb.ca.gov/toxics/harp/harp.htm.

Click the ***Download Software, User Guide, and Sample Files*** link for RAST. Follow the online instructions for complete details on how to download the installation software.

On the RAST homepage, click the ***Download Software*** link.

Please note that HARP 2 RAST may be installed to a computer with an older version of the HARP 1 series.

Once the installation setup file has been downloaded and saved to your hard drive, double-click on it to begin the program setup. Follow the on-screen instructions to complete the setup.

The default destination folder is ***C:\HARP2***. It is recommended that you install to the default destination folder. In addition, the installer will create a HARP folder on your desktop. This folder will contain a shortcut to HARP 2 RAST.

c. Opening the Program

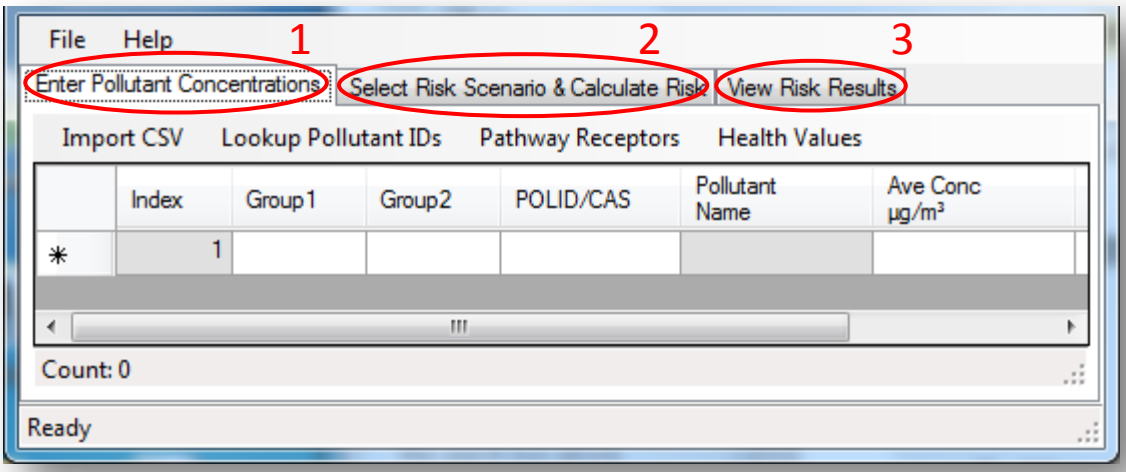
To launch the HARP 2 RAST, open the HARP2 folder found on your desktop. Double-click on the ***Risk Assessment Standalone Tool*** icon.

d. Getting Familiar with the Program

RAST is divided into three steps, represented by three separate tabs:

1. Enter your pollutant concentrations,
2. Select your risk scenario to calculate risk, and
3. View your results for saving.

Upon opening the program, this is what you will see. It is the main screen to step 1.



In the first step, pollutant concentrations are entered. The pollutants can be entered manually or imported using a CSV file. The second step is the area where the type of risk scenario is selected and the cancer and noncancer hazard index (HI) risks are calculated. The final step is where the risk results are viewed.

e. Training

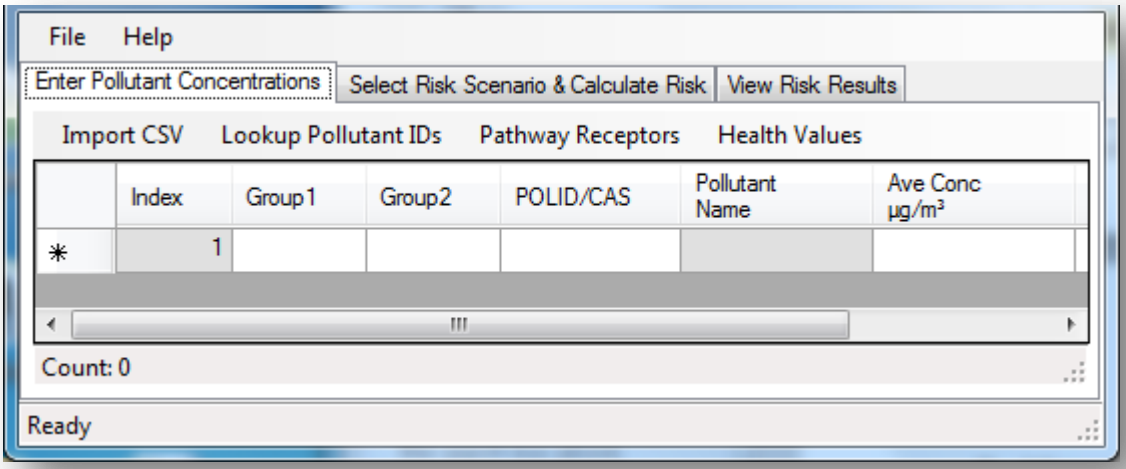
Future training for HARP 2 is under development. Please sign up on the HARP listserver for updates at http://www.arb.ca.gov/listserv/listserv_ind.php?listname=harp.

3. USER INTERFACE OVERVIEW

This section provides an overview of the HARP 2 RAST user interface, available help resources, and software updates.

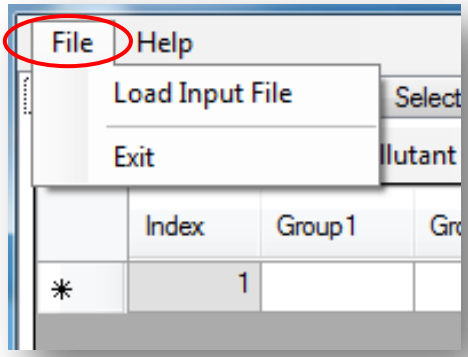
a. Main Screen

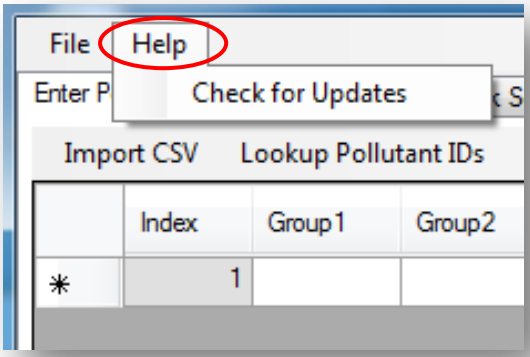
When the program is launched, it will open to the main screen. Its three steps will be visible represented by three tabs: 1) Enter Pollutant Concentrations, 2) Select Risk Scenario & Calculate Risk, and 3) View Risk Results.



b. Main Menu Options

There are two menu options: ***File*** and ***Help***.





Under the ***File*** menu option, there are options to load data for an existing project or to exit the program. Under the ***Help*** menu option, there are options to open the help files or check for updates.

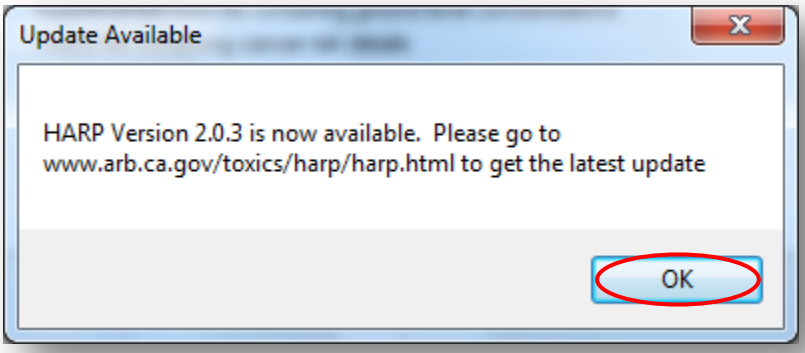


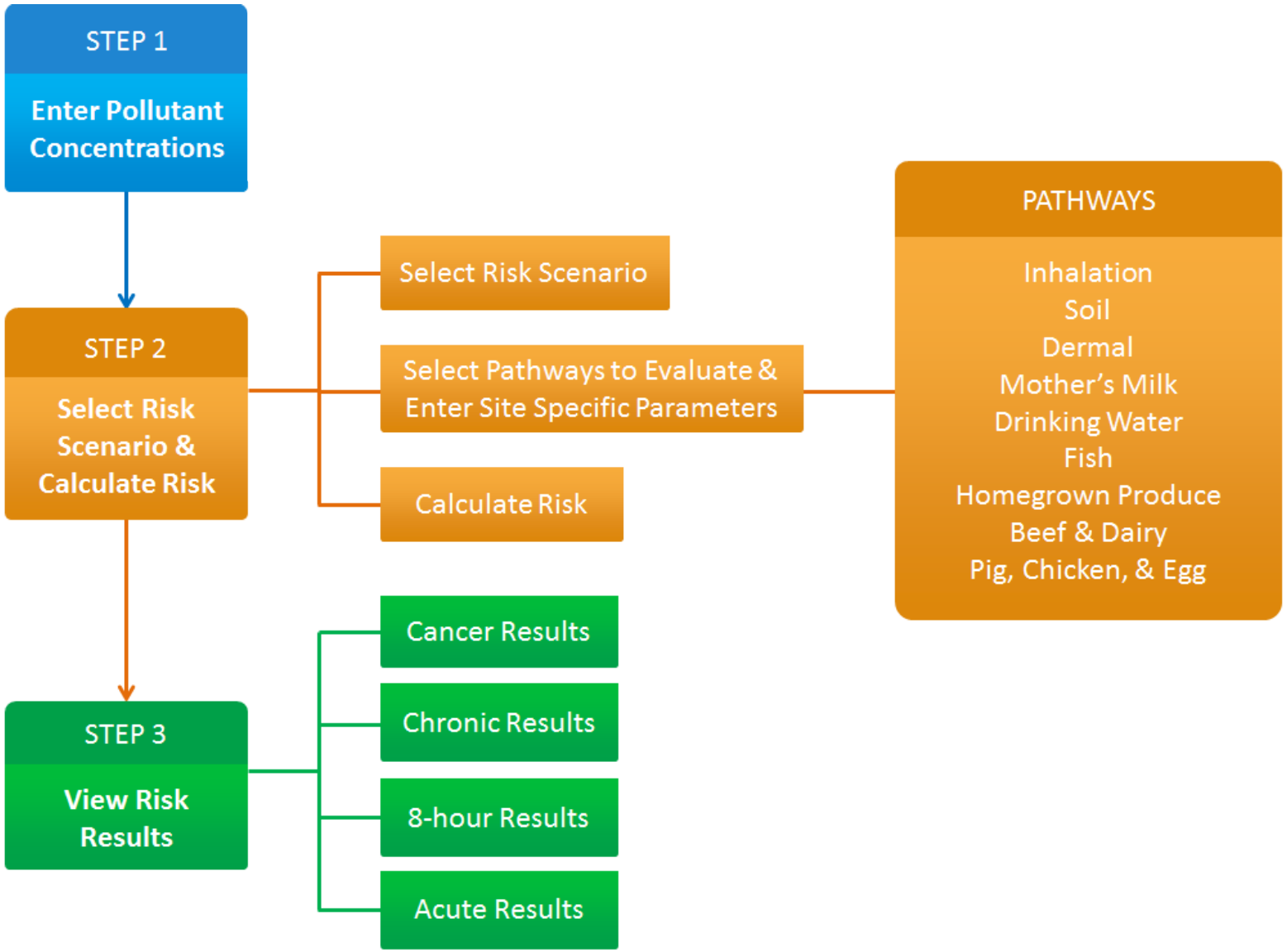
Table 3-1 provides a description of each of the main menu options.

Table 3-1. Main Menu Options

Menu Option	Description
File	
Load Input File	Loads .hra file to quickly load data inputs needed to generate a risk assessment. Data comes either from a .hra file created previously by the program or from a file with data inputs saved by another program.
Exit	Exits the program. Settings and data will *not* be saved unless exported in the ***Risk Scenario & Calculate Risk\Calculate Risk*** screen.
Help	
Check for Updates	Checks for software updates to ensure the program is current.

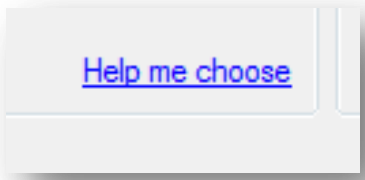
c. Tab Pages

In the HARP 2 RAST, the windows are displayed as tabs in the application workspace. The diagram below provides information on the tab windows available in RAST.


STEP 1
Enter Pollutant Concentrations
STEP 2
Select Risk Scenario & Calculate Risk
STEP 3
View Risk Results
Select Risk Scenario
Select Pathways to Evaluate & Enter Site Specific Parameters
Calculate Risk
PATHWAYS
Inhalation
Soil
Dermal
Mother's Milk
Drinking Water
Fish
Homegrown Produce
Beef & Dairy
Pig, Chicken, & Egg
Cancer Results
Chronic Results
8-hour Results
Acute Results

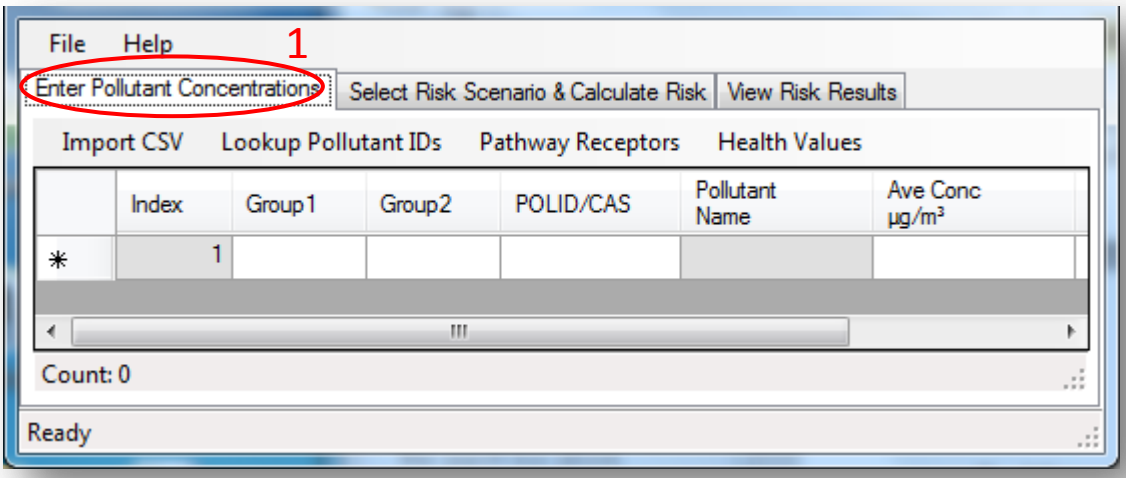
d. *Help* Resources

Throughout HARP 2 RAST, ***Help*** links will be available to guide you through options, terms, and site specific (Tier 2) features.



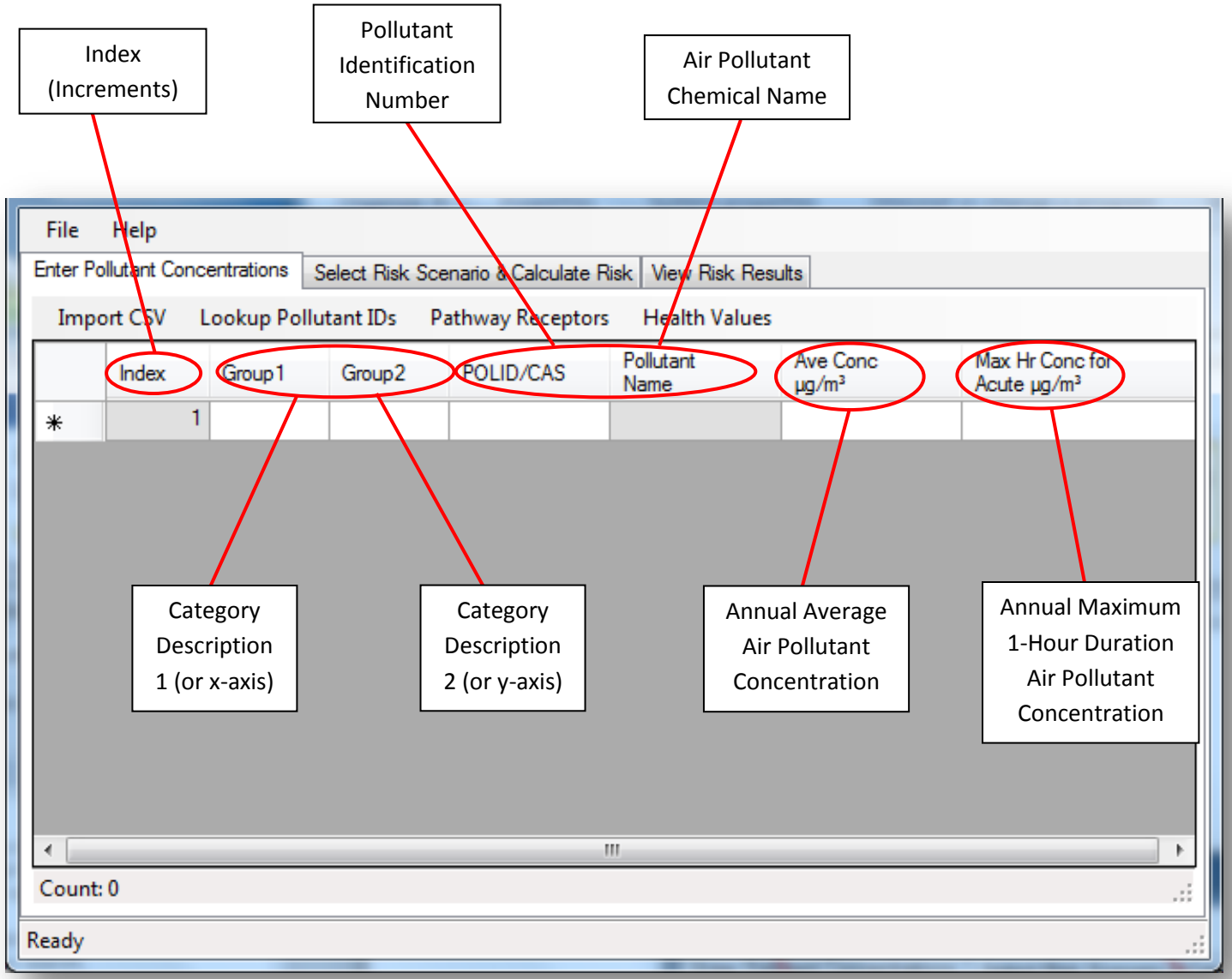
4. STEP 1: ENTERING POLLUTANT CONCENTRATIONS

In this first step, you must provide pollutant information (e.g., pollutant ID, annual ground level concentration (GLC), and max hourly GLC) for the analysis. Data can be 1) manually entered or 2) imported using a CSV file. The subsections below describe how to enter the pollutant information.



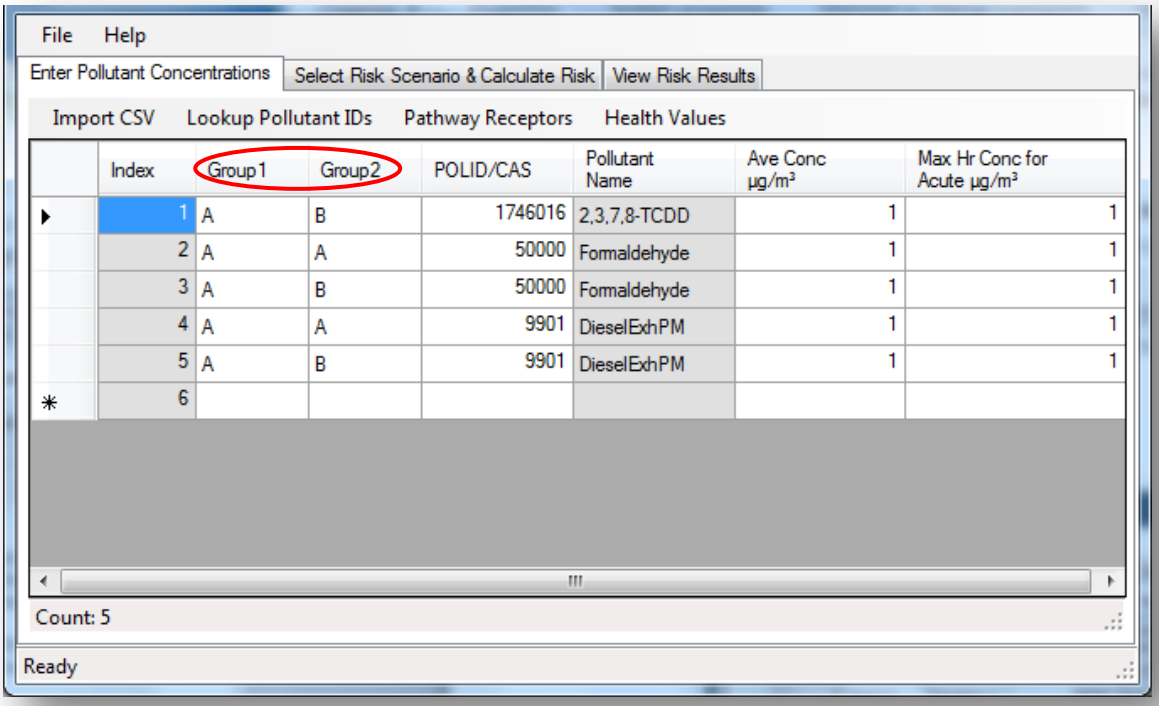
a. Manually Adding Pollutant Information

Pollutant information can be manually entered directly to the ***Enter Pollutant Concentrations*** grid. This section describes the columns available and how to use them. If pollutant data is already available to upload, please skip to section ***b. Uploading Previous Pollutant Concentrations from a CSV File***.


Index (Increments)
Pollutant Identification Number
Air Pollutant Chemical Name
File
Help
Enter Pollutant Concentrations
Select Risk Scenario & Calculate Risk
View Risk Results
Import CSV
Lookup Pollutant IDs
Pathway Receptors
Health Values
Index
Group1
Group2
POLID/CAS
Pollutant Name
Ave Conc µg/m³
Max Hr Conc for Acute µg/m³
1
Category Description 1 (or x-axis)
Category Description 2 (or y-axis)
Annual Average Air Pollutant Concentration
Annual Maximum 1-Hour Duration Air Pollutant Concentration
Count: 0
Ready

i. Group1 & Group2 (Optional)

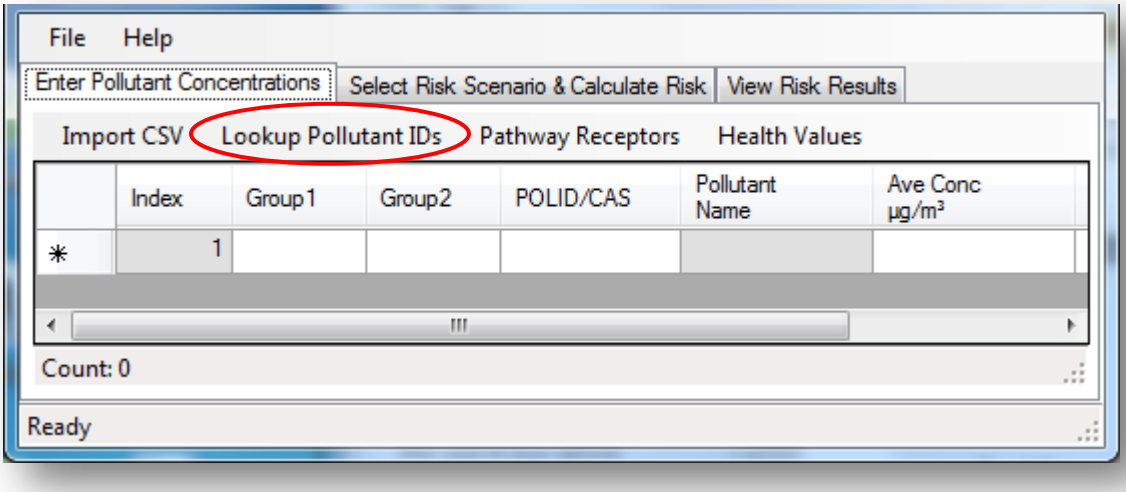
Group1 and ***Group2*** are optional fields. These fields may be used to help categorize the pollutant information. For example, Group 1: Smokestack A and Group 2: Paint Production. These fields may also be used to designate X and Y coordinates.



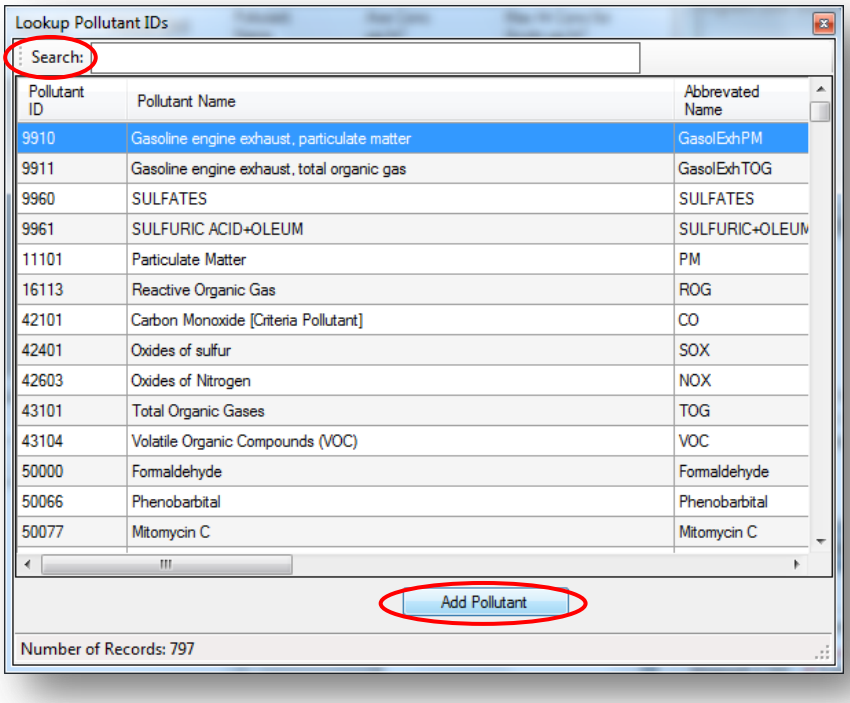
ii. POLID/CAS

The ***POLID/CAS*** is a required field. To find the correct ***POLID/CAS*** for your pollutant, refer to the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (http://www.arb.ca.gov/toxics/healthval/contable.pdf). You can also use the ***Lookup Pollutant IDs*** tool to add the pollutant ID. The pollutant ID is automatically populated when the pollutant ID is entered.

- Note: If the pollutant name displays “unknown”, this means the pollutant ID does not have any available health values.



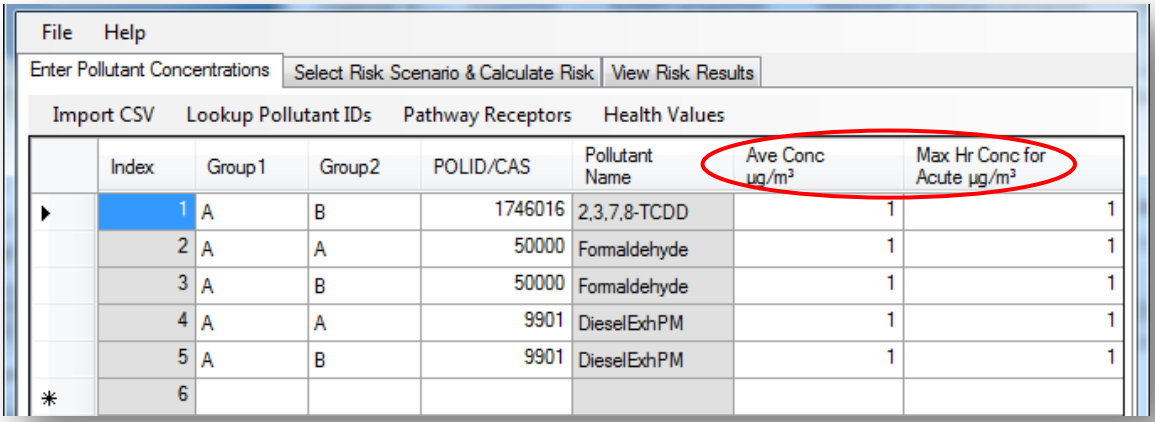
To look up the pollutant ID, click ***Lookup Pollutant IDs***. Enter a partial pollutant name to search for a specific pollutant. To add the pollutant to the grid, select the pollutant record and click ***Add Pollutant***. The grid will automatically populate with the selected pollutant ID. Repeat the steps to add additional pollutants and then close the window when finished.



iii. Average & Maximum Concentrations

There are two fields for entering pollutant concentrations. One is for the annual average concentration and the other is for the maximum hourly concentration. Annual average concentrations are used for cancer and noncancer chronic assessments. Maximum hourly concentrations are used for acute assessments. Both fields are provided so that cancer and noncancer impacts may be run at the same time. The risk values will result in a zero (0), if these fields are left blank.

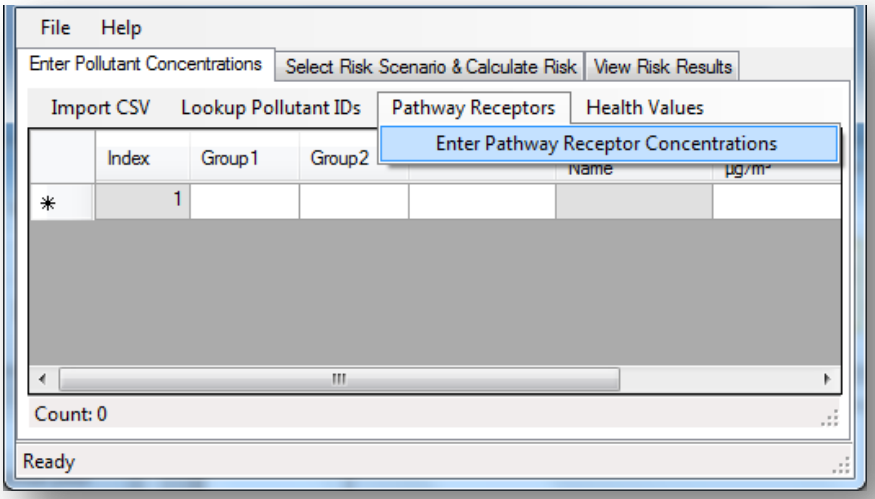
- Note: *Molecular weight adjustment factors (MWAFs) are typically applied at the emission level*. However, MWAFs are automatically applied when calculating risk. For more information on MWAFs, see Section 4.2.1.1.1 in the OEHHA Guidance Manual for more information.



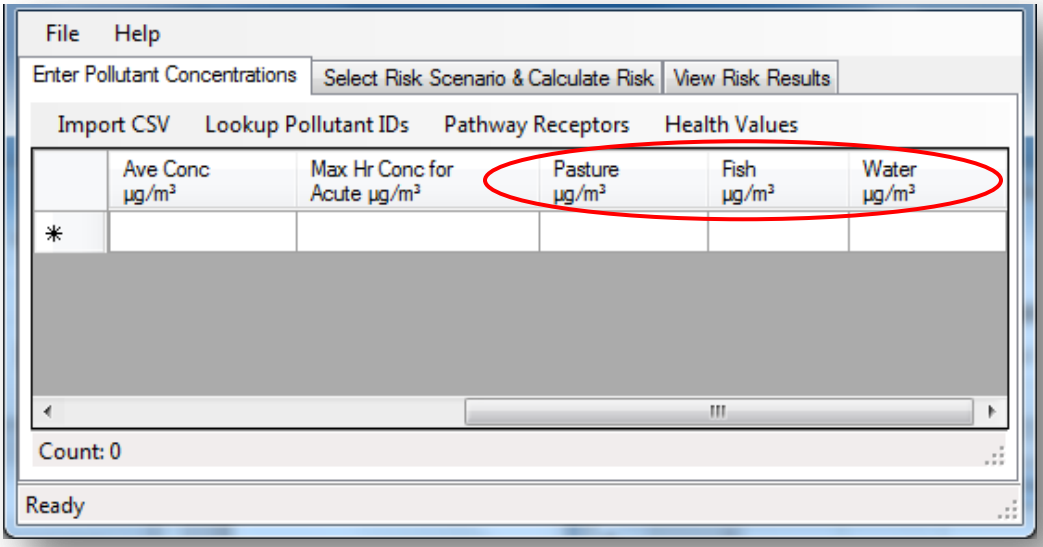
	Index	Group1	Group2	POLID/CAS	Pollutant Name	Ave Conc µg/m³	Max Hr Conc for Acute µg/m³
▶	1	A	B	1746016	2,3,7,8-TCDD	1	1
	2	A	A	50000	Formaldehyde	1	1
	3	A	B	50000	Formaldehyde	1	1
	4	A	A	9901	DieselExhPM	1	1
	5	A	B	9901	DieselExhPM	1	1
*	6						

iv. Pathway Receptors

If site specific pathways are to be evaluated (fish, homegrown crops, water, and animal pathways), pathway concentrations may also be entered. To enter pathway concentrations, click ***Pathway Receptors\Enter Pathway Receptor Concentrations***.



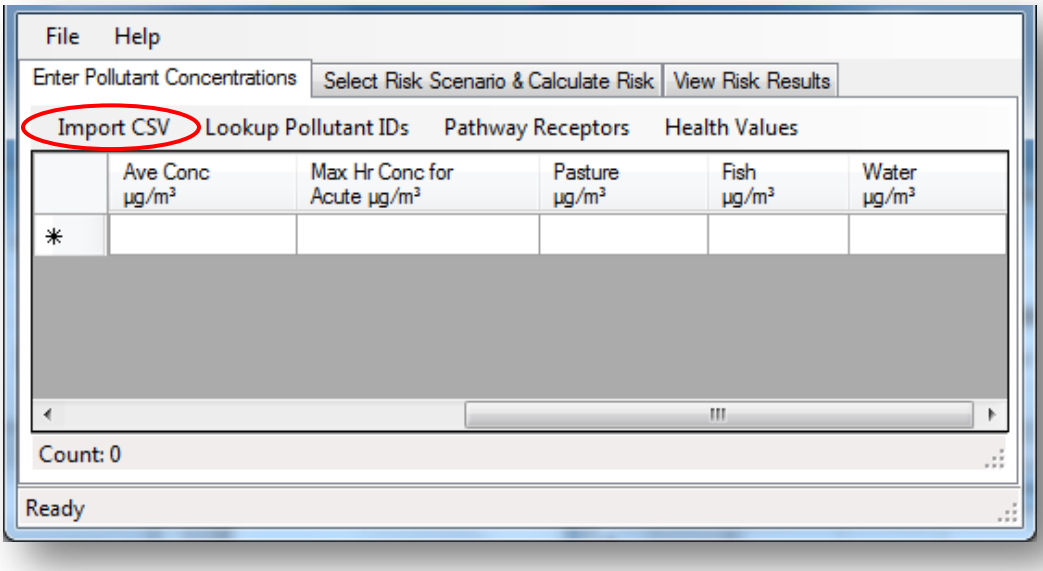
Three more columns will appear in the grid.



1. ***Pasture µg/m^3*** Column: Enter the ground level pollutant concentration over ***Pasture*** at your risk receptor point or zone of impact that is used for grazing animals (for meat and dairy products) for human consumption.
2. ***Fish µg/m^3*** Column: Enter the ground level pollutant concentration over ***Fish*** raised for human consumption at your receptor.
3. ***Water µg/m^3*** Column: Enter the ground level pollutant concentration over a ***Water*** source used at your receptor.

b. Importing Pollutant Information Using a CSV File

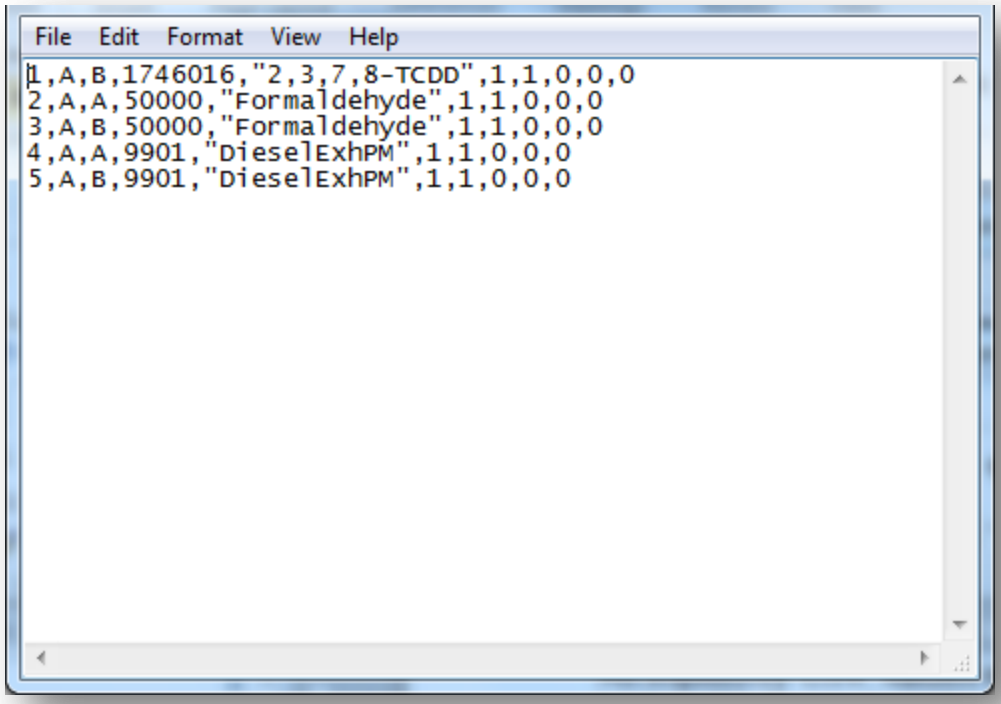
By clicking ***Import CSV***, pollutant information may also be imported using a CSV file that is correctly formatted. See ***Appendix D*** for more information on how to construct and format the CSV file.



Values should be entered in the following order: ***Index***, ***Group1***, ***Group2***, ***POLID/CAS***, ***Pollutant Name***, ***Ave Conc µg/m^3***, ***Max Hr Conc µg/m^3***, ***Pasture***, ***Fish***, and ***Water***. Do not include units, column names, or spaces in between commas. Separate each record by one line break.

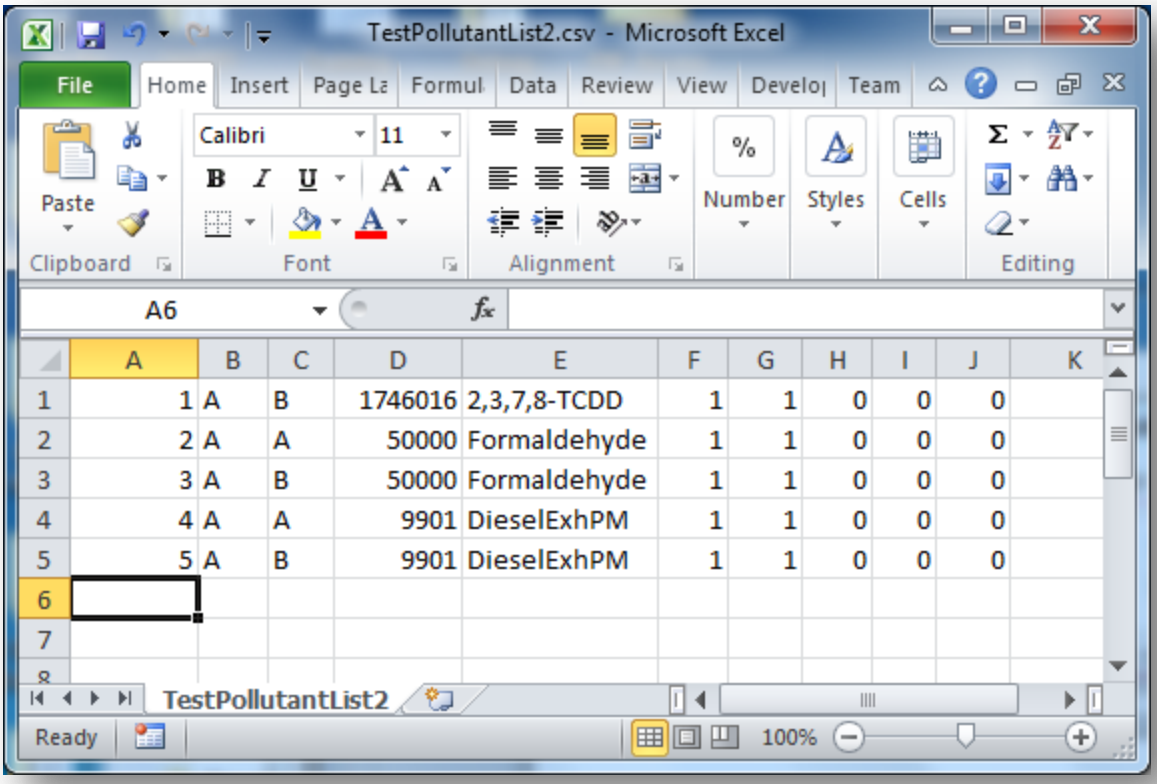
To find the correct ***POLID/CAS*** for your pollutant, refer to the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (http://www.arb.ca.gov/toxics/healthval/contable.pdf). If two numbers are available, select the number that is not four digits long; otherwise it may result in an error. You can also use the program's ***Lookup Pollutant IDs*** tool.

If you have no ***Pasture***, ***Fish***, or ***Water*** pollutant concentration data, type 0 as your value.

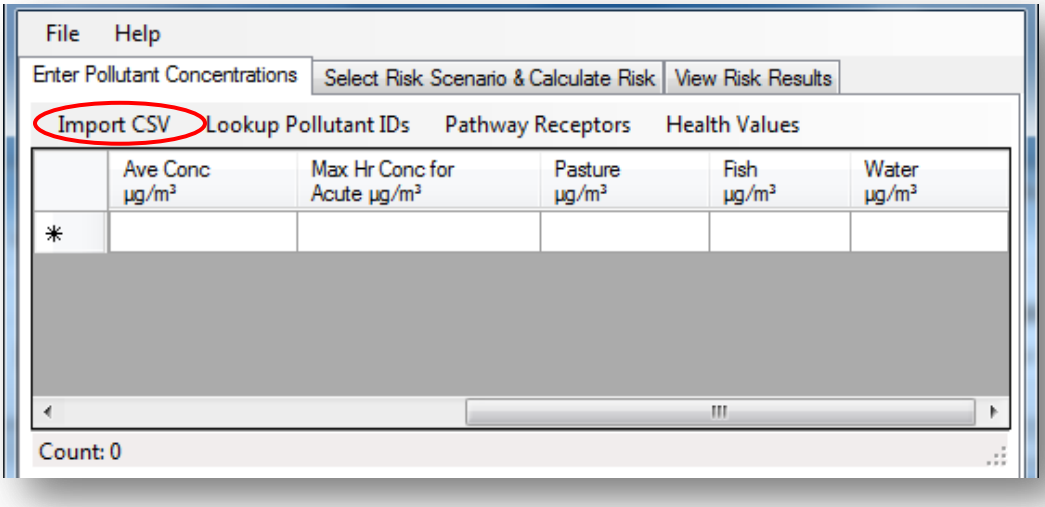


- Note: *If special characters (. - , * ? ! / &) are included in your group or pollutant name, quotes are required*. For example, while quotes around ***Formaldehyde*** is optional, ***2,3,7,8-TCDD*** or a group name with special characters would require them.

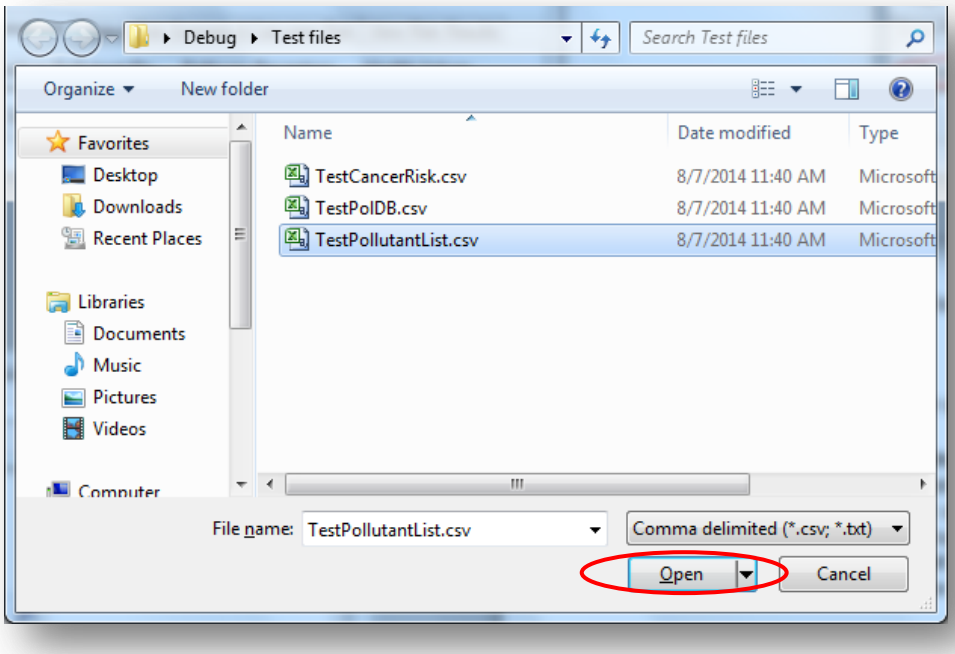
A CSV file may also be created in spreadsheet form. Instead of using commas, values and records are separated by cells.



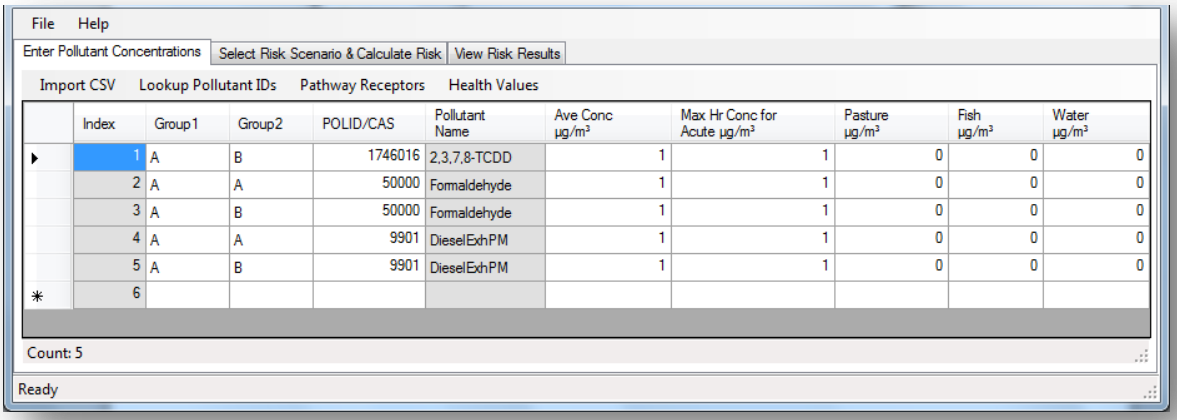
To use your CSV file with ground level concentrations data, go back into RAST. On the ***Enter Pollutant Concentrations*** screen, choose ***Import CSV*** in the ribbon.



Browse to the CSV file in the file dialog box and click ***Open***.



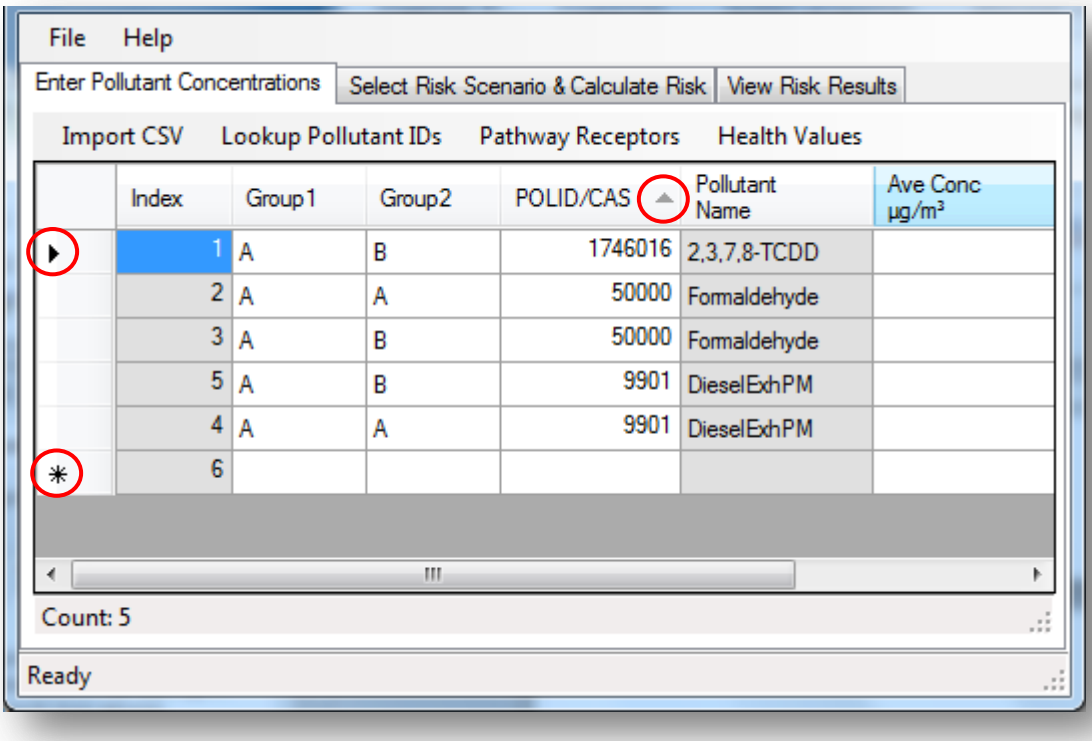
The CSV file will automatically populate in the grid.



	Index	Group1	Group2	POLID/CAS	Pollutant Name	Ave Conc µg/m³	Max Hr Conc for Acute µg/m³	Pasture µg/m³	Fish µg/m³	Water µg/m³
▸	1	A	B	1746016	2,3,7,8-TCDD	1	1	0	0	0
	2	A	A	50000	Formaldehyde	1	1	0	0	0
	3	A	B	50000	Formaldehyde	1	1	0	0	0
	4	A	A	9901	DieselExhPM	1	1	0	0	0
	5	A	B	9901	DieselExhPM	1	1	0	0	0
✳	6									

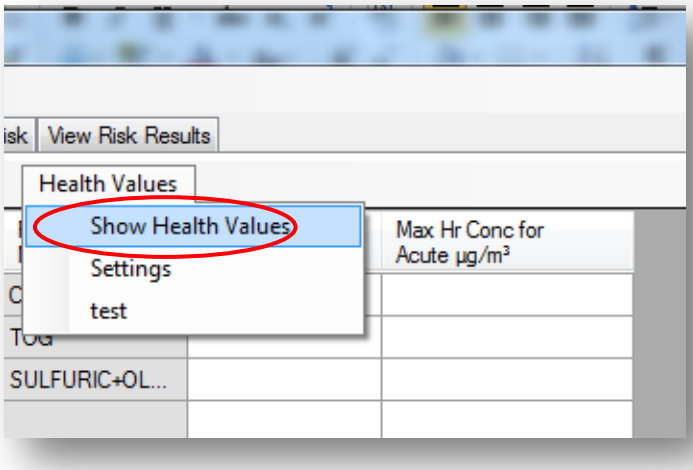
c. Sorting and Editing Data

The grid has basic editing capabilities. These include typing, copying and pasting individual cells, and deleting entire rows. A symbol ✳ indicates the next row to be added, and an arrow ► shows which row is active. You may also sort your data by clicking at the top of the column name.

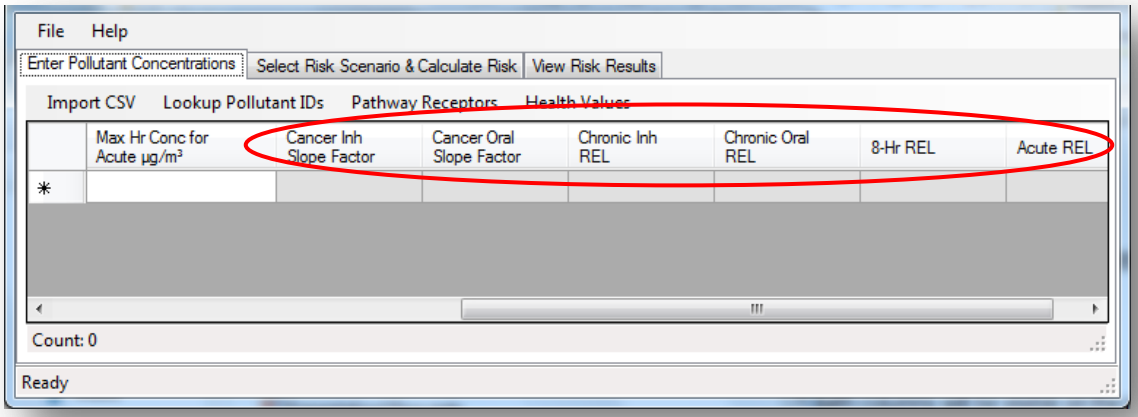


d. Viewing Pollutant Health Values

Pollutant health values may also be viewed from the grid. To view the available health values for each pollutant, click ***Health Values\Show Health Values***.

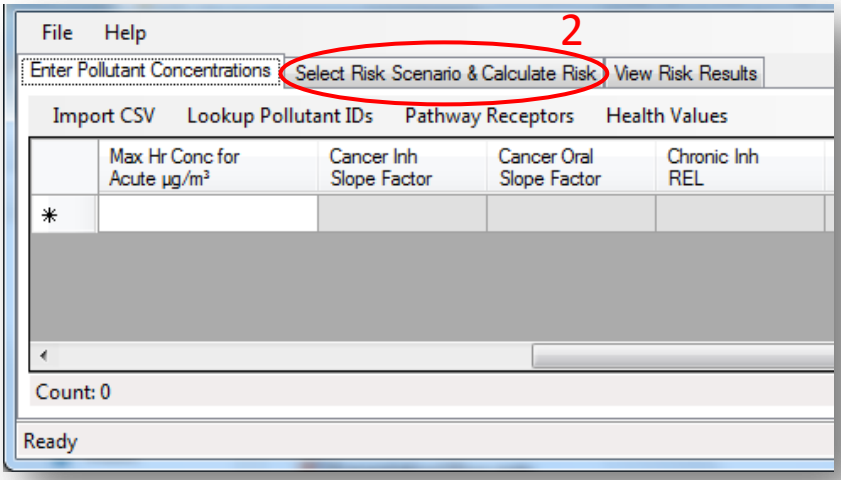


The health columns will appear on the right side of the grid.

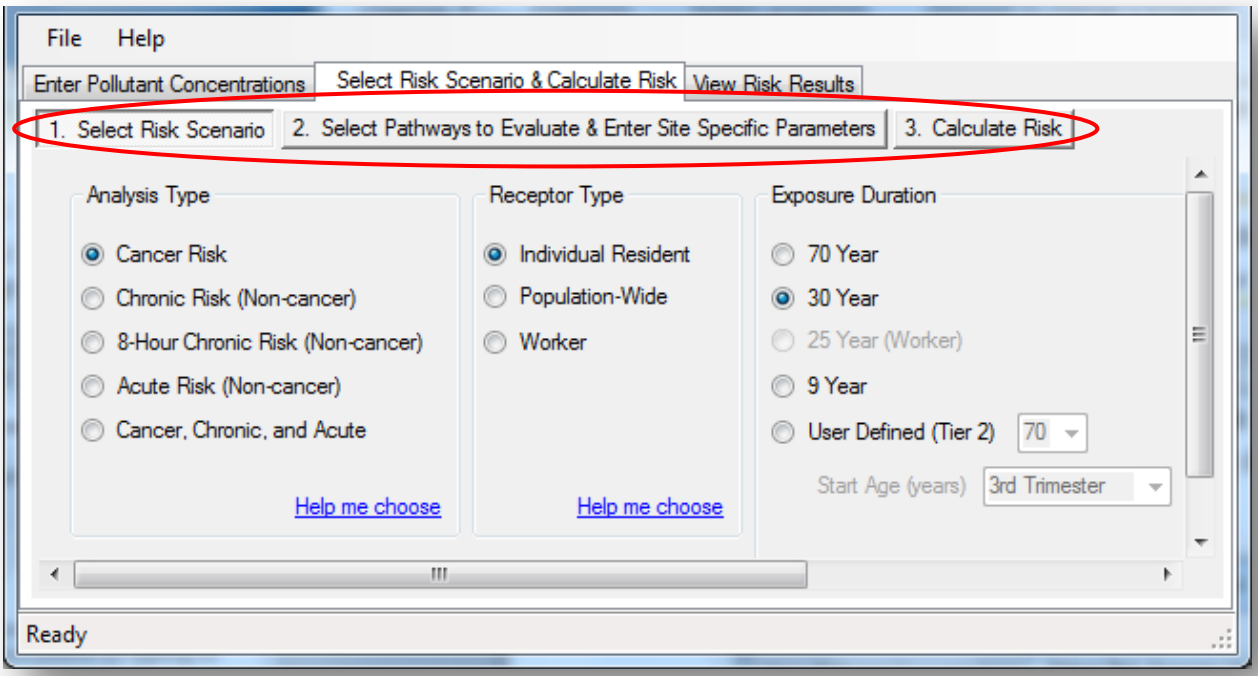


5. STEP 2: SELECTING RISK SCENARIO & CALCULATING RISK

This section provides information on how to select the risk scenario, choose pathways to evaluate, and how to calculate risk. To open Step 2, click the ***Select Risk Scenario & Calculate Risk*** tab.

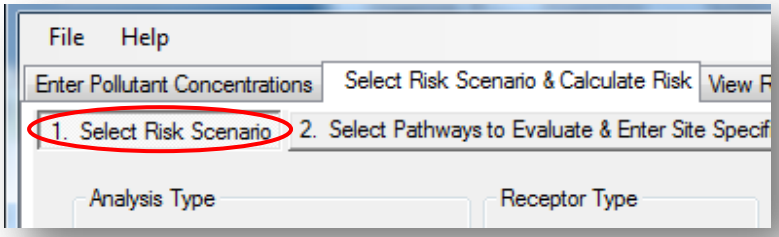


There are three parts in this step: 1) ***Select Risk Scenario***, 2) ***Select Pathways to Evaluate & Enter Site Specific Parameters***, and 3) ***Calculate Risk***.



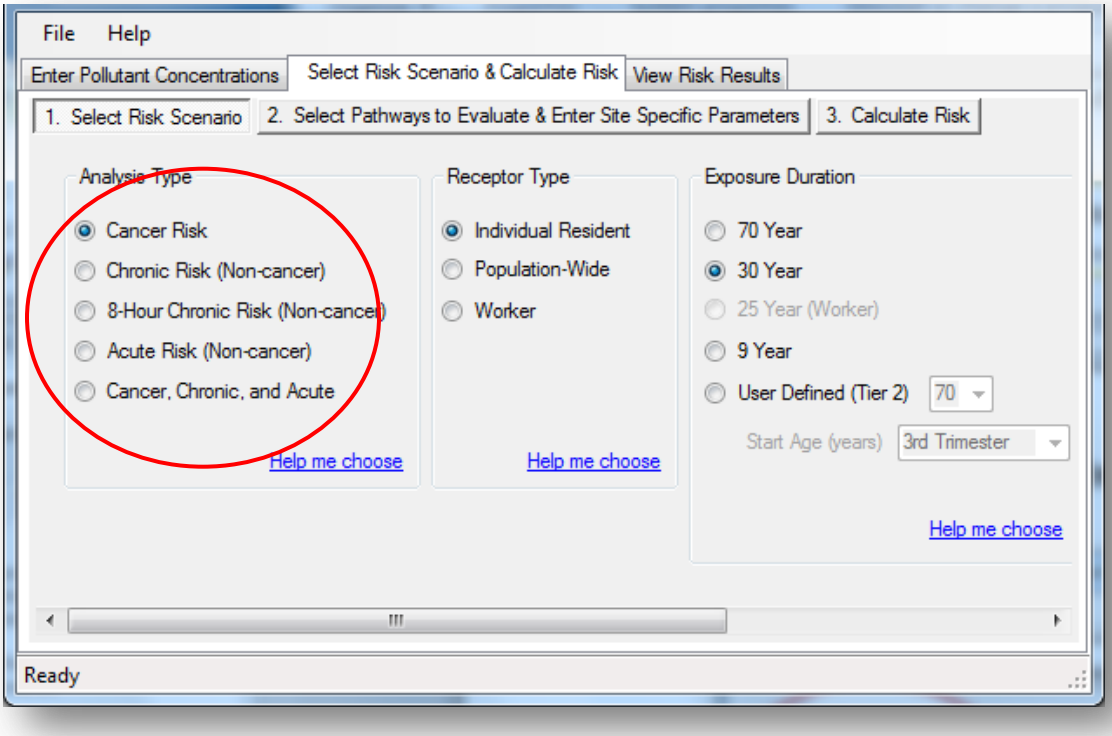
6. STEP 2: SELECT RISK SCENARIO

Find the first sub-tab underneath ***Select Risk Scenario & Calculate Risk***. The first part to sub-tab ***1. Select Risk Scenario*** is choosing the analysis type.



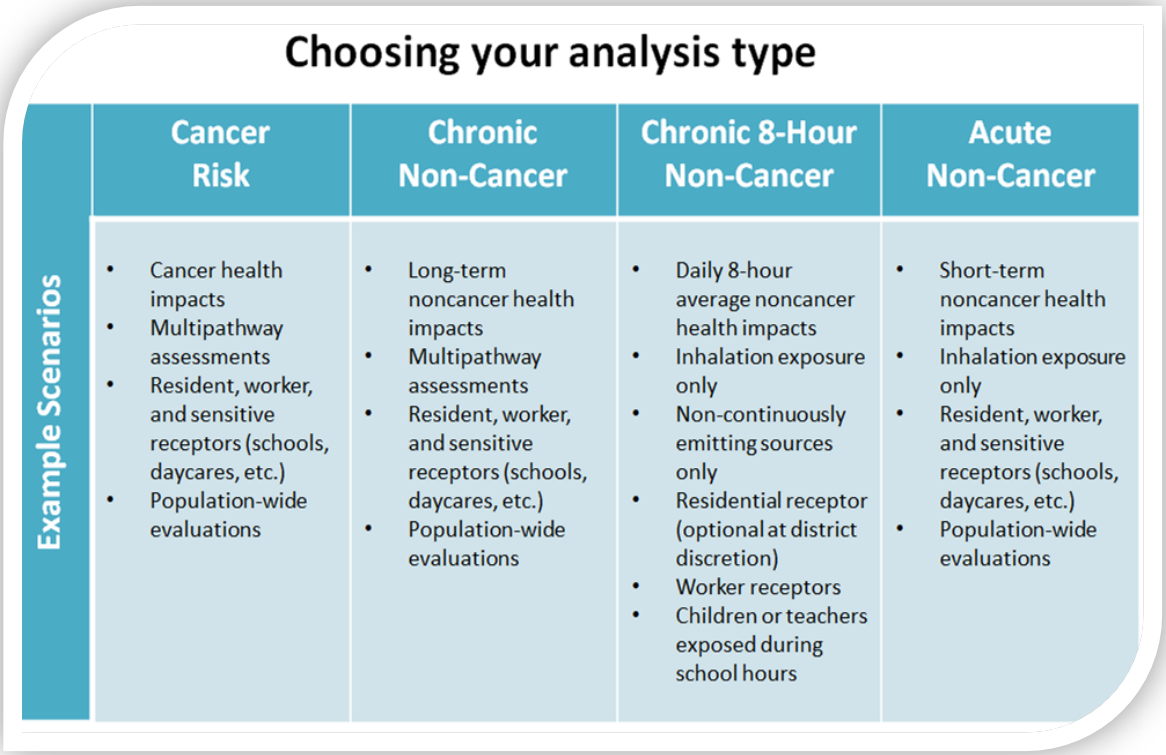
a. Choosing the Analysis Type

Choosing your analysis type means choosing what type of health risk you want to assess. There is ***Cancer Risk***, ***Chronic Risk***, ***8-Hour Chronic Risk***, or ***Acute Risk***. You may also conduct three assessments together: ***Cancer, Chronic, and Acute Risk***. Table 6-1 can help you decide which assessment to use.



- Note: ***<u>Acute</u>*** *and* ***<u>8-Hour Chronic Risk</u>*** *<u>allow for health risk calculations from inhalation only</u>*, and does not include other pathways (e.g., dermal exposure, ingestion of soil, water).

Table 6-1. Analysis Types



Choosing your analysis type

	Cancer Risk	Chronic Non-Cancer	Chronic 8-Hour Non-Cancer	Acute Non-Cancer
Example Scenarios	• Cancer health impacts • Multipathway assessments • Resident, worker, and sensitive receptors (schools, daycares, etc.) • Population-wide evaluations	• Long-term noncancer health impacts • Multipathway assessments • Resident, worker, and sensitive receptors (schools, daycares, etc.) • Population-wide evaluations	• Daily 8-hour average noncancer health impacts • Inhalation exposure only • Non-continuously emitting sources only • Residential receptor (optional at district discretion) • Worker receptors • Children or teachers exposed during school hours	• Short-term noncancer health impacts • Inhalation exposure only • Resident, worker, and sensitive receptors (schools, daycares, etc.) • Population-wide evaluations

b. Determining the Receptor Type

Next, choose your receptor type: ***Individual Resident***, off-site ***Worker***, or ***Population-Wide***. Table 6-2 gives examples of each receptor type.

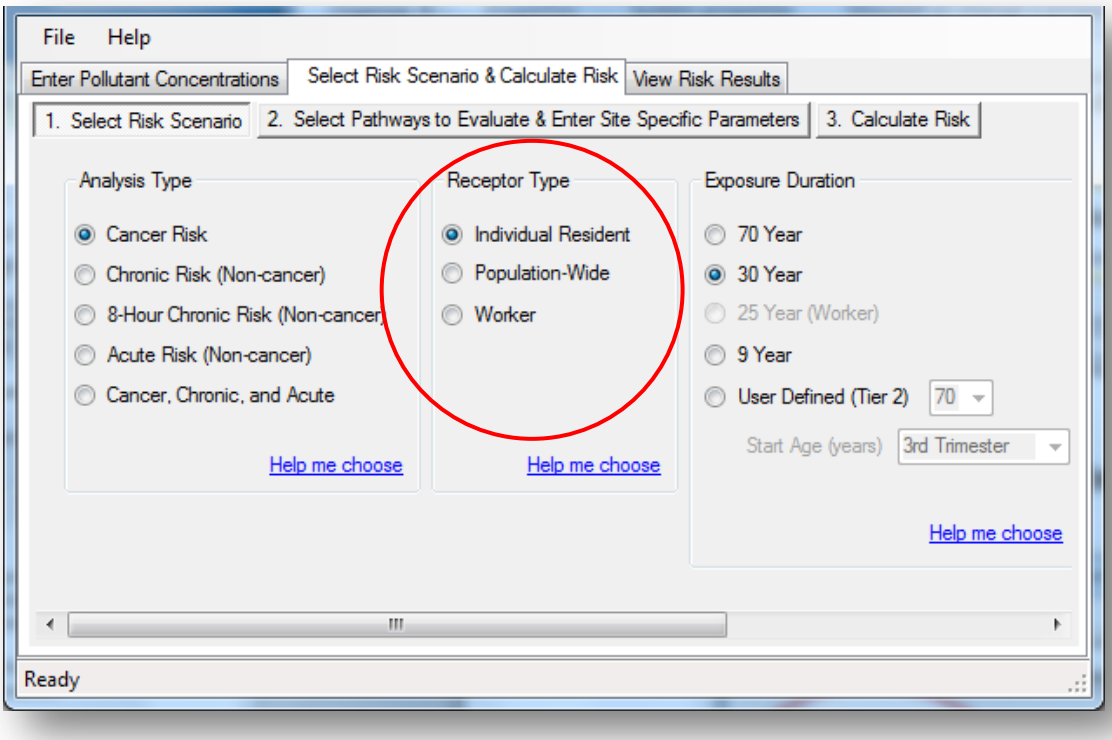


Table 6-2. Receptor Types[1]

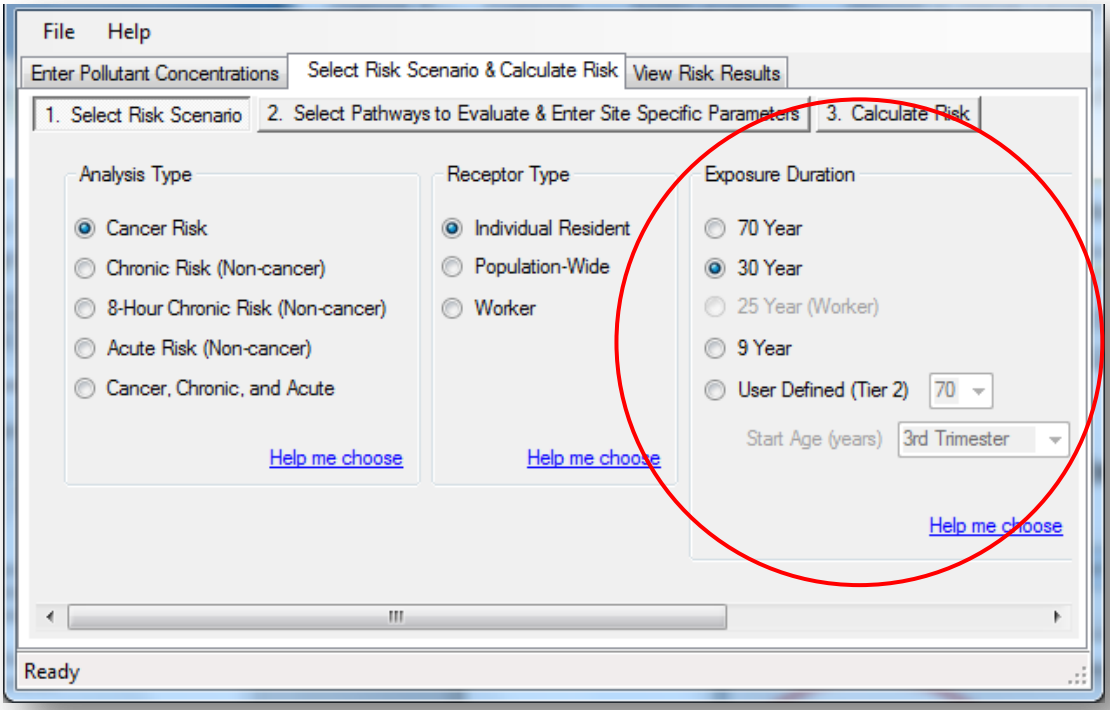
Choosing your receptor type

Individual Resident	Population-Wide	Worker
• An individual resident receptor can be any non-work-related location where a person may reside (e.g., home apartment, school, dorm, prison, care facility).	• The population-wide receptor presents the impacts to multiple people within a geographic area of interest. • Needed to assess estimates of the exposed population or cancer burden analyses.	• The worker receptor can be any place where an off-site worker is exposed to pollutants on a daily basis, according to their work schedule.

[1]Off-site workers typically are adjacent workers not employed or directly employed by the emitting facility. The worker can be onsite if there is a separate business on the premises, such as a daycare, franchise, etc.

c. Exposure Duration for Cancer Risk Assessments

Exposure Duration is a feature available for ***Cancer Risk*** assessments.



The ***Exposure Duration*** is the number of years the receptor is exposed to facility pollutants. Depending on your risk assessment needs, more than one ***Exposure Duration*** may be needed for a complete risk evaluation. Table 6-3 shows exposure duration options for the maximum-exposed individual resident (MEIR) and maximum-exposed individual worker (MEIW).

Table 6-3. Exposure Duration Options for Cancer Risk Assessments				
70 Year	***30 Year***	***9 Year***	***25 Year (Worker)***	***User Defined (Tier 2)***
70-year exposure may be used to estimate cancer risk for residential receptors. The 70-year exposure duration is required for estimates of population-wide risks.	30-year exposure is used to estimate Tier 1 cancer risk at a residential receptor.	9-year exposure may be used to estimate cancer risk for residential receptors.	25-year exposure duration is the Tier 1 default used to estimate cancer risk for the (off-sire) worker scenario.	The user defined Tier 2 option allows the use of a user defined exposure duration and the designation of a start age for that exposure. User defined exposure durations can be used for both residential and worker receptors. All user defined inputs must be supported.

Table 6-4 provides a summary of recommendations for exposure duration for ***Individual*** cancer risk assessments. Population-wide assessments require 70-year evaluations.

Table 6-4. Recommendations for Exposure Duration for Individual Cancer Risk Assessments at the MEIR and MEIW[1]	
Receptor	***Recommendation***
Resident (MEIR)	9 years 30 years* 70 years
Worker (MEIW)	25 years

[1]OEHHA Guidance Manual, Table 8.5 Summary of Recommendations for Exposure Duration for Individual Cancer Risk Assessments at the MEIR and MEIW.

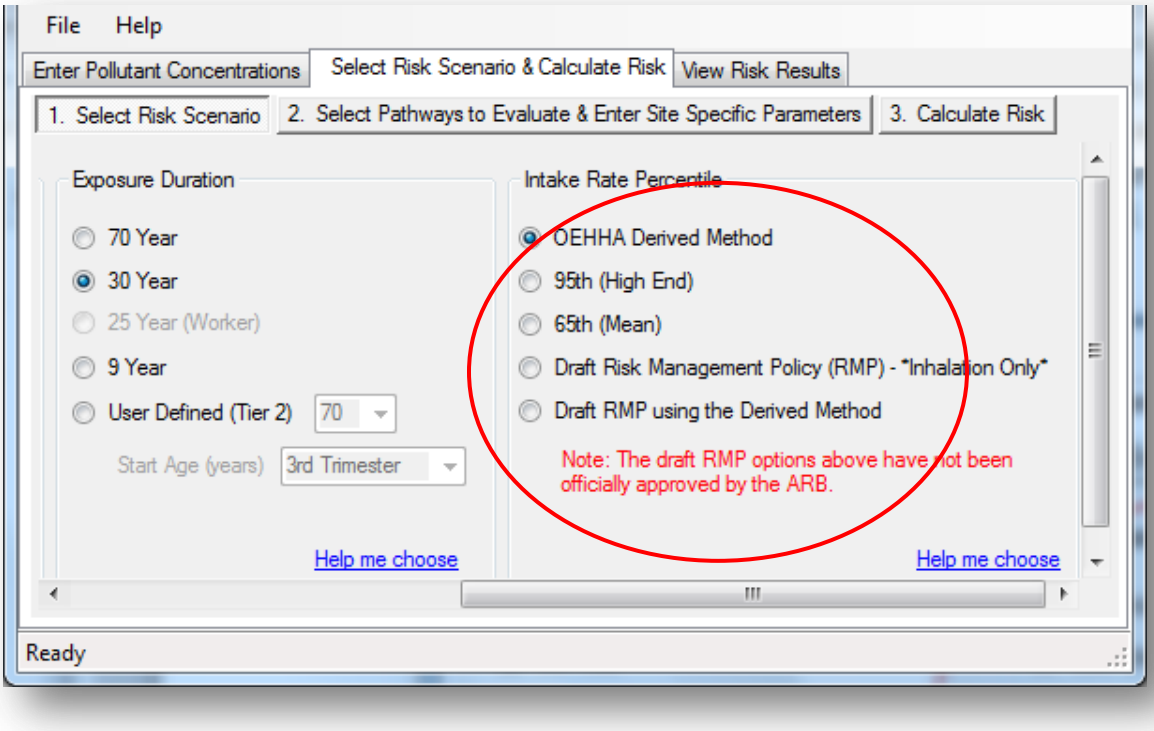
*30-years is the default for Tier 1 residential receptors. 9, 30, and 70-year periods are useful for public notification requirements, risk reduction, or supplemental information.

i. ADVANCED FEATURE: User Defined Start Age and Duration

User Defined (Tier 2) is an advanced optional feature to personalize your duration of exposure and the ***Start Age***. By default, all durations start with exposure in the third trimester (except for the worker scenario).

d. Intake Rate Percentile

The ***Intake Rate Percentile*** sets the intake rate at which a person is exposed to the air pollutant. The intake rate percentile you select will determine the percentiles for all of the exposure pathways included in your assessment. For more information on the intake rates, see the OEHHA Guidance Manual.



OEHHA Derived Method – In cancer risk assessments, the derived method uses the high-end point estimate (i.e., 95th percentile) for the *two* driving (dominant) exposure pathways (e.g., soil and breast milk) and the mean (65th percentile) point estimate for the remaining pathways. In non-cancer chronic assessments, the inhalation pathway is always considered a driving pathway, the next two risk driving pathways will use the 95th percentile, and the remaining pathways will use the mean intake rate.

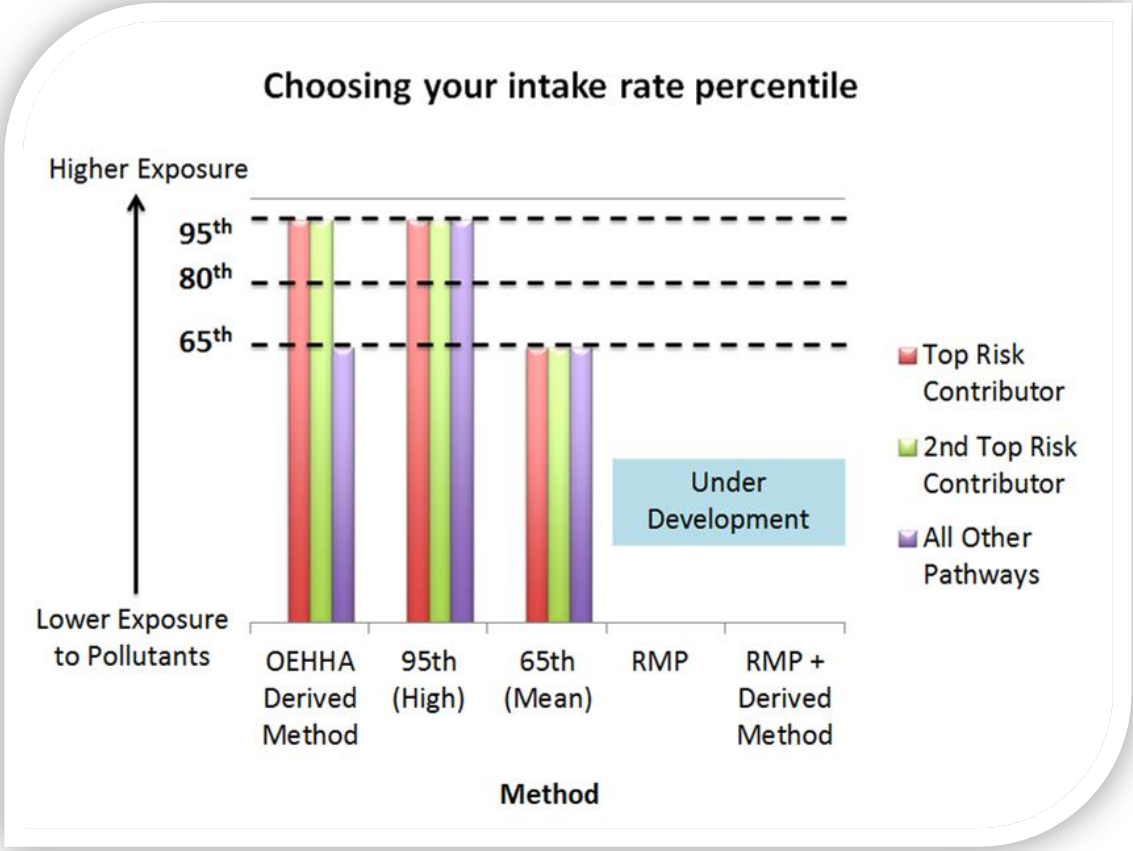
95th Percentile (High End) – Select the high end intake rate to assess risk at the 95th percentile exposure rate for all pathways.

65th Percentile (Mean) – Select the mean intake rate to assess risk at the 65th percentile exposure rate for all pathways.

Risk Management Policy (RMP) – This is currently under development. For more information, see http://www.arb.ca.gov/toxics/rma/rma.htm.

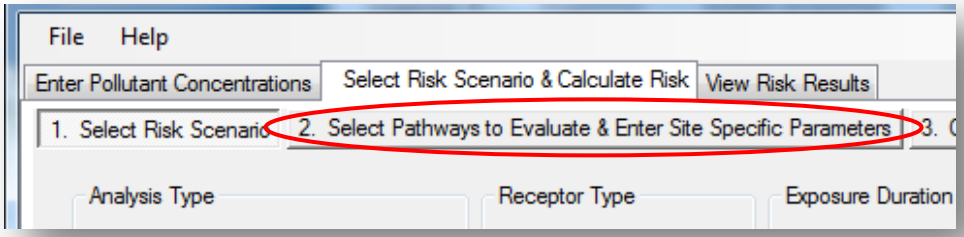
RMP using the Derived Method – This is currently under development. For more information, see http://www.arb.ca.gov/toxics/rma/rma.htm.

Table 6-5. Intake Rate Percentile Methods



7. STEP 2: SELECT PATHWAYS TO EVALUATE & ENTER SITE SPECIFIC PARAMETERS

This section discusses the second part of the ***Select Risk Scenario & Calculate Risk*** step. To select the pathways to evaluate, click ***2. Select Pathways to Evaluate & Enter Site Specific Parameters***.



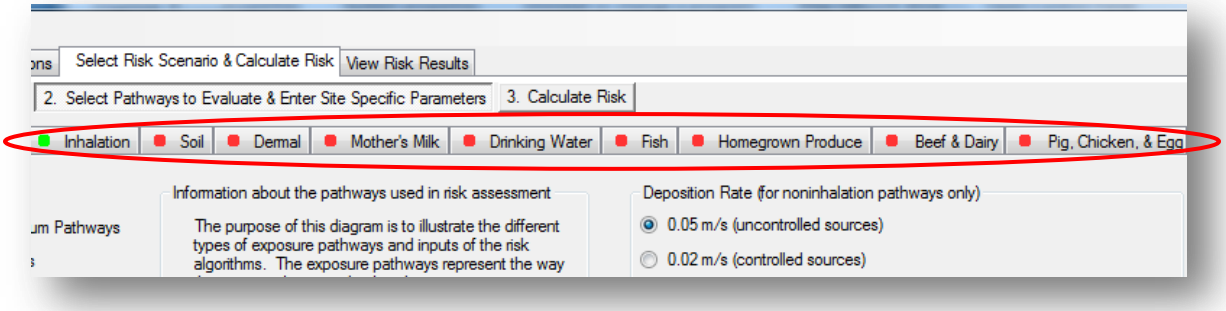
a. Pathways to Evaluate

As part of your risk assessment, you will need to determine which pathways to evaluate. Pathways can be turned on and off in this program.

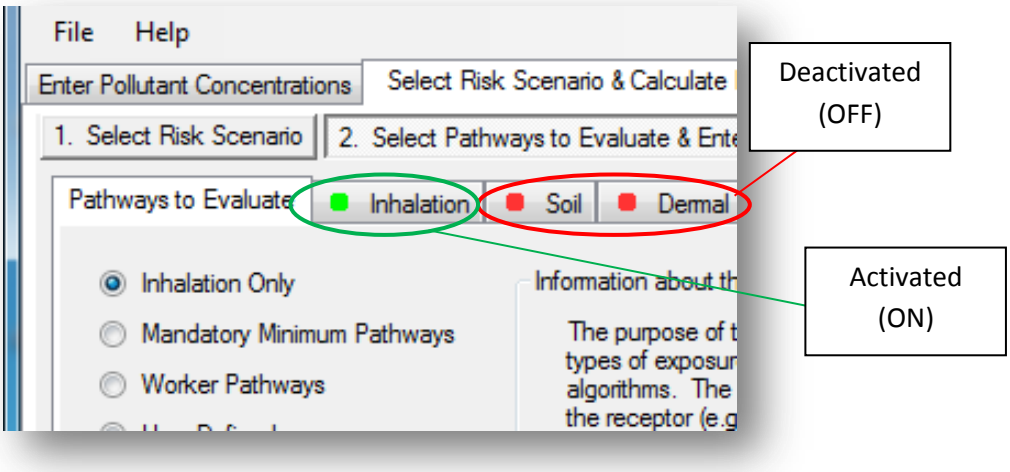
i. Activating and Deactivating Pathways

Data may be included for the following pathways:

- ***Inhalation*** (Always On),
- ***Soil***,
- ***Dermal***,
- ***Mother's Milk,***
- ***Drinking Water***,
- ***Fish***,
- ***Homegrown Produce***,
- ***Beef & Dairy***, and
- ***Pig, Chicken, & Egg***.

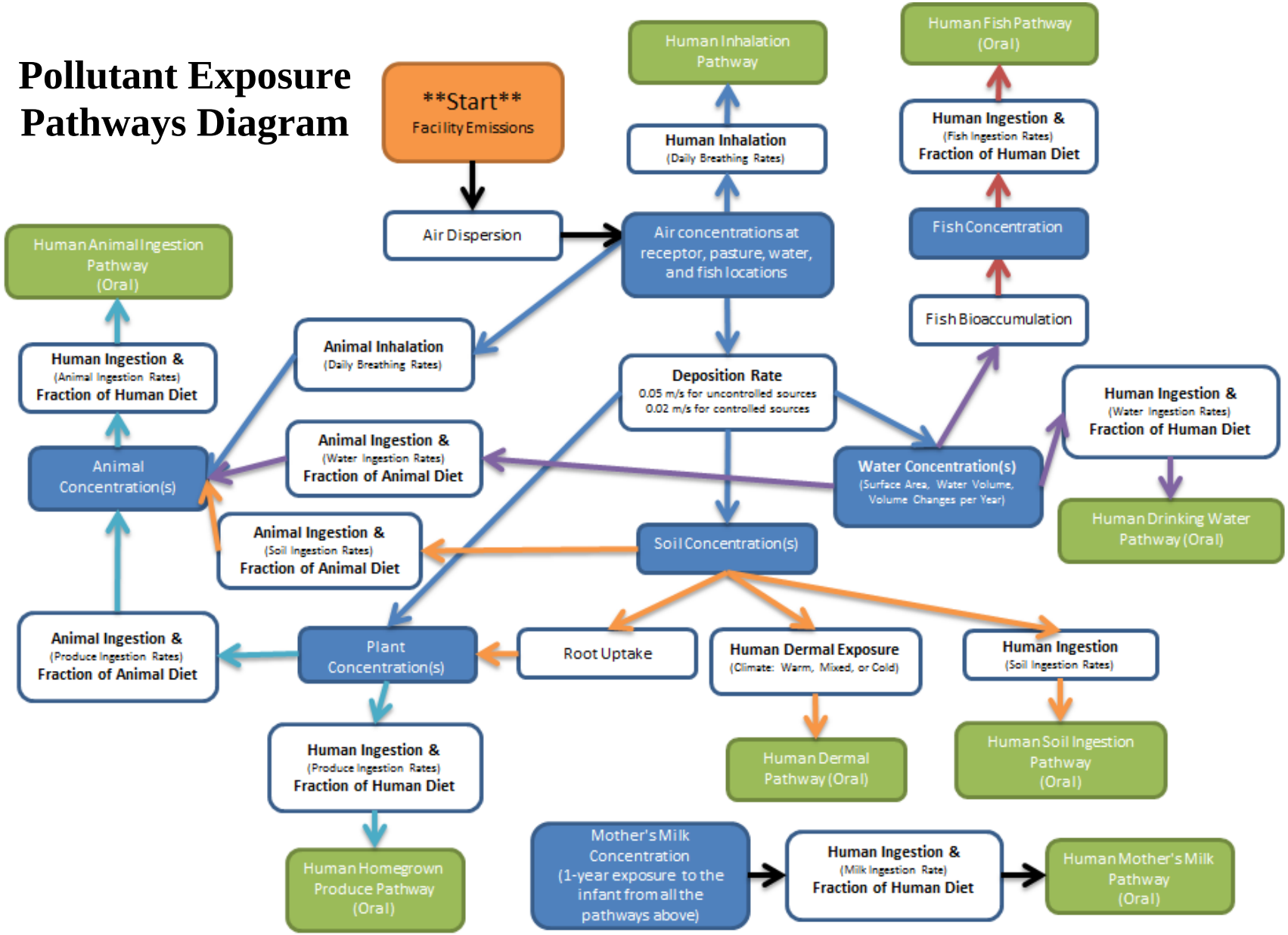


The ***Pathways to Evaluate*** tab allows you to activate and deactivate pathways. A green square means the pathway is ON and a red square means the pathway is OFF.



For a better understanding of how these pathways are connected to air pollution and human exposure, view the pathway diagram.

Pollutant Exposure Pathways Diagram



ii. Choosing Pathways to Evaluate

There are a number of exposure pathways by which humans may be exposed to airborne chemicals. Therefore, the program provides three preset options and one user defined option:

1. ***Inhalation Only*** will account for inhaled toxics and no other pathways of exposure.
2. ***Mandatory Minimum Pathways*** will activate the four minimum exposure pathways required by OEHHA to conduct a health risk assessment for residents, when multi-pathway pollutants are involved. These include inhalation, soil, dermal, and mother's milk.
3. ***Worker Pathways*** are used for potential exposure at the workplace during working hours. Worker pathways are inhalation, soil, and dermal.
4. ***User Defined*** allows you to choose your pathways, but always includes ***Inhalation***.

Table 7-1 specifies which pathways may be analyzed for each multipathway substance. The table is also provided in ***Appendix C***.

Table 7-1. Specific Pathways to be Analyzed for each Multipathway Substance[1]

Substance	Soil Ingestion	Dermal	Meat, Milk, & Egg Ingest.	Fish Ingest.	Exposed Vegetable Ingest.	Leafy Vegetable Ingest.	Protected Vegetable Ingest.	Root Vegetable Ingest.	Water Ingest.	Breast Milk Ingest.
Inorganic chemicals										
Arsenic & compounds	X	X	X	X	X	X	X	X	X	
Beryllium & compounds	X	X	X	X	X	X	X	X	X	
Cadmium & compounds	X	X	X	X	X	X	X	X	X	
Chromium VI & compounds	X	X	X[a]	X	X	X	X	X	X	
Fluorides (soluble compounds)	X	X	X		X	X	X	X	X	
Lead & compounds	X	X	X	X	X	X	X	X	X	X
Mercury & compounds	X	X	X	X	X	X	X	X	X	
Nickel & compounds	X	X	X	X	X	X	X	X	X	
Selenium & compounds	X	X	X	X	X	X	X	X	X	
Organic chemicals										
Creosotes	X	X	X	X	X	X			X	X
Diethylhexylphthalate	X	X	X	X	X	X			X	
Hexachlorobenzene	X	X	X	X	X	X			X	
Hexachlorocyclohexanes	X	X	X	X	X	X			X	
4,4'-Methylene dianiline	X	X			X	X			X	
Pentachlorophenol[b]										
PCBs	X	X	X	X	X	X			X	X
Polychlorinated dibenzo-p-dioxins and dibenzofurans	X	X	X	X	X	X			X	X
PAHs	X	X	X	X	X	X			X	X

[1] OEHHA Guidance Manual, Table 5.1 Specific Pathways to be Analyzed for each Multipathway Substance.
[a] Cow's milk only; no multipathway analysis for meat and egg ingestion.
[b] Cow's milk only; no multipathway analysis for meat and egg ingestion.

Mandatory Exposure Pathways

For all multipathway substances, the exposure pathways that must be evaluated at every residential and worker site (in addition to inhalation) are soil ingestion and dermal exposure. If polycyclic aromatic hydrocarbons (PAHs) and creosotes, lead, dioxins, furans, or polychlorinated biphenyls (PCBs) are emitted, then the breast-milk consumption pathway is also evaluated.

The other exposure pathways (e.g., ingestion of homegrown produce or fish) are site specific. If the resident can be exposed through an impacted exposure pathway, then it should be included in the health risk assessment. Consult with the reviewing authority to determine which pathways must be considered.

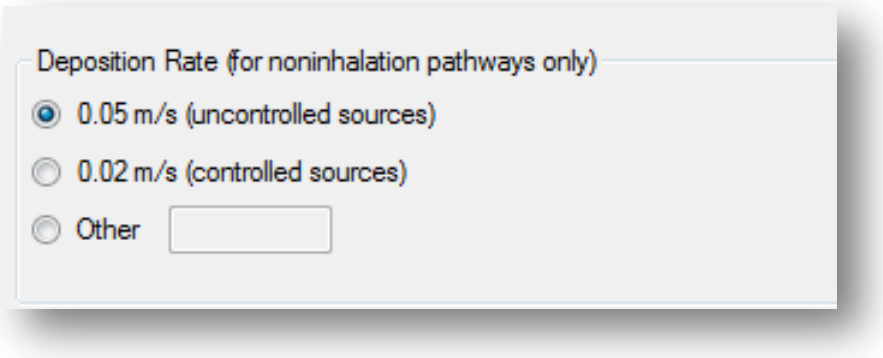
Table 7-2 identifies the residential receptor exposure pathways that are mandatory and those that are dependent on the available routes of exposure. It also identifies the three exposure pathways that are relevant for a worker receptor. While residents can be exposed though several exposure pathways, worker receptors are only evaluated for inhalation, soil ingestion, and dermal exposure using point estimates.

Table 7-2. Mandatory and Site/Route Dependent Exposure Pathways[1]	
Mandatory Exposure Pathways	Site/Route Dependent Exposure Pathways
• Inhalation[W] • Soil Ingestion[W] • Dermal Exposure to Contaminated Soil[W] • Breast Milk Consumption*	• Homegrown Produce Ingestion • Angler-Caught Fish Ingestion • Drinking Water Ingestion • Home-Raised Animal Product Ingestion (Dairy (Cow's) Milk, Meat (Beef, Pork, Chicken) and Egg)

[1]OEHHA Guidance Manual, Table 8.6 Mandatory and Site-Route Dependent Exposure Pathways.
(w) Identifies the appropriate exposure pathways that should be evaluated for a worker. These pathways are inhalation, dermal exposure, and the soil ingestion pathway.
(*) If PAHs (including creosotes), lead, dioxins, furans, or PCBs are emitted, then the breast-milk consumption pathway becomes mandatory.

iii. Deposition Rates

Facilities can release and deposit air pollutants at various rates depending on the pollution control of their source.

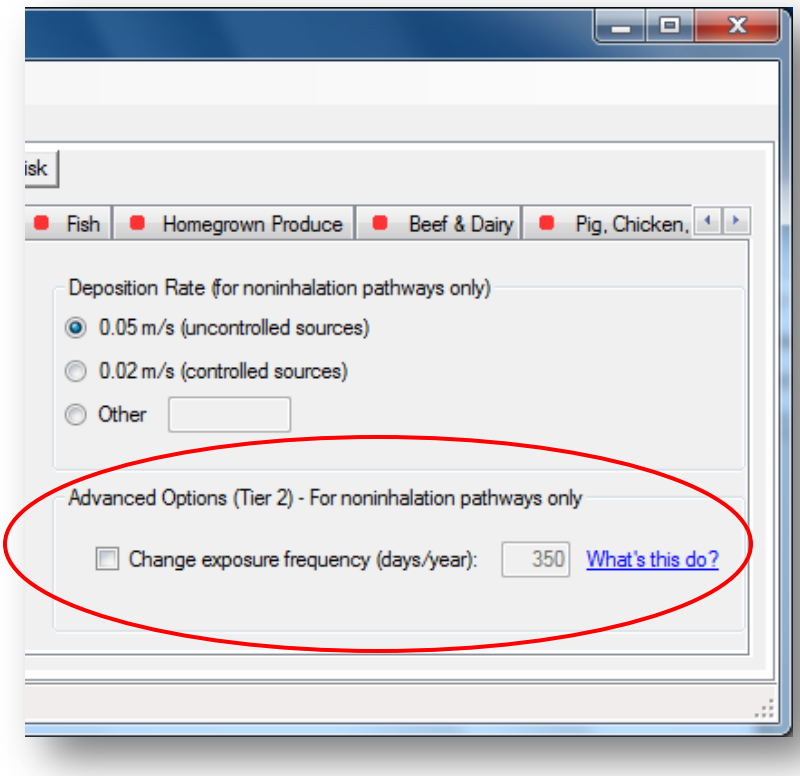


There are two source types:

1. Choose ***Uncontrolled Source*** at 0.05 m/s if the point of toxic release does not include an air pollution control device.
2. Choose ***Controlled Source*** at 0.02 m/s if the point of toxic release does include an air pollution control device (e.g., bag house, internal combustion engine powered by compressed natural gas).

For particulate matter, the default value of 0.02 meters per second is used for emission sources that have verifiable particulate matter control devices or for emission sources that may be uncontrolled but only emit particulate matter that is less than 2.5 microns (e.g., bag house, internal combustion engine powered by compressed natural gas).

iv. ADVANCED FEATURE: Changing the Exposure Frequency



This Tier 2 option applies to *non-inhalation* pathways only. By default, the program assumes the subject at risk is exposed to pollutants through non-inhalation pathways (e.g., eating contaminated crops) 350 days out of the year. This option allows you to change the default assumption.

Once you have finished choosing your pathways and site specific parameters, click on the green pathway tabs and enter the required data. The first tab will be ***Inhalation***.

b. Inhalation

This section describes features for the inhalation pathway of exposure to pollutants. The inhalation pathway is always on.

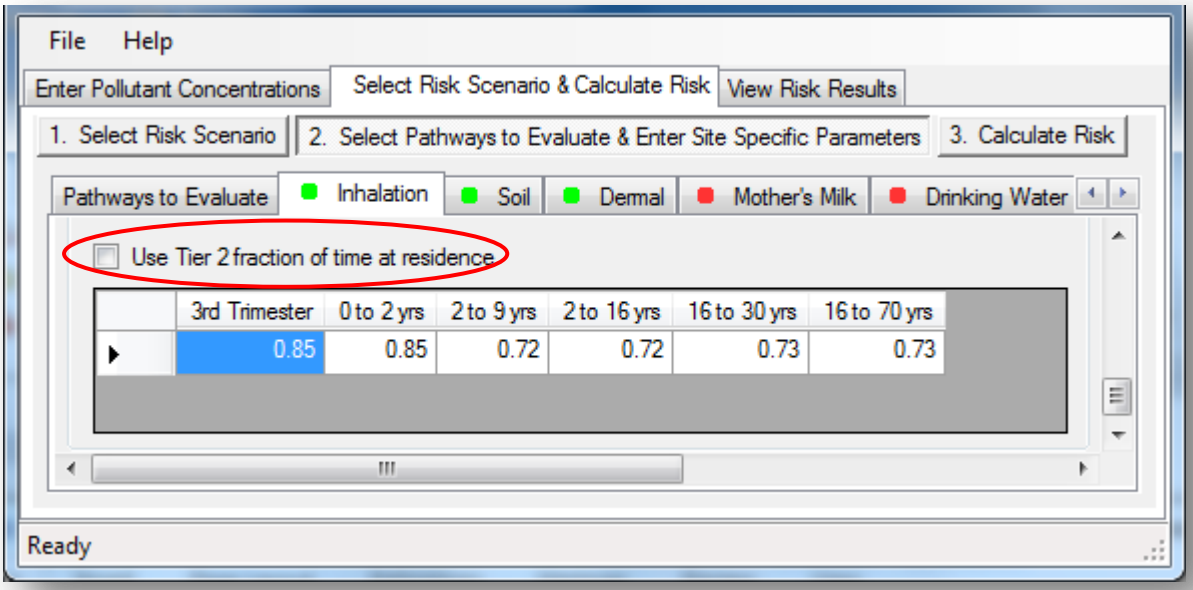
i. Time at Home

If you are conducting an assessment for a residential receptor, the ***Fraction of time at home*** is used to adjust exposure duration. This is based on the assumption that exposure to a toxic air contaminant is not occurring away from home. By age group, apply the fraction of time at residence if you wish to assume that the individual spends only part of his or her day at home.

- Note: *For age bins less than 16 years*, OEHHA advises time at residence should be 1 (100%), if a school is located within a 1 per million or greater cancer risk isopleth (zone) of the emissions source. This is based on the assumption that children are still exposed to comparable air pollutant concentrations if they attend school close to home.

ii. ADVANCED FEATURE: Time at Residence

The default fractions of time at residence are shown in the lower table. Under ***Advanced Option (Tier 2)***, click ***Use Tier 2 fraction of time at residence*** (home) to change them.



*Numbers in table are default fractions of time at residence by age.

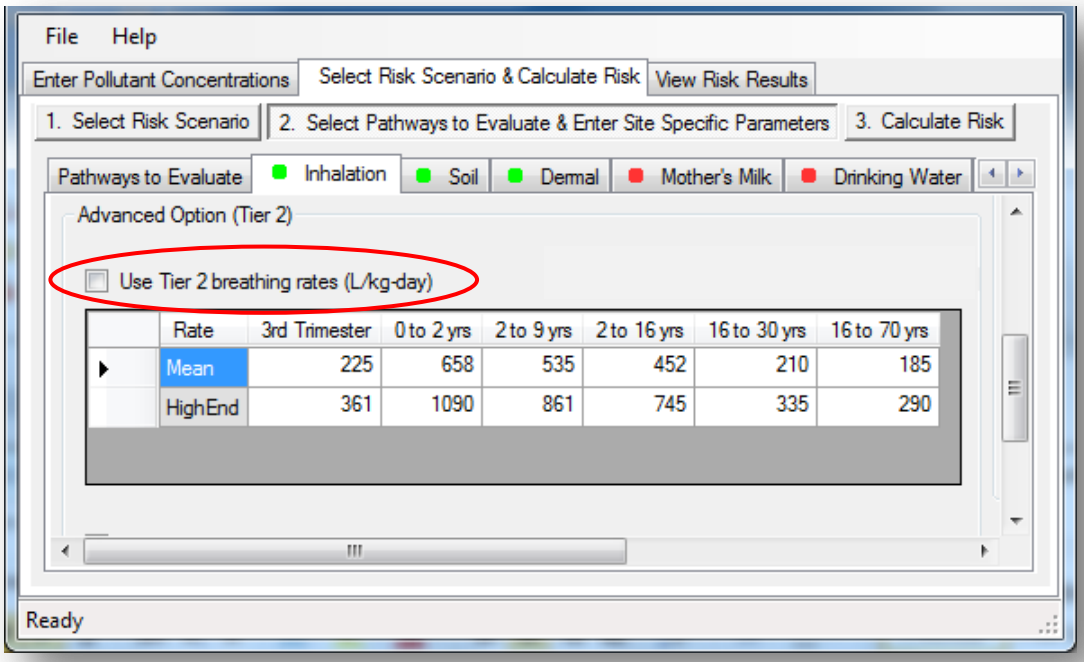
iii. 8-Hour Breathing Rates

Primarily, the ***Use 8-Hour Breathing Rates*** option is available to reflect worker exposures that are on a recurring basis but for only a portion of the day. For individual resident assessments, 8-hour breathing rates may be used in scenarios that involve exposures only during facility operations of 8-12 hours per day. Breathing rate based

on ***Moderate Intensity*** is recommended, but ***Light*** and ***Passive Intensity*** is also available for assessments of less active persons.

iv. ADVANCED FEATURE: Breathing Rates

The ***Use Tier 2 breathing rates (L/kg-day)*** feature allows you to change the default average breathing rates by age group.

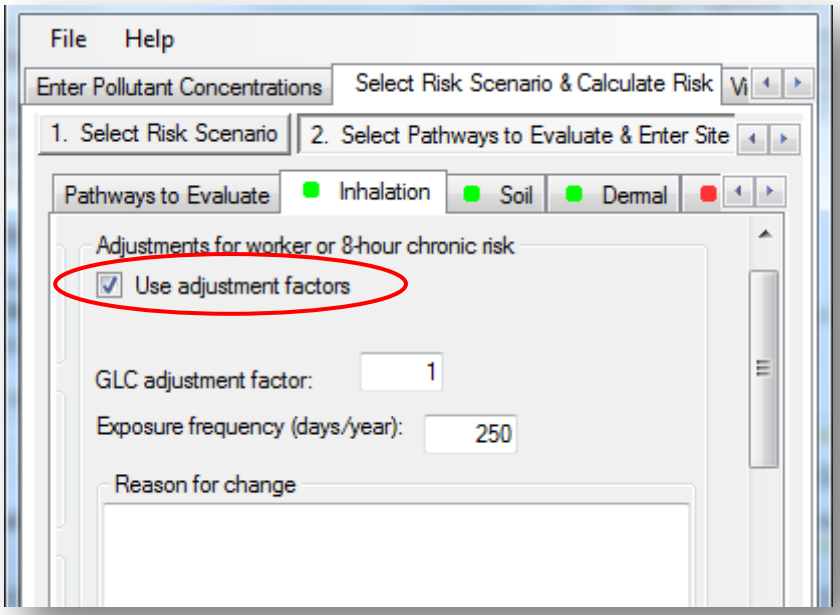


*Numbers in table are default breathing rates by age.

- Note: *The software feature for Tier 2 SB 352 is under development and will be available in a future version of HARP 2 RAST.*

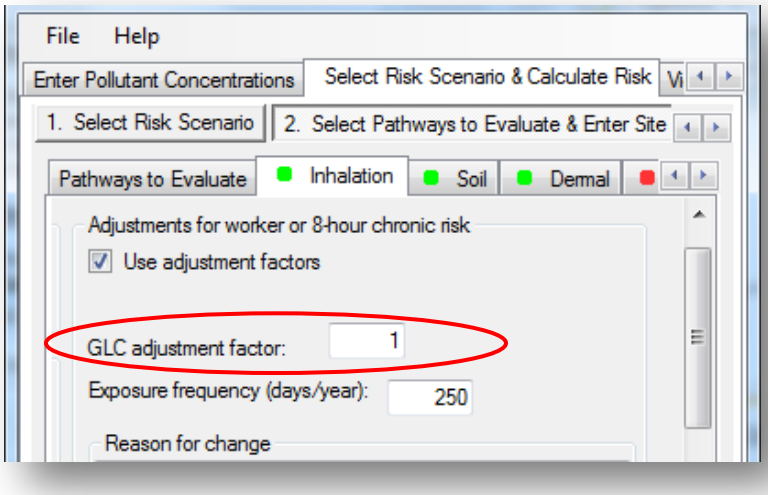
v. Adjustments for Worker or 8-Hour Chronic Risk

For worker scenarios, you may adjust the GLC of your pollutants, and the exposure frequency (EF) in days exposed per year to individuals. Check the ***Use Adjustment Factors*** box to change the ***GLC*** and ***EF***, and describe your ***Reason for change***.



vi. GLC Adjustment Factor

The ***GLC adjustment factor*** is the factor that is multiplied to GLCs on the ***Enter Pollutant Concentrations*** screen. By default, the program uses your original concentrations to calculate risk and, consequently, the default adjustment factor is ***1***. This prevents adjustment to your facility's average pollutant concentrations. Increasing or decreasing the adjustment factor from 1, however, will change your concentrations, thereby changing the risk results.

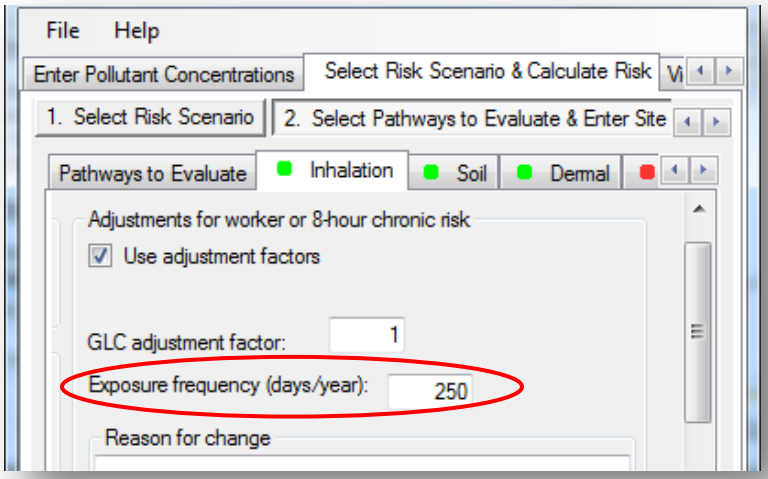


The ***GLC adjustment factor*** is best used for ***Worker*** scenarios when the 24-hour annual average of pollutants you entered does not represent what workers are really exposed to. For example, the average GLC over 24 hours may be too low if the worker is exposed only during peak hours of a facility's operations. These peak hours are likely higher in pollutant emissions than the 24-hour average, which includes hours when the facility might not be operating. If the ground level air concentrations from a facility operating 5 days a week and 8 hours per day have been estimated by a 24 hour annual average, an adjustment factor can be applied to estimate the air concentration for that worker with the same schedule as the polluting facility.

For 8-hour chronic assessments (e.g., the average daily worker), OEHHA advises the 24-hour annual average concentration (provided in the first step of the program) be multiplied by a factor of 4.2. Therefore, the recommended ***GLC adjustment factor*** would be 4.2.

vii. Exposure Frequency

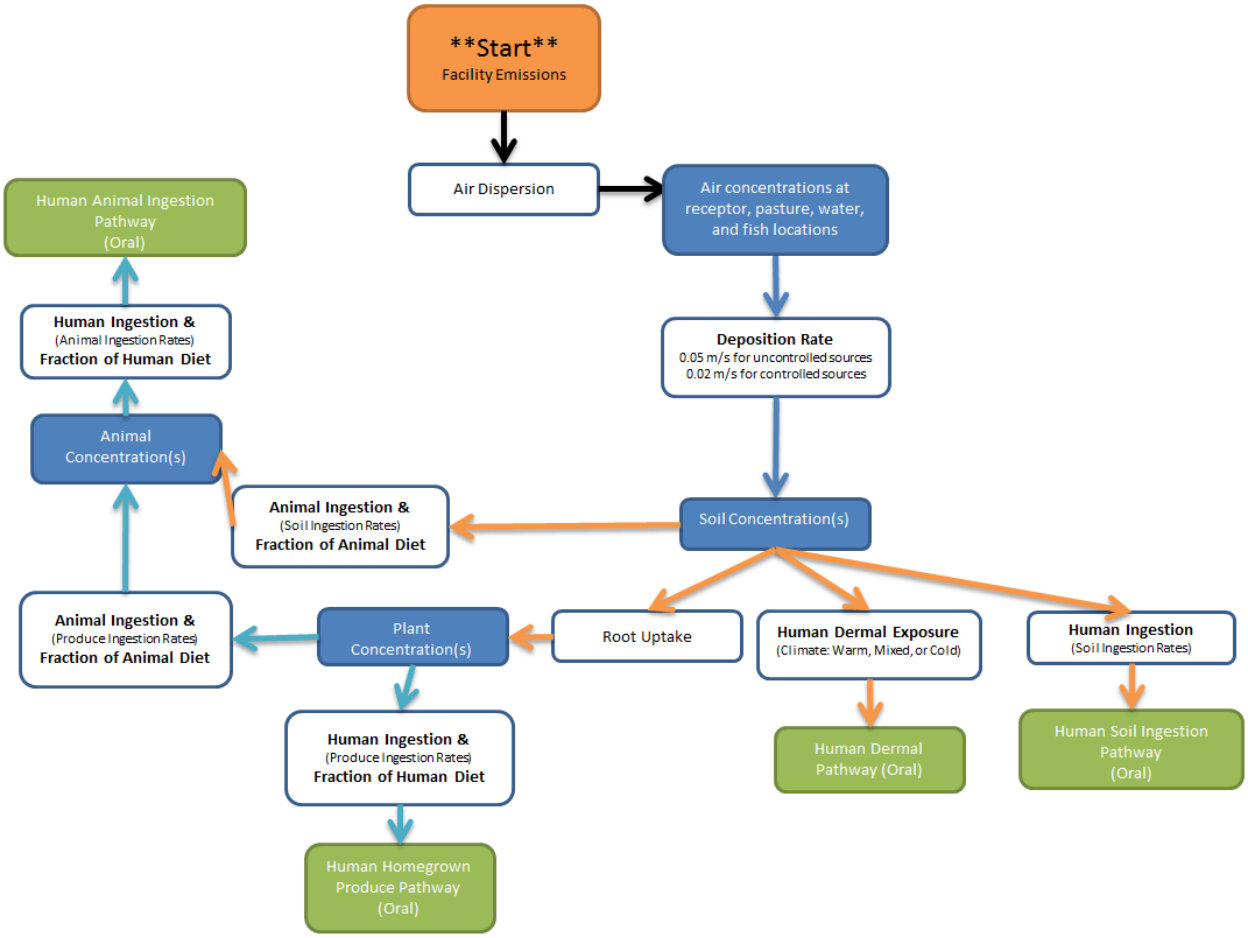
The ***Exposure frequency (days/year)*** takes into account time spent away from the exposure site (e.g., school or work site) for worker and 8-hour noncancer chronic risk assessments.



By default, RAST assumes ***250*** days out of the year are spent at the receptor site, which may not always be appropriate. For example, if you are evaluating seasonal workers, you may want to use an exposure frequency of less than 250 days.

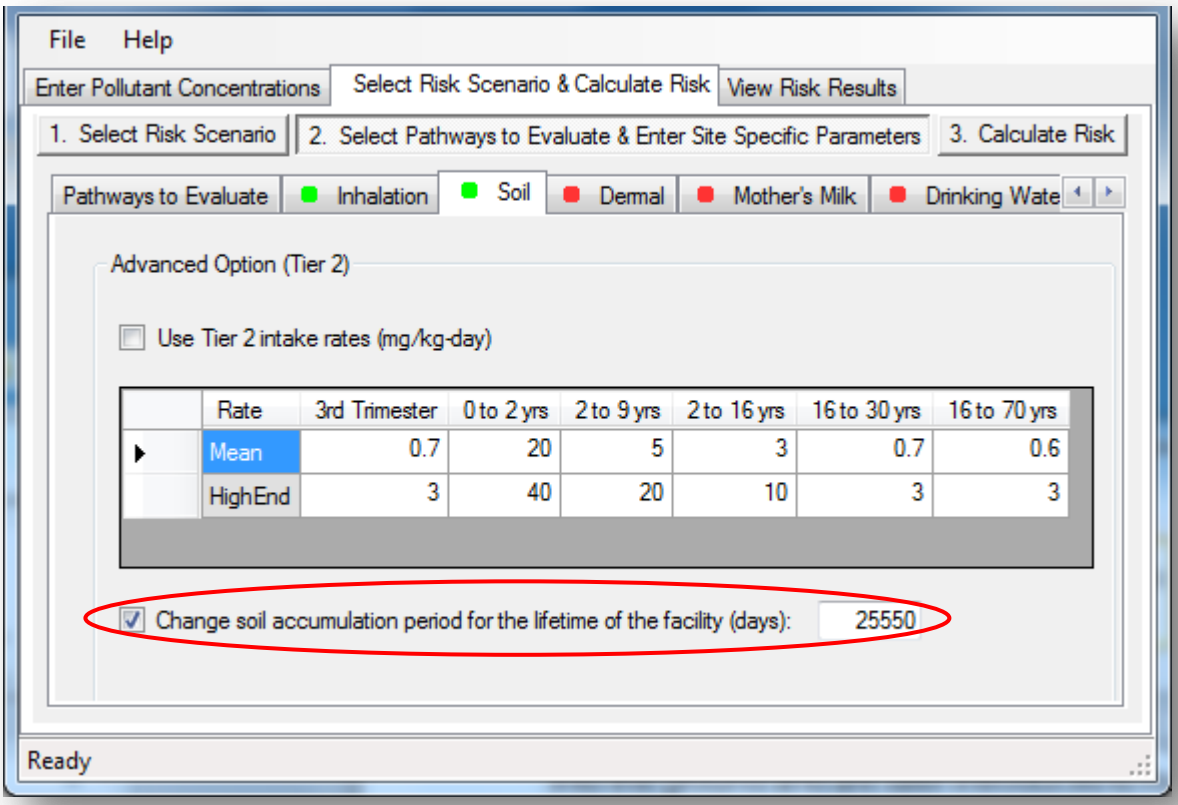
c. Soil

The ***Soil*** tab is used to account for multipathway pollutants that eventually settle into the ground and are later introduced to humans by incidental or intentional soil ingestion. The chemical half-life in soil is also accounted for, based on how many days your facility has been operating.



i. ADVANCED FEATURE: Soil Intake Rates

For advanced users, check ***Use Tier 2 Intake Rates*** to change the default soil ingestion intake by age in milligrams per kilogram of bodyweight per day.

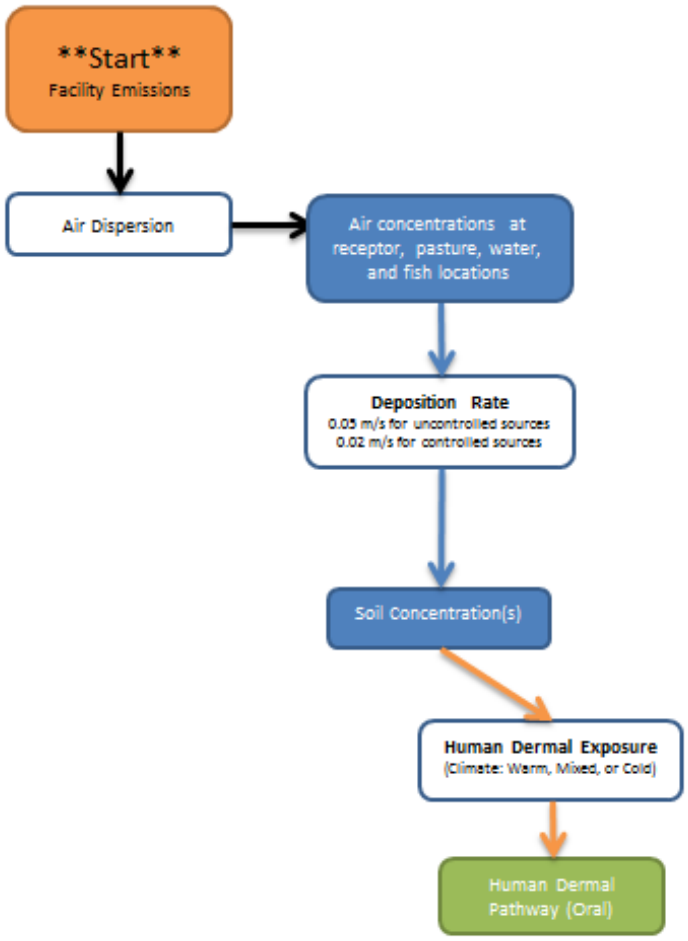


ii. ADVANCED FEATURE: Soil Accumulation Period

The default assumes that facility air pollutants have been released and deposited into the soil for a total of 25,550 days (70 years), settling in soil. If you have site specific data, you may check the box ***Change soil accumulation period for the lifetime of the facility (days)***.

d. Dermal

The ***Dermal*** pathway accounts for pollutants absorbed through the skin. In the dermal pathway, climate-type is important to specify because it influences people's choice of clothing which in turn determines skin exposure.

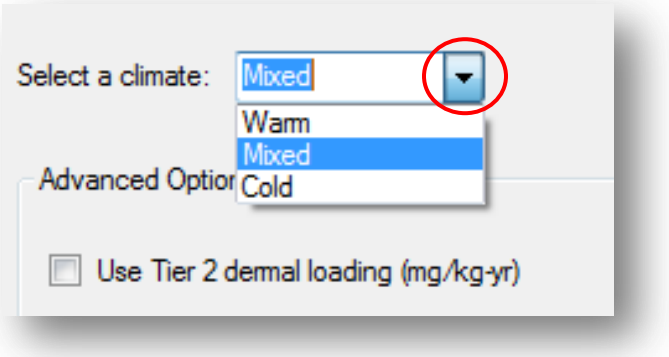


i. Climate

Clothing choice influences dermal (skin) exposure to pollutants through dermal loading, which is influenced by climate. Dermal loading is defined here as the exposure to polluted soil through dermal absorption. It is a function of the soil or dust loading of the exposed skin surface, the amount of skin surface area exposed, and the concentration and availability of the pollutant. In California, climate will strongly influence people's choice of clothing due its varied regions and data on clothing choices at different temperatures. Thus, three levels of climatic conditions, warm, mixed, and cold, are used to describe California's climate regions:

1. A ***Warm*** climate is characteristic of Southern California areas such as Los Angeles, which can have warm to hot temperatures throughout the year.
2. A "***Mixed***" climate is one that has warm-to-hot temperatures during much of the year (daily highs over 80 degrees are common), roughly from April to October, and cold temperatures (lows near or below freezing) during the remainder of the year. The mountains and central valley are examples of a mixed climate.
3. A ***Cold*** climate is representative of San Francisco, Eureka, and other northern coastal communities, which have cool temperatures (daily highs of less than 65 degrees) for the majority of the year and can receive a considerable amount of fog and rainfall.

When evaluating the ***Dermal*** pathway, select a ***Warm***, ***Cold***, or ***Mixed*** climate by clicking the dropdown menu.



A summary of climate types in California is provided. Additionally, OEHHA recommends consulting the local air district for help on selecting the most appropriate climate.

Table 7-3. Climate Types

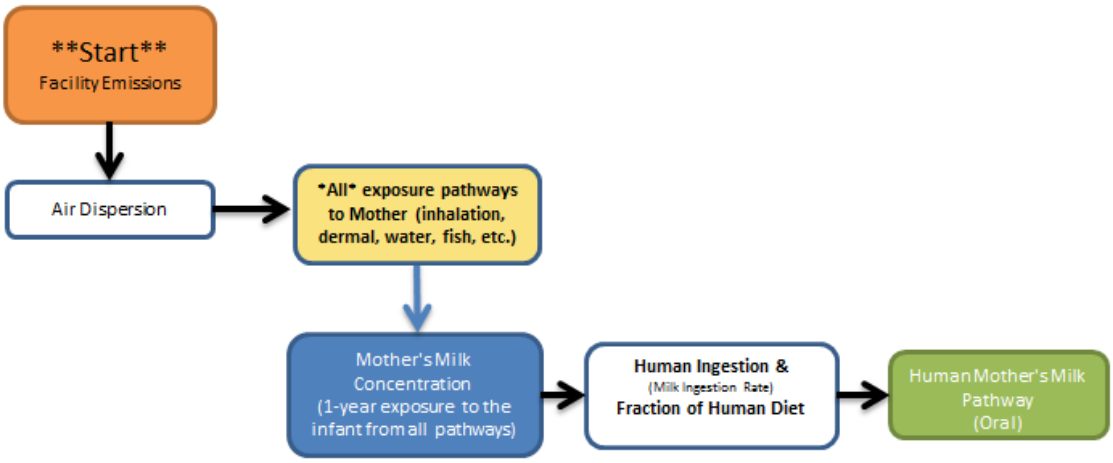
Warm	Mixed	Cold
• Warm to hot throughout the year. • Ex: Southern California areas such as Los Angeles.	• April – Oct: ≥ 80 °Fahrenheit • Nov – March: ≤ 32 °Fahrenheit • Ex: The mountains and central valley are examples of a mixed climate.	• Daily highs < 65 °Fahrenheit • Rainy and foggy. • Ex: San Francisco, Eureka, and other northern coastal communities with cool temperatures.

ii. ADVANCED FEATURE: Dermal Loading Rates

As an advanced feature, you may apply your own dermal loading rates, in mg/kg per year. Click ***Use Tier 2 dermal loading***, and type your own rates into the table.

e. Mother's Milk

The ***Mother's Milk*** pathway, based on a child's first year of food intake, considers transference of pollutants to infants through breastfeeding. It is a product of all exposure routes (i.e., inhalation, food ingestion, dermal absorption, etc.) to the mother.

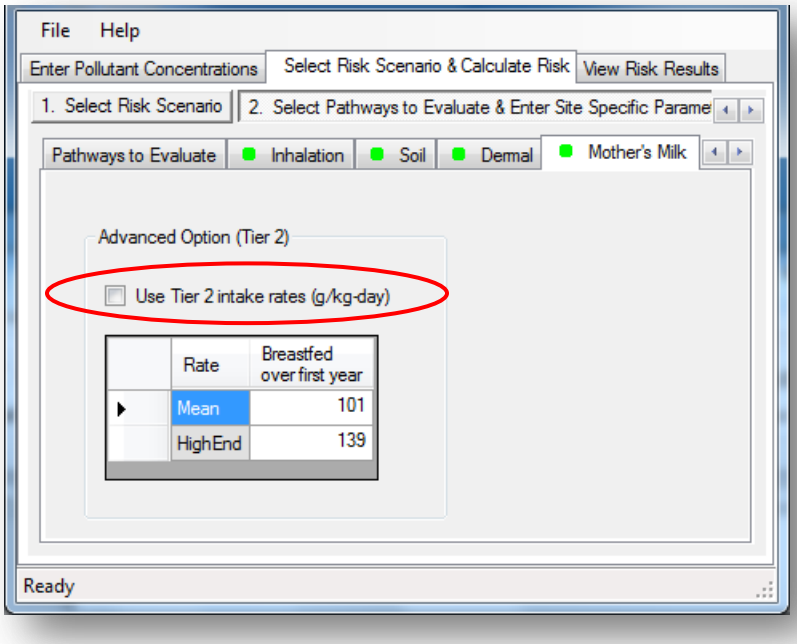


Exposure through ***Mother's Milk*** ingestion is a function of the average concentration of the pollutant in the mother's milk and the amount of mother's milk ingested. The minimum pathways a nursing mother is exposed to include ***Inhalation***, ***Soil*** ingestion, and ***Dermal***. This is because the pollutants evaluated by the mother's milk pathway are multipathway chemicals. Other pathways may be appropriate depending on site conditions (e.g., the presence of vegetable gardens or home grown chickens). The compounds currently considered for the mother's milk pathway are:

1. Dioxins and Furans (PCDDs and PCDFs)
2. Polychlorinated biphenyls (PCBs)
3. Polycyclic Aromatic Hydrocarbons (PAHs), including Creosotes
4. Lead

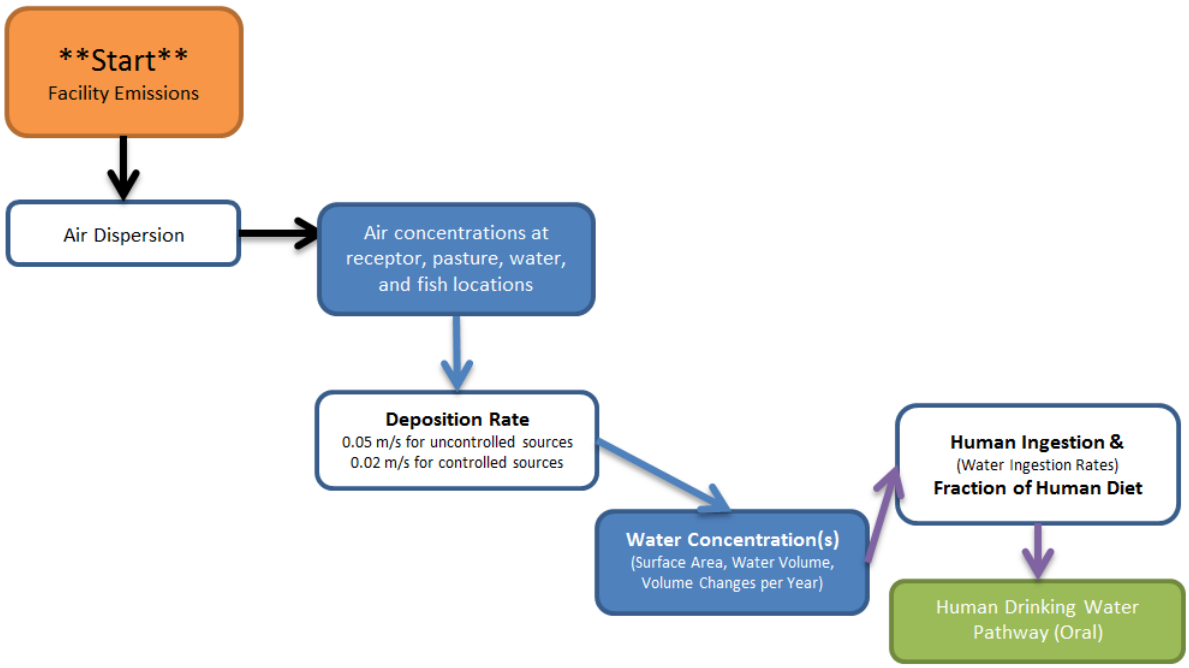
i. ADVANCED FEATURE: Mother's Milk Intake Rates

The default intakes of ***Mother's Milk*** by infants are shown in the following screenshot in grams consumed per kg of bodyweight per day. As an advanced feature, click ***Use Tier 2 intake rates*** to change them. You may type the new ***Mean*** (65^{th} percentile) and ***HighEnd*** (95^{th} percentile) intake rates of breast milk by infants in g/kg/d.



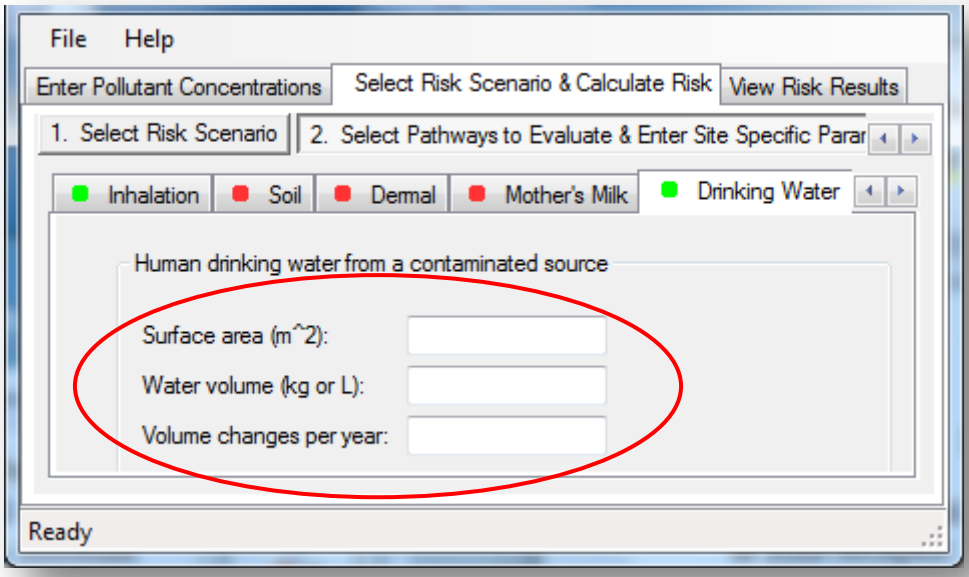
f. Drinking Water

The water pathway (e.g. human drinking water) may be evaluated if a standing water body (e.g., pond or lake) is contaminated by facility emissions and is used as a source for human drinking water.



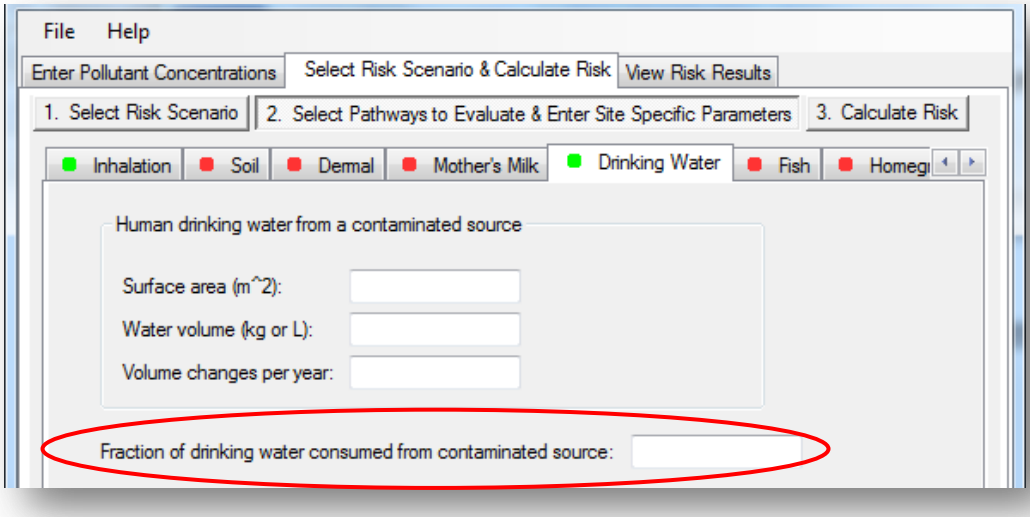
i. Surface Area, Water Volume, & Volume Changes

Provide the total ***Surface area*** and ***Water volume*** that applies to human drinking water at your receptor. In addition, enter the average number of ***Volume changes per year*** the body or bodies of water undergo at your receptor point. Water bodies go through volume changes, in which their water contents turn over through emptying and filling.



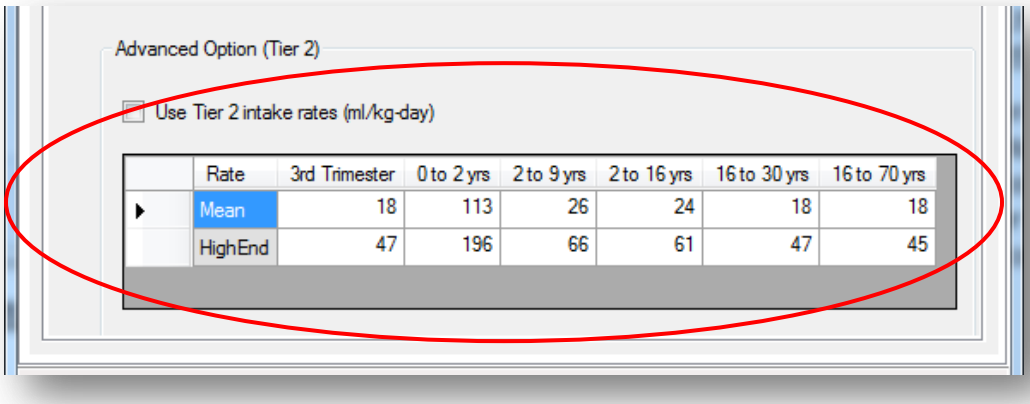
ii. Fraction of Drinking Water from Contaminated Source

Enter the ***Fraction of drinking water consumed from contaminated source***.



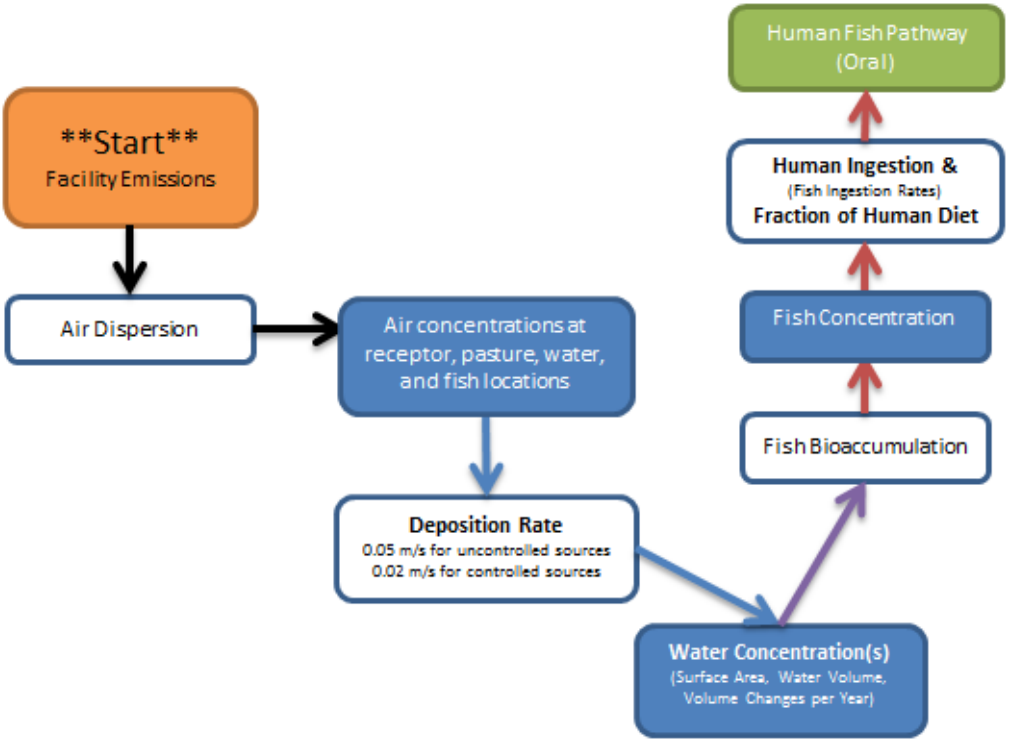
iii. ADVANCED FEATURE: Average Human Water Consumption

Choose ***Use Tier 2 intake rates (ml/kg-day)*** as an advanced feature to change the average water consumed by humans by age group in milligrams per kilogram of bodyweight per day.



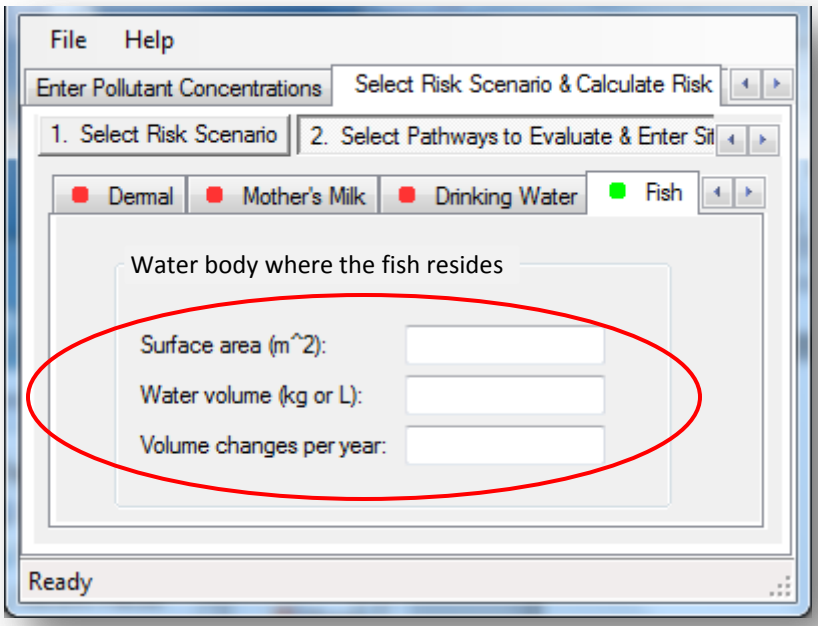
g. Fish

The ***Fish*** pathway calculations assume that pollutants deposited into the water remains suspended or dissolved in the water column and is available for bioaccumulation in fish. This pathway should be evaluated when a body of water (e.g., river, lake) is located at your receptor point and is used as a source of angler-caught fish for human consumption.



i. Surface Area, Water Volume, & Volume Changes

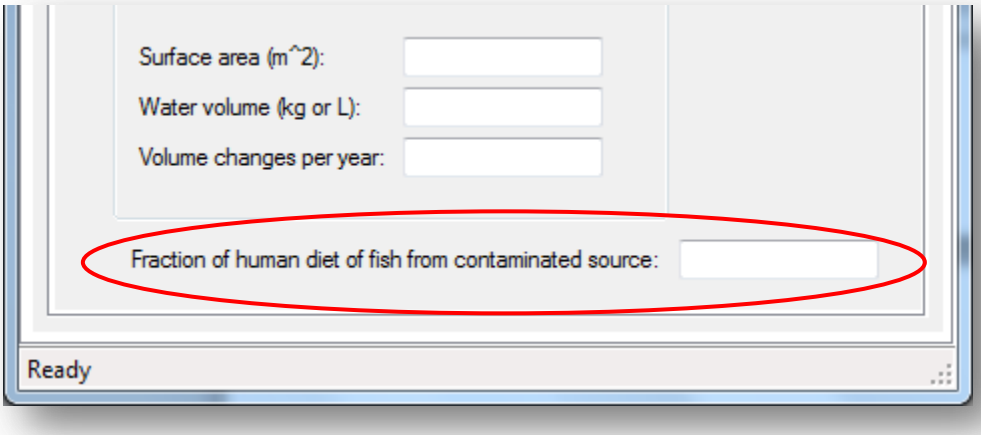
Provide the total ***Surface area*** and ***Volume*** of the water body or bodies. In addition, enter the average number of ***Volume changes per year*** the body or bodies of water undergo at the receptor. Water bodies go through volume changes, in which their water contents turn over through emptying and filling. This occurs through evaporation, precipitation, stream flow, and other processes.



ii. Fraction of Fish Consumed from Contaminated Source

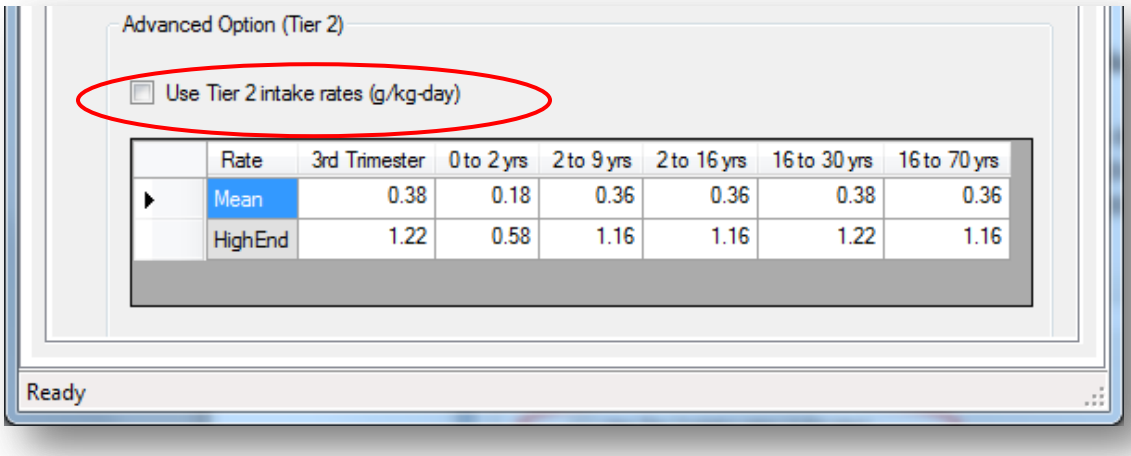
Human exposure to pollutants through ingestion of angler-caught fish is a function of the fraction of fish ingested that is caught in the exposed water body, which differs for each age grouping, and the gastrointestinal absorption factor. Ingestion of angler-caught fish on a milligram per kilogram of body weight per day basis varies by age. This results in differences in exposure dose by age. The age-specific groupings to determine dose is needed primarily to properly use the age sensitivity factors for cancer risk assessment and to calculate a time-weighted average dose for chronic noncancer assessment.

Enter the ***Fraction of human diet of fish from contaminated source***.



iii. ADVANCED FEATURE: Average Human Fish Consumption

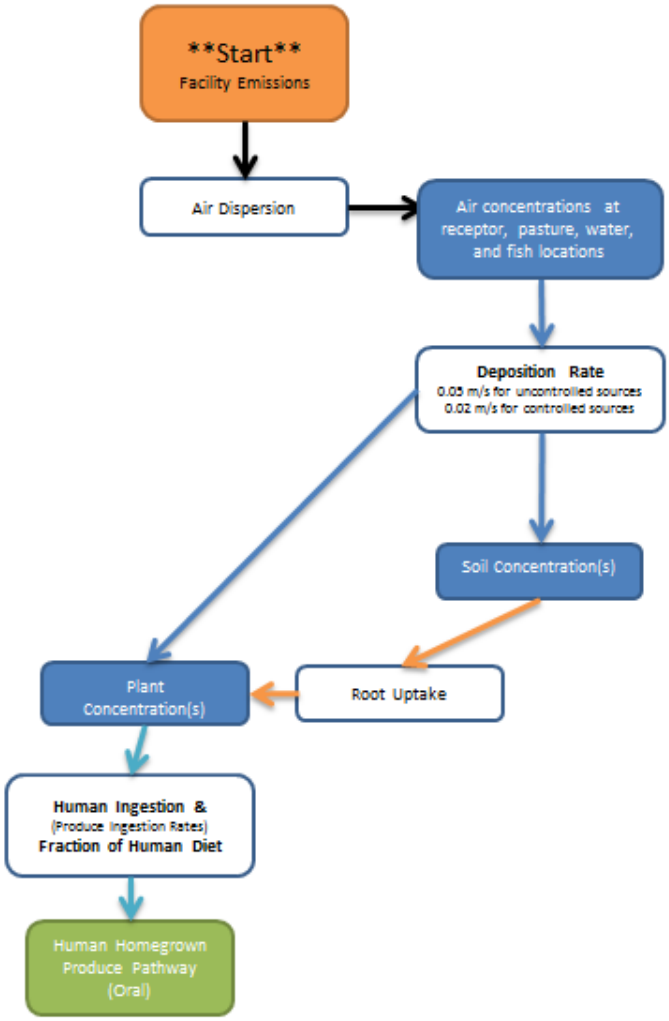
RAST takes into account how much fish humans eat on average. Click ***Use Tier 2 intake rates (g/kg-day)*** for the advanced feature.



h. Homegrown Produce

Humans are exposed to facility pollutants when eating contaminated vegetation grown at the receptor. The average concentration of a pollutant in and on vegetation is a function of direct deposition of the substance onto the vegetation and of root translocation or uptake from soil contaminated by the pollutant. Currently, OEHHA recommends root translocation only for inorganic pollutant compounds.

Use the ***Homegrown Produce*** tab if there is a homegrown garden or farm at the receptor and the receptor consumes produce from that garden. The ***Homegrown Produce*** pathway accounts for produce that is grown in soil at the receptor point and thus may be contaminated by the facility emissions. Those eating this produce may be further exposed to air pollutants from the facility.



i. Leafy, Exposed, Protected, & Root Produce

Because multipathway pollutants can impact different parts of the plant, produce is separated into the following four types:

1. ***Leafy*** (e.g., spinach)
2. ***Exposed*** (e.g., apple or other produce where outer layer is eaten)
3. ***Protected*** (e.g., orange or other produce where outer layer is uneaten)
4. ***Root*** (e.g., carrot)

Pollutants translocate and accumulate differently depending on the plant part and the pollutant. Table 7-4 presents a list of multipathway pollutants and their respective regions of accumulation in plants.

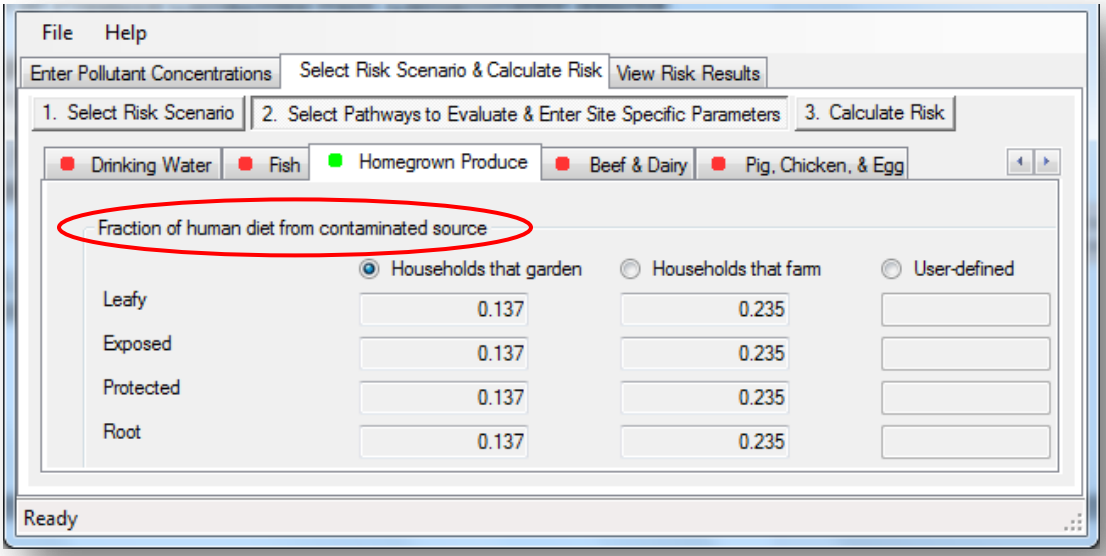
Table 7-4. Multipathway Pollutants and Uptake by Crop Type[1]

Substance	Exposed Vegetable	Leafy Vegetable	Protected Vegetable	Root Vegetable
Inorganic chemicals				
Arsenic & compounds	X	X	X	X
Beryllium & compounds	X	X	X	X
Cadmium & compounds	X	X	X	X
Chromium VI & compounds	X	X	X	X
Fluorides (soluble compounds)	X	X	X	X
Lead & compounds	X	X	X	X
Mercury & compounds	X	X	X	X
Nickel & compounds	X	X	X	X
Selenium & compounds	X	X	X	X
Organic chemicals				
Creosotes	X	X		
Diethylhexylphthalate	X	X		
Hexachlorobenzene	X	X		
Hexachlorocyclohexanes	X	X		
4,4'-Methylene dianiline	X	X		
Pentachlorophenol				
PCBs	X	X		
Polychlorinated dibenzo-p-dioxins and dibenzofurans	X	X		
PAHs	X	X		

[1]OEHHA Guidance Manual, Table 5.1 Specific Pathways to be Analyzed for each Multipathway Substance.

ii. Fraction of Produce Consumed from Contaminated Source

Select ***Households that garden***, ***Households that farm***, or ***User-defined***. This step determines what percentage of your receptor's produce consumption comes from the receptor point. Foods grown at the receptor point are assumed to be contaminated. If, for example, 0.137 (or 13.7%) of an individual's total leafy diet comes from their contaminated farm, then 86.3% of the total leafy intake comes from other sources (e.g., the store). Households that garden assume a ***0.137*** fraction for all crops and households that farm assume a fraction of ***0.235*** for all crops.



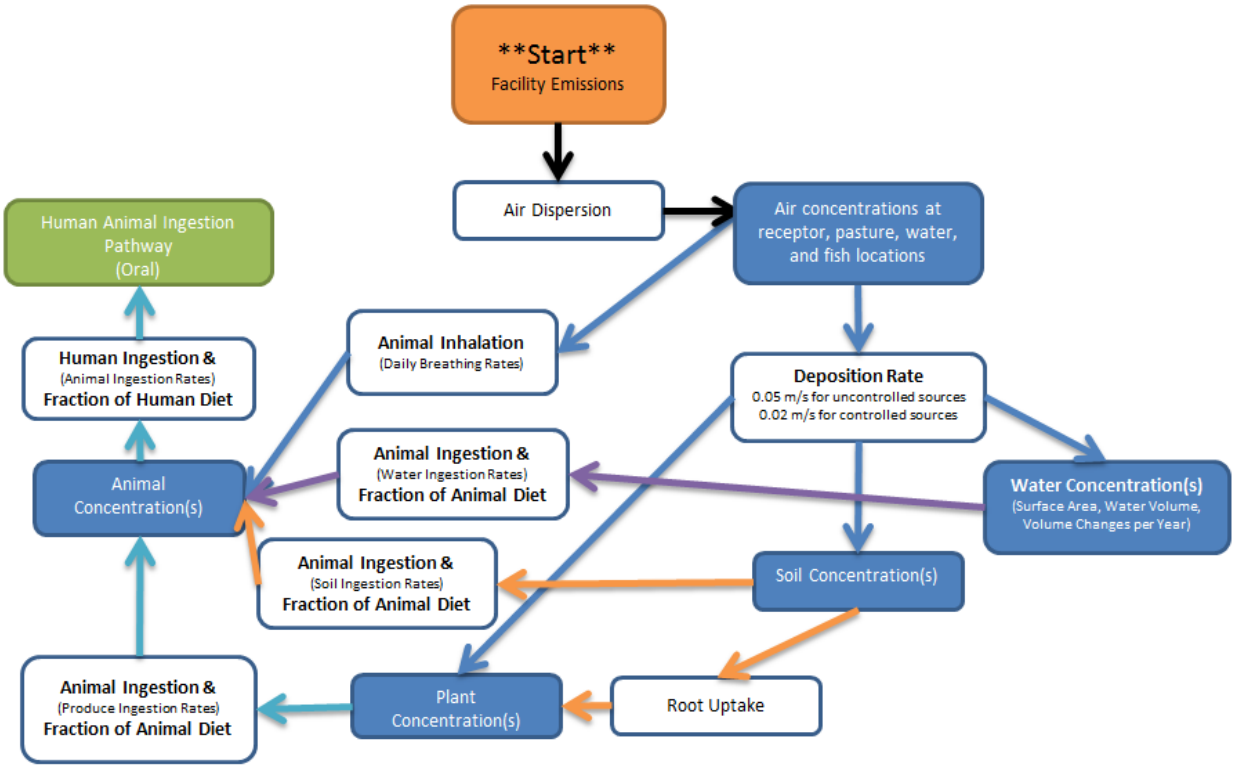
- Note: *The fractions of contaminated leafy, exposed, protected, and root produce eaten may be the same but are independent of one another*.

iii. ADVANCED FEATURE: Human Produce Consumption Rate

Two variables are needed to calculate the total amount of contaminated produce your receptor receives: the percentage of produce eaten that is contaminated, and the amount of produce eaten per day by age. Click ***Use Tier 2 intake rates*** box to change the default daily produce consumption rates in g/kg/d.

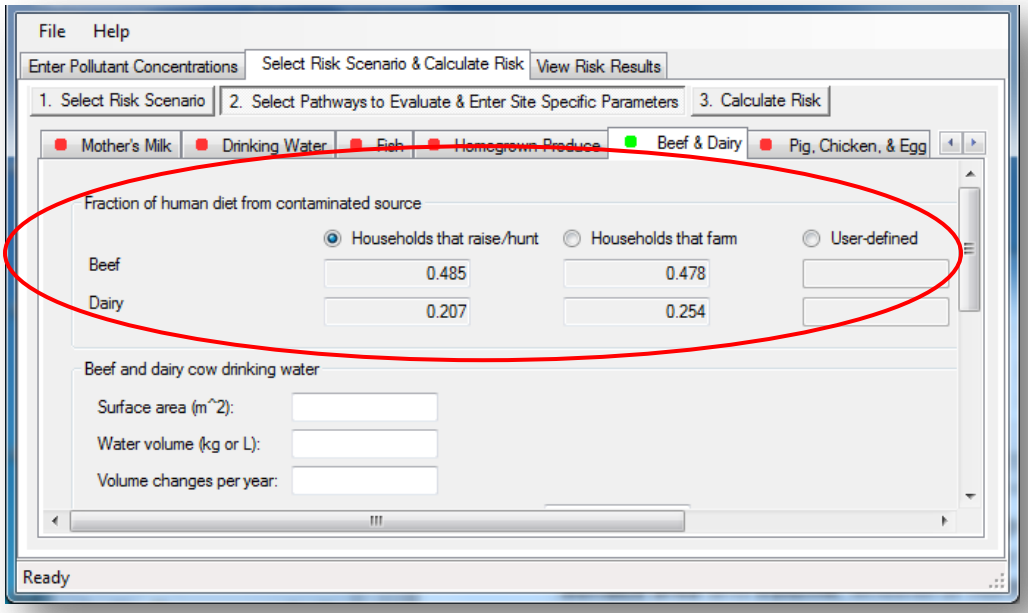
i. Beef & Dairy

The ***Beef & Dairy*** pathway accounts for individuals exposed to toxics from consuming beef and dairy grown and produced at the receptor. Cows affected by facility emissions may be exposed to pollutants through various pathways (drinking, breathing, grazing, etc.).



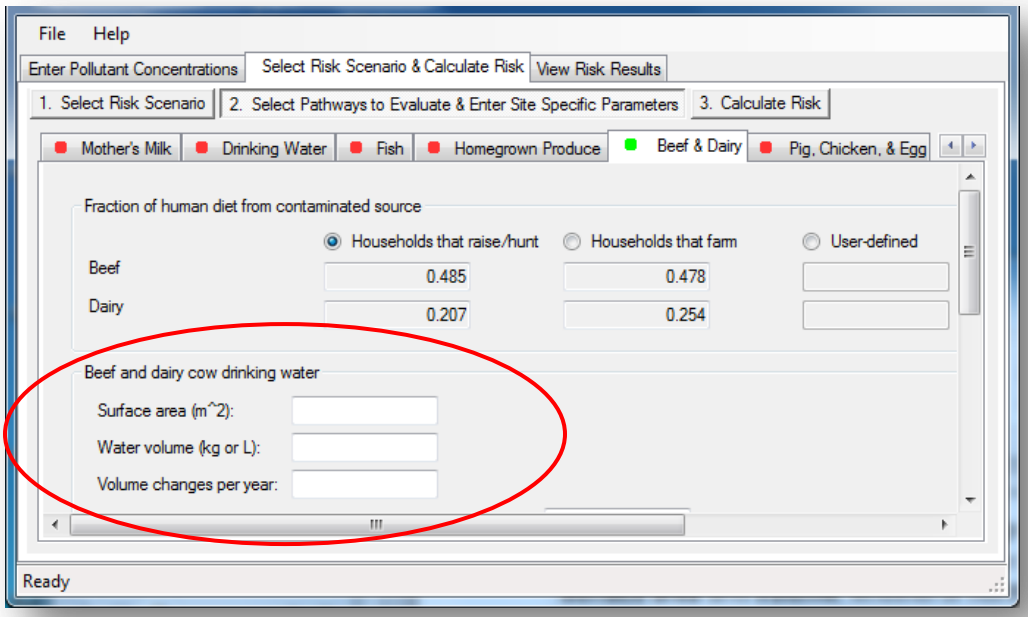
i. Fraction of Beef & Dairy from Contaminated Source

To use the beef and dairy pathway, select ***Households that raise/hunt***, ***Households that farm***, or ***User-defined***. The objective is to define what fraction of the receptor's total beef and dairy intake comes from cows at the receptor location. Cow food products raised and produced at the receptor point are assumed to be impacted by pollutants. For example, the default percentage of dairy consumption that comes from a household that raises dairy cows is ***0.207*** (20.7%). This means the other 79.3% is assumed to come from other sources and regions not contaminated by the facility.

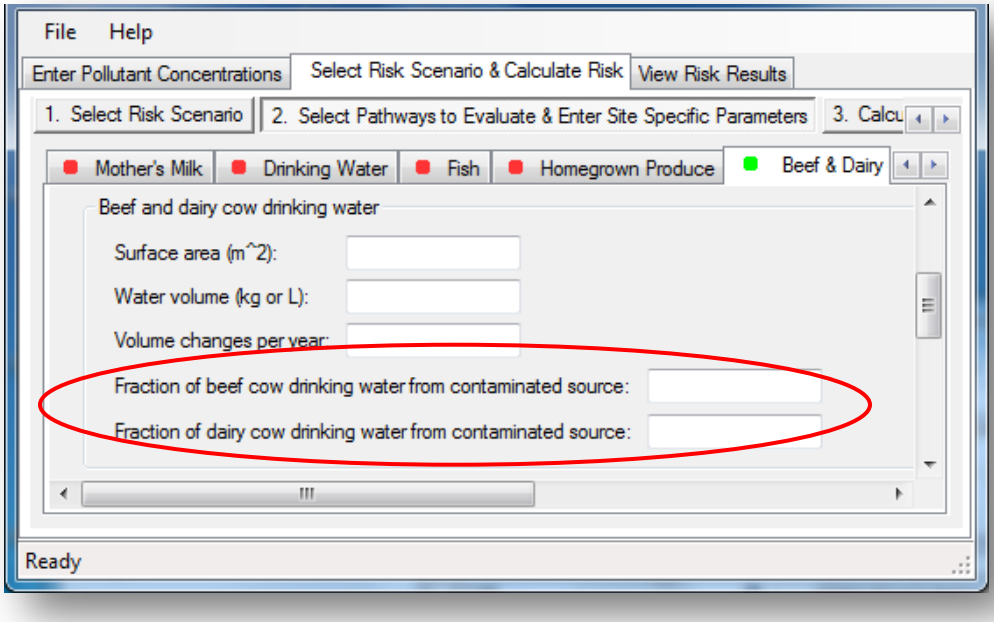


ii. Beef & Dairy Cow Drinking Water

If a water source exists from which beef and dairy cows drink from at the receptor location, enter information about the water source. Provide the ***Surface area*** and ***Volume***. In addition, enter the average number of ***Volume changes per year*** the body or bodies of water undergo at your receptor. Water bodies go through volume changes, in which their water contents turn over through emptying and filling. This occurs through evaporation, precipitation, stream flow, and other processes.

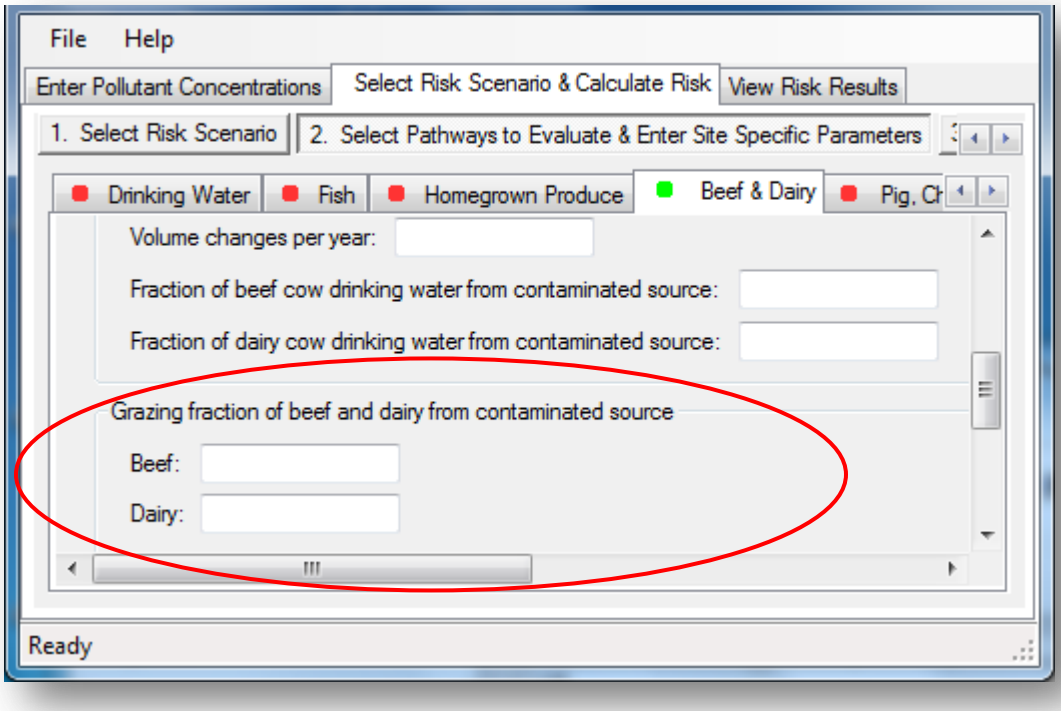


Next, account for the amount the cows may drink from this contaminated water source. Input the ***fraction of (beef cow) drinking water*** and ***fraction of (dairy cow) drinking water*** that comes from receptor contaminated water. If the fraction is none, input 0.



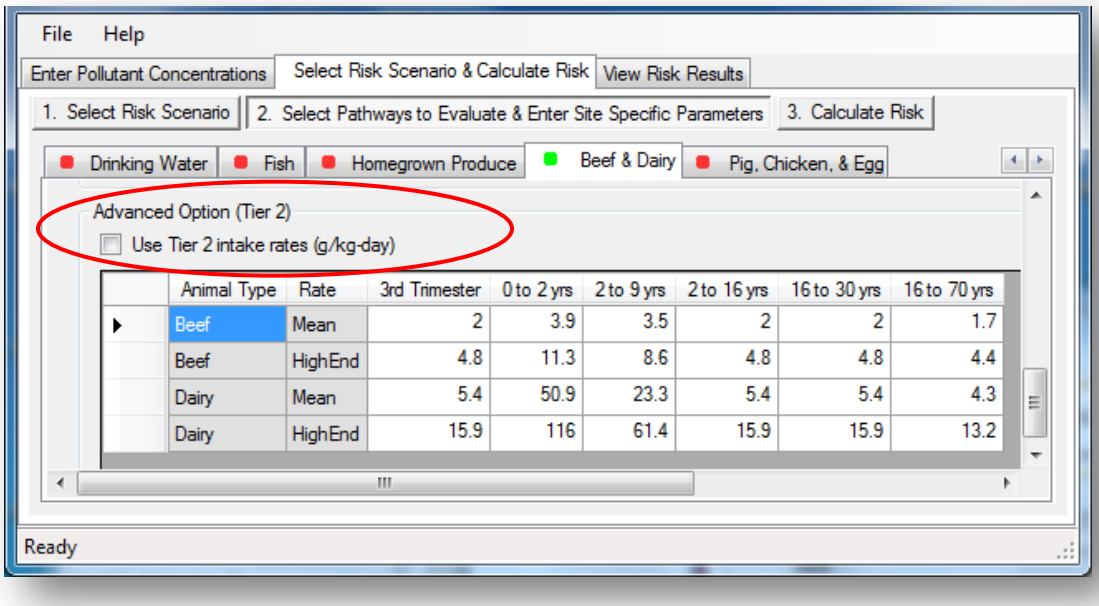
iii. Beef & Dairy Cow Diet

The ***Grazing fraction of beef and dairy from contaminated source*** will indicate the extent to which cows are exposed to emissions-contaminated soil from grazing. The feeds provided to dairy and beef cattle may contain small quantities of soil, but a larger fraction of soil is taken up during grazing. Enter the fraction of the beef cow and dairy cow diet that comes from grazing at the receptor. For example, if it is half, enter 0.5.



iv. ADVANCED FEATURE: Human Beef & Dairy Consumption Rates

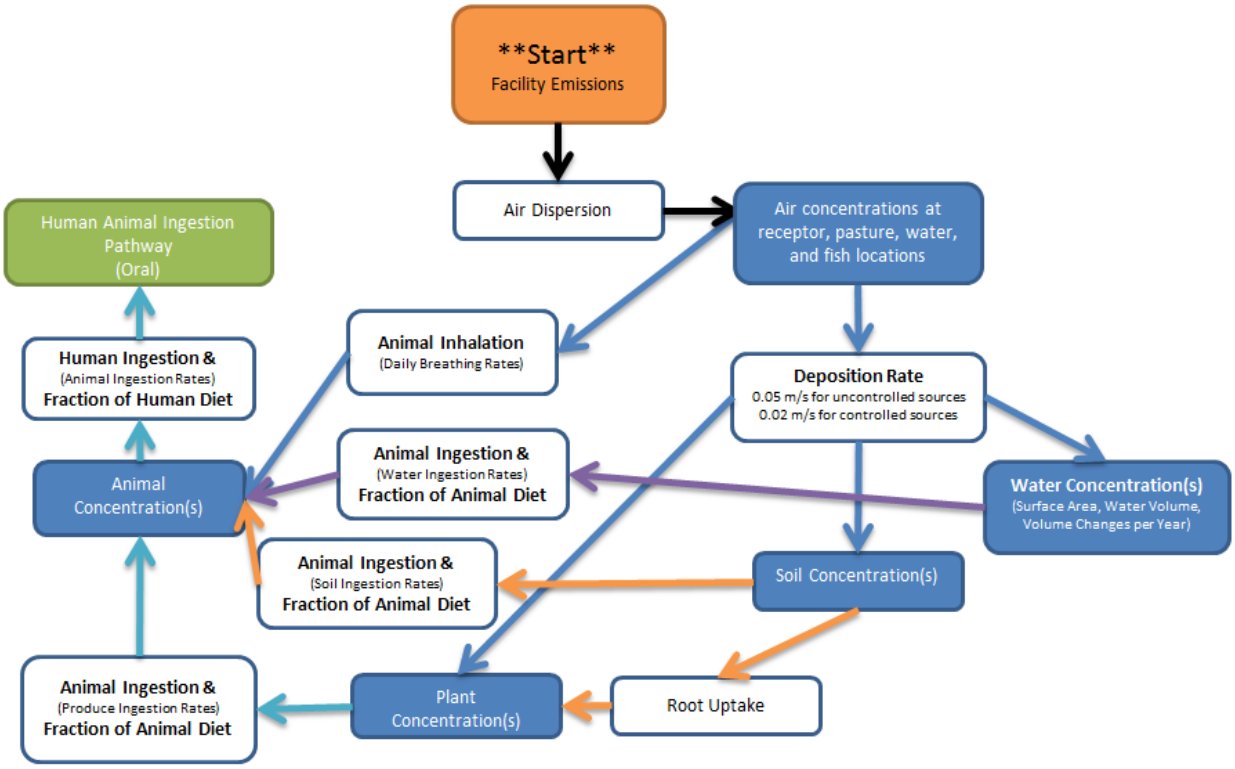
The program uses a default for the average rate that humans eat beef and dairy per day. To change this, check the box ***Use Tier 2 intake rates (g/kg-day)***, and enter your new rates by typing them into the table. By age group, apply the grams of beef and dairy consumed per kilogram of bodyweight per day.



Animal Type	Rate	3rd Trimester	0 to 2 yrs	2 to 9 yrs	2 to 16 yrs	16 to 30 yrs	16 to 70 yrs
Beef	Mean	2	3.9	3.5	2	2	1.7
Beef	HighEnd	4.8	11.3	8.6	4.8	4.8	4.4
Dairy	Mean	5.4	50.9	23.3	5.4	5.4	4.3
Dairy	HighEnd	15.9	116	61.4	15.9	15.9	13.2

j. Pig, Chicken, & Egg

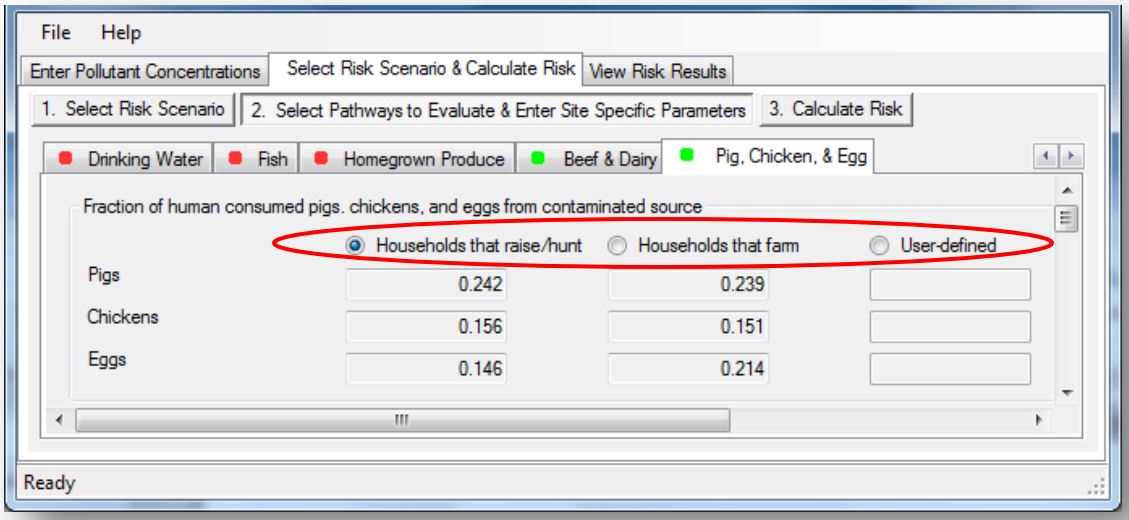
The ***Pig, Chicken, & Egg*** tab is used to account for animal food products impacted by pollutants and eaten by the receptor.



The pathway diagram accounts for pigs, chickens, and eggs that are raised and consumed at the same receptor site as the receptor that's being evaluated. The pigs, chickens, and eggs are exposed to facility emissions and thus can be contaminated from exposure pathways like breathing, eating, and drinking.

i. Fraction of Pig, Chicken, & Egg from Contaminated Source

Select ***Households that raise/hunt***, ***Households that farm***, or ***User-defined*** to define what fraction of the receptor's total pig, chicken, and egg intake comes from the receptor site.

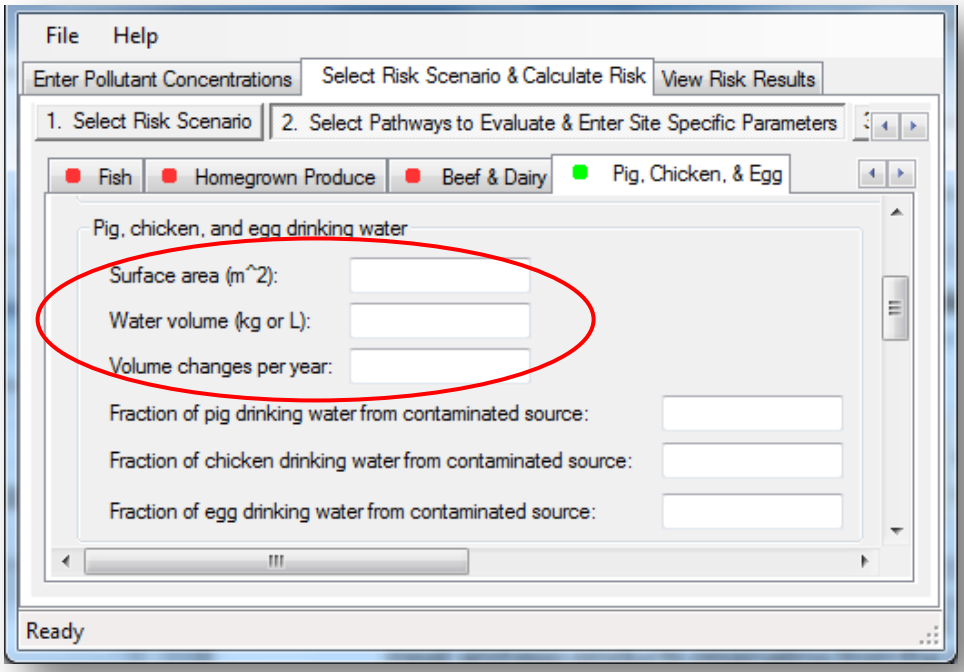


For example, the default fraction for eggs consumed that are contaminated is ***0.146*** (or 14.6%) for households that raise chickens. That means the other 85.4% comes from other sources (e.g., store) and is not impacted.

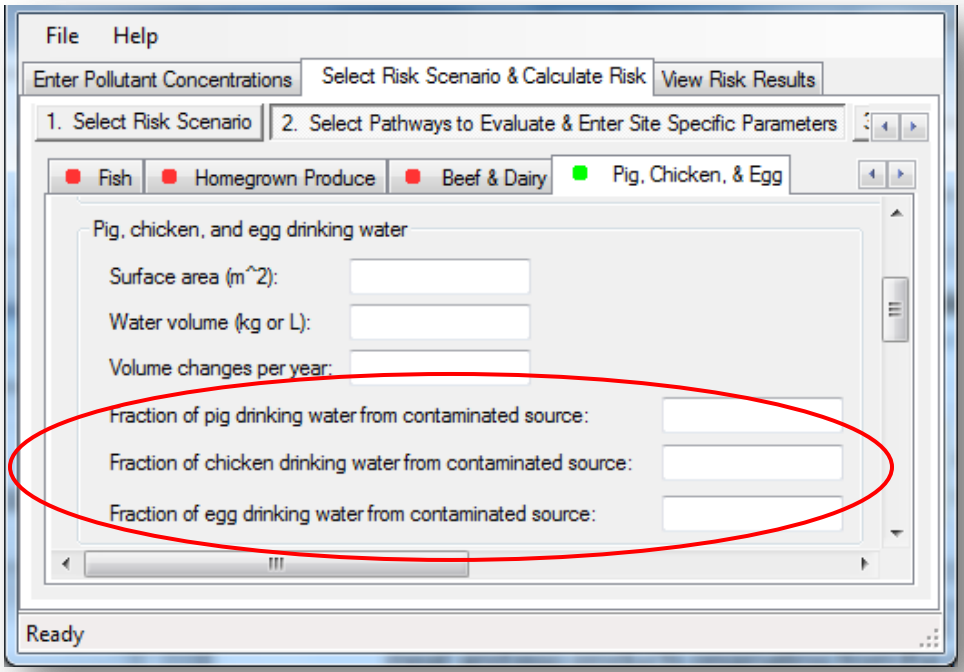
ii. Pig, Chicken, & Egg Drinking Water

Pig, chicken, & egg drinking water accounts for toxic bioaccumulation in pig meat, chicken meat, and chicken eggs from drinking water contaminated by the facility's emissions.

If there is a water source at the receptor, enter the total ***Surface area*** in m^2 and ***Volume*** in kilograms or liters. In addition, enter the average number of ***Volume changes per year*** the body or bodies of water undergo at your receptor. Water bodies go through volume changes, in which their water contents turn over through a process of emptying and filling. This occurs through evaporation, precipitation, stream flow, and other processes.



Next, input the ***Fraction of (pig/chicken/egg-producing chicken) drinking water from contaminated source*** that is impacted by facility pollutants.

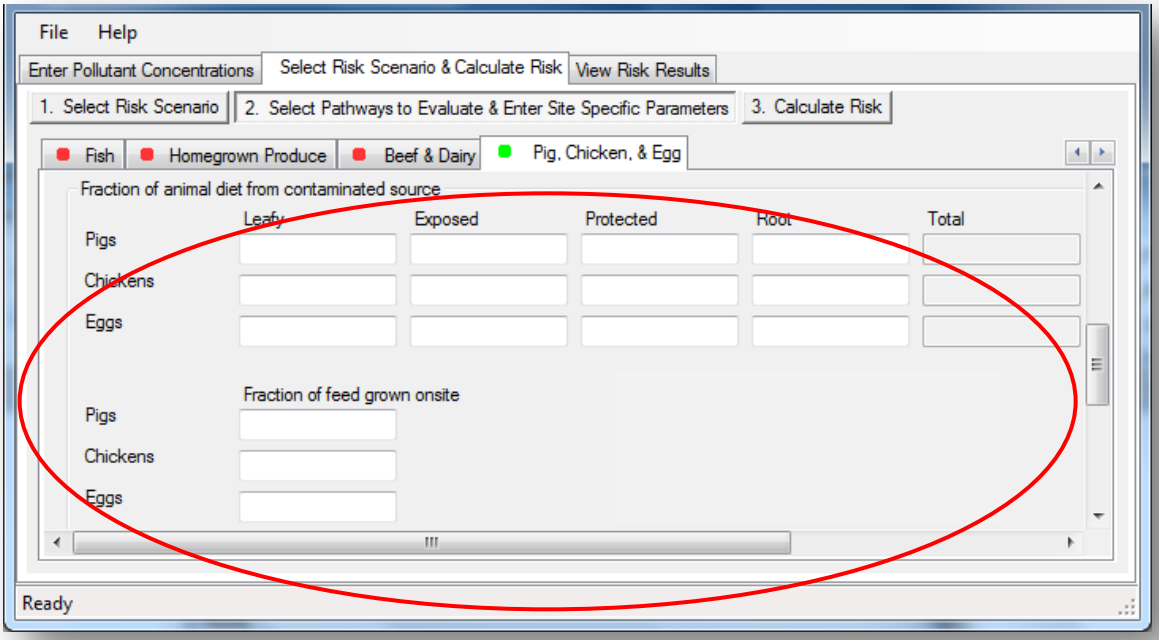


iii. Pig, Chicken, & Egg Diet

The ***Pig, Chicken, & Egg Diet*** accounts for pollutants that animals eat at the receptor point and subsequently store in their food products (e.g., meat, eggs).

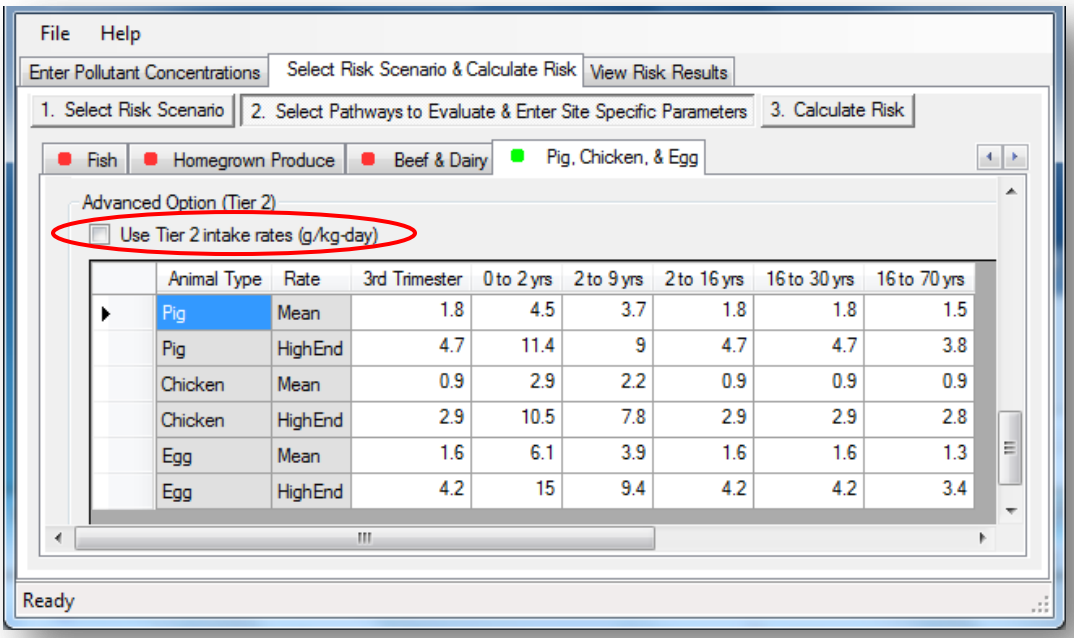
Input the ***Fraction of animal diet from contaminated source***. For the total food intake for pigs, chickens, and egg-producing chickens, the fraction should be the portion coming from crops contaminated by emissions. For example, pigs affected by the facility emissions may receive 1.00 (100%) of their leafy produce (like cabbage) from the contaminated crops.

Next, specify the ***Fraction of feed grown onsite***.



iv. ADVANCED FEATURE: Human Pig, Chicken, & Egg Consumption Rate

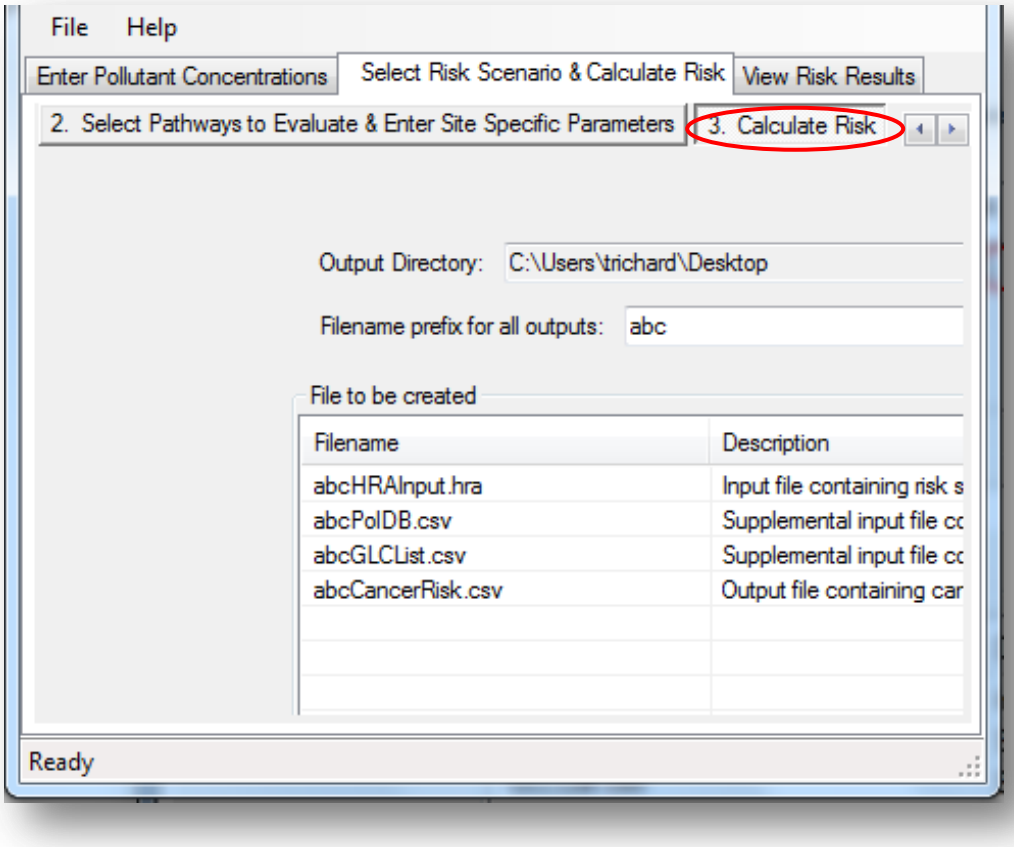
To change the default rates that humans consume pigs, chickens, and eggs, check the ***Use Tier 2 intake rates (g/kg-day)*** box. Input your average human intake rates of chicken, pig, and eggs by age group in grams of animal product eaten per kilogram of bodyweight per day.



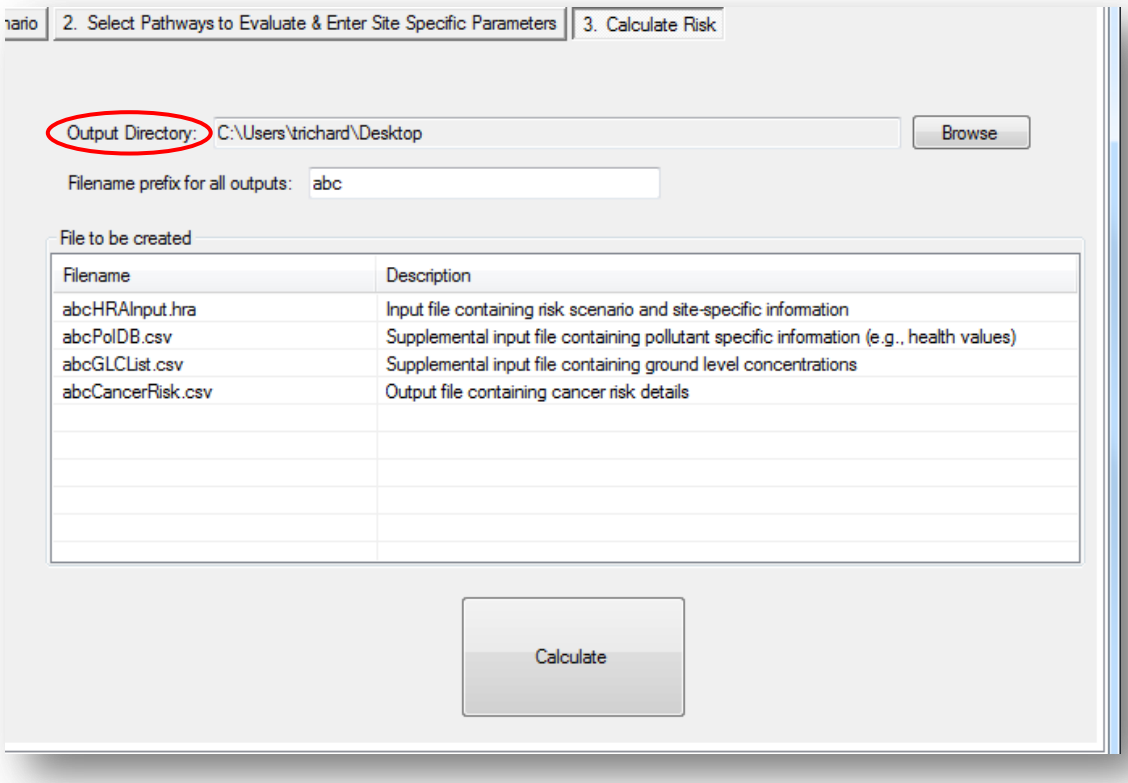
Animal Type	Rate	3rd Trimester	0 to 2 yrs	2 to 9 yrs	2 to 16 yrs	16 to 30 yrs	16 to 70 yrs
Pig	Mean	1.8	4.5	3.7	1.8	1.8	1.5
Pig	HighEnd	4.7	11.4	9	4.7	4.7	3.8
Chicken	Mean	0.9	2.9	2.2	0.9	0.9	0.9
Chicken	HighEnd	2.9	10.5	7.8	2.9	2.9	2.8
Egg	Mean	1.6	6.1	3.9	1.6	1.6	1.3
Egg	HighEnd	4.2	15	9.4	4.2	4.2	3.4

8. STEP 2: CALCULATE RISK

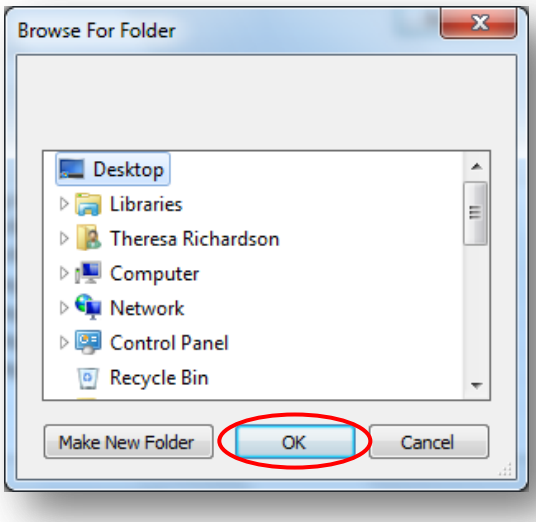
After inputting your pollutant concentrations, risk scenario and parameters, calculate risk by selecting the ***Calculate Risk*** tab. This is the third and last part of Step 2 in the program: ***Select Risk Scenario & Calculate Risk***.



First, designate the ***Output Directory*** for your risk assessment files. This is where your calculated risk values, assessment settings, and pollutant data will be saved.

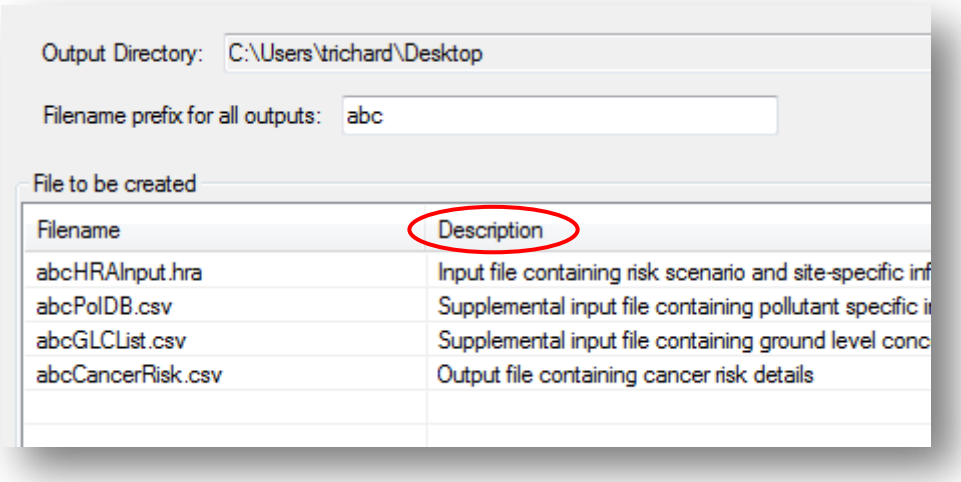


Click the browse button. Find a location, folder, or create a folder to store your risk documents. Click ***OK***.

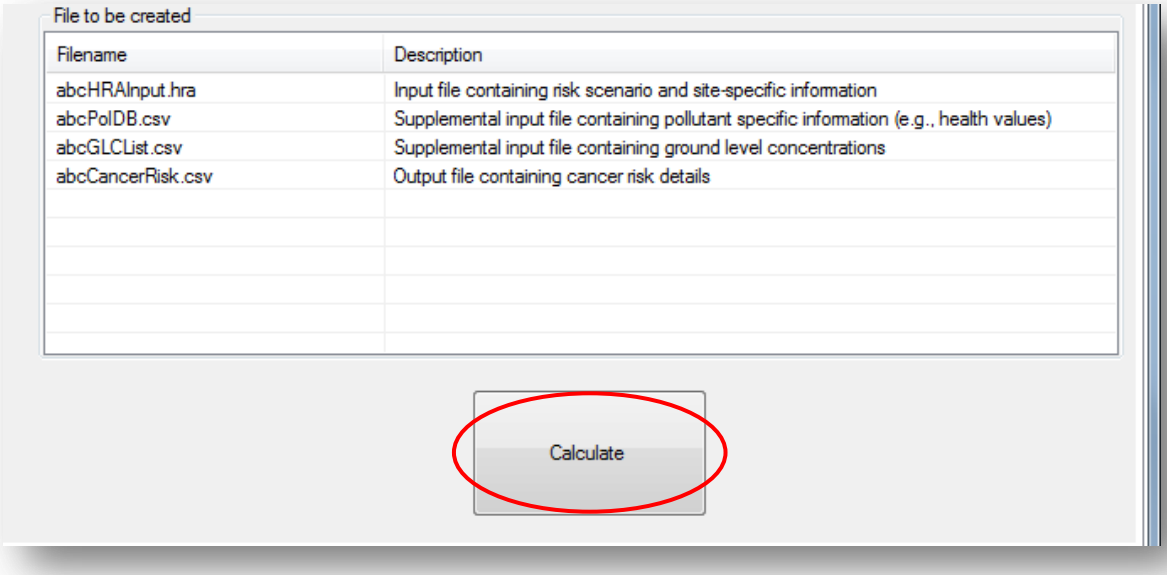


Indicate the ***Filename prefix for all outputs***. This is the label that will appear at the beginning of all filenames that will be generated for your health risk assessment.

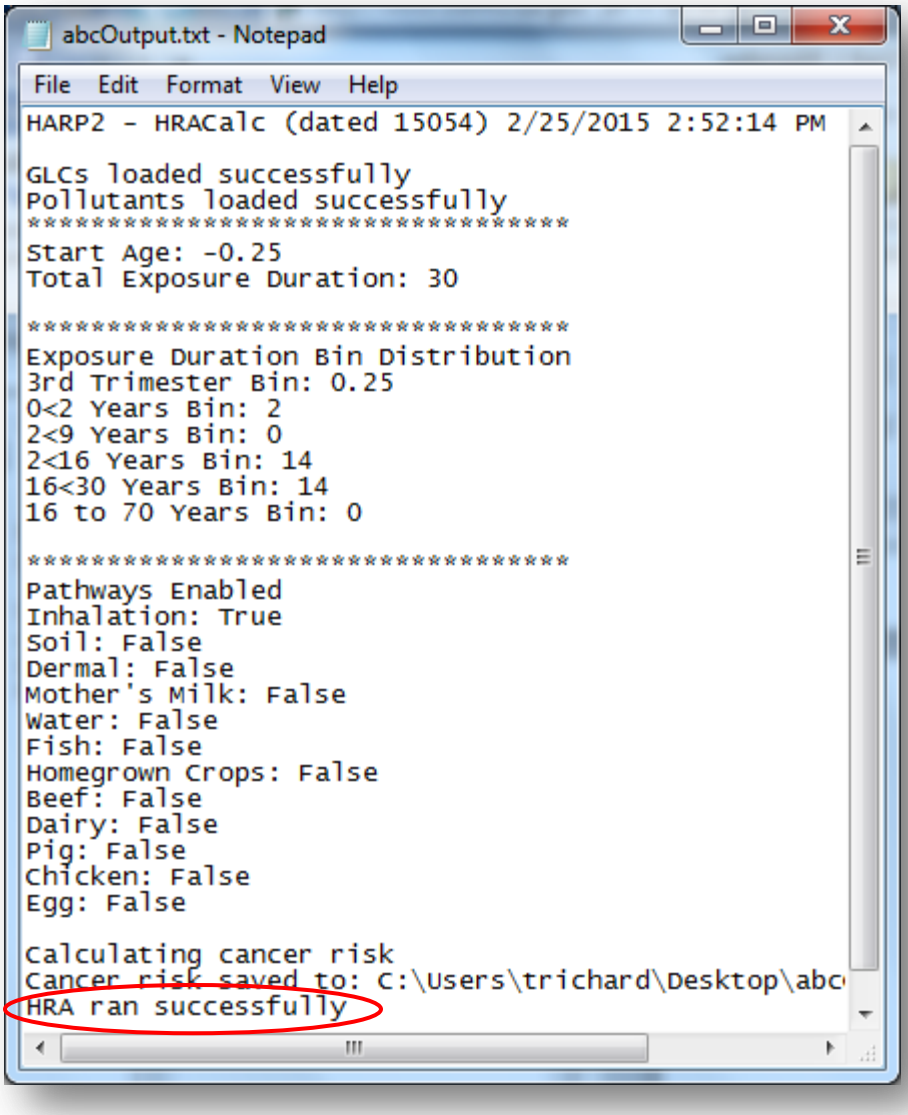
As you type, examples of what your filenames will look like are generated in the ***File to be created*** table. Read the ***Description***, in the ***File to be created*** table to understand what contents that file holds. For example, the HRAInput.hra file is the input file containing risk scenario and site-specific information that you determined earlier in the program.



Click ***Calculate***.



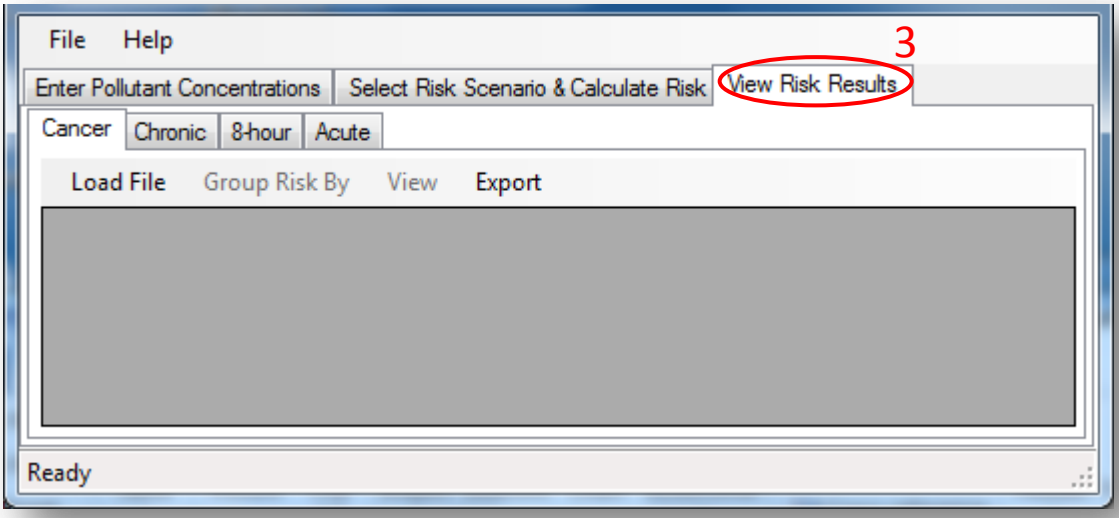
A pop-up screen will appear to confirm that the risk results are calculated and ready to view in the ***View Risk Results*** tab.



This document will be saved as Output.txt. Your exported files will be saved to the destination (e.g., folder, desktop) you chose previously.

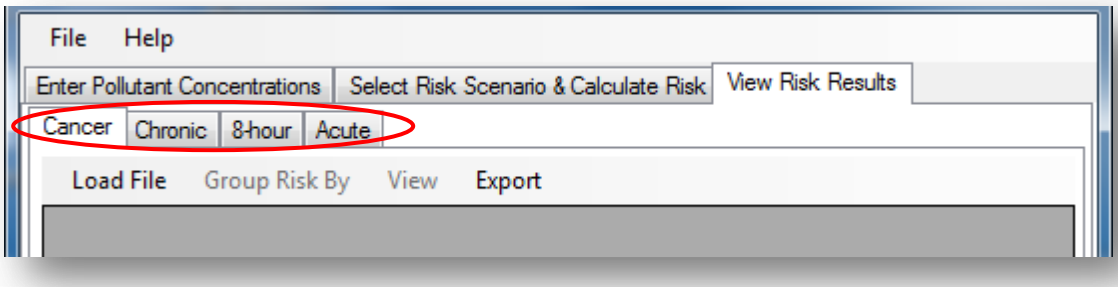
9. STEP 3: VIEW RISK RESULTS

This section discusses how to view and manage the risk results.

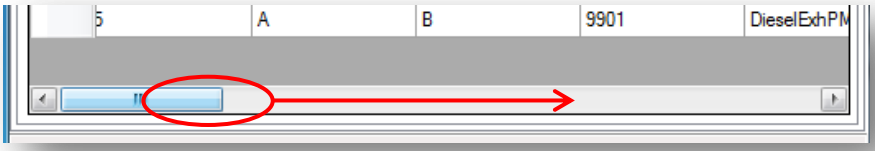


a. Navigating Risk Tables

The risk results are tabbed and organized in tables by risk type: ***Cancer***, ***Chronic***, ***8-hour***, and ***Acute***. Each tab will only contain data in a table if that risk assessment type was conducted. For example, if a cancer assessment was conducted, the cancer table will populate with data while the chronic, 8-hour, and acute tabs will remain empty. Your assessment type was chosen previously in ***6.a. Choosing the Analysis Type***.

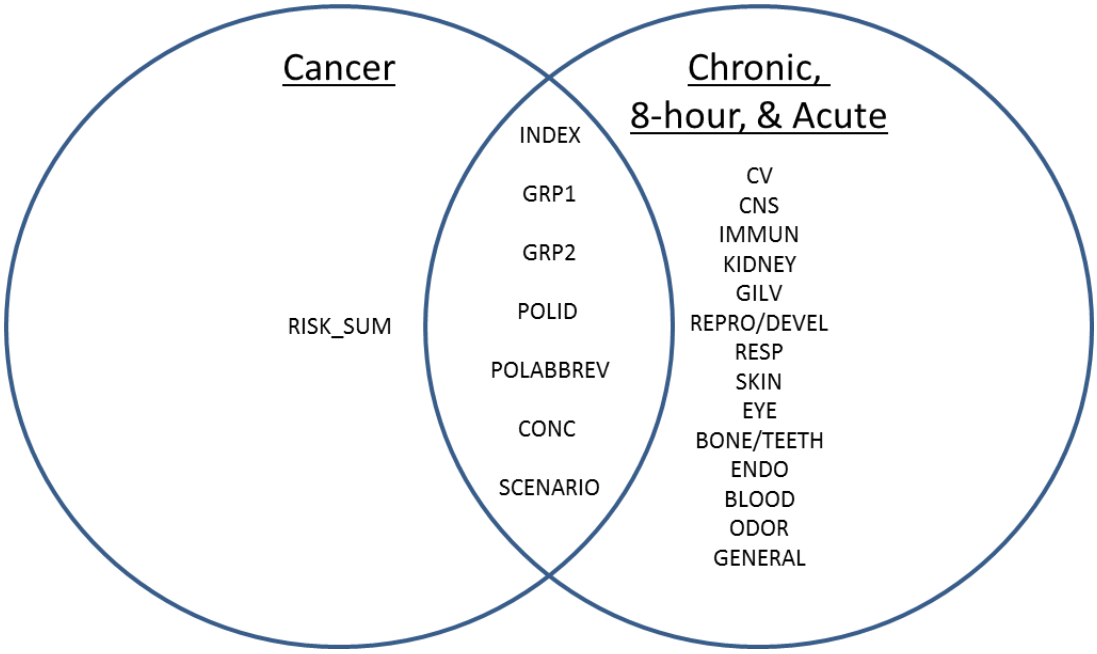


- Note: *Scroll the lower bar to see all columns in a table*.



b. Cancer & Noncancer Columns

The four risk results tables for cancer, chronic, 8-hour chronic, and acute assessments share similarities and differences in the data they present. While cancer risk is expressed as a probability of developing cancer, noncancer risk is indicated with a hazard index number (HI) for pollutant-targeted organ systems.



*Acronyms defined in following table.

Table 9-1. Cancer Risk Sum versus Noncancer Hazard Quotient

Cancer Risk Sum:	**Noncancer Target Organ Hazard Quotient (HQ)**:
The cancer risk sum is the calculated pollutant-specific estimated probability of developing cancer based upon the scenario and pathway parameters inputted by the user in Parts I and II. Cancer risk is calculated using the predefined cancer potency factor of a pollutant, ground level exposure concentration, duration of exposure, and other parameters (e.g., age sensitivity).	The noncancer HQ is the calculated pollutant-specific indicator for risk of developing an adverse health outcome at a target organ system. The HQ is based upon user inputs in Parts I and II. The HQ is estimated using the predefined reference exposure level (REL) of a pollutant, ground level concentration, exposure duration, and other parameters. The REL is a concentration below which there is assumed to be no observable adverse health impact to a target organ system. For an acute HQ the one hour maximum concentration is divided by the acute REL for the substance.

Column labels found in the risk results tables are shown in Table 9-2.

Table 9-2. Risk Results Column Names and Definitions

Cancer Risk Results Table	All Risk Results Tables	Chronic, 8-hour, & Acute Risk Results Tables
• ***RISK_SUM***: Total Cancer Risk	• ***INDEX*** : Pollutant Index • ***GRP1***: Category 1 (x-axis) • ***GRP2***: Category 2 (y-axis) • ***POLID***: Pollutant Identification Number • ***POLABBREV***: Pollutant Name Abbreviation • ***CONC***: Pollutant Concentration • ***SCENARIO***	• ***CV***: Cardiovascular System • ***CNS***: Central Nervous System • ***IMMUN***: Immune System • ***KIDNEY***: Kidneys • ***GILV***: Gastrointestinal Tract & Liver or Alimentary Tract • ***REPRO/DEVEL***: Reproductive System & Developmental • ***RESP***: Respiratory System • ***SKIN***: Skin • ***EYE***: Eyes • ***BONE/TEETH***: Bones & Teeth • ***ENDO***: Endocrine System • ***BLOOD***: Hematological System • ***ODOR***: Response to Odors • ***GENERAL***: General Toxicity

To learn more about individual acute, chronic, and 8-hour RELs, see OEHHA's *Technical Support Document for the Derivation of Noncancer Reference Exposure Levels and RELs for Six Chemicals* (2008) at http://oehha.ca.gov/air/hot_spots/rels_dec2008.html.

c. Target Organ Systems

Acute, 8-hour, and chronic RELs are used to calculate risk for the respective target organs that they impact. A list of pollutants and the target organs they affect at their respective REL is available in the OEHHA Guidance Manual.

Many acute RELs are based on mild adverse effects to the body, while others are more severe. Acute health effects include mild irritation of the eyes, nose, or throat, hepatotoxicity of the alimentary tract, or anemia and hemolysis in the hematological system. Specific health effects used in deriving a chronic REL include lowered red and white blood cell counts in the hematological system, thyroid enlargement in the endocrine system, or macrophage hyperplasia in the immune system. General toxicity is a category used to describe other health effects, such as failure to thrive.

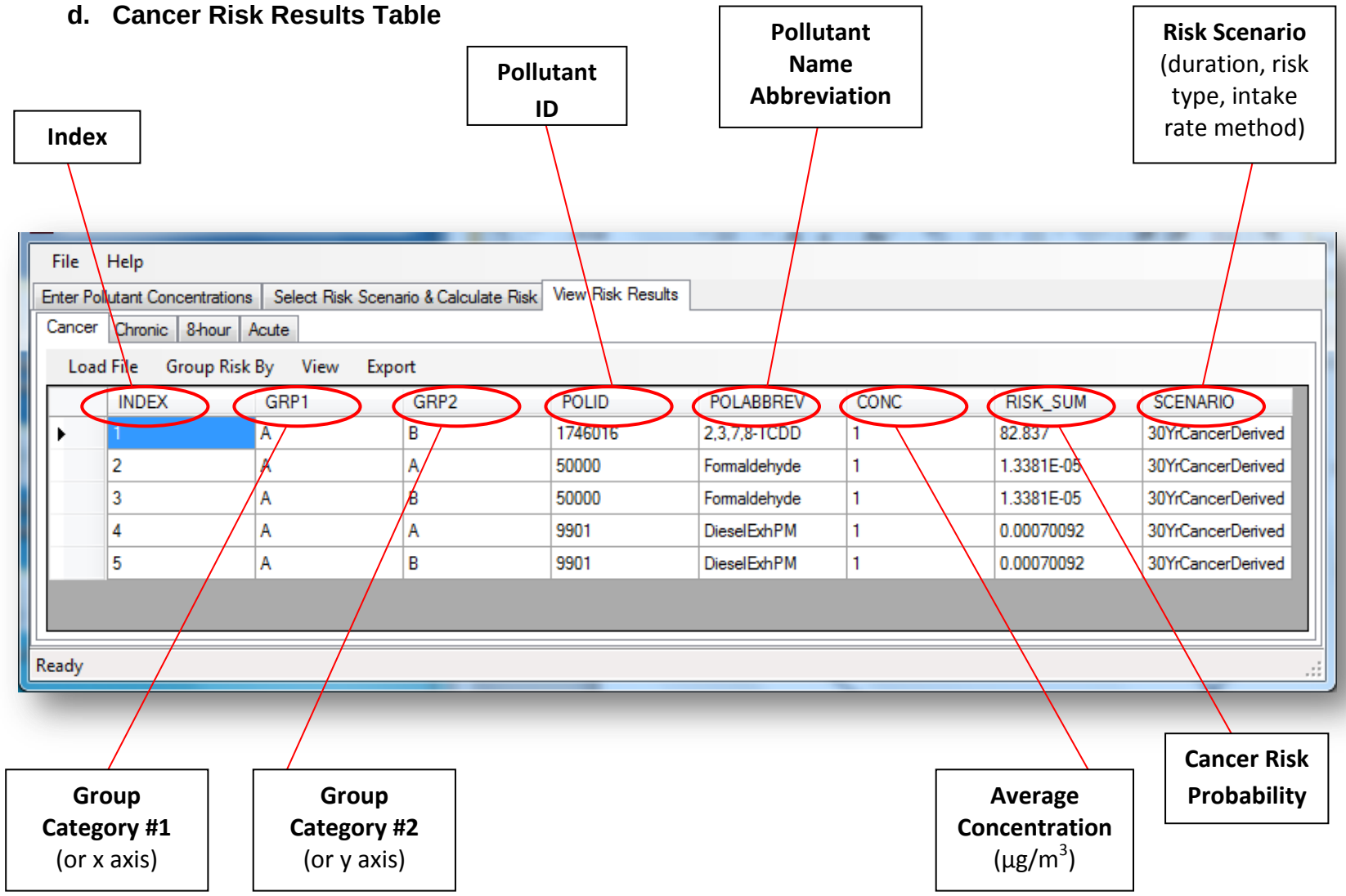
The abbreviations and acronyms RAST uses for the target organ systems are shown in Table 9-3.

Table 9-3. Target Organ Systems in RAST[1]

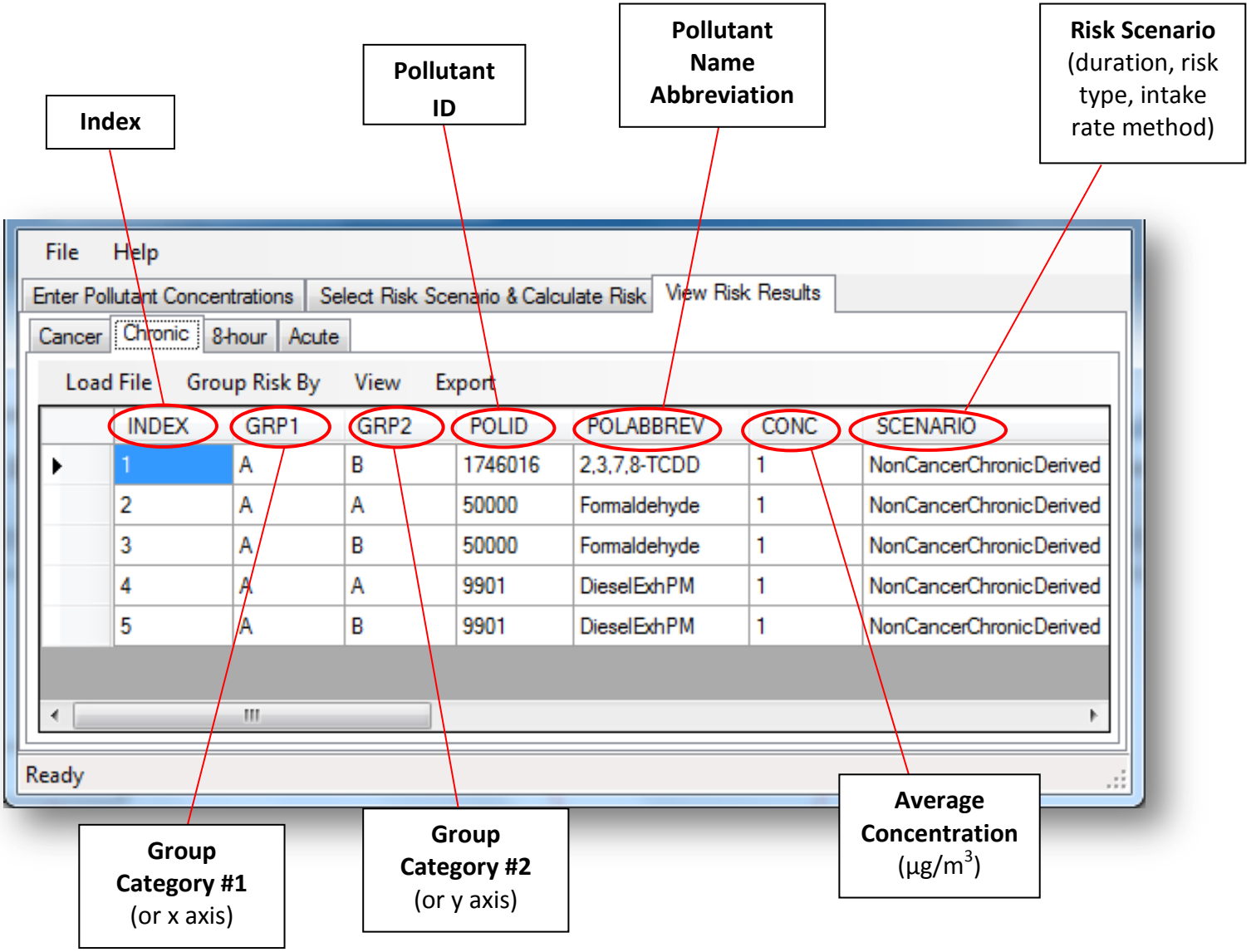
Target Organ Categories	RAST Acronyms & Abbreviations
Hematological System	BLOOD
Central Nervous System	CNS
Cardiovascular System	CS
Endocrine System	ENDO
Eyes	EYE
General Toxicity	GENERAL
Alimentary Tract	GILV
Immune System	IMMUN
Reproductive/Developmental	REPRO/DEVEL
Respiratory System	RESP
Skin	SKIN
Physiological Response to Odors	ODOR
Skeletal System	BONE/TEETH

[1]*Technical Support Document for the Derivation of Non-Cancer Reference Exposure Levels* (OEHHA, 2007).

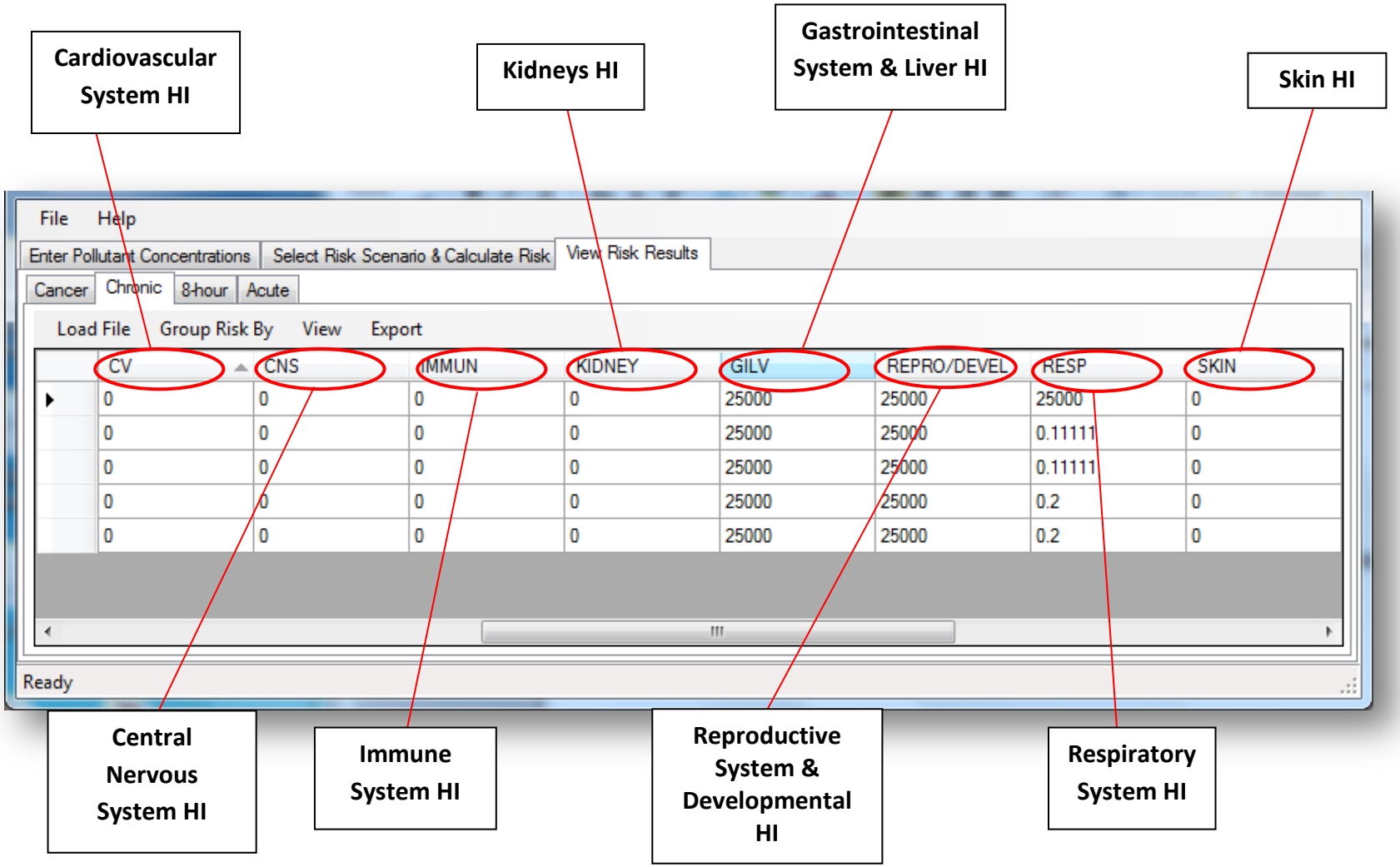
d. Cancer Risk Results Table



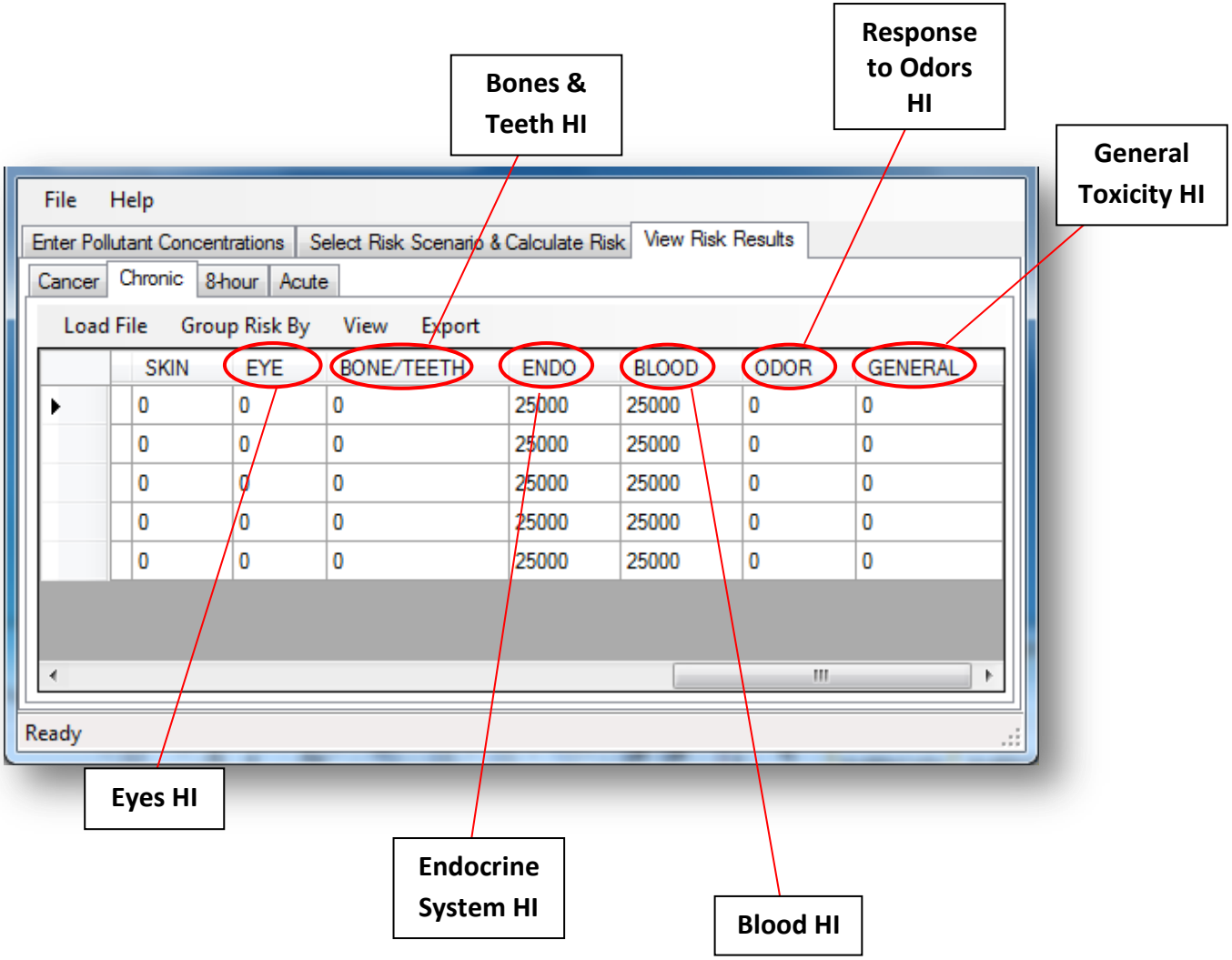
e. Chronic, 8-hour, & Acute (Noncancer) Risk Results Tables



e. Chronic, 8-hour, & Acute (Noncancer) Risk Results Tables (continued)

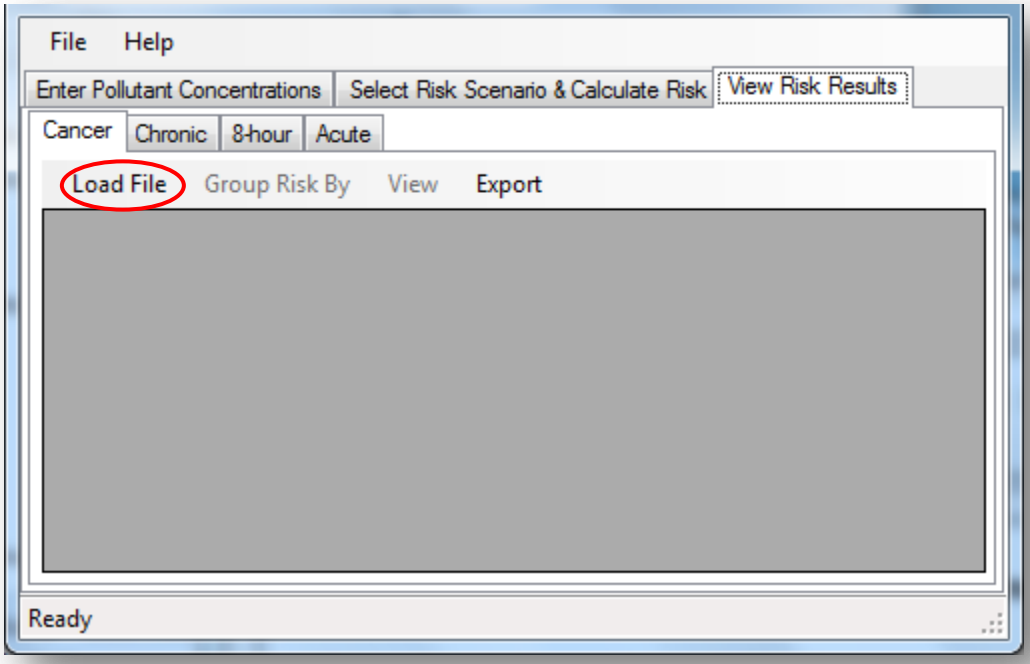


e. Chronic, 8-hour, & Acute (Noncancer) Risk Results Tables (continued)

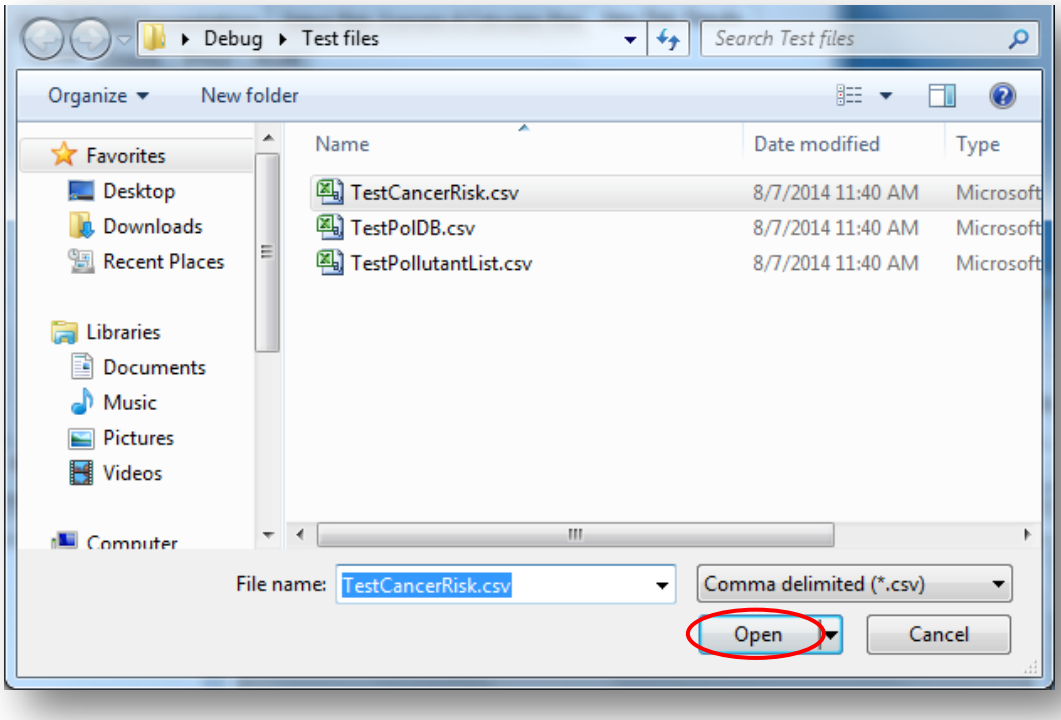


f. Load, Group, View, & Export Risk Data

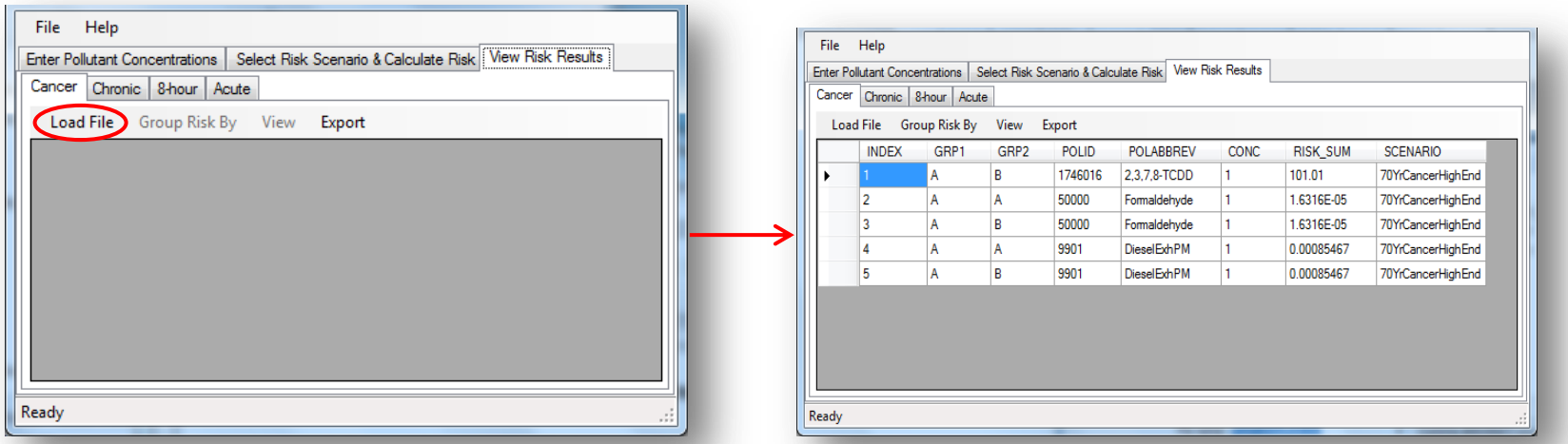
If you already have risk results files that you wish to upload and view in RAST, click ***Load File***.



Select the risk results file (in CSV format) you wish to view inside RAST and click ***Open***.

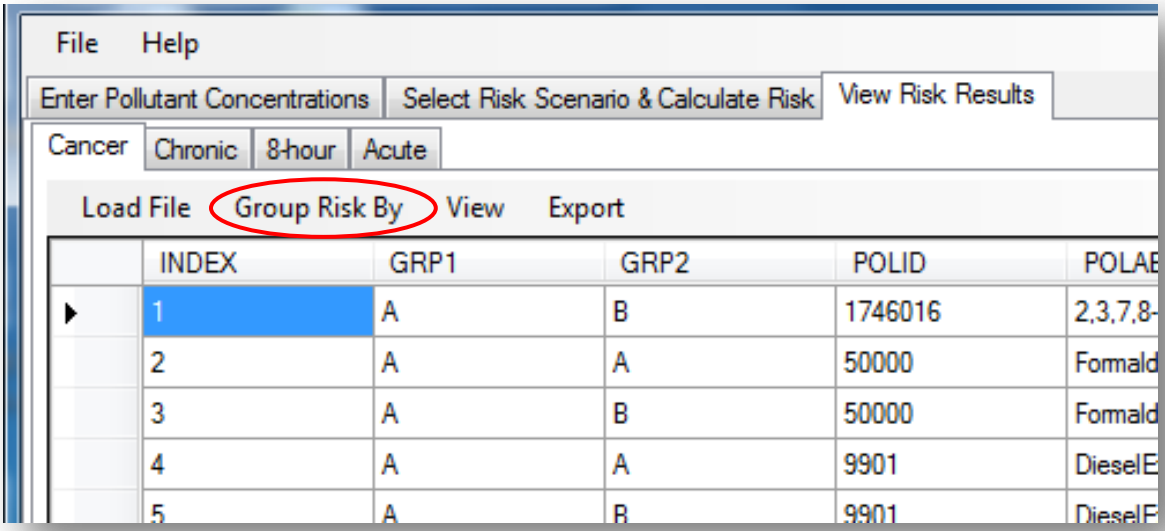


Your data should be visible on the ***View Risk Results*** tab.

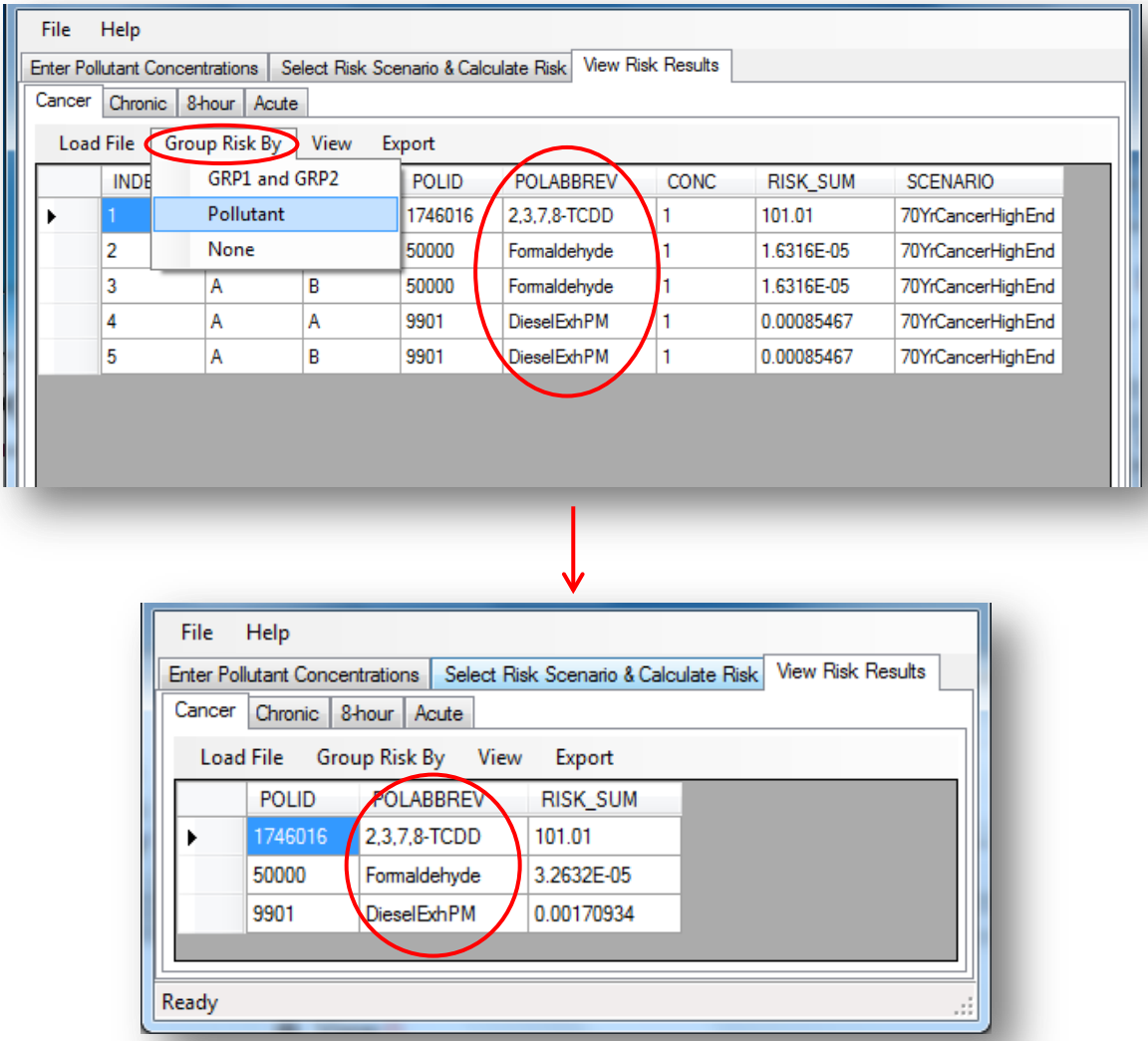


Above is an example of what your screen will look like before and after loading a risk results file.

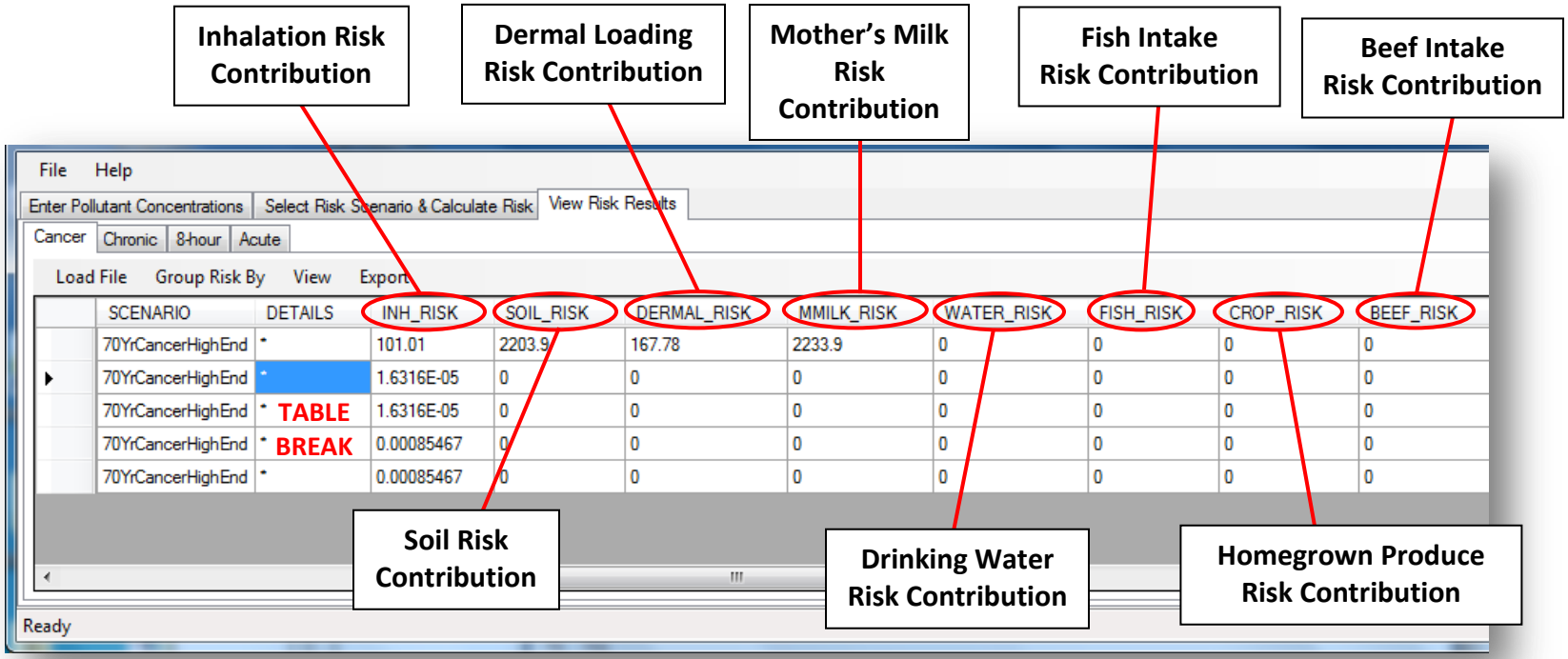
The feature, ***Group Risk By***, allows you to sum risk by group categories or pollutant-type. This can help you determine which source (e.g. equipment, coordinate point, production process) or which pollutant contributes the highest risk.



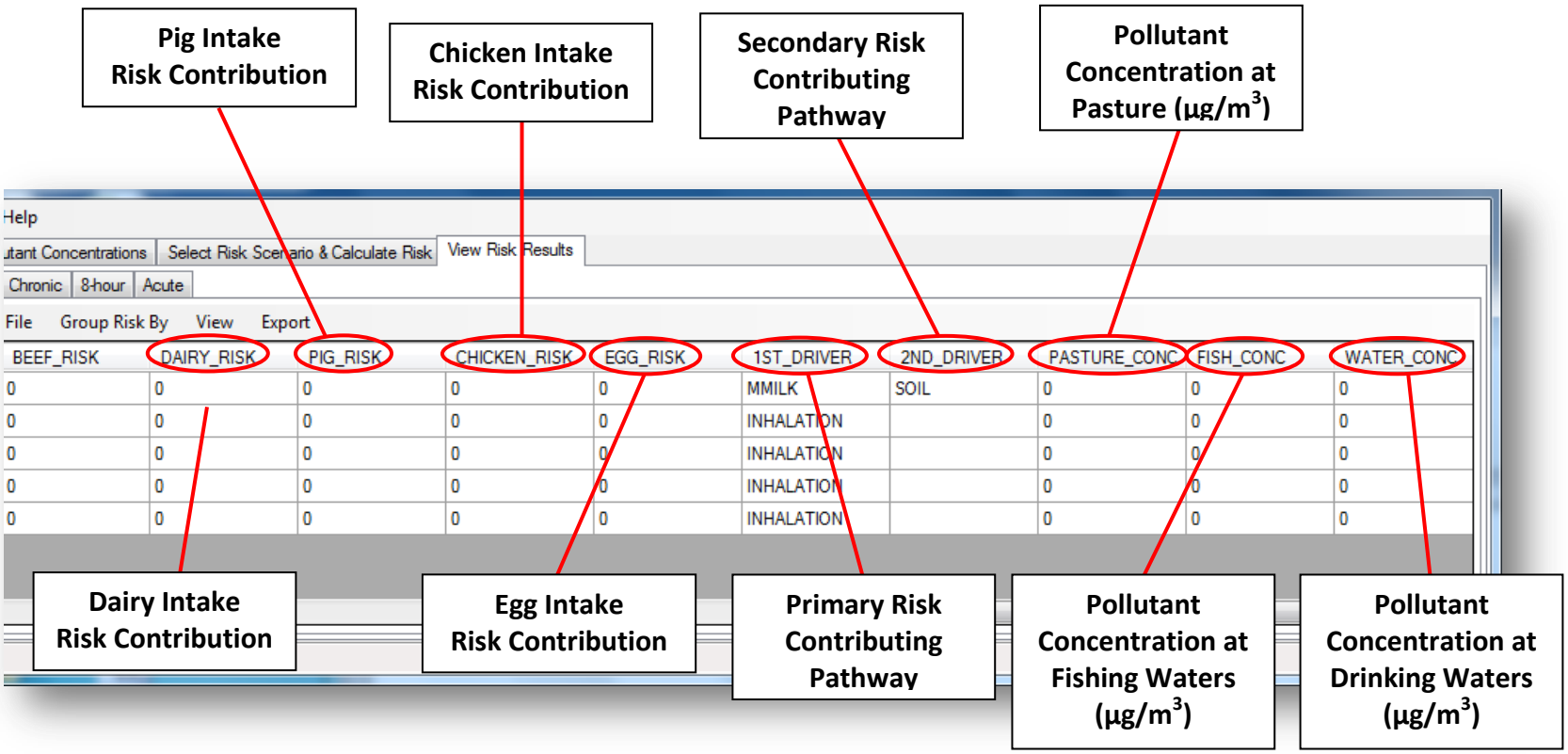
In the example below, risk is grouped by pollutant type. After grouping, it is easier to see that 2,3,7,8-TCDD contributes the most risk, while diesel exhaust PM contributes the least.



View\Pathway Breakdown Details is available for cancer and noncancer chronic assessments. This feature is not available in the 8-hour and acute tabs, as inhalation is the only measured pathway for these scenarios. Clicking ***View\Pathway Breakdown Details*** will display additional columns that break down the risk probability contributed by each individual exposure pathway to the risk sum. The new cells begin with the ***DETAILS*** column, which serves as a table break.

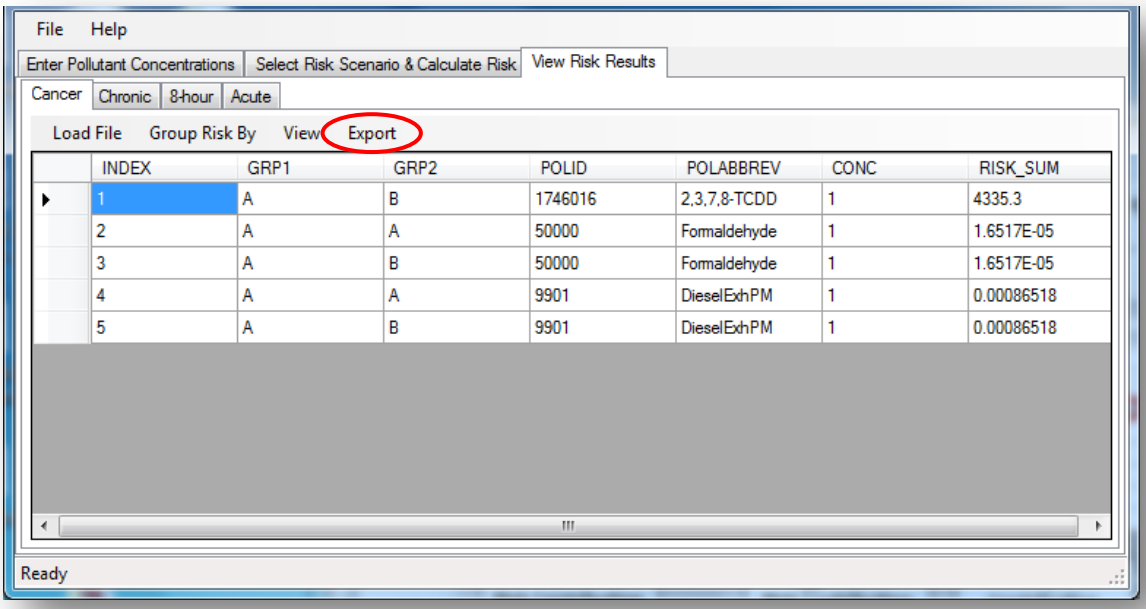


Remember to slide the scroll bar to view all columns in the risk results table after selecting ***View\Pathway Breakdown Details***. The remaining columns are continued below.

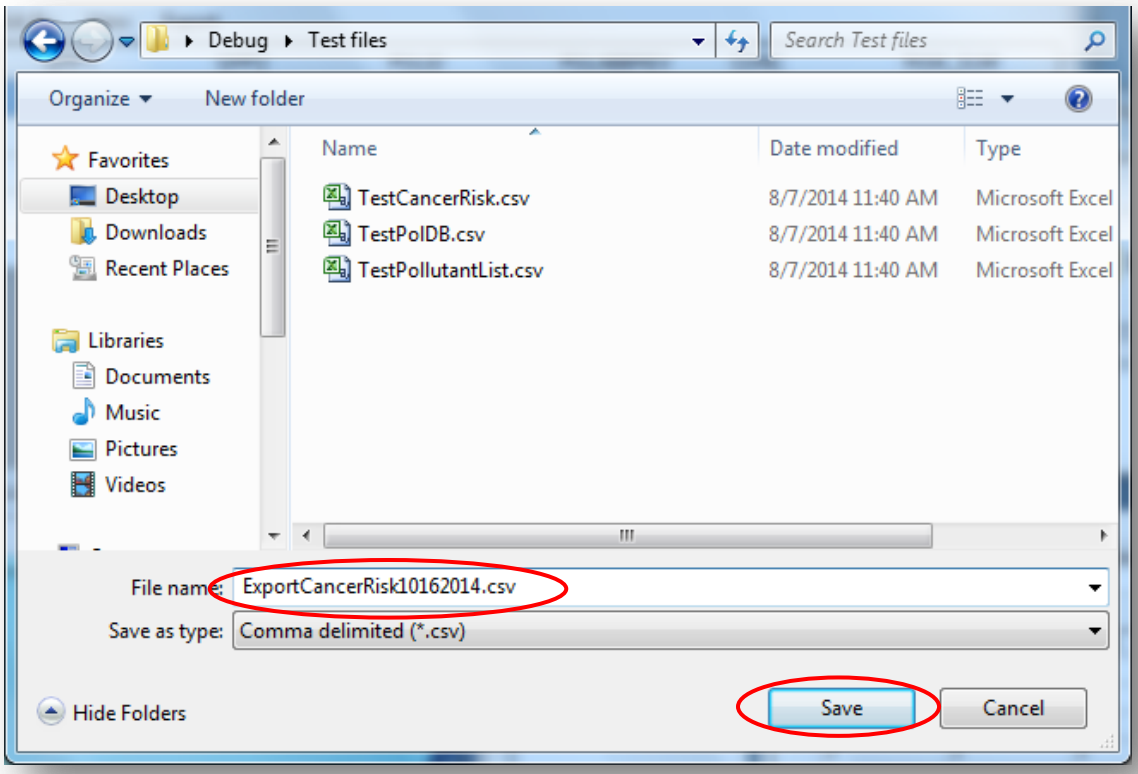


The ***1ST_DRIVER*** and ***2ND_DRIVER*** columns indicate which pathways contribute the first-most and second-most risk to the ***RISK_SUM*** for cancer and hazard index.

The ***Export*** button will convert your risk results data into a CSV file and save at a designated location to your computer.

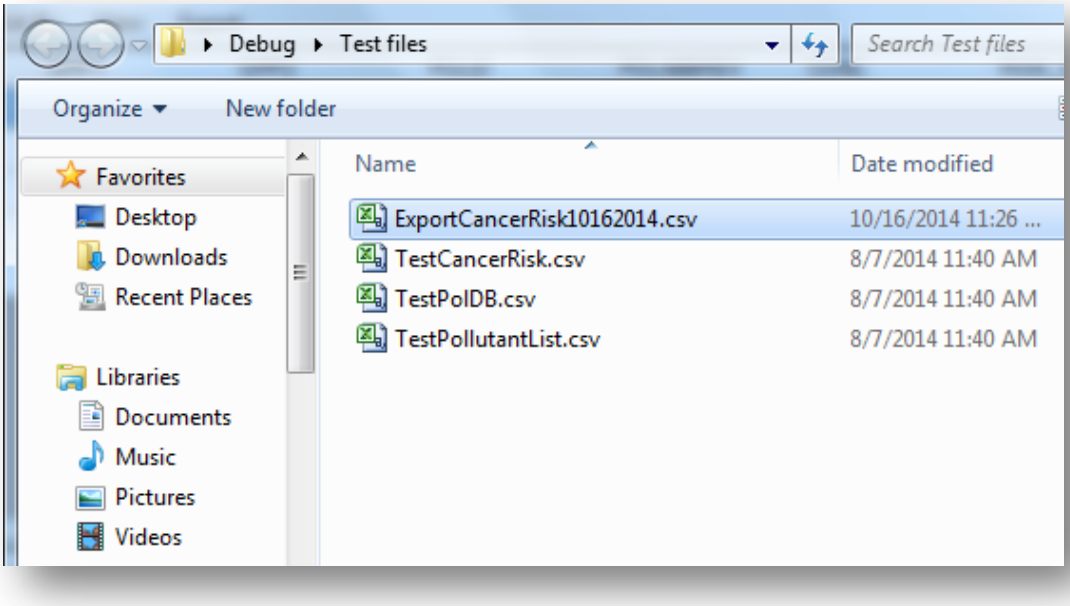


To export the risk results file, click ***Export***. The ***Save to CSV*** window will pop open to designate a saving place for your file. Choose the file location and hit ***Save***.



The risk file will be saved to the area you designated. By default, the program will save your file as ***ExportCancerRisk***, followed by the date of creation. Type a new name in the ***File name box*** if you wish to change this.

Below is an image of the file saved in its designated location.



Once saved, the risk results CSV file may be reopened in RAST at any time for later use by clicking the ***Load File*** button discussed previously in this section, and double clicking on the desired file.

Appendix: A
Glossary of Acronyms and Definitions of Selected Terms

Acronyms

AB 2588: Assembly Bill 2588

ADMRT: Air Dispersion Modeling and Risk Assessment Tool

ARB: Air Resources Board

CSV: Comma Separated Values

Districts: Air Quality Management Districts

EF: Exposure Frequency

EIM: Emission Inventory Module

GLC: Ground Level Concentrations

HARP 2: Hotspots Analysis and Reporting Program Version 2

HI: Hazard Index

High End: 95th Percentile

Mean: 65th Percentile

MEIR: Maximum-Exposed Individual Resident

MEIW: Maximum-Exposed Individual Worker

MWAF: Molecular Weight Adjustment Factor

OEHHA: Office of Environmental Health Hazard Assessment

OEHHA Guidance Manual: Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments

PAHs: Polycyclic Aromatic Hydrocarbons

PCBs: Polychlorinated Biphenyls

PCDDs: Dioxins

PCDFs: Furans

PM: Particulate Matter

RAST: Health Risk Assessment Standalone Tool

REL: Reference Exposure Level

TTD: Transportation and Toxics Division

Definitions

Acute Risk: Risk that is a product of exposure, via inhalation, to a pollutant for one-hour above the acute reference exposure level.

Age Sensitivity Factor (ASF): ASFs are default weighting factors to account for potential increased sensitivity to carcinogens during early life stages including prenatal, postnatal and juvenile life stages. ASFs are applied to the cancer risk equation.

Air Dispersion Modeling: Models of air dispersal using algorithms, usually performed with a computer, that relate a mass emission rate, source configuration, and meteorological information to calculate ambient air concentrations.

Air Pollution Control Device: Control technology installed for the purpose of reducing pollutants emitted into the ambient air.

Algorithm: A set of rules for solving a problem in a finite number of steps.

Ambient Air: The air external to a building.

Bioaccumulation: The concentration of a substance in a body or part of a body or other living tissue in a concentration higher than that of the surrounding environment.

Blood: The hematological system. Toxicity indicators include hemolysis, anemia, platelet abnormalities, and adverse effects on hematopoietic stem cells.

Cancer Potency Factor (CPF): Cancer Potency Factor (CPF): The theoretical upper bound probability of extra cancer cases occurring in an exposed population assuming a lifetime exposure to the chemical when the chemical dose is expressed in units of milligrams/kilogram body weight-day (mg/kg-d). The CPF is thus expressed in inverse units of mg/kg-d ($(mg/kg\text{-}d)^{-1}$).

Census Tract: A physical area used by the U.S. Census Bureau to compile population and other statistical data.

Chronic Risk: The risk of developing an adverse health impact due to exposure of an air pollutant. Chronic relative exposure levels (RELs) are designed to address

continuous exposures for up to a lifetime: the exposure metric used is the annual average exposure.

CNS: The central nervous system. Toxicity indicators include abnormal electroencephalograph results, altered performance on neurobehavioral or neuropsychological tests, and lightheadedness.

Comma Separated Values (CSV): A CSV is a comma separated values file, which allows data to be saved in a table structured format. CSVs look like a garden-variety spreadsheet but with a .csv extension. Traditionally, they take the form of a text file containing information separated by commas, hence the name.

CV: The cardiovascular system. The cardiovascular toxicity hazard trait is defined as the occurrence of adverse effects on the structure or function of the heart or the vascular system following exposure to a chemical substance. Toxicological endpoints for cardiovascular toxicity include but are not limited to observations indicating: structural effects associated with cell necrosis, cellular degeneration, proliferation, fibrosis, or inflammation of the heart or vasculature, atherosclerosis, thickening of arterial walls, or cardiac hypertrophy; functional effects such as arrhythmia or changes in rhythmicity or contractility of the heart, hypo- or hyper- tension, decreased cardiac output, alteration of vascular reactivity or vessel dilation or contraction; outcomes of structural or functional impairment including high blood pressure, myocardial infarct, or cardiac failure; epidemiological or laboratory animal observations of cardiovascular morbidity or mortality in association with chemical substance exposure.

Default: A value used to account for a factor when specific information on that factor that applies to a specific situation is not available.

Dermal Load: Amount of a substance per unit area of skin.

Dose: A calculated amount of a substance estimated to be received by the subject, whether human or animal, as a result of exposure. Doses are generally expressed in terms of amount of chemical per unit body weight; typical units are mg/kg-day.

Exposure Frequency (EF): A feature of the worker assessment scenario, exposure frequency is the number of days worked (exposed to a pollutant) per year.

Exposure: Contact of an organism with a chemical, physical, or biological agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, digestive tract) and available for absorption.

Facility: An area with equipment designated for the purpose of something. For the purpose of the module, it is a stationary facility that also emits pollutants into the ambient air (power plants, steel mills, smelters, refineries, etc.).

GILV: Gastrointestinal tract and liver or alimentary tract. Toxicity indicators include hepatotoxicity, nausea, and vomiting.

Ground Level Concentration (GLC): Estimated ground level concentration, usually for a specified averaging time (e.g., annual average, 1 hour, etc.).

GRP1: Primary group category or x-axis.

GRP2: Secondary group category or y-axis.

Hazard Quotient (HQ): The estimated ground level concentration, divided by the reference exposure level, for a single substance and a particular endpoint. For an acute HQ the one hour maximum concentration is divided by the acute Reference Exposure Level (REL) for the substance. For a repeated 8 hr HQ, the 8 hr average concentration is divided by the 8 hour REL. For a chronic HQ, the annual concentration is divided by the chronic REL.

Health Risk Assessment: Health risk assessment is the characterization of the potential adverse health effects of human exposures to environmental hazards. In the Air Toxics Hot Spots program, a health risk assessment (HRA) is an evaluation or report that a risk assessor (e.g., district, consultant, or facility operator) develops to describe the potential a person or population may have of developing adverse health effects from exposure to a facility's emissions. Some health effects that are evaluated could include cancer, developmental effects, or respiratory illness. The pathways that can be included in an HRA depend on the toxic air pollutants that a person (receptor) may be exposed to, and can include breathing, the ingestion of soil, water, crops, fish, meat, milk, and eggs, and dermal exposure.

High-End Intake Rate: The 95^{th} percentile exposure rate to a pollutant. The high-end intake rate is the most conservative intake rate method.

Hot Spots Analysis and Reporting Program (HARP): A single integrated software package designed to promote statewide consistency, efficiency, and cost-effective implementation of health risk assessments and the Hot Spots Program. The HARP software package consists of three modules that include: 1) EIM, 2) ADMRT, and 3) RAST.

8-Hour Chronic Risk: 8-hour chronic risk is the risk of an adverse health impact based on daily eight-hour exposures to a pollutant. Eight-hour relative exposure levels were designed to address off-site worker exposures. However, they may also be used to characterize 8-hour residential noncancer exposures, particularly for a facility that operates non-continuously rather than 24-hours/day, 7 days/week as assessed for chronic exposure. The 8-hour chronic risk assessment can also be used to assess exposure of students and teachers while at school (OEHHA, 2008). This assessment type can be useful if applying the chronic risk assessment is overly conservative for your scenario.

IMMUN: The immune system. Immune system toxicity indicators include macrophage hyperplasia.

Individual Excess Cancer Risk: The theoretical probability of an individual person developing cancer as a result of lifetime exposure to carcinogenic substances. The Individual Excess Cancer Risk is calculated by summing the potential cancer risks due to both inhalation and non-inhalation routes of exposure, generally at the off-site point of maximum impact. This "individual" is the maximally exposed individual (MEI).

Isopleth: A line on a map connecting points of equal value (e.g., risk, concentration).

KIDNEY: The kidneys. Indicators of kidney toxicity include increased blood urea nitrogen and uric acid levels.

Mandatory Minimum Pathways: The minimum pathways required by OEHHA in conducting a health risk assessment. These are the inhalation, soil, dermal, and mother's milk pathway.

Maximum Hourly Concentration (Max Hr Conc): One-hour maximum concentrations are required for the analysis of acute effects. The modeled one-hour peak concentrations are typically much greater than the maximum annual averageized concentrations used for determining chronic exposure and risk. Thus, it is assumed that acute exposures are independent of the long-term average exposure based on the modeled annualized maximum average concentration. Concentrations close to the maximum one-hour exposure may occur many times during the year including on consecutive days. In addition, it is conceivable that exposure concentrations close to the maximum may occur in consecutive hours. Currently, OEHHA does not ascertain how often exposures close to the one-hour maximum occur in a given day, week, month or year.

Mean: In health risk assessments, the 65^{th} percentile of exposure to a pollutant**.**

Multipathway substance: A substance or chemical that once airborne from an emission source can, under environmental conditions, be taken into a human receptor by multiple exposure routes, such as inhalation, skin contact with contaminated surfaces, ingestion of soil contaminated by the emission, etc.

Non-Carcinogenic (Noncancer) Effects: Noncancer health effects which may include birth defects, organ damage, morbidity, and death.

OEHHA Derived Method: In cancer risk assessments, the derived method uses the high-end point estimate (i.e., 95^{th} percentile) for two driving (dominant) exposure pathways (e.g., soil and breast milk) and the mean (65^{th} percentile) point estimate for the remaining pathways. In non-cancer chronic assessments, the inhalation pathway will always use the 95^{th} percentile intake rate, the next two risk driving pathways will use the 95^{th} percentile, and the remaining pathways will use the mean intake rate.

Pathway of Exposure: A route of exposure by which xenobiotics enter the human body, (e.g., inhalation, ingestion, dermal absorption).

Point Estimate: A single value estimate for a given variate.

POLID/CAS: A number for pollutant identification. CAS Registry Numbers (often referred to as CAS RNs or CAS Numbers) are universally used to provide unique identifiers for chemical substances. A CAS Registry Number itself has no inherent chemical significance but provides an unambiguous way to identify a chemical substance or molecular structure. CAS Registry Numbers are used in many other public and private databases as well as chemical inventory listings. Those pollutant identification numbers relevant to HARP are provided in the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values.*

Receptor: A location with or without people present at which the ground level concentration of an emitted chemical can be estimated.

Reference Exposure Level (REL): The REL is an exposure level at or below which no noncancer adverse health effect is anticipated to occur in a human population, including sensitive subpopulations, exposed for a specific duration. One hour RELs are designed to be protective for infrequent one hour maximum exposures. Eight-hour RELs are designed to be protective for repeated 8 hour exposures. Chronic RELs are designed to be protective for continuous long-term exposures. RELs are used to evaluate toxicity endpoints other than cancer. RELs are expressed in units of $\mu g/m^3$ for inhalation exposures and of mg/kg-d for non-inhalation exposures.

REPRO/DEVEL: The reproductive system and developmental. Reproductive toxicity is defined here as the harmful effects on sexual function in males or females, fertility or gestation, caused by exposure of either parent to a substance. Reproductive toxicity also includes developmental effects on the offspring. Developmental toxicity is defined as the adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. Major manifestations of developmental toxicity include: death of the developing organism; induction of structural birth defects; altered growth; and functional deficiency.

RESP: The respiratory system. Respiratory toxicity is defined as the occurrence of adverse effects on the structure or function of the respiratory tract following exposure to a chemical substance, including respiratory tract injury or decreased ability of the lungs to function in gas exchange.

Risk: The estimated probability of adverse effects to human health, in this instance from the exposure to environmental hazards.

RISK_SUM: Risk sum is the calculated pollutant-specific estimated probability of developing cancer, based upon a specific exposure scenario and parameters (e.g., concentration, duration, pathway data) inputted by the user.

Sensitive Receptor: A location such as a hospital or daycare center where the human occupants are considered to be more sensitive to pollutants than “average”.

SKIN: The skin. Toxicity indicators include irritation of the skin.

Stationary Source: A non-mobile source of air pollutants which can be either a point or area source.

Stochastic Process: A process that involves random variation.

Volatile: Chemicals that rapidly pass off from the liquid state in the form of vapors.

Zone of Impact: The area in the vicinity of the facility in which an individual is exposed to a specified cancer risk.

Appendix: B

Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values

CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	MWAF[e]
ACETALDEHYDE	75-07-0	4.7E+02	12/08	3.0E+02	12/08	1.4E+02	12/08			2.7E-06	1.0E-02	4/99 [5/93]			1
ACETAMIDE	60-35-5									2.0E-05	7.0E-02	4/99			1
ACROLEIN	107-02-8	2.5E+00	12/08	7.0E-01	12/08	3.5E-01	12/08								1
ACRYLAMIDE	79-06-1									1.3E-03	4.5E+00	4/99 [7/90]			1
ACRYLIC ACID	79-10-7	6.0E+03	4/99												1
ACRYLONITRILE	107-13-1					5.0E+00	12/01			2.9E-04	1.0E+00	4/99 [1/91]			1
ALLYL CHLORIDE	107-05-1									6.0E-06	2.1E-02	4/99			1
2-AMINOANTHRAQUINONE	117-79-3									9.4E-06	3.3E-02	4/99			1
AMMONIA	7664-41-7	3.2E+03	4/99			2.0E+02	2/00								1
ANILINE	62-53-3									1.6E-06	5.7E-03	4/99			1
ARSENIC AND COMPOUNDS (INORGANIC)[TAC]	7440-38-2 1016 [1015]	2.0E-01	12/08	1.5E-02	12/08	1.5E-02	12/08	3.5E-06	12/08	3.3E-03 TAC	1.2E+01	7/90	1.5E+00	10/00	1
ARSINE	7784-42-1	2.0E-01	12/08	1.5E-02	12/08	1.5E-02	12/08								1
ASBESTOS[TAC, f]	1332-21-4									1.9E-04 TACf	2.2E+02	3/86			333.33
BENZENE[TAC]	71-43-2	2.7E+01	6/14	3.0E+00	6/14	3.0E+00	6/14			2.9E-05[TAC]	1.0E-01	1/85			1
BENZIDINE (AND ITS SALTS) *values also apply to:*	92-87-5									1.4E-01	5.0E+02	4/99 [1/91]			1
Benzidine based dyes	*1020*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
Direct Black 38	*1937-37-7*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
Direct Blue 6	*2602-46-2*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
Direct Brown 95 (technical grade)	*16071-86-6*									*1.4E-01*	*5.0E+02*	*4/99 [1/91]*			*1*
BENZYL CHLORIDE	100-44-7	2.4E+02	4/99							4.9E-05	1.7E-01	4/99			1
BERYLLIUM AND COMPOUNDS	7440-41-7 [1021]					7.0E-03	12/01	2.0E-03	12/01	2.4E-03	8.4E+00	4/99 [7/90]			1
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111-44-4									7.1E-04	2.5E+00	4/99			1
BIS(CHLOROMETHYL)ETHER	542-88-1									1.3E-02	4.6E+01	4/99 [1/91]			1
BROMINE AND COMPOUNDS	7726-95-6 [1040]														1
POTASSIUM BROMATE	7758-01-2									1.4E-04	4.9E-01	4/99 [10/93]			1

Table last updated: July 3, 2014

CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	MWAF[e]
1,3-BUTADIENE[TAC]	106-99-0	6.6E+02	7/13	9.0E+00	7/13	2.0E+00	7/13			1.7E-04 [TAC]	6.0E-01	7/92			1
CADMIUM AND COMPOUNDS[TAC]	7440-43-9 [1045]					2.0E-02	1/01	5.0E-04	10/00	4.2E-03 [TAC]	1.5E+01	1/87			1
CAPROLACTAM	105-60-2	5.0E+01	10/13	7.0E+00	10/13	2.2E+00	10/13								
CARBON DISULFIDE	75-15-0	6.2E+03	4/99			8.0E+02	5/02								1
CARBON MONOXIDE	630-08-0	2.3E+04	4/99												1
CARBON TETRACHLORIDE[TAC] (Tetrachloromethane)	56-23-5	1.9E+03	4/99			4.0E+01	1/01			4.2E-05 [TAC]	1.5E-01	9/87			1
CHLORINATED PARAFFINS	108171-26-2									2.5E-05	8.9E-02	4/99			1
CHLORINE	7782-50-5	2.1E+02	4/99			2.0E-01	2/00								1
CHLORINE DIOXIDE	10049-04-4					6.0E-01	1/01								1
4-CHLORO-O-PHENYLENEDIAMINE	95-83-0									4.6E-06	1.6E-02	4/99			1
CHLOROBENZENE	108-90-7					1.0E+03	1/01								1
CHLOROFORM[TAC]	67-66-3	1.5E+02	4/99			3.0E+02	4/00			5.3E-06 [TAC]	1.9E-02	12/90			1
Chlorophenols	*1060*														*1*
PENTACHLOROPHENOL	87-86-5									5.1E-06	1.8E-02	4/99			1
2,4,6-TRICHLOROPHENOL	88-06-2									2.0E-05	7.0E-02	4/99 [1/91]			1
CHLOROPICRIN	76-06-2	2.9E+01	4/99			4.0E-01	12/01								1
p-CHLORO-o-TOLUIDINE	95-69-2									7.7E-05	2.7E-01	4/99			1
CHROMIUM 6+[TAC] *values also apply to:*[g]	18540-29-9					2.0E-01	1/01	2.0E-02	10/00	1.5E-01 [TAC]	5.1E+02	1/86	5.0E-01	*1/14*	1
Barium chromate	*10294-40-3*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01* [TAC]	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.2053*
Calcium chromate	*13765-19-0*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01* [TAC]	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.3332*
Lead chromate	*7758-97-6*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01* [TAC]	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.1609*
Sodium dichromate	*10588-01-9*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01* [TAC]	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.397*
Strontium chromate	*7789-06-2*					*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*1.5E-01* [TAC]	*5.1E+02*	*1/86*	*5.0E-01*	*1/14*	*0.2554*
CHROMIUM TRIOXIDE (as chromic acid mist)	1333-82-0					2.0E-03	1/01	2.0E-02	10/00	1.5E-01 [TAC]	5.1E+02	1/86	5.0E-01	*1/14*	0.52
COPPER AND COMPOUNDS	7440-50-8 [1067]	1.0E+02	4/99												1
p-CRESIDINE	120-71-8									4.3E-05	1.5E-01	4/99			1
CRESOLS (mixtures of)	1319-77-3					6.0E+02	1/01								1
m-CRESOL	108-39-4					6.0E+02	1/01								1

Table last updated: July 3, 2014

CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	MWAF[e]
o-CRESOL	95-48-7					6.0E+02	1/01								1
p-CRESOL	106-44-5					6.0E+02	1/01								1
CUPFERRON	135-20-6									6.3E-05	2.2E-01	4/99			1
Cyanide Compounds (inorganic)	*57-12-5 1073*	*3.4E+02*	*4/99*			*9.0E+00*	*4/00*								*1*
HYDROGEN CYANIDE (Hydrocyanic acid)	74-90-8	3.4E+02	4/99			9.0E+00	4/00								1
2,4-DIAMINOANISOLE	615-05-4									6.6E-06	2.3E-02	4/99			1
2,4-DIAMINOTOLUENE	95-80-7									1.1E-03	4.0E+00	4/99			1
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96-12-8									2.0E-03	7.0E+00	4/99 [1/92]			1
p-DICHLOROBENZENE	106-46-7					8.0E+02	1/01			1.1E-05	4.0E-02	4/99 [1/91]			1
3,3-DICHLOROBENZIDINE	91-94-1									3.4E-04	1.2E+00	4/99 [1/91]			1
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75-34-3									1.6E-06	5.7E-03	4/99			1
1,1-DICHLOROETHYLENE ... (see Vinylidene Chloride)															
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117-81-7									2.4E-06	8.4E-03	4/99 [1/92]	8.4E-03	10/00	1
DIESEL EXHAUST ... (see Particulate Emissions from Diesel-Fueled Engines)															
DIETHANOLAMINE	111-42-2					3.0E+00	12/01								
p-DIMETHYLAMINOAZOBENZENE	60-11-7									1.3E-03	4.6E+00	4/99			1
N,N-DIMETHYL FORMAMIDE	68-12-2					8.0E+01	1/01								1
2,4-DINITROTOLUENE	121-14-2									8.9E-05	3.1E-01	4/99			1
1,4-DIOXANE (1,4-Diethylene dioxide)	123-91-1	3.0E+03	4/99			3.0E+03	4/00			7.7E-06	2.7E-02	4/99 [1/91]			1
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106-89-8	1.3E+03	4/99			3.0E+00	1/01			2.3E-05	8.0E-02	4/99 [1/92]			1
1,2-EPOXYBUTANE	106-88-7					2.0E+01	1/01								1
ETHYL BENZENE	100-41-4					2.0E+03	2/00			2.5E-06	8.7E-3	11/07			1
ETHYL CHLORIDE (Chloroethane)	75-00-3					3.0E+04	4/00								1
ETHYLENE DIBROMIDE[TAC] (1,2-Dibromoethane)	106-93-4					8.0E-01	12/01			7.1E-05 TAC	2.5E-01	7/85			1
ETHYLENE DICHLORIDE[TAC] (1,2-Dichloroethane)	107-06-2					4.0E+02	1/01			2.1E-05 TAC	7.2E-02	9/85			1
ETHYLENE GLYCOL	107-21-1					4.0E+02	4/00								1

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Substance	Chemical Abstract Number[b]	Noncancer Effects								Cancer Risk					
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ETHYLENE GLYCOL BUTYL ETHER … (see Glycol ethers)															
ETHYLENE OXIDE[TAC] (1,2-Epoxyethane)	75-21-8					3.0E+01	1/01			8.8E-05 TAC	3.1E-01	11/87			1
ETHYLENE THIOUREA	96-45-7									1.3E-05	4.5E-02	4/99			1
Fluorides	1101	2.4E+02	4/99			1.3E+01	8/03	4.0E-02	8/03						1
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664-39-3	2.4E+02	4/99			1.4E+01	8/03	4.0E-02	8/03						1
FORMALDEHYDE[TAC]	50-00-0	5.5E+01	12/08	9.0E+00	12/08	9.0E+00	12/08			6.0E-06 TAC	2.1E-02	3/92			1
GLUTARALDEHYDE	111-30-8					8.0E-02	1/01								1
GLYCOL ETHERS	1115														1
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111-76-2	1.4E+04	4/99												1
ETHYLENE GLYCOL ETHYL ETHER – EGEE	110-80-5	3.7E+02	4/99[1/92]			7.0E+01	2/00								1
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA	111-15-9	1.4E+02	4/99			3.0E+02	2/00								1
ETHYLENE GLYCOL METHYL ETHER – EGME	109-86-4	9.3E+01	4/99			6.0E+01	2/00								1
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110-49-6					9.0E+01	2/00								1
HEXACHLOROBENZENE	118-74-1									5.1E-04	1.8E+00	4/99 [1/91]			1
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608-73-1									1.1E-03	4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
alpha-HEXACHLOROCYCLOHEXANE	319-84-6									1.1E-03	4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
beta-HEXACHLOROCYCLOHEXANE	319-85-7									1.1E-03	4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58-89-9									3.1E-04	1.1E+00	4/99	1.1E+00	10/00	1
n-HEXANE	110-54-3					7.0E+03	4/00								1
HYDRAZINE	302-01-2					2.0E-01	1/01			4.9E-03	1.7E+01	4/99 [7/90]			1
HYDROCHLORIC ACID (Hydrogen chloride)	7647-01-0	2.1E+03	4/99			9.0E+00	2/00								1
HYDROGEN BROMIDE … (see Bromine & Compounds)															
HYDROGEN CYANIDE … (see Cyanide & Compounds)															

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CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
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HYDROGEN FLUORIDE ... (see Fluorides & Compounds)															
HYDROGEN SELENIDE ... (see Selenium & Compounds)															
HYDROGEN SULFIDE	7783-06-4	4.2E+01	4/99[7/90]			1.0E+01	4/00								1
ISOPHORONE	78-59-1					2.0E+03	12/01								
ISOPROPYL ALCOHOL (Isopropanol)	67-63-0	3.2E+03	4/99			7.0E+03	2/00								1
LEAD AND COMPOUNDS[TAC, h] (inorganic) *values also apply to:*	7439-92-1 1128 [1130]									1.2E-05 TAC	4.2E-02	4/97	8.5E-03	10/00	1
Lead acetate	*301-04-2*									*1.2E-05 TAC*	*4.2E-02*	*4/97*	*8.5E-03*	*10/00*	*0.637*
Lead phosphate	*7446-27-7*									*1.2E-05 TAC*	*4.2E-02*	*4/97*	*8.5E-03*	*10/00*	*0.7659*
Lead subacetate	*1335-32-6*									*1.2E-05 TAC*	*4.2E-02*	*4/97*	*8.5E-03*	*10/00*	*0.7696*
LINDANE ... (see gamma-Hexachlorocyclohexane)															
MALEIC ANHYDRIDE	108-31-6					7.0E-01	12/01								1
MANGANESE AND COMPOUNDS	7439-96-5 [1132]			1.7E-01	12/08	9.0E-02	12/08								1
MERCURY AND COMPOUNDS (INORGANIC)	7439-97-6 [1133]	6.0E-01	12/08	6.0E-02	12/08	3.0E-02	12/08	1.6E-04	12/08						1
Mercuric chloride	*7487-94-7*	*6.0E-01*	*12/08*	*6.0E-02*	*12/08*	*3.0E-02*	*12/08*	*1.6E-04*	*12/08*						*1*
METHANOL	67-56-1	2.8E+04	4/99			4.0E+03	4/00								1
METHYL BROMIDE (Bromomethane)	74-83-9	3.9E+03	4/99			5.0E+00	2/00								1
METHYL tertiary-BUTYL ETHER	1634-04-4					8.0E+03	2/00			2.6E-07	1.8E-03	11/99			1
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71-55-6	6.8E+04	4/99			1.0E+03	2/00								1
METHYL ETHYL KETONE (2-Butanone)	78-93-3	1.3E+04	4/99												1
METHYL ISOCYANATE	624-83-9					1.0E+00	12/01								1
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101-14-4									4.3E-04	1.5E+00	4/99			1
METHYLENE CHLORIDE[TAC] (Dichloromethane)	75-09-2	1.4E+04	4/99			4.0E+02	2/00			1.0E-06 TAC	3.5E-03	7/89			1
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101-77-9					2.0E+01	12/01			4.6E-04	1.6E+00	4/99	1.6E+00	10/00	1
METHYLENE DIPHENYL ISOCYANATE	101-68-8					7.0E-01	1/01								1
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90-94-8									2.5E-04	8.6E-01	4/99			1

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N-NITROSODI-n-BUTYLAMINE	924-16-3									3.1E-03	1.1E+01	4/99 [1/92]			1
N-NITROSODI-n-PROPYLAMINE	621-64-7									2.0E-03	7.0E+00	4/99 [1/91]			1
N-NITROSODIETHYLAMINE	55-18-5									1.0E-02	3.6E+01	4/99 [1/91]			1
N-NITROSODIMETHYLAMINE	62-75-9									4.6E-03	1.6E+01	4/99 [1/91]			1
N-NITROSODIPHENYLAMINE	86-30-6									2.6E-06	9.0E-03	4/99			1
N-NITROSO-N-METHYLETHYLAMINE	10595-95-6									6.3E-03	2.2E+01	4/99 [7/90]			1
N-NITROSOMORPHOLINE	59-89-2									1.9E-03	6.7E+00	4/99 [7/92]			1
N-NITROSOPIPERIDINE	100-75-4									2.7E-03	9.4E+00	4/99 [7/92]			1
N-NITROSOPYRROLIDINE	930-55-2									6.0E-04	2.1E+00	4/99 [7/90]			1
NAPHTHALENE ... (see Polycyclic aromatic hydrocarbons)															
NICKEL AND COMPOUNDS[TAC] *values also apply to:*	7440-02-0 [1145]	2.0E-01	3/12	6.0E-02	3/12	1.4E-02	3/12	1.1E-02	3/12	2.6E-04 TAC	9.1E-01	8/91			1
Nickel acetate	*373-02-4*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*0.3321*
Nickel carbonate	*3333-67-3*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*0.4045*
Nickel carbonyl	*13463-39-3*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*0.3438*
Nickel hydroxide	*12054-48-7*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*0.6332*
Nickelocene	*1271-28-9*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*0.4937*
NICKEL OXIDE	1313-99-1	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	2.0E-02	3/12	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			0.7859
Nickel refinery dust from the pyrometallurgical process	*1146*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*1*
Nickel subsulfide	*12035-72-2*	*2.0E-01*	*3/12*	*6.0E-02*	*3/12*	*1.4E-02*	*3/12*	*1.1E-02*	*3/12*	*2.6E-04* TAC	*9.1E-01*	*8/91*			*0.2443*
NITRIC ACID	7697-37-2	8.6E+01	4/99												1
NITROGEN DIOXIDE	10102-44-0	4.7E+02	4/99[1/92]												1
p-NITROSODIPHENYLAMINE	156-10-5									6.3E-06	2.2E-02	4/99			1
OZONE	10028-15-6	1.8E+02	4/99[1/92]												1
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES[TAC, f]	9901					5.0E+00 TAC	8/98			3.0E-04 TAC	1.1E+00	8/98			1

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PENTACHLOROPHENOL ... (see Chlorophenols)															
PERCHLOROETHYLENE[TAC] (Tetrachloroethylene)	127-18-4	2.0E+04	4/99			3.5E+01 TAC	10/91			5.9E-06 TAC	2.1E-02	10/91			1
PHENOL	108-95-2	5.8E+03	4/99			2.0E+02	4/00								1
PHOSGENE	75-44-5	4.0E+00	4/99												1
PHOSPHINE	7803-51-2					8.0E-01	9/02								1
PHOSPHORIC ACID	7664-38-2					7.0E+00	2/00								1
PHTHALIC ANHYDRIDE	85-44-9					2.0E+01	1/01								1
PCB (POLYCHLORINATED BIPHENYLS) (unspeciated mixture)[j]	1336-36-3									2.0E-05 [lowest risk] 1.1E-04 [low risk] 5.7E-04 [high risk]	7.0E-02 [lowest risk] 4.0E-01 [low risk] 2.0E+00 [high risk]	4/99	7.0E-02 [lowest risk] 4.0E-01 [low risk] 2.0E+00 [high risk]	10/00	1
PCB (POLYCHLORINATED BIPHENYLS (speciated)[k]															
3,3',4,4'-TETRACHLOROBIPHENYL (PCB 77)	32598-13-3					4.0E-01	8/03	1.0E-04	8/03	3.8E-03	1.3E+01	8/03	1.3E+01	8/03	1
3,4,4',5-TETRACHLOROBIPHENYL (PCB 81)	70362-50-4					1.3E-01	1/11	3.3E-05	1/11	1.1E-02	3.9E+01	1/11	3.9E+01	1/11	1
2,3,3',4,4'-PENTACHLOROBIPHENYL (PCB 105)	32598-14-4					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3,4,4',5-PENTACHLOROBIPHENYL (PCB 114)	74472-37-0					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3',4,4',5-PENTACHLOROBIPHENYL (PCB 118)	31508-00-6					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3',4,4',5'-PENTACHLOROBIPHENYL (PCB 123)	65510-44-3					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
3,3',4,4',5-PENTACHLOROBIPHENYL (PCB 126)	57465-28-8					4.0E-04	8/03	1.0E-07	8/03	3.8E+00	1.3E+04	8/03	1.3E+04	8/03	1
2,3,3',4,4',5-HEXACHLOROBIPHENYL (PCB 156)	38380-08-4					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
2,3,3',4,4',5'-HEXACHLOROBIPHENYL (PCB 157)	69782-90-7					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1

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2,3',4,4',5,5'-HEXACHLOROBIPHENYL (PCB 167)	52663-72-6					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
3,3',4,4',5,5'-HEXACHLOROBIPHENYL (PCB 169)	32774-16-6					1.3E-03	1/11	3.3E-07	1/11	1.1E+00	3.9E+03	1/11	3.9E+03	1/11	1
2,3,3',4,4',5,5'-HEPTACHLOROBIPHENYL (PCB 189)	39635-31-9					1.3E+00	1/11	3.3E-04	1/11	1.1E-03	3.9E+00	1/11	3.9E+00	1/11	1
POLYCHLORINATED DIBENZO-*P*-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[TAC, k]	1085 1086					4.0E-05	2/00	1.0E-08	10/00	3.8E+01 TAC	1.3E+05	8/86	1.3E+05 TAC	8/86	1
2,3,7,8-TETRACHLORODIBENZO-*P*-DIOXIN[TAC]	1746-01-6					4.0E-05	2/00	1.0E-08	10/00	3.8E+01 TAC	1.3E+05	8/86	1.3E+05 TAC	8/86	1
1,2,3,7,8-PENTACHLORODIBENZO-*P*-DIOXIN	40321-76-4					4.0E-05	8/03	1.0E-08	8/03	3.8E+01	1.3E+05	8/03	1.3E+05	8/03	1
1,2,3,4,7,8-HEXACHLORODIBENZO-*P*-DIOXIN	39227-28-6					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,6,7,8-HEXACHLORODIBENZO-*P*-DIOXIN	57653-85-7					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8,9-HEXACHLORODIBENZO-*P*-DIOXIN	19408-74-3					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-*P*-DIOXIN	35822-46-9					4.0E-03	2/00	1.0E-06	10/00	3.8E-01	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-*P*-DIOXIN	3268-87-9					1.3E-01	1/11	3.3E-05	1/11	1.1E-02	3.9E+01	1/11	3.9E+01	1/11	1
POLYCHLORINATED DIBENZOFURANS (PCDF)[TAC, k] (Treated as 2,3,7,8-TCDD for HRA)	1080					4.0E-05	2/00	1.0E-08	10/00	3.8E+01 TAC	1.3E+05	8/86	1.3E+05 TAC	8/86	1
2,3,7,8-TETRACHLORODIBENZOFURAN	5120-73-19					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8-PENTACHLORODIBENZOFURAN	57117-41-6					1.3E-03	1/11	3.3E-07	1/11	1.1E+00	3.9E +03	1/11	3.9E +03	1/11	1
2,3,4,7,8-PENTACHLORODIBENZOFURAN	57117-31-4					1.3E-04	1/11	3.3E-08	1/11	1.1E+01	3.9E +04	1/11	3.9E +04	1/11	1
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	70648-26-9					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	57117-44-9					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1

Table last updated: July 3, 2014

CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	MWAF[e]
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	72918-21-9					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	60851-34-5					4.0E-04	2/00	1.0E-07	10/00	3.8E+00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	67562-39-4					4.0E-03	2/00	1.0E-06	10/00	3.8E-01	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	55673-89-7					4.0E-03	2/00	1.0E-06	10/00	3.8E-01	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	39001-02-0					1.3E-01	1/11	3.3E-05	1/11	1.1E-02	3.9E +01	1/11	3.9E +01	1/11	1
POLYCYCLIC AROMATIC HYDROCARBON (PAH)[f] [Treated as B(a)P for HRA][f]	1150 1151									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
BENZ(A)ANTHRACENE[f]	56-55-3									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(A)PYRENE[f]	50-32-8									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
BENZO(B)FLUORANTHENE[f]	205-99-2									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(J)FLUORANTHENE[f]	205-82-3									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(K)FLUORANTHENE[f]	207-08-9									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
CHRYSENE[f]	218-01-9									1.1E-05	3.9E-02	4/99 [4/94]	1.2E-01	10/00 [4/94]	1
DIBENZ(A,H)ACRIDINE[f]	226-36-8									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
DIBENZ(A,H)ANTHRACENE[f]	53-70-3									1.2E-03	4.1E+00	4/99 [4/94]	4.1E+00	10/00 [4/94]	1
DIBENZ(A,J)ACRIDINE[f]	224-42-0									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
DIBENZO(A,E)PYRENE[f]	192-65-4									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
DIBENZO(A,H)PYRENE[f]	189-64-0									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1

Table last updated: July 3, 2014

CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	M[e] W A F
DIBENZO(A,I)PYRENE[l]	189-55-9									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
DIBENZO(A,L)PYRENE[l]	191-30-0									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
7H-DIBENZO(C,G)CARBAZOLE[l]	194-59-2									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
7,12-DIMETHYLBENZ(A)ANTHRACENE[l]	57-97-6									7.1E-02	2.5E+02	4/99 [4/94]	2.5E+02	10/00 [4/94]	1
1,6-DINITROPYRENE[l]	42397-64-8									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
1,8-DINITROPYRENE[l]	42397-65-9									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
INDENO(1,2,3-C,D)PYRENE[l]	193-39-5									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
3-METHYLCHOLANTHRENE[l]	56-49-5									6.3E-03	2.2E+01	4/99 [4/94]	2.2E+01	10/00 [4/94]	1
5-METHYLCHRYSENE[l]	3697-24-3									1.1E-03	3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
NAPHTHALENE	91-20-3					9.0E+00	4/00			3.4E-05	1.2E-01	8/04			1
5-NITROACENAPHTHENE[l]	602-87-9									3.7E-05	1.3E-01	4/99 [4/94]	1.3E-01	10/00 [4/94]	1
6-NITROCHRYSENE[l]	7496-02-8									1.1E-02	3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
2-NITROFLUORENE[l]	607-57-8									1.1E-05	3.9E-02	4/99 [4/94]	1.2E-01	10/00 [4/94]	1
1-NITROPYRENE[l]	5522-43-0									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
4-NITROPYRENE[l]	57835-92-4									1.1E-04	3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
POTASSIUM BROMATE.... ... (see Bromine & Compounds)															
1,3-PROPANE SULTONE	1120-71-4									6.9E-04	2.4E+00	4/99			1
PROPYLENE (PROPENE)	115-07-1					3.0E+03	4/00								1
PROPYLENE GLYCOL MONOMETHYL ETHER	107-98-2					7.0E+03	2/00								1
PROPYLENE OXIDE	75-56-9	3.1E+03	4/99			3.0E+01	2/00			3.7E-06	1.3E-02	4/99 [7/90]			1
SELENIUM AND COMPOUNDS[m]	7782-49-2 [1170]					2.0E+01	12/01	5.0E-03	12/01						1
HYDROGEN SELENIDE	7783-07-5	5.0E+00	4/99												1
Selenium sulfide	*7446-34-6*					*2.0E+01*	*12/01*	*5.0E-03*	*12/01*						*1*

Table last updated: July 3, 2014

CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	MWAF[e]
SILICA [CRYSTALLINE, RESPIRABLE]	1175					3.0E+00	2/05								1
SODIUM HYDROXIDE	1310-73-2	8.0E+00	4/99												1
STYRENE	100-42-5	2.1E+04	4/99			9.0E+02	4/00								1
SULFATES	9960	1.2E+02	4/99												1
SULFUR DIOXIDE	7446-09-5	6.6E+02	4/99[1/92]												1
SULFURIC ACID	7664-93-9	1.2E+02	4/99			1.0E+00	12/01								1
SULFUR TRIOXIDE	*7446-71-9*	*1.2E+02*	*4/99*			*1.0E+00*	*12/01*								*1*
OLEUM	8014-95-7	1.2E+02	4/99												1
1,1,2,2-TETRACHLOROETHANE	79-34-5									5.8E-05	2.0E-01	4/99			1
TETRACHLOROPHENOLS ... (see Chlorophenols)															
2,4,5-TRICHLOROPHENOL ... (see Chlorophenols)															
2,4,6-TRICHLOROPHENOL ... (see Chlorophenols)															
THIOACETAMIDE	62-55-5									1.7E-03	6.1E+00	4/99			1
TOLUENE	108-88-3	3.7E+04	4/99			3.0E+02	4/00								1
Toluene diisocyantates	*26471-62-5*					*7.0E-02*	*1/01*			*1.1E-05*	*3.9E-02*	*4/99*			*1*
TOLUENE-2,4-DIISOCYANATE	584-84-9					7.0E-02	1/01			1.1E-05	3.9E-02	4/99			1
TOLUENE-2,6-DIISOCYANATE	91-08-7					7.0E-02	1/01			1.1E-05	3.9E-02	4/99			1
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79-00-5									1.6E-05	5.7E-02	4/99			1
TRICHLOROETHYLENE[TAC]	79-01-6					6.0E+02	4/00			2.0E-06 [TAC]	7.0E-03	10/90			1
TRIETHYLAMINE	121-44-8	2.8E+03	4/99			2.0E+02	9/02								1
URETHANE (Ethyl carbamate)	51-79-6									2.9E-04	1.0E+00	4/99 [7/90]			1
Vanadium Compounds	*N/A*														*1*
Vanadium (fume or dust)	*7440-62-2*	*3.0E+01*	*4/99*												*1*
VANADIUM PENTOXIDE	1314-62-1	3.0E+01	4/99												1
VINYL ACETATE	108-05-4					2.0E+02	12/01								1
VINYL CHLORIDE[TAC] (Chloroethylene)	75-01-4	1.8E+05	4/99							7.8E-05 [TAC]	2.7E-01	12/90			1
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75-35-4					7.0E+01	1/01								1

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CONSOLIDATED TABLE OF OEHHA/ARB APPROVED RISK ASSESSMENT HEALTH VALUES[a]

Substance	Chemical[b] Abstract Number	Noncancer Effects								Cancer Risk					
		Acute Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	8-Hour Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Inhalation ($\mu g/m^3$)	Date[c] Value Reviewed [Added]	Chronic Oral (mg/kg-d)	Date[c] Value Reviewed [Added]	Inhalation[d] Unit Risk $(\mu g/m^3)^{-1}$	Inhalation[d] Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date[c] Value Reviewed [Added]	MWAF[e]
XYLENES (mixed isomers)	1330-20-7	2.2E+04	4/99			7.0E+02	4/00								1
m-XYLENE	108-38-3	2.2E+04	4/99			7.0E+02	4/00								1
o-XYLENE	95-47-6	2.2E+04	4/99			7.0E+02	4/00								1
p-XYLENE	106-42-3	2.2E+04	4/99			7.0E+02	4/00								1

Table last updated: July 3, 2014

Appendix: C
Table of Specific Pathways to be Analyzed for each Multipathway Substance

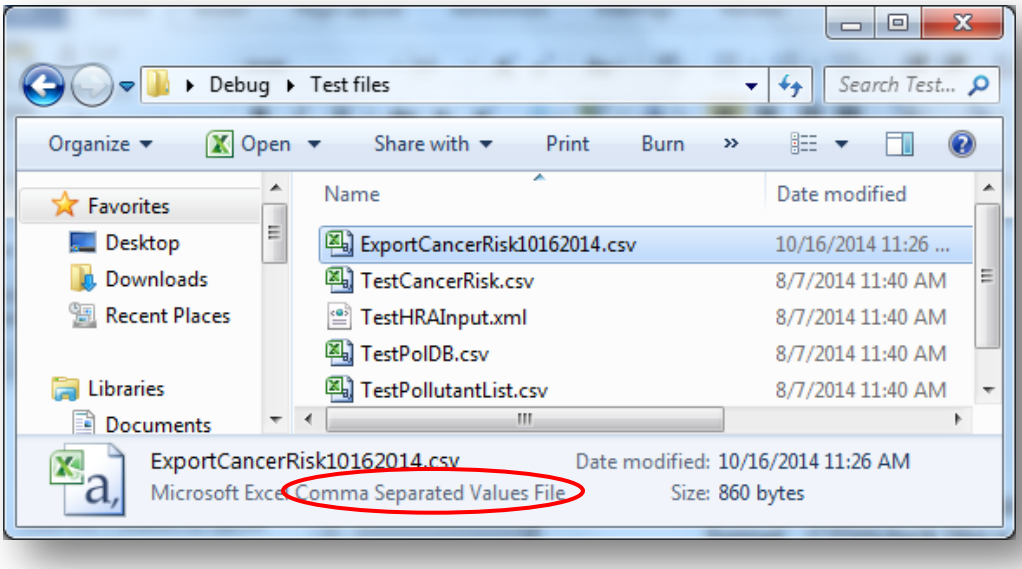
Table 7-1. Specific Pathways to be Analyzed for each Multipathway Substance[1]

Substance	Soil Ingestion	Dermal	Meat, Milk, & Egg Ingest.	Fish Ingest.	Exposed Vegetable Ingest.	Leafy Vegetable Ingest.	Protected Vegetable Ingest.	Root Vegetable Ingest.	Water Ingest.	Breast Milk Ingest.
Inorganic chemicals										
Arsenic & compounds	X	X	X	X	X	X	X	X	X	
Beryllium & compounds	X	X	X	X	X	X	X	X	X	
Cadmium & compounds	X	X	X	X	X	X	X	X	X	
Chromium VI & compounds	X	X	X[a]	X	X	X	X	X	X	
Fluorides (soluble compounds)	X	X	X		X	X	X	X	X	
Lead & compounds	X	X	X	X	X	X	X	X	X	X
Mercury & compounds	X	X	X	X	X	X	X	X	X	
Nickel & compounds	X	X	X	X	X	X	X	X	X	
Selenium & compounds	X	X	X	X	X	X	X	X	X	
Organic chemicals										
Creosotes	X	X	X	X	X	X			X	X
Diethylhexylphthalate	X	X	X	X	X	X			X	
Hexachlorobenzene	X	X	X	X	X	X			X	
Hexachlorocyclohexanes	X	X	X	X	X	X			X	
4,4'-Methylene dianiline	X	X			X	X			X	
Pentachlorophenol[b]										
PCBs	X	X	X	X	X	X			X	X
Polychlorinated dibenzo-p-dioxins and dibenzofurans	X	X	X	X	X	X			X	X
PAHs	X	X	X	X	X	X			X	X

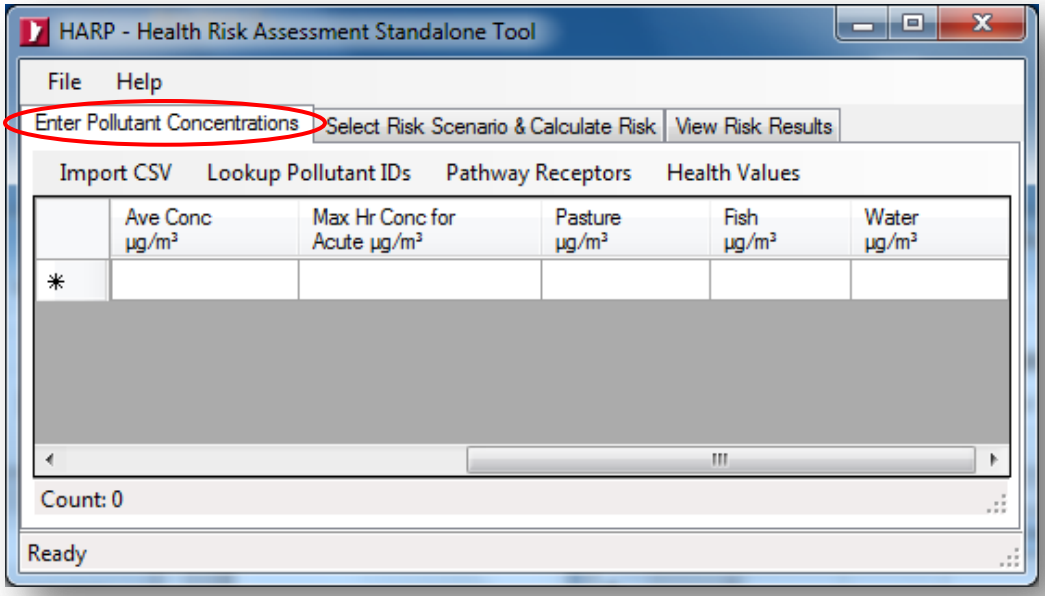
[1] OEHHA Guidance Manual, Table 5.1 Specific Pathways to be Analyzed for each Multipathway Substance.
[a] Cow's milk only; no multipathway analysis for meat and egg ingestion.
[b] Cow's milk only; no multipathway analysis for meat and egg ingestion.

Appendix: D
How to Format a CSV File for Import

A CSV file allows data to be saved in a table structured format, such as the pollutant concentrations table in the ***Enter Pollutant Concentrations*** tab. Traditionally, CSVs take the form of a text file containing information separated by commas, hence the name.



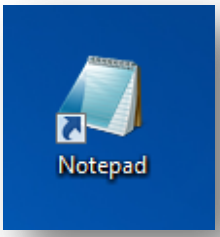
CSV is the file format that RAST accepts. Knowing how to format a CSV can allow you to more efficiently import ground level pollutant concentrations in the ***Enter Pollutant Concentrations*** screen.



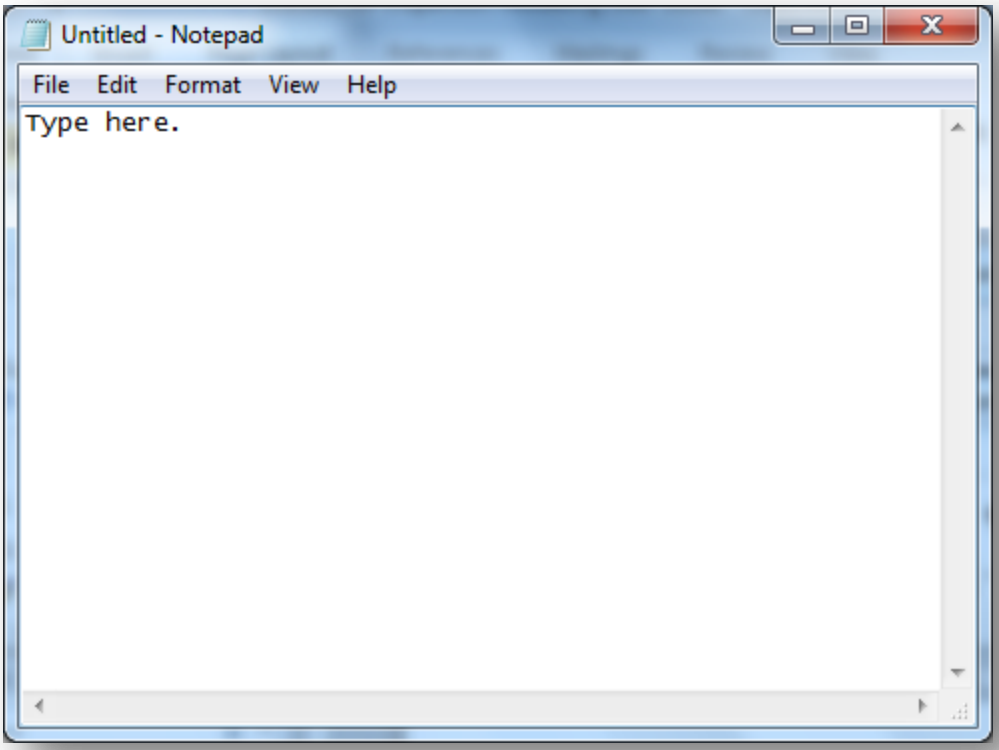
First, choose a spreadsheet application or text editor. Example programs include:

- Notepad
- Microsoft Excel

For this example, we will use Notepad. First, open your program by double-clicking its icon.

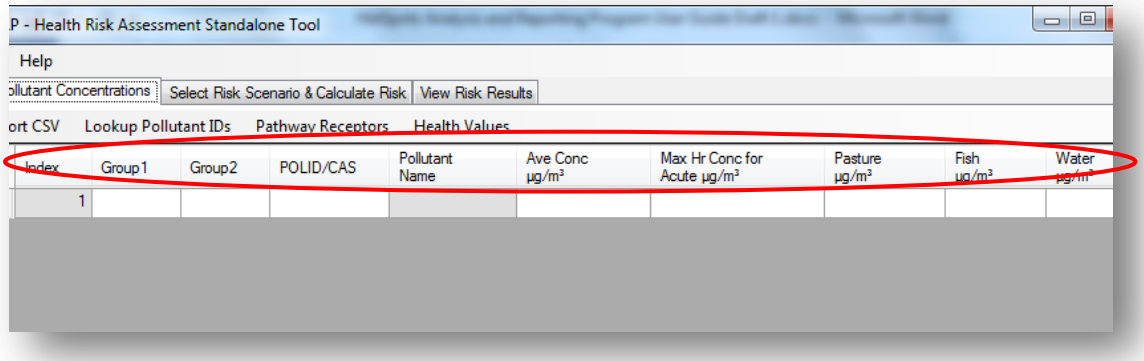


Notepad (or your alternative program) will open its text workspace. Enter the pollutant values separated by commas.



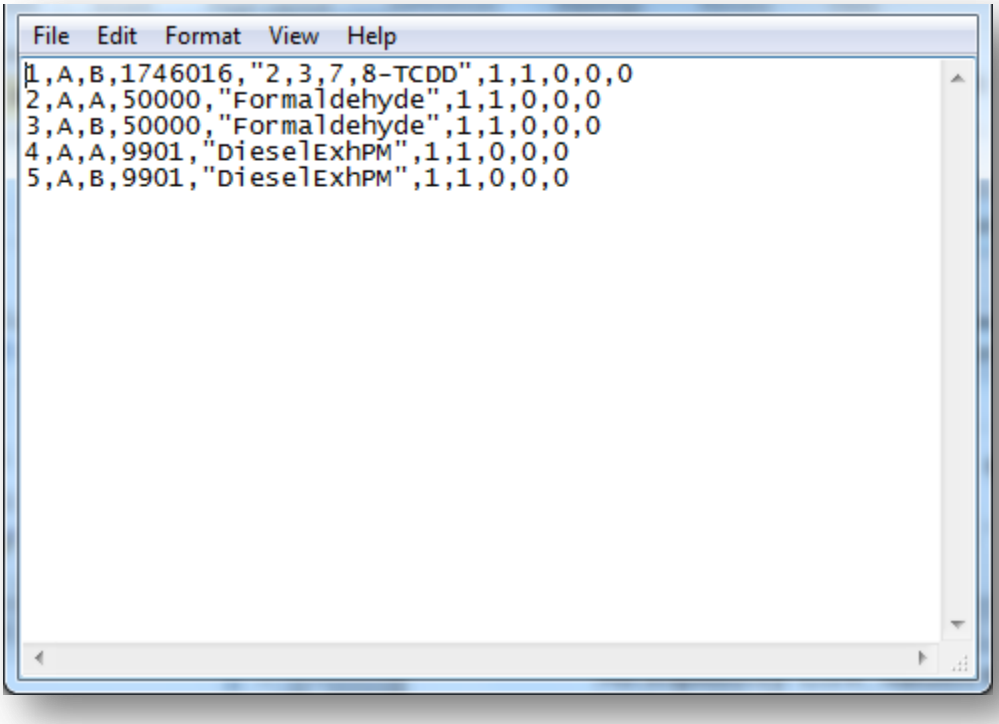
Your values should be typed in the same order as the ***Enter Pollutant Concentrations*** table. Do not include units, column names, or spaces in between commas. Separate each record by one line break.

Values should be entered in the following order: ***Index***, ***Group1***, ***Group2***, ***POLID/CAS***, ***Pollutant Name***, ***Ave Conc µg/m^3***, ***Max Hr Conc µg/m^3***, ***Pasture***, ***Fish***, and ***Water***.



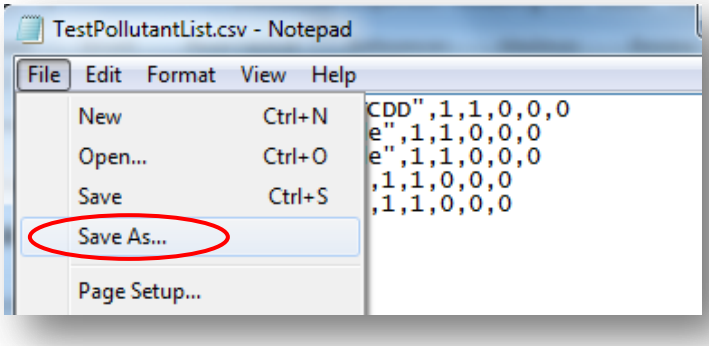
To find the correct ***POLID/CAS*** for your pollutant, refer to the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (http://www.arb.ca.gov/toxics/healthval/contable.pdf). If two numbers are available, select the number that is not four digits long; it may result in an error. You can also use

the module's ***Lookup Pollutant IDs*** tool. If you have no ***Pasture***, ***Fish***, or ***Water*** pollutant concentration data, type 0 as your value. Below is an example of five pollutant concentration records.

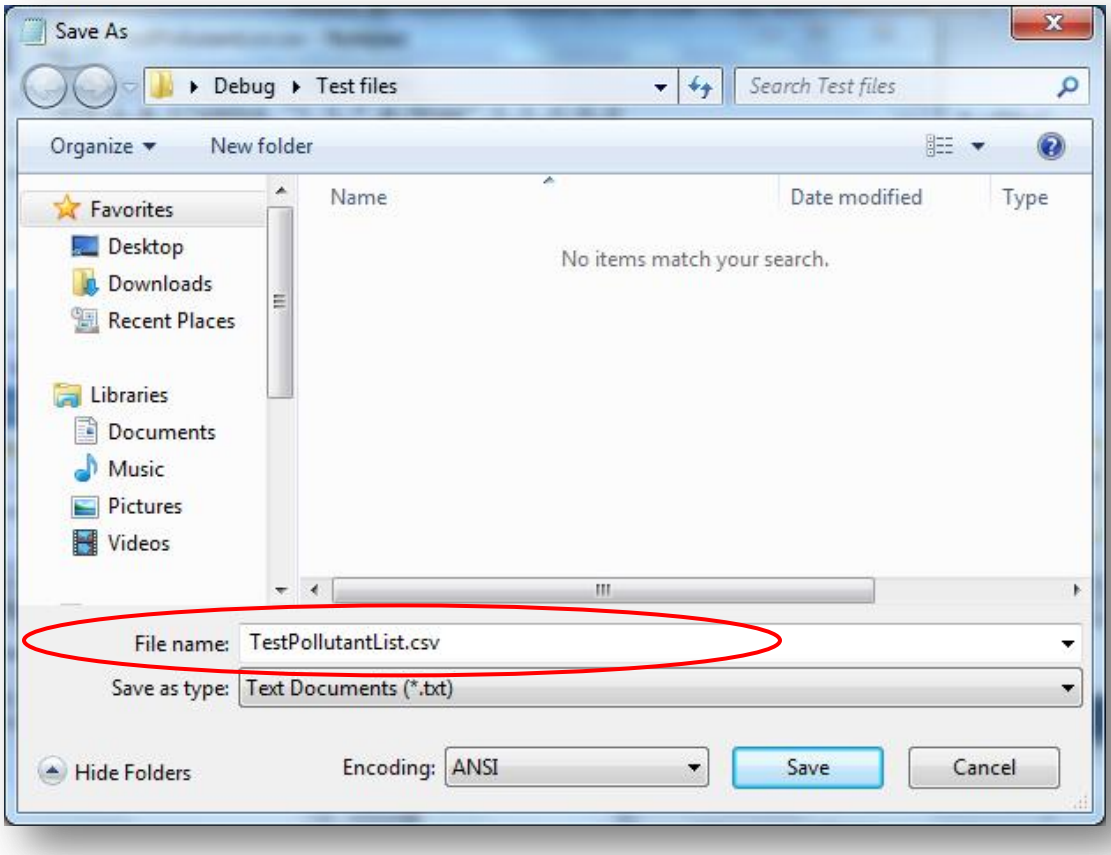


- Note: *If special characters (. - , * ? ! / &) are included in your group or pollutant name, quotes are required*. For example, while quotes around ***Formaldehyde*** is optional, ***2,3,7,8-TCDD*** or a group name with special characters would require them.

Next, save your file as a CSV by clicking ***File\Save As***.

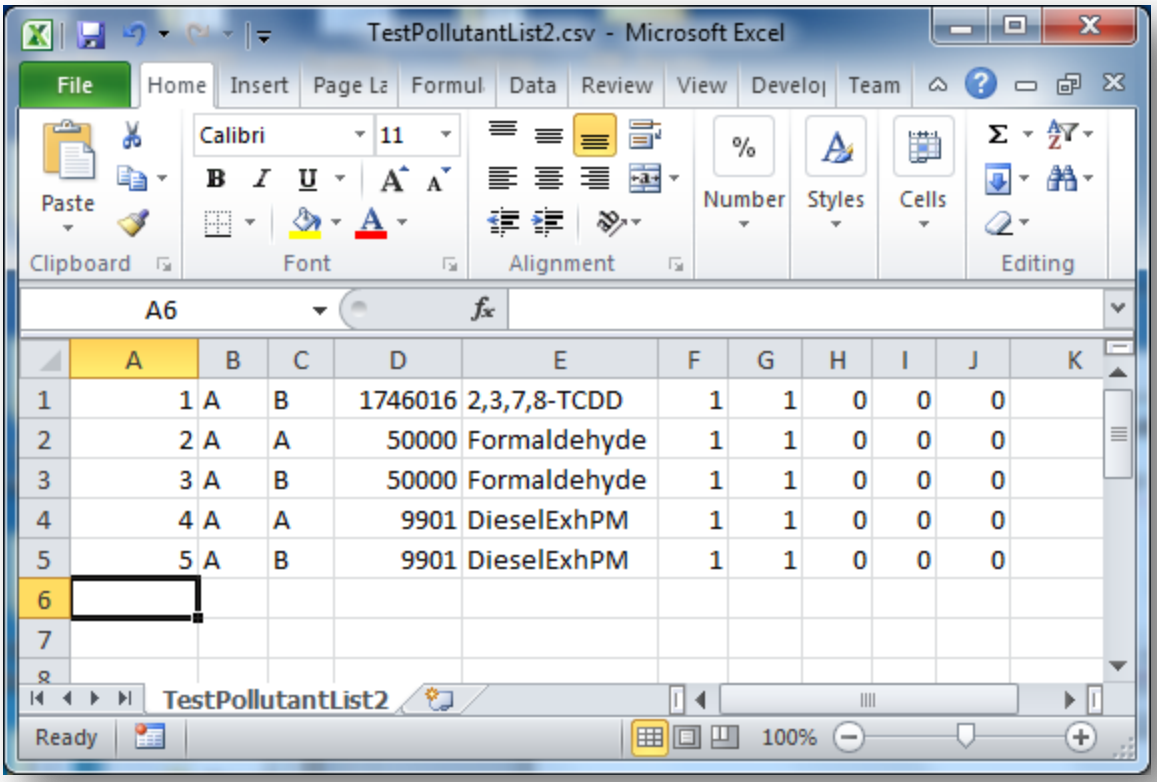


Designate the file location and name. Include ***.csv*** at the end of the filename. In this example, it will be ***TestPollutantList.csv*** and it is being saved to the ***Test files*** folder.



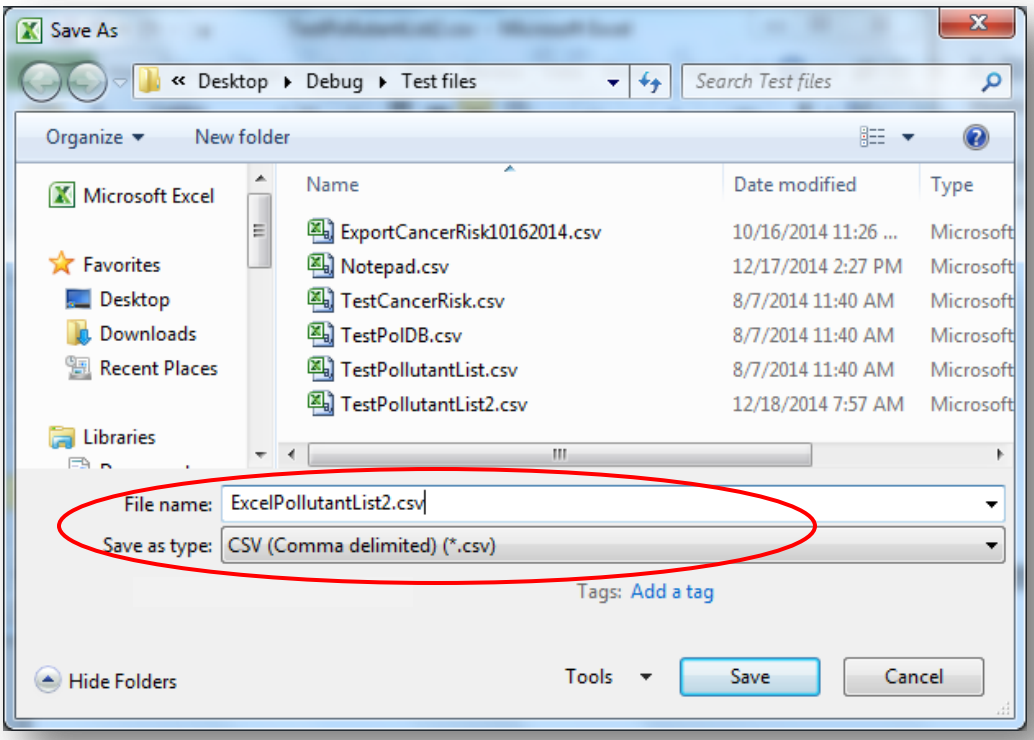
Save as type should be CSV, but if not available, choose ***Text Documents (*.txt)***, and end the filename with ***.csv***. Click ***Save***. Your pollutant file is ready to import later into the module.

A CSV file may also be created in spreadsheet form. But instead of using commas, values and records are separated by cells, and column names and units are omitted. Below is an example of what the previous information in Notepad would look like in Microsoft Excel. When using a spreadsheet like Excel, quotes are not required for values containing special characters.



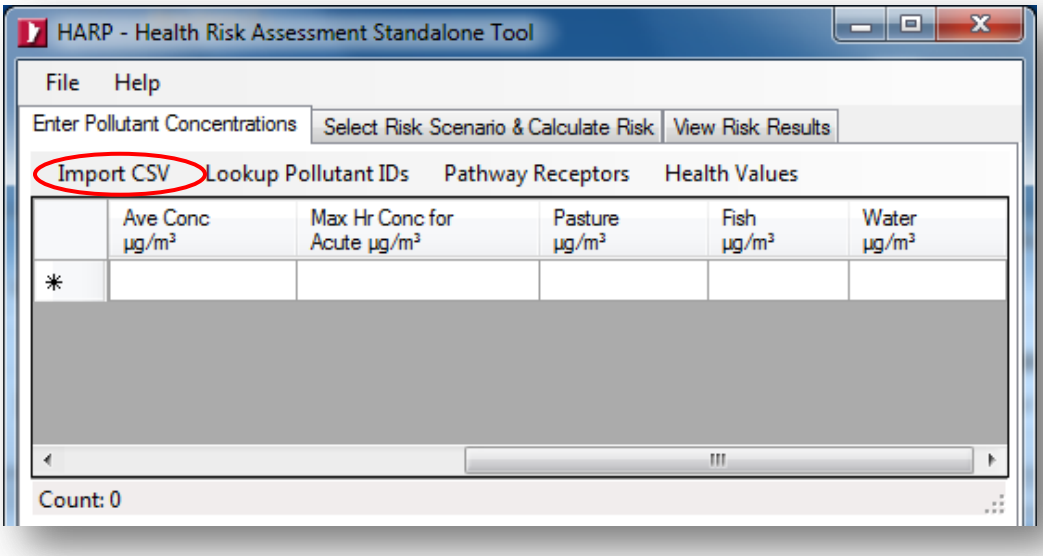
- Note: If the ***Pollutant Name*** field (column E) is not filled, the module will be able to generate that information from the ***POLID/CAS*** (column D).

In your program's spreadsheet, click ***File\Save As***, and choose ***CSV (comma delimited)*** for your ***Save as type***.

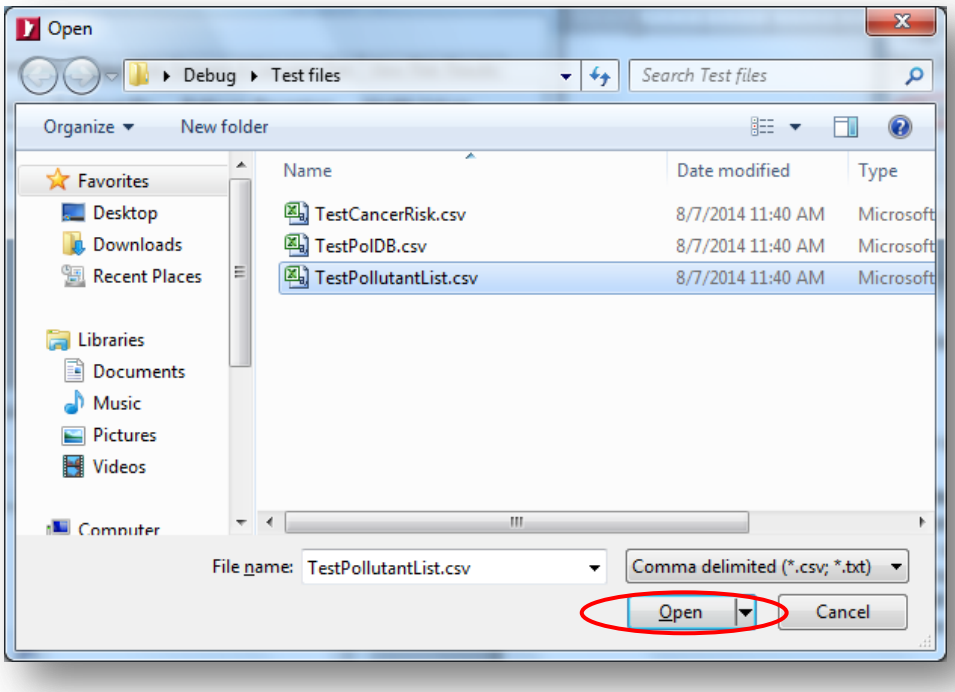


End your filename with ***.csv***. In this example, the filename is ***ExcelPollutantList2.csv***. Your pollution data is now ready for importing.

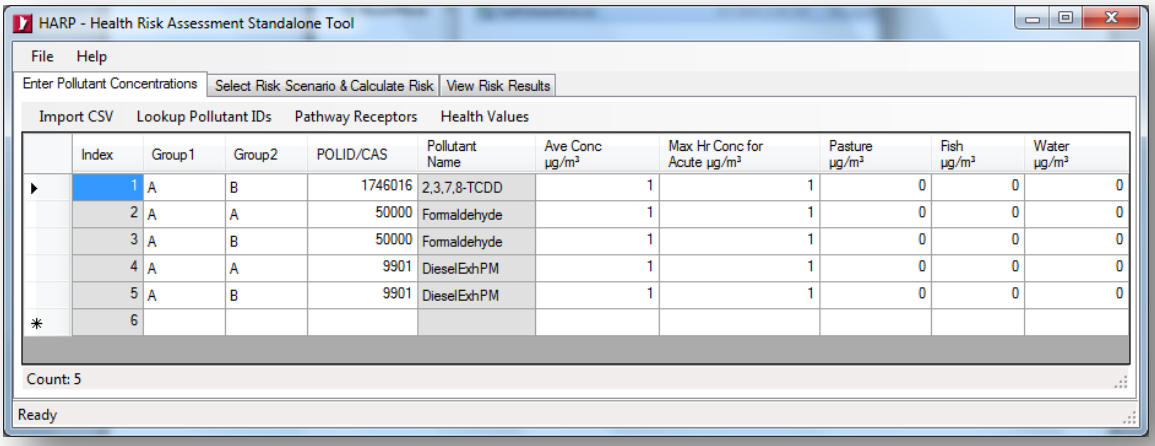
To use your CSV file with ground level concentrations data, go back in the program. On the ***Enter Pollutant Concentrations*** screen, choose ***Import CSV*** in the ribbon.



Locate the CSV file you wish to use. Be sure it is a ***.csv*** file, and click ***Open***.

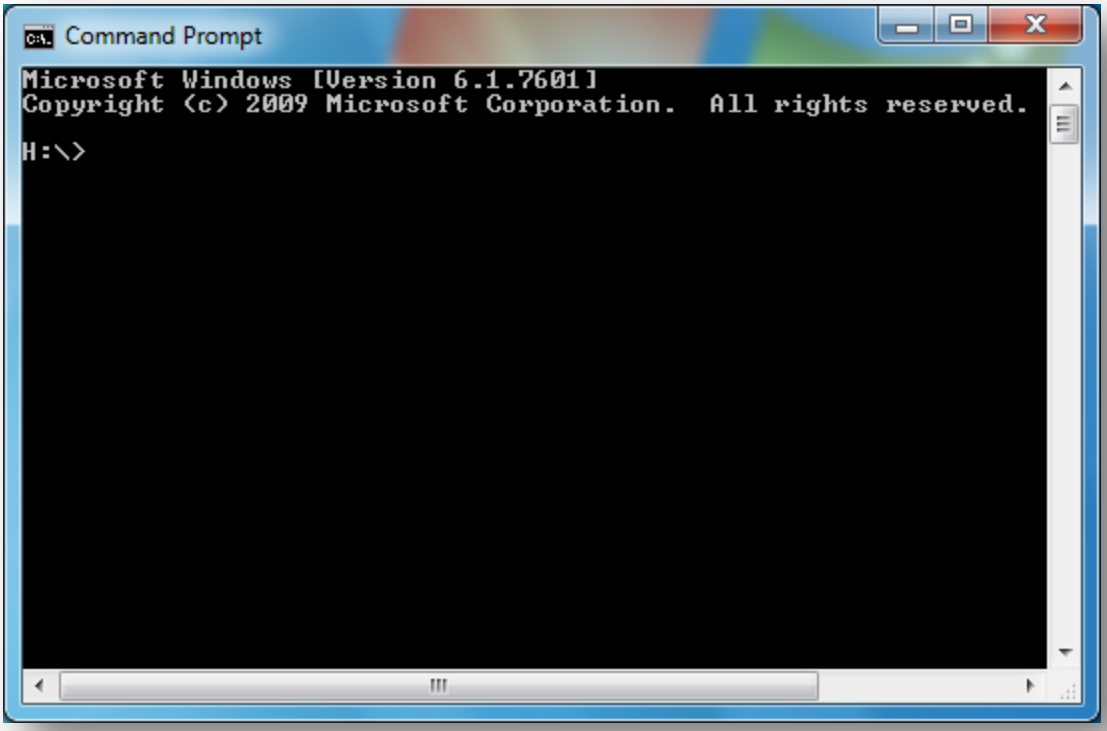


Your data will populate the ground level concentrations table in the program.



Appendix: E
How to Use the Command Prompt to Calculate Risk from Data Inputted in Another Program

The ***Command Prompt*** window is an entry point for typing computer commands to perform various functions, like communicating with the RAST risk calculator.



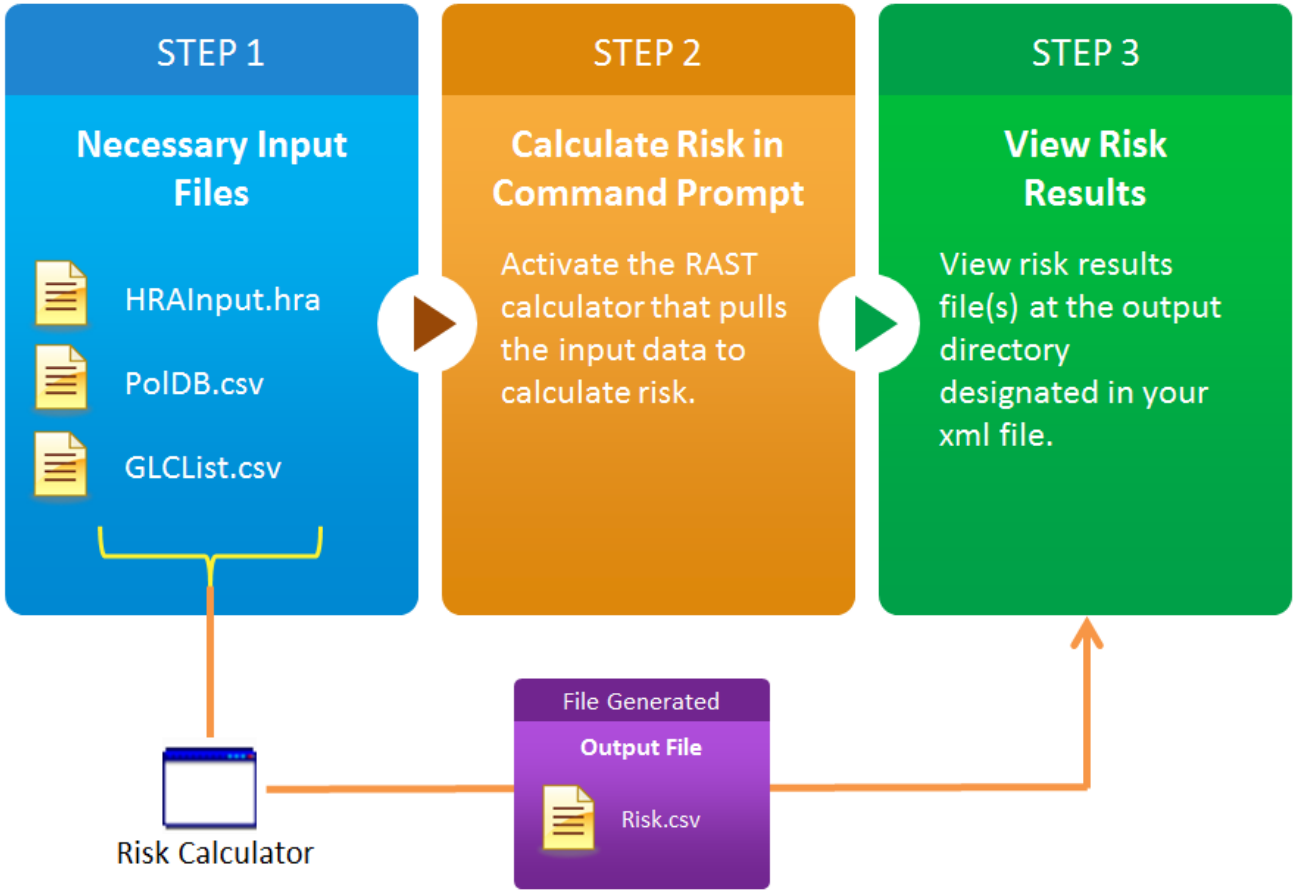
By typing commands at the ***Command Prompt***, you can perform tasks on your computer without using the Windows graphical interface. In the case with RAST, you may calculate risk without using the RAST user interface, provided the necessary data is available. You will need three components:

1. The Command Prompt;
2. The RAST HRACalc.exe file (calculator);
3. A .hra file with all of your risk scenario inputs.

- Note: Your .hra input file will require pathways to other files that have stored your GLC (GLCList.csv) and pollutant database information (PolDB.csv). Without them, error messages will occur.

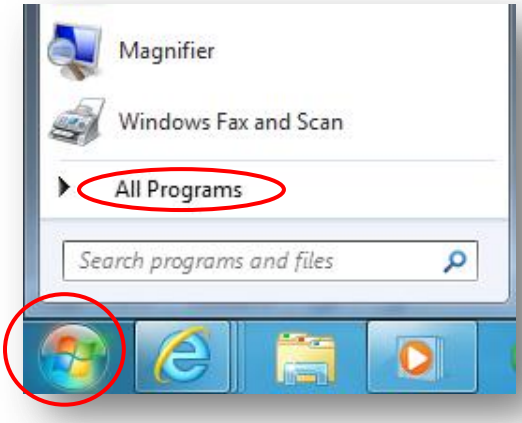
The pollutant and risk scenario inputs you need may come from files exported by RAST or another compatible program. The next page is a visual of how the Command Line process works.

Process Flow for Using Command Prompt to Calculate Risk Outside of Module Interface

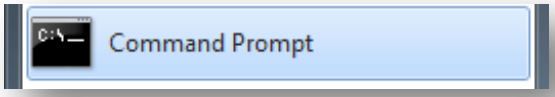


First, open the program. There are several ways to do this, of which two are shown here.

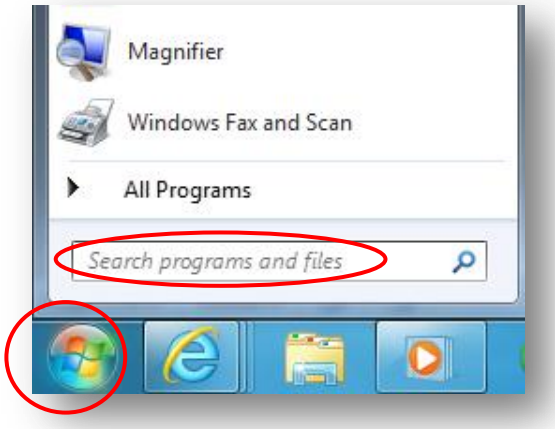
1. From your desktop, click the ***Start*** button, ***All Programs\Accessories***.



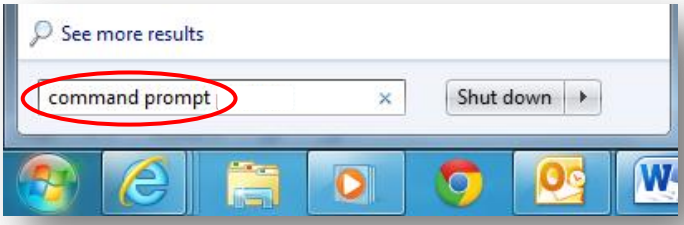
Then click ***Command Prompt***.



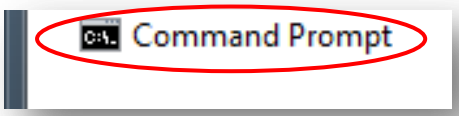
2. You can also click the ***Start*** button and go to the ***Search*** box.



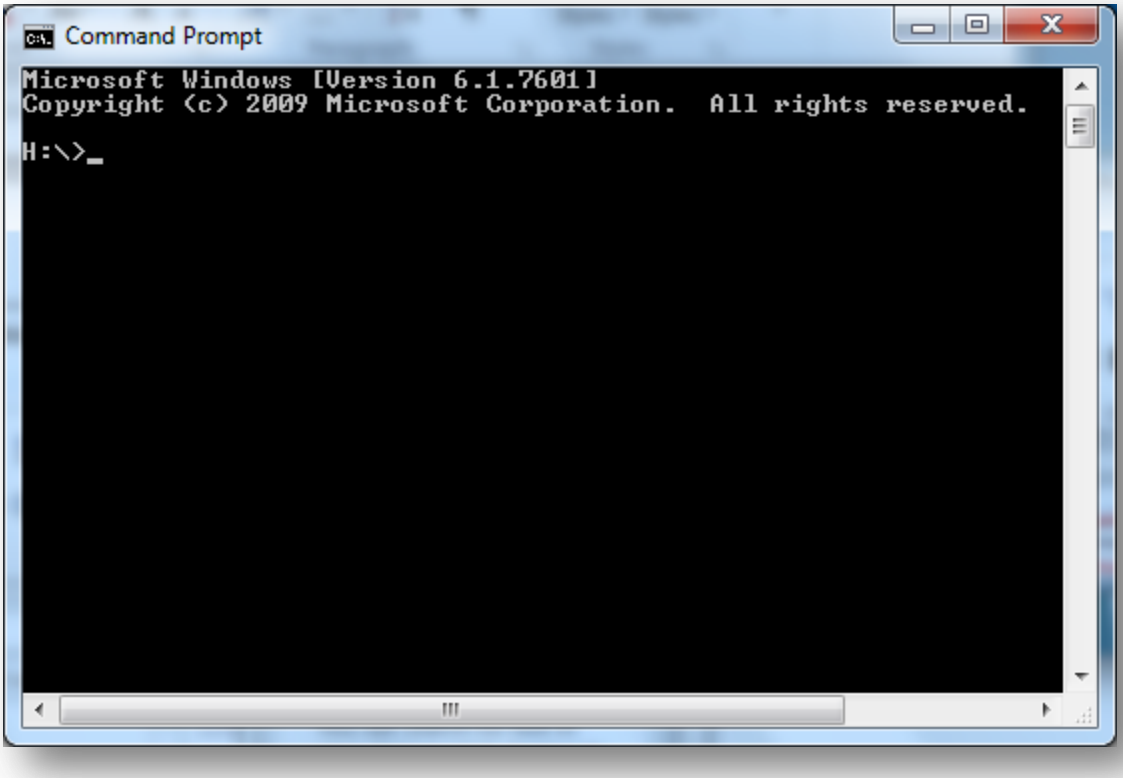
Type ***Command Prompt***.



In the list of results, double-click ***Command Prompt***.

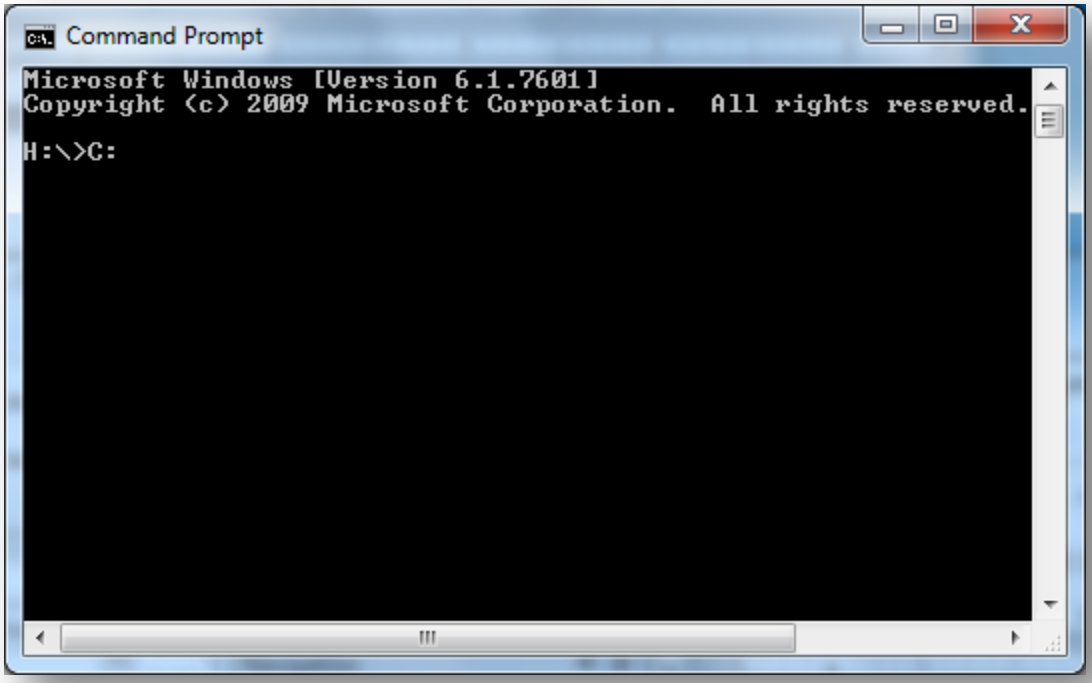


In this example, the Command Prompt opens with drive H, as indicated by ***H:\>***.

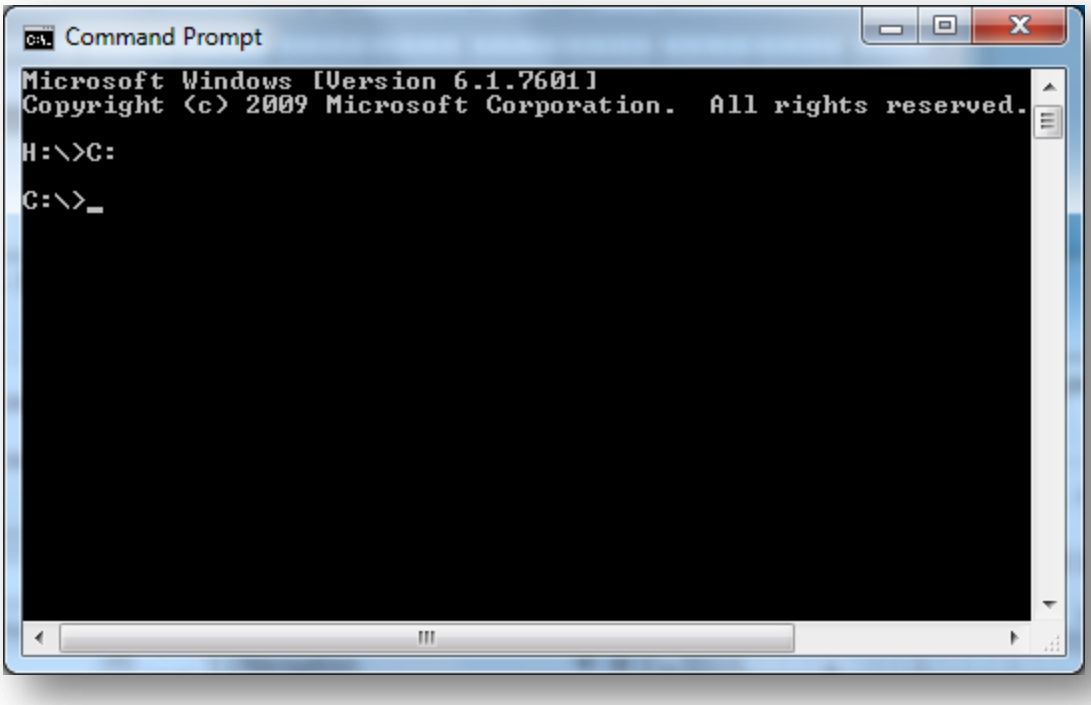


However, the default location of RAST is your hard drive, drive C. Upon opening the Command Prompt, if you are not in drive C, do so by typing ***C:*** and hit enter. Likewise, if RAST is located in a drive other than C, move to that drive instead. You may double check which drive the module is located in by opening the drive beforehand.

Hard drives can be accessed by clicking ***Start*** ***\Computer***.

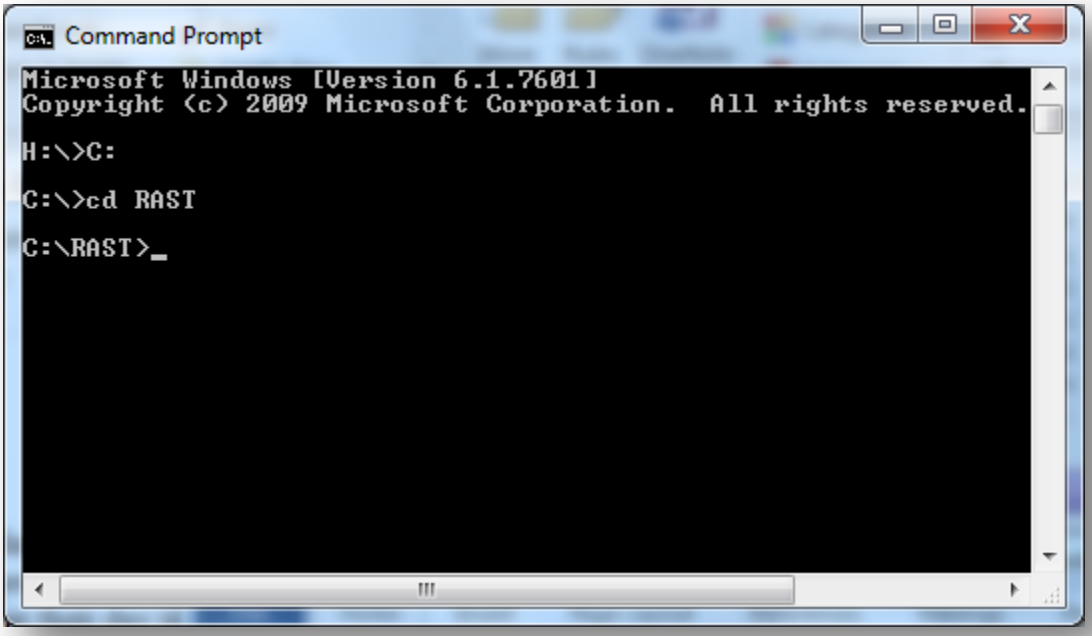


As indicated by ***C:\>***, you are now in drive C.

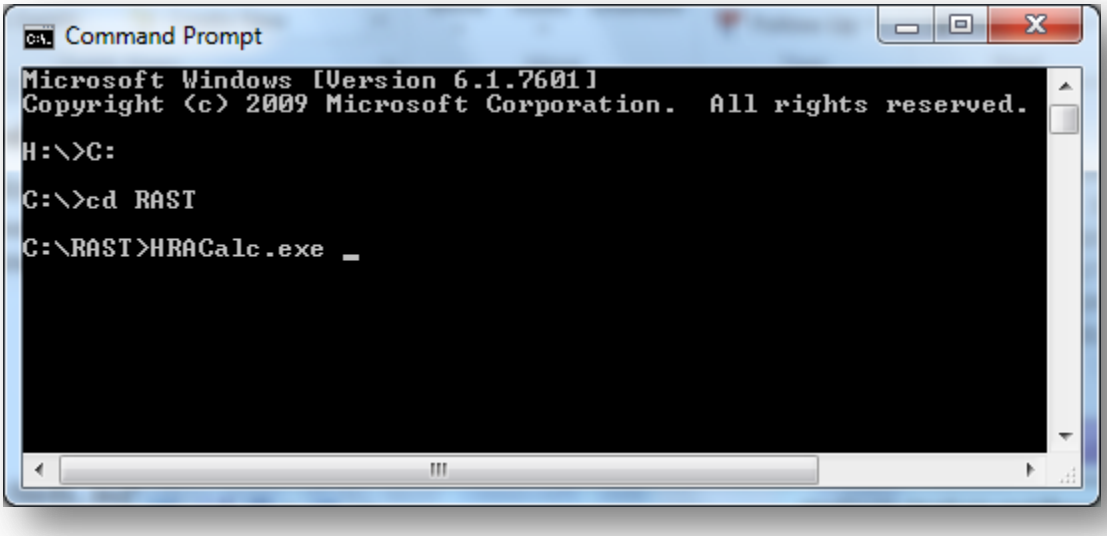


Now that you are in the correct drive where RAST is located, determine the calculator's directory, or file pathway. In other words, the folder(s) under which it is located. In this example, the module's directory folder is ***RAST***. This can be seen by opening hard drive C, as shown below. Notice the calculator (HRACalc.exe) that you need is there.

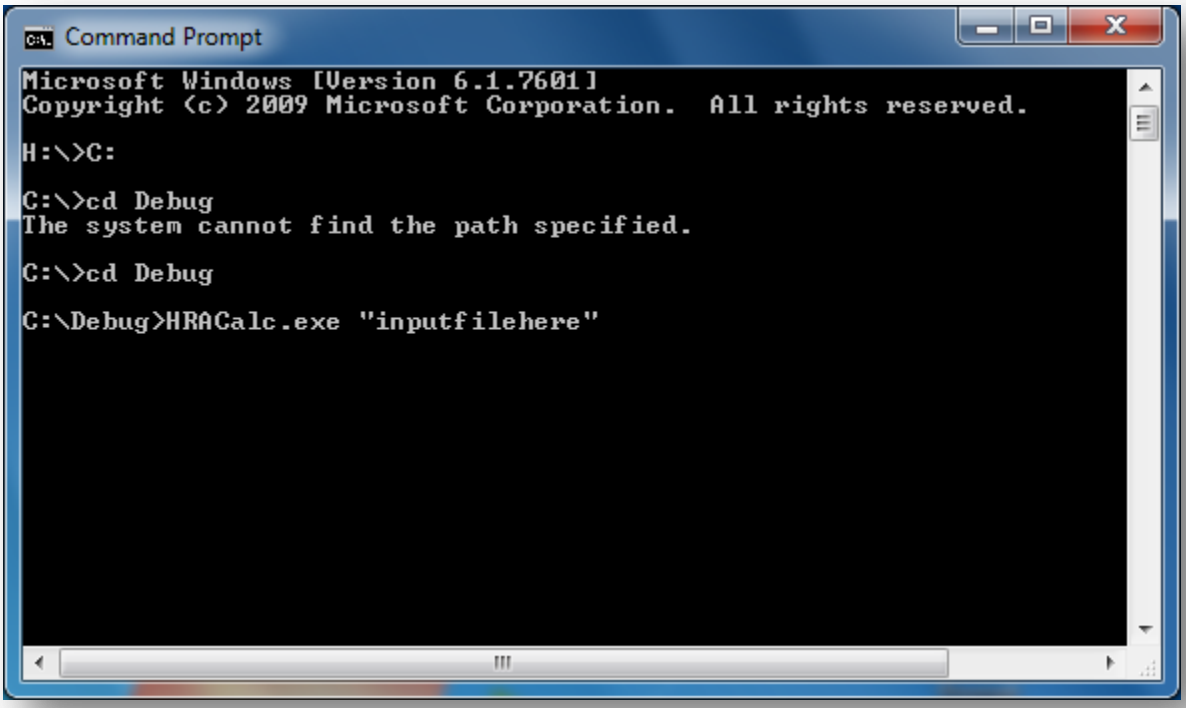
Now that the calculator's filename and directory has been determined, switch directories to that one in the Command Prompt. Do so by typing ***cd*** (change directory) and the directory folder (***RAST***). Hit enter. ***C:\RAST>*** will appear next, and indicate that you are in that directory.



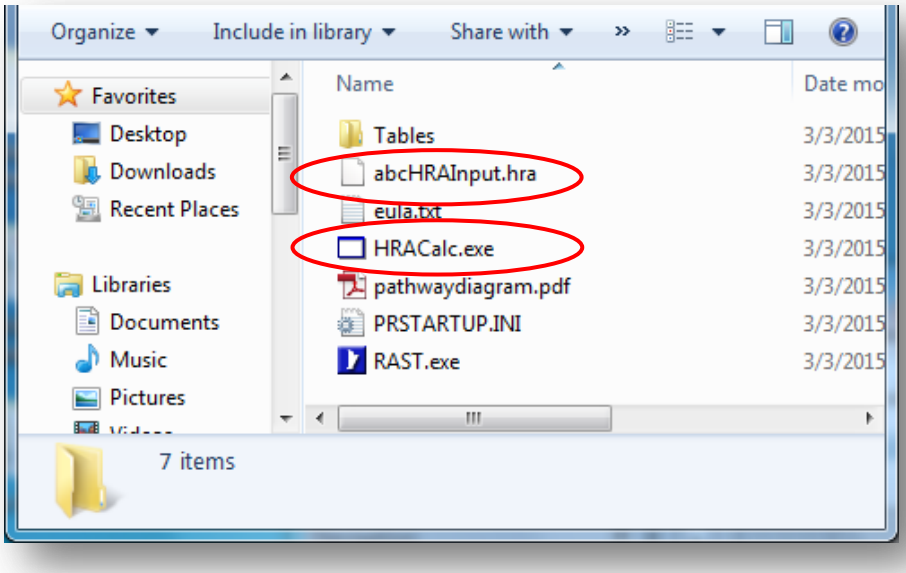
Then, type in the calculator's filename. Unless renamed, recall it is ***HRACalc.exe***. Do *not* hit enter yet, because the calculator will look for files that are not yet specified.



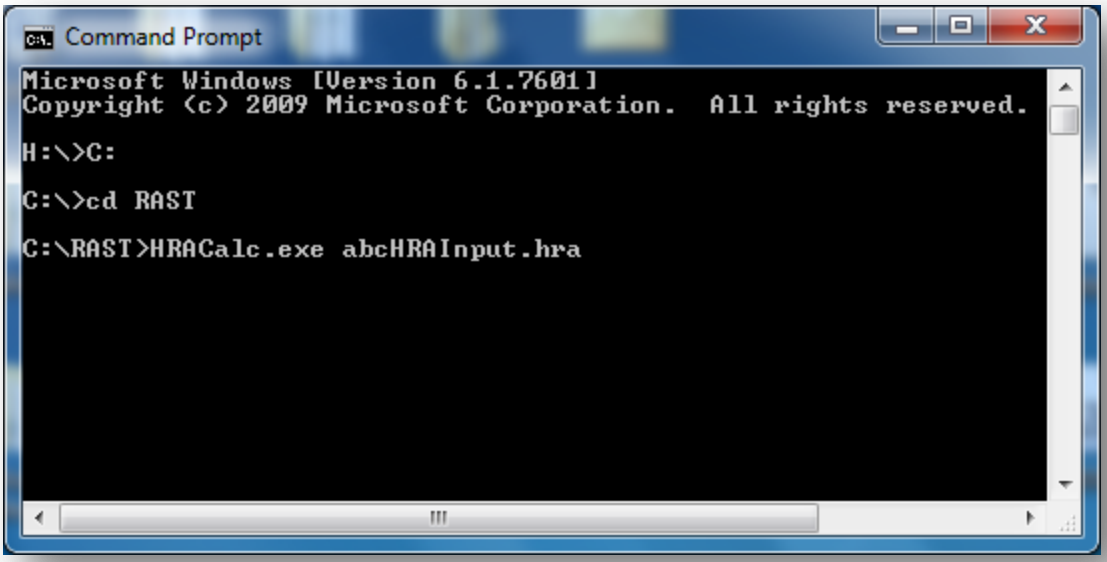
Next you will specify your .hra filename next to the calculator, designated by ***"inputfilehere"***.



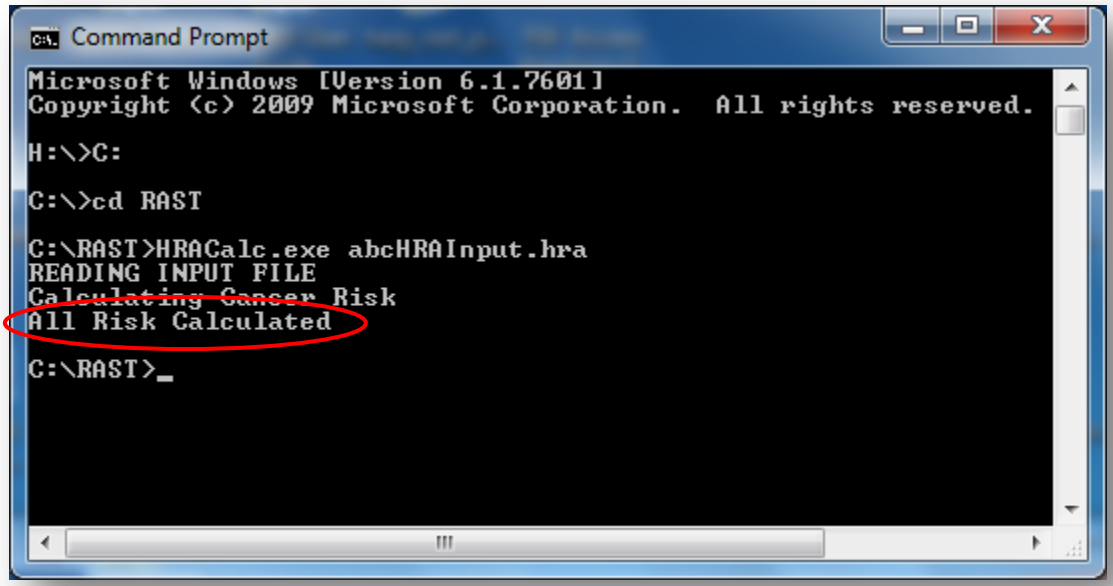
Be sure that the .hra file is located in the same directory as the calculator. In this scenario, the filename is ***abcHRAInput.hra*** and it is properly located in the same directory as the calculator, in C:\RAST.



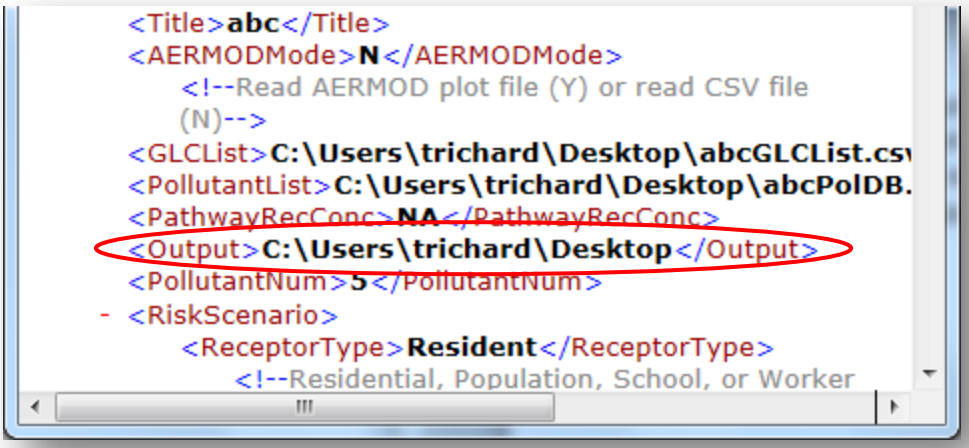
Thus, ***abcHRAInput.hra*** should be typed next to HRACalc.exe, with or without quotes.



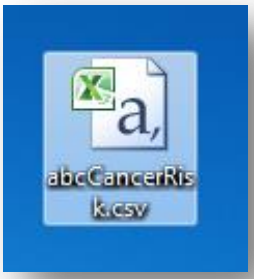
Hit enter.



The Command Prompt will notify you that risk has been calculated, exported, and saved as CSV to a location designated in your .hra file. The locations at which your risk results have been saved are shown in the .hra input file in the ***<Output>*** tag.



In this example, the risk results will be found on the ***Desktop***.



The CSV file will be named according to your chosen filename prefix and risk assessment-type. In this case, the risk results are generated for a cancer risk assessment with prefix ***abc*** and is consequently named ***abcCancerRisk.csv***. Double-click the file icon to see your results.