State of California
California Environmental Protection Agency

Air Resources Board
Transportation & Toxics Division
P.O. Box 2815
Sacramento, California 95812-2815

USER MANUAL
FOR THE
HOTSPOTS ANALYSIS AND REPORTING PROGRAM
AIR DISPERSION MODELING AND RISK ASSESSMENT TOOL
VERSION 2

Last Revised: March 17, 2015

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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 ADMRT.

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?

As described above, there are three distinct tools for HARP 2, referred to as the Emission Inventory Module (EIM), Air Dispersion Modeling and Risk Assessment Tool (ADMRT), and the Health Risk Assessment Standalone Tool (RAST). This document relates to information about the HARP 2 ADMRT. It is organized, into three steps, in the

sequence that one would conduct an air dispersion model and health risk assessment. *Help* topics and ***ADVANCED FEATURES*** are provided throughout the guide.

- Step I requires entering air dispersion data needed to run AERMOD.
- Step II explains how to import the results from AERMOD in order to calculate pollutant specific ground level concentrations (GLCs) from the emission inventory.
- Step III provides the calculated risk based on the OEHHA risk assessment guidelines and exports risk data to various formats.

B. What can HARP 2 Air Dispersion Modeling and Risk Assessment Tool do?

HARP 2 ADMRT assists with setting up and running an air dispersion analysis using AERMOD. From these results the user is able to estimate health impacts at one or 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.

- 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* (OEHHA, 2012). All equations, default parameter values, and variable distributions encoded into HARP 2 are from the OEHHA Guidance Manual.

Table 1-1 below describes ADMRT in relation to the other two modules.

- Note: *HARP 2 ADMRT 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 are to be added in subsequent versions of HARP 2.

[2] Note: *HARP 2 ADMRT 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 can only calculate risk for pollutants that have health values approved for use in the AB 2588 program. These are listed in Table 1-2. For a current table of approved heath 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
- 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
- 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)

Table 1-2. Pollutants with OEHHA/ARB Approved Risk Assessment Health Values[1] (Continued)	
• Di(1-ethylhexyl)phthalate (DEHP) • 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) • 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.

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

The list contains pollutants for which there are exceptions when calculating risk in the ADMRT. 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 2.

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 ADMRT 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.

2. GETTING STARTED & PROCESS OVERVIEW

This section provides information for installing and running the program.

A. System Requirements

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

Minimum System Requirements

- The current version of HARP 2 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.
- 2GB of RAM
- 200 MB of free space for program files
- The amount of storage space required on the hard disk will depend greatly on the output options selected in the air dispersion analysis. Some of the optional output files of concentration and risk data can be very large.

Credits in Software Used

The contouring subroutine used for contouring the risk results was adapted from the Fortran-77 routine CONREC.F developed by Paul D. Bourke. It is available at http://paulbourke.net/.

The visual chart used to plot air dispersion information uses the NPlot library. NPlot is a free charting library for .NET. The latest copy is available at http://sourceforge.net/projects/nplot/files/

B. Installing HARP 2 ADMRT

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

Click the *HARP 2 Air Dispersion Modeling and Risk Assessment Tool* link. Follow the online instructions for complete details on how to download the installation software.

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

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. During the installation process, the installer will create a

HARP folder on your desktop. The HARP folder will contain shortcuts to the HARP 2 ADMRT.

Note the HARP 2 ADMRT can be installed to a computer with an older version of the HARP 1 series.

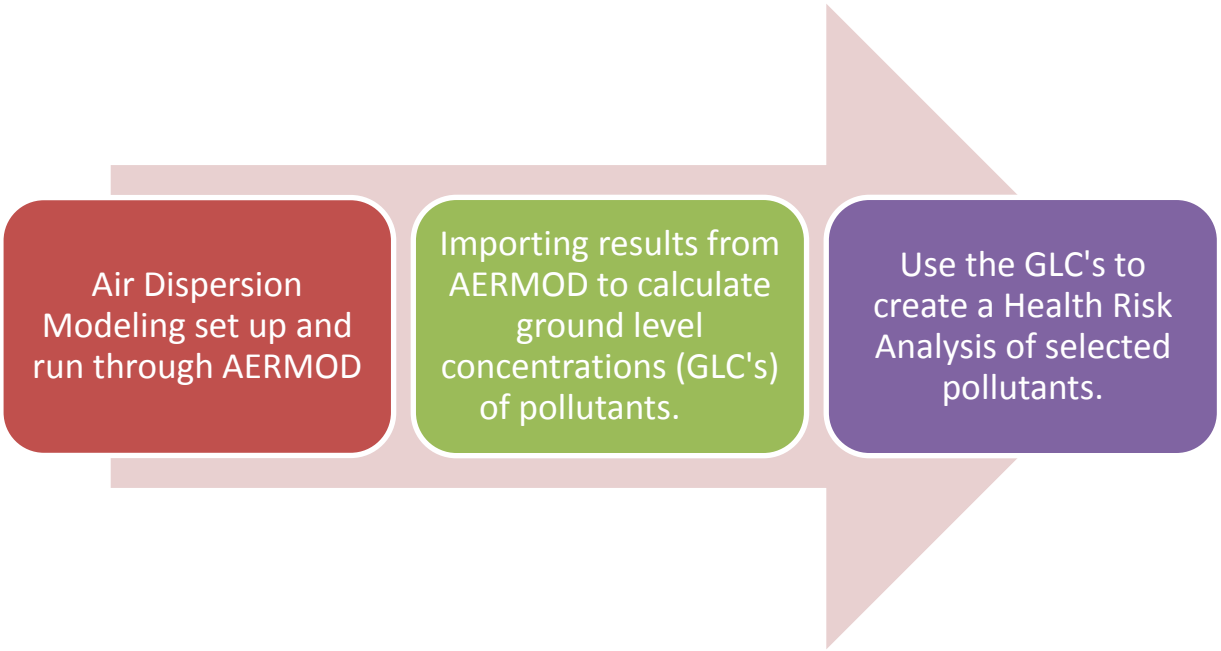
C. Opening the Program

To launch the HARP 2 ADMRT, open the HARP2 folder found on your desktop. Double-click on the Air Dispersion Modeling and Risk Assessment icon.

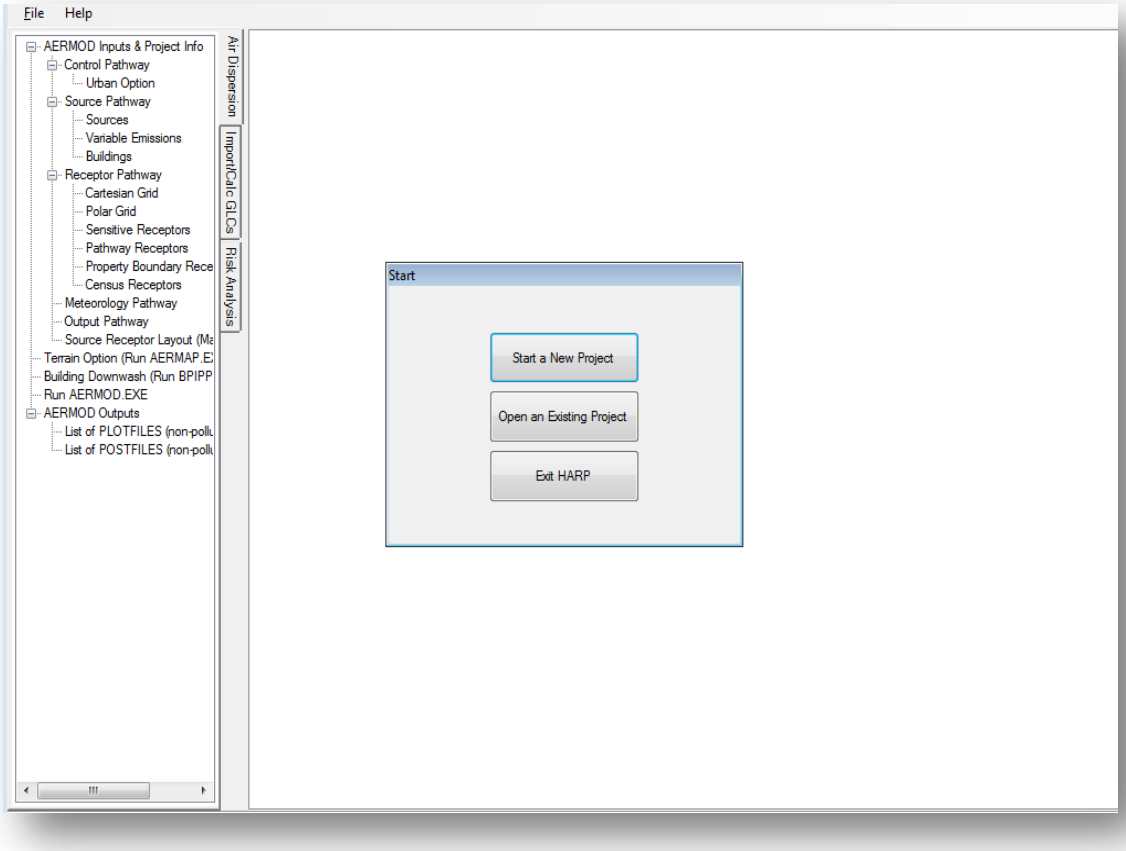
D. Getting Familiar with the Program

The ADMRT is organized in three steps, shown by tabs:

- Air Dispersion
- Import/Calc GLCs
- Risk Analysis



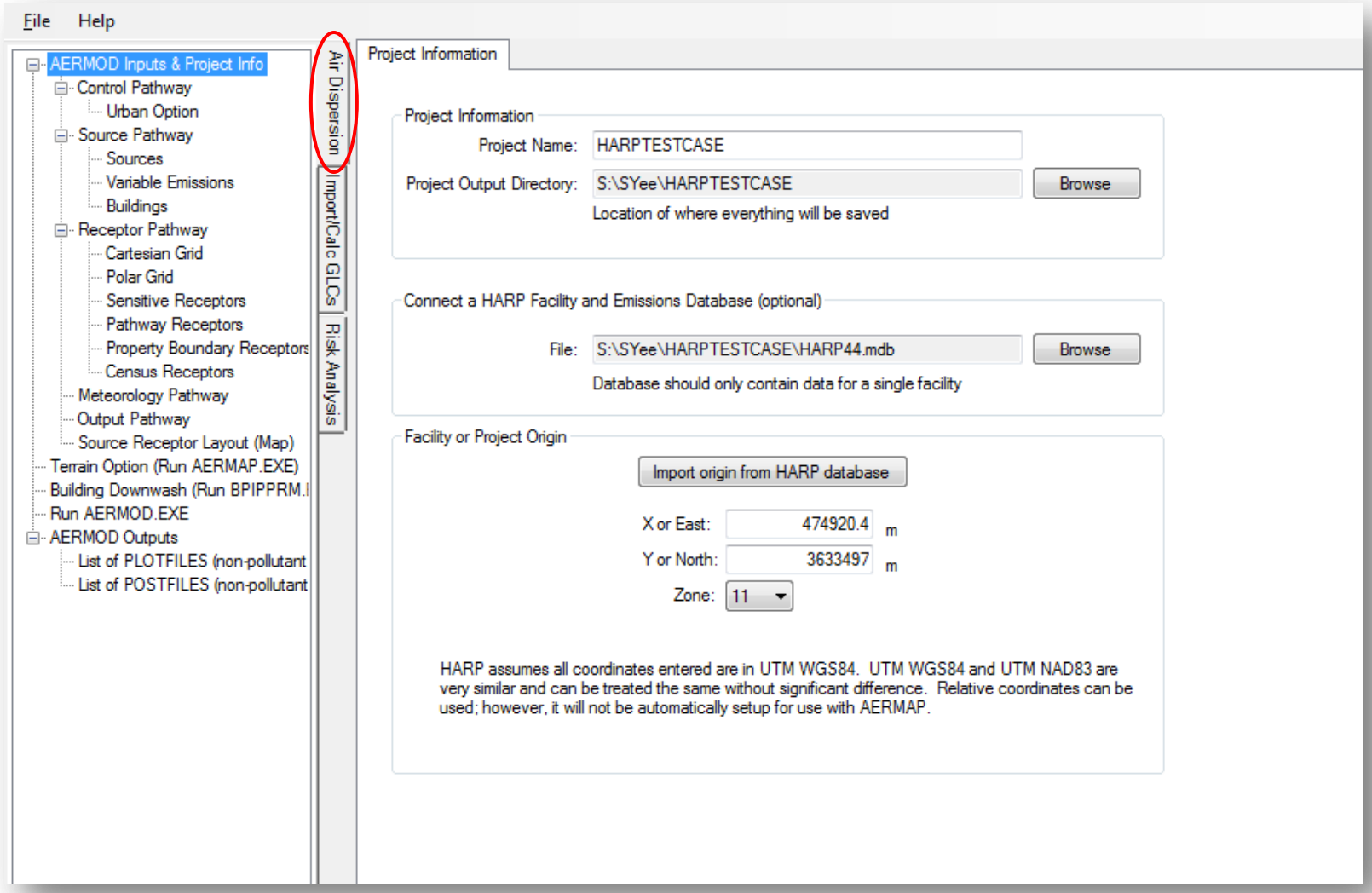
After opening the program, the following screen will appear:



Each step of the program will be visible from the tabs throughout the program. To begin, select ***Start a New Project***.

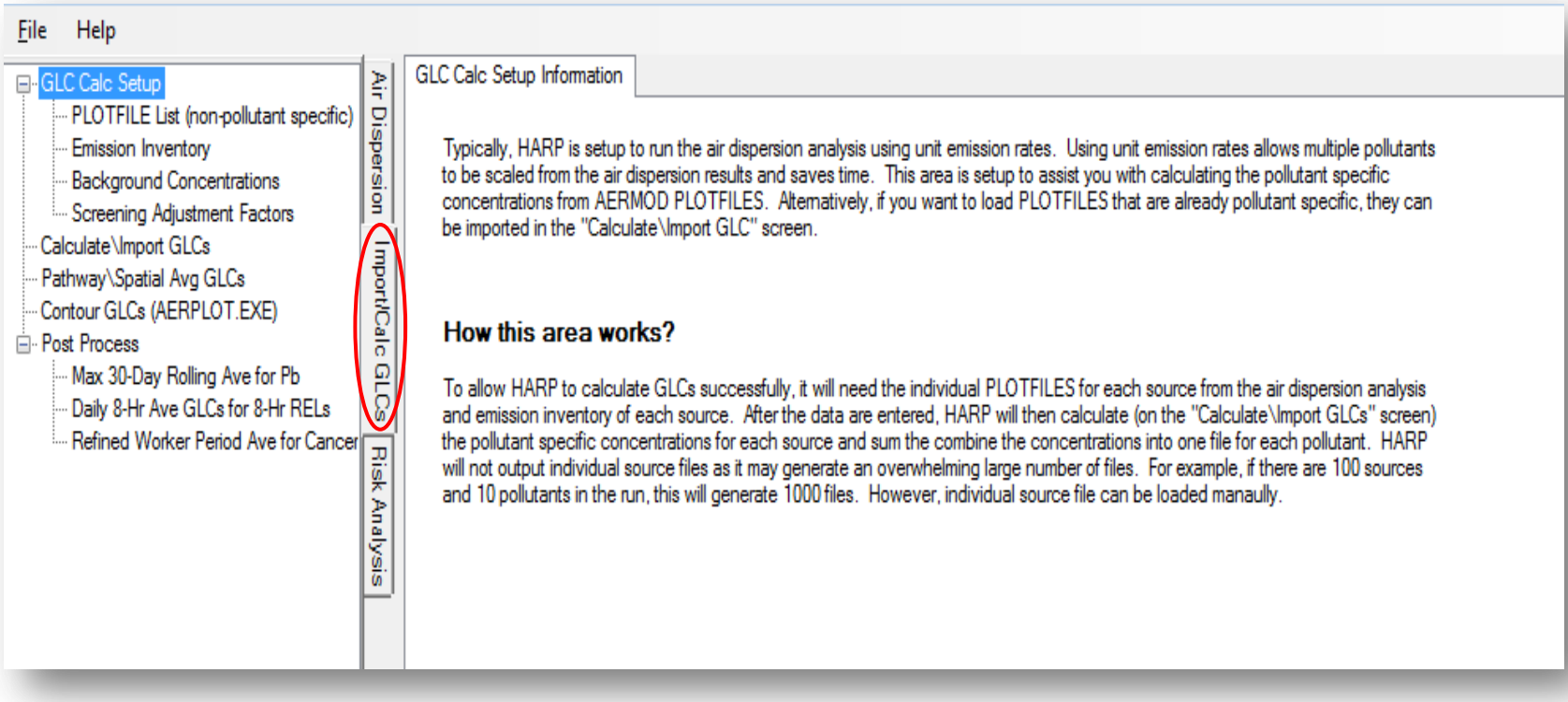
To view each step, click the individual tabs for step 1, step 2, and step 3 shown above. Each step (tab) is a key component to completing the module and health risk assessment results. The steps are comprised of smaller components with individual data needs that will be explained further in each section.

1. Step One Overview: Entering Air Dispersion Data and Running AERMOD



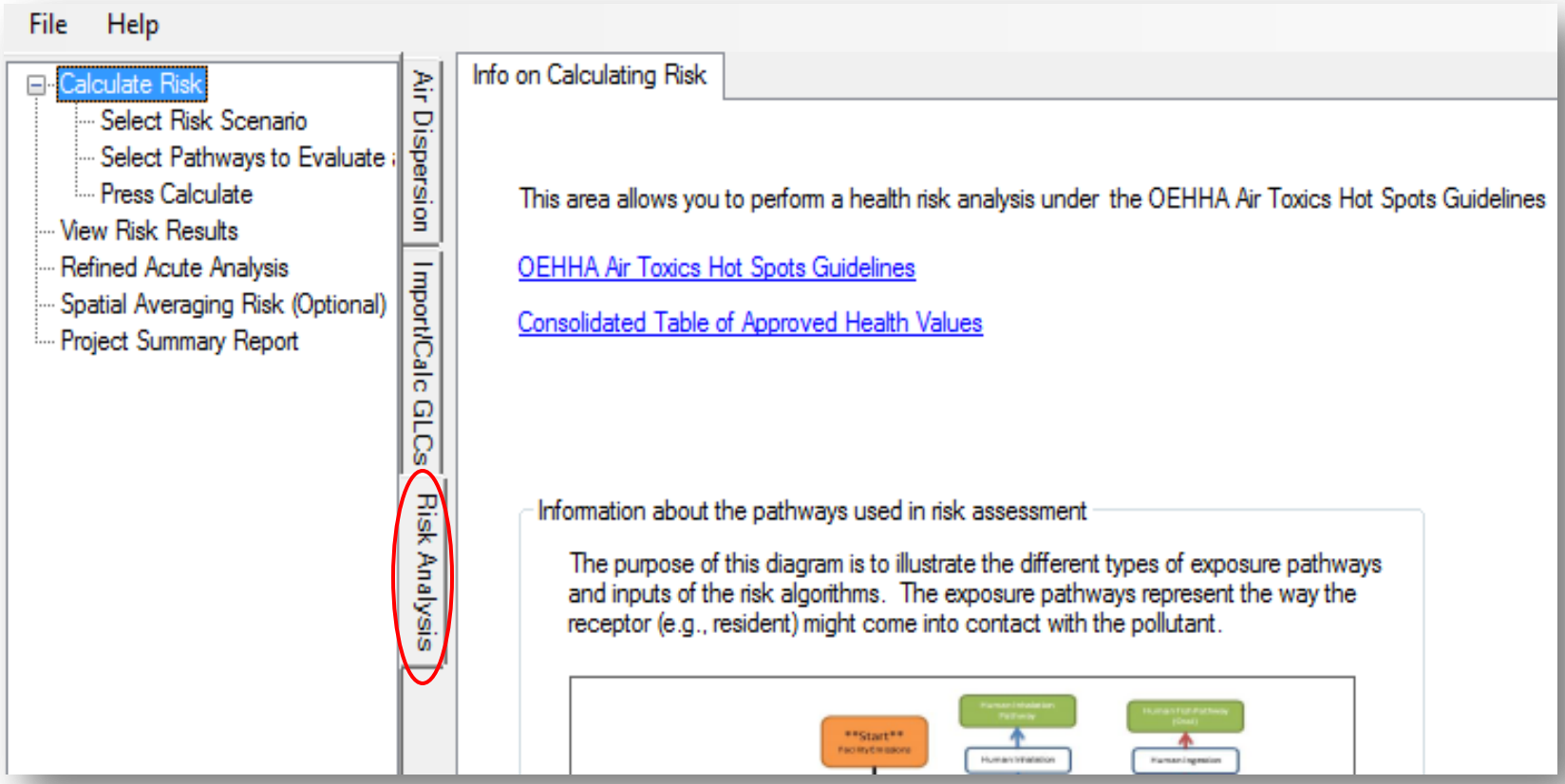
The purpose of this step is to set up and run AERMOD. New features in HARP 2 include preset air dispersion settings to expedite runs and the ability to select different AERMOD versions to rerun older projects.

2. Step Two Overview: Calculating/Importing Ground Level Concentrations



The purpose of this step is to use the air dispersion model results to calculate the pollutant specific GLCs from the HARP 2 EIM or a CSV file. New to HARP 2 is the ability to import air dispersion results run outside of HARP.

3. <u>Step Three Overview</u>: Health Risk Results and Analysis



The purpose of this step is to generate the risk results. You will have the ability to export the risk data in various formats, including CVS, PLOTFILE, and KML.

E. Training

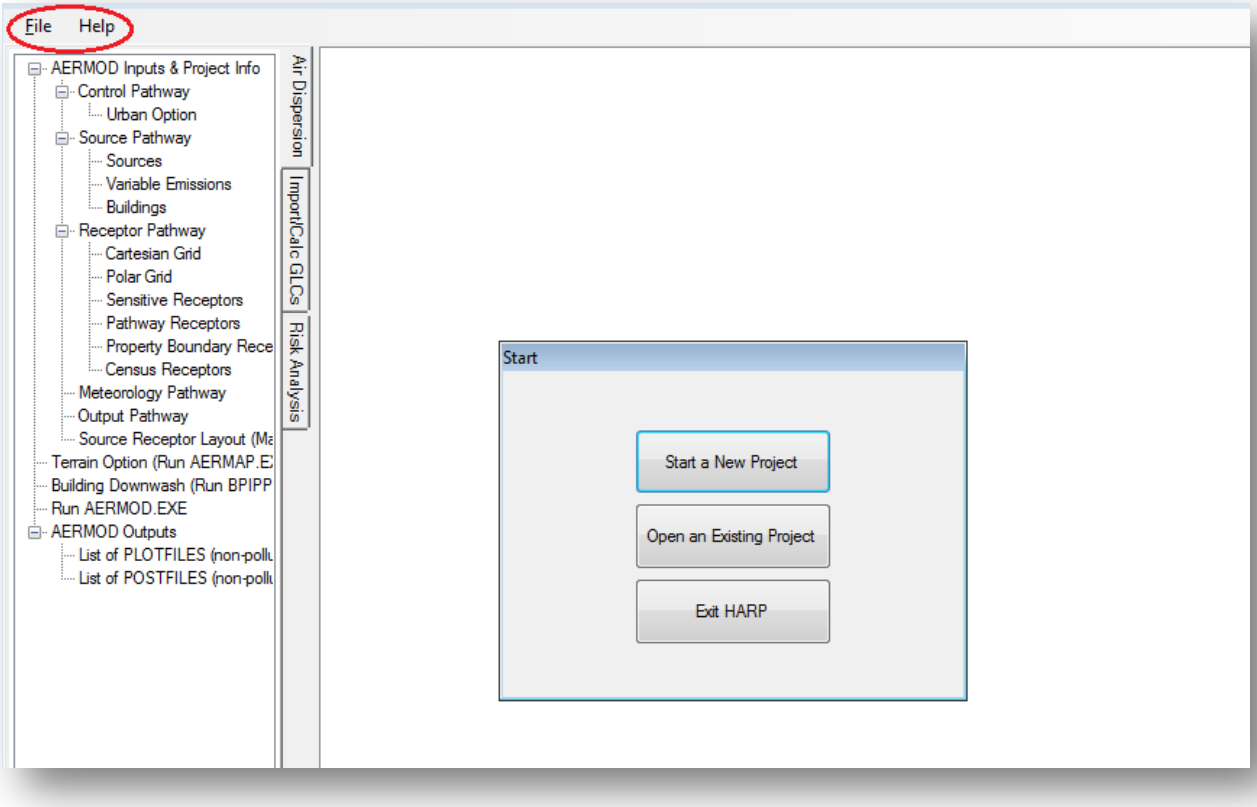
Future training for HARP 2 is under development. Please sign up on the HARP list server for updates at http://www.arb.ca.gov/listserv/listserv_ind.php?listname=harp.

3. USER INTERFACE OVERVIEW

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

A. Main Screen

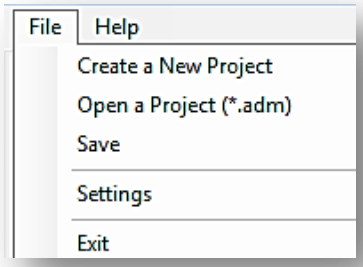
Below is a screenshot of the first display seen upon starting a new project in HARP 2 ADMRT.

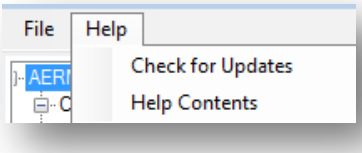


From this main menu you can alternate between three tabs: ***Air Dispersion, Import/Calc GLCs, and Risk Analysis.***

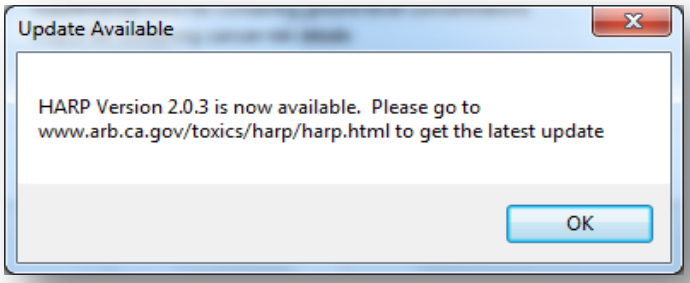
B. Main Menu Options

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



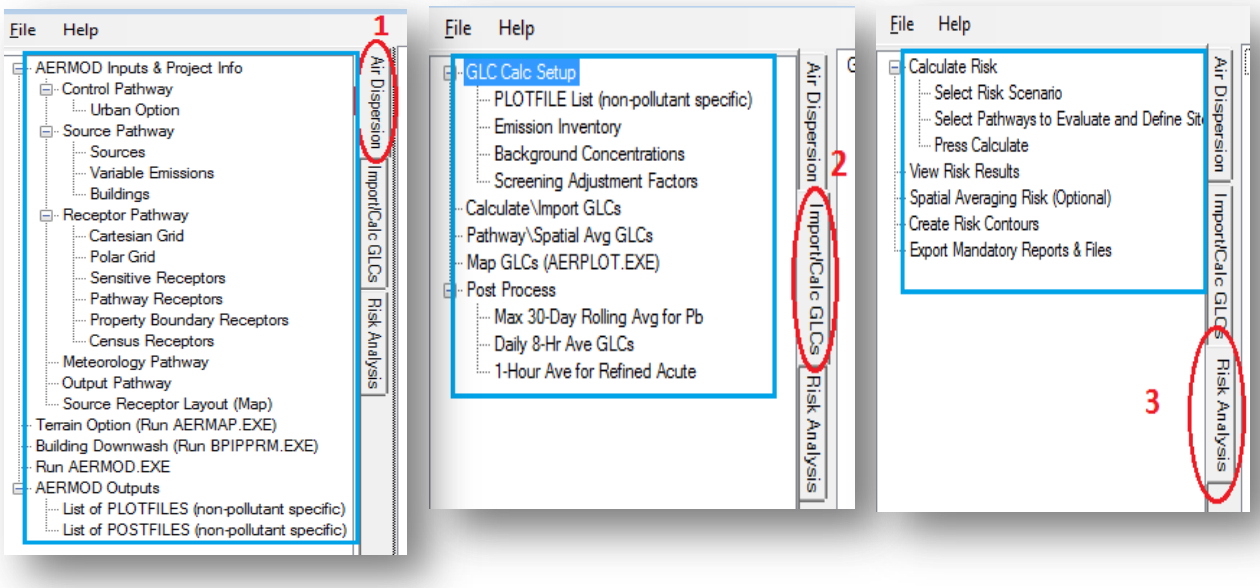


The ***File*** dropdown will give the option to create a new project, open a preexisting project, or save the current project you are working on. Under the ***Help*** menu option, there are options to open the help files or check for updates.



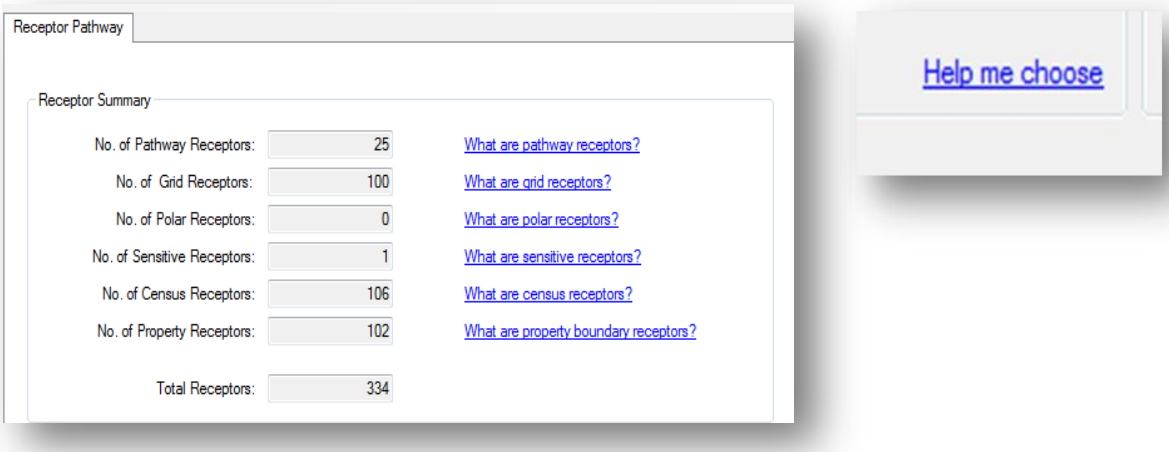
C. Navigating Tabs

There are three main tabs to navigate in the ADMRT that coincide with the main steps to completing the air dispersion modeling and risk assessment, labeled 1-3 in the diagram below. However, each main tab has subsections that will need to be completed before moving to the next tab. All tabs will remain open in HARP 2 ADMRT, as they are necessary for the completion of the health risk assessment.



D. *Help* Resources

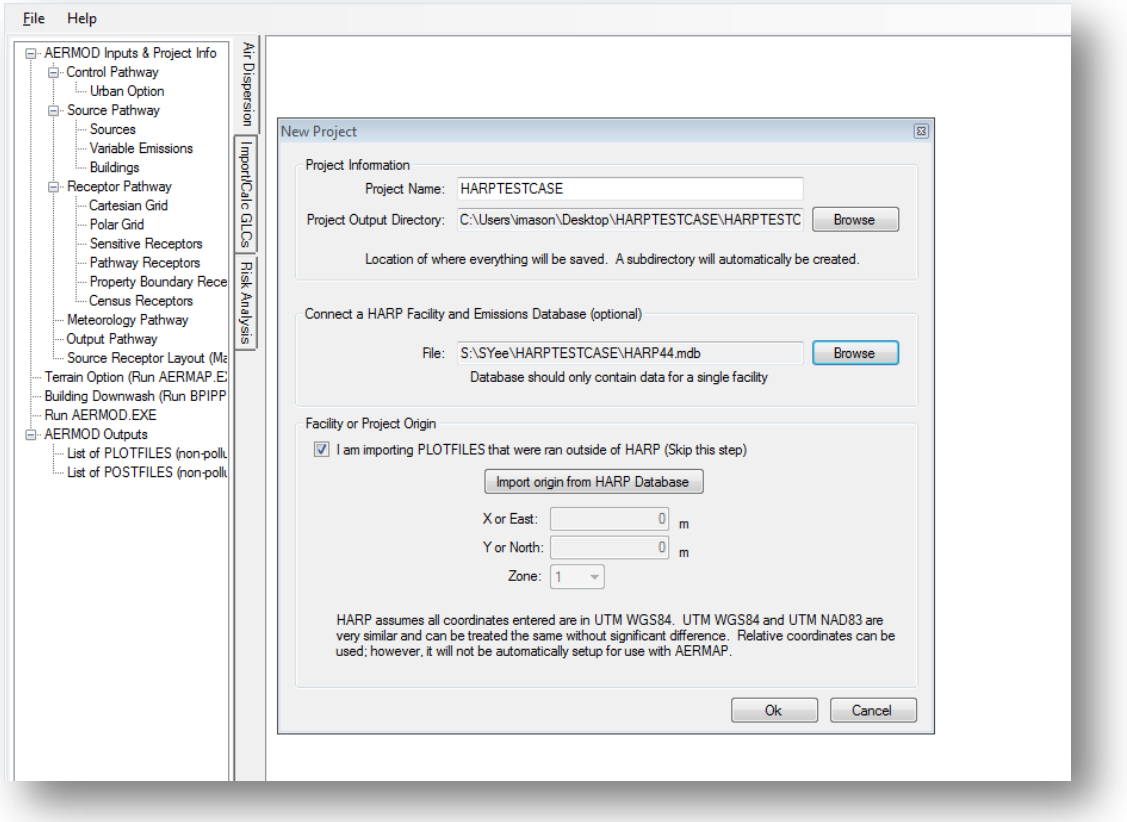
Help links in blue will be available to guide you through options, terms, and advanced (Tier 2) features.



4. STEP ONE: ENTERING AIR DISPERSION DATA AND RUNNING AERMOD

A. Entering AERMOD Pathways and Project Information

This will be the first screen you will see upon opening a new project.



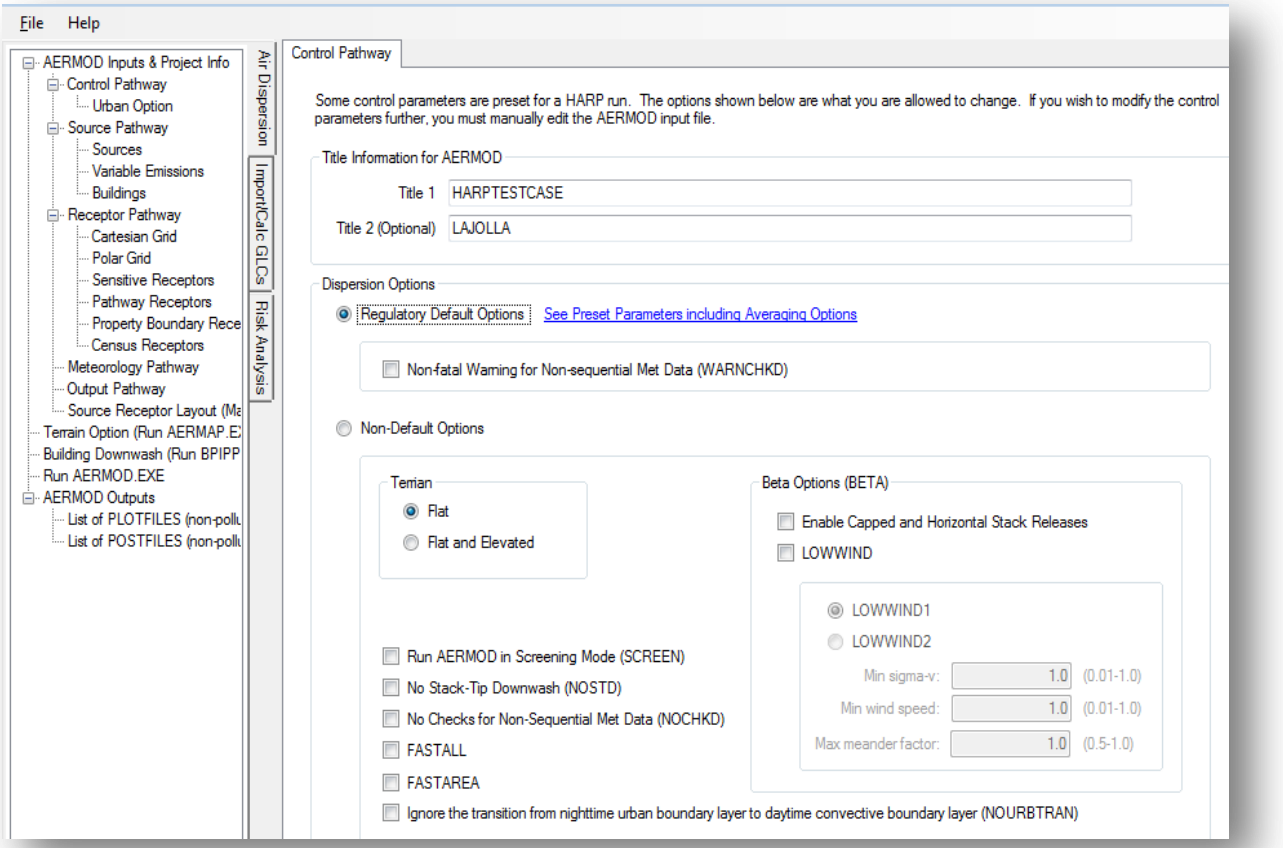
If you choose to import your facility outside of the HARP database you will have to manually enter the coordinates by using any form of GPS device, for example Google Earth. Coordinates must be in UTM WGS84 or UTM NAD83 format.

If you are choosing to load PLOTFILES from outside of HARP 2, make sure to check the box indicating they are from an outside source.

Several AERMOD keywords and parameters used in HARP 2 will be defined in this section; however for a complete list of AERMOD keywords and parameters refer to Appendix A: Summary of AERMOD Keywords and Parameters.

1. Control Pathways

The ***Control Pathway*** contains the keywords that provide the overall control of the model run. These include terrain height options, beta options and others that are shown below.



Below are main terms that will help interpret the variety of options the ***Control Pathway*** provides:

DFAULT	Specifies use of regulatory default options
CONC	Specifies calculation of concentration values
FLAT *	Option to assume flat terrain
ELEV *	Option to assume elevated terrain
NOSTD	Option to use no stack-tip downwash
NOCHKD	Option to by-pass date checking for non-sequential meteorological data file

WARNCHKD Option of issuing warning messages rather than fatal errors will be used for non-sequential meteorological data files.

SCREEN Option to run AERMOD in a screening mode (makes centerline calculations, sets NOCHKD option on, limits averaging period to 1-hour)

FASTALL Option to optimize model runtime through use of alternative implementation of horizontal meander for Point and Volume sources; also optimizes model runtime for AREA/AREAPOLY/AREACIRC and OPENPIT sources through hybrid approach

FASTAREA Option to optimize model runtime through hybrid approach for AREA/ AREAPOLY/AREACIRC and OPENPIT sources

NOURBTRAN Option to ignore the transition from nighttime urban boundary layer to daytime convective boundary layer

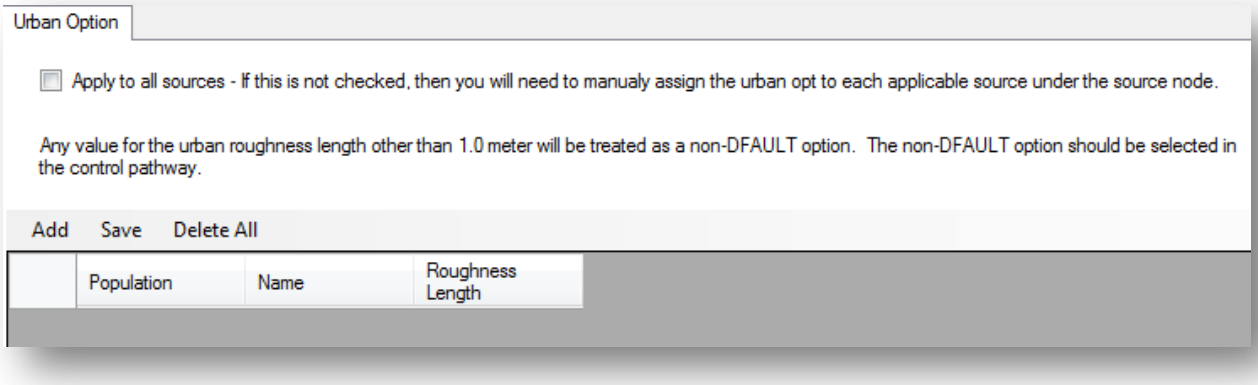
LOWWIND1 ** Option to address concerns regarding model performance under low wind speed conditions. The LOWWIND1option increases the minimum value of sigma-v from 0.2 m/s to 0.5 m/s, and "turns off" the horizontal meander component

LOWWIND2 ** Option to address concerns regarding model performance under low wind speed conditions. The LOWWIND2 option increases the minimum value of sigma-v from 0.2 m/s to 0.3 m/s, and includes some adjustments to the horizontal meander component

*Note that FLAT and ELEV may be specified in the same model run to allow specifying the non-DFAULT FLAT terrain option on a source-by-source basis.
**Note that LOWWIND1 and LOWWIND2 cannot both be invoked in the same model run.

a. Urban Option

AERMOD allows you to incorporate the effects of increased surface heating from an urban area. The amount of increased surface heating is driven by the urban-rural temperature difference that develops at night.



In the ***Urban Option*** screen you can apply the same urban option data to all sources or individually assign urban data to each source.

For relatively isolated urban areas, the user may use published census data corresponding to the Metropolitan Statistical Area (MSA) for that location to define the population. Since census tracts vary in size and shape, another acceptable approach would be to develop gridded estimates of population data based on census block or block group data. In such cases, a grid resolution of 6 kilometers is suggested.

The urban surface roughness parameter is used to define a reference height for purposes of adjusting dispersion for surface and low-level releases to account for the enhanced turbulence associated with the nighttime urban heat island. The default value of 1.0 meter for urban surface roughness length is considered appropriate for most applications.

For further information in determining the ***population*** and ***roughness length*** for the Urban Option please reference the U.S. EPA AERMOD Implementation Guide (2009).

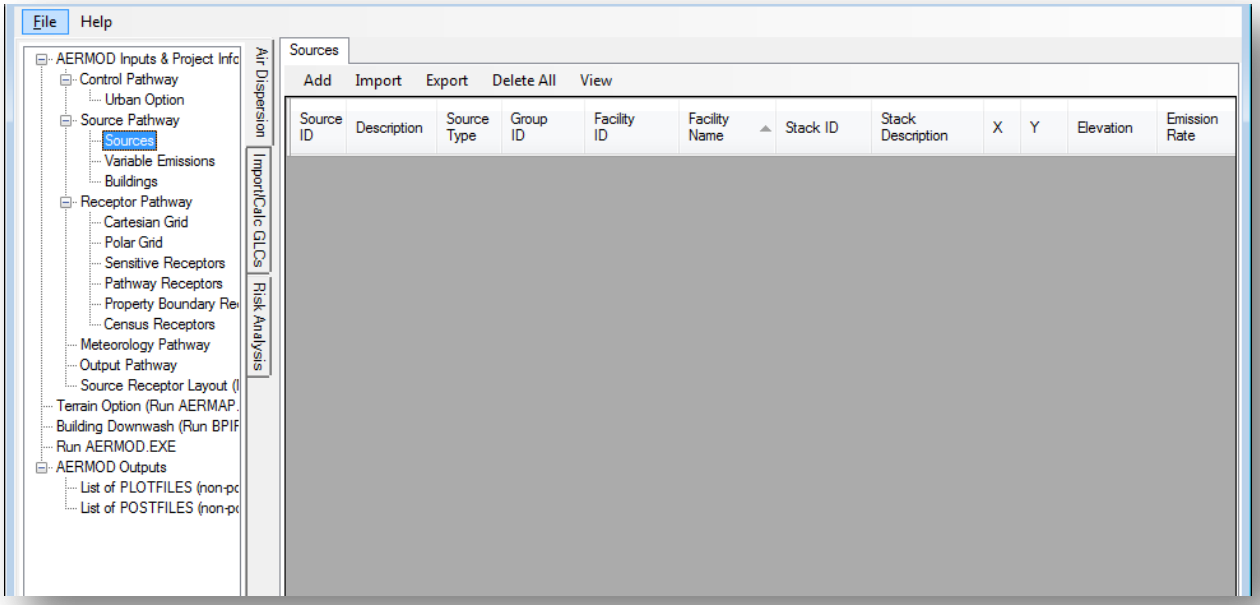
2. Source Pathways

The ***Source Pathway*** contains the keywords that define the source information for a particular model run.

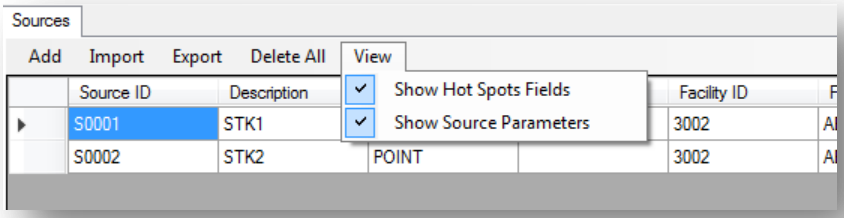
a. Sources

The model currently handles five source types, identified as: ***Point, Volume, Area, Open Pit, and Line***. However, ***Point*** and ***Area*** sources have additional options: ***Point Capped, Point Horizontal, Area Polygon, and Area Circular***.

The main screen for sources under the ***Source Pathway*** will look like this:

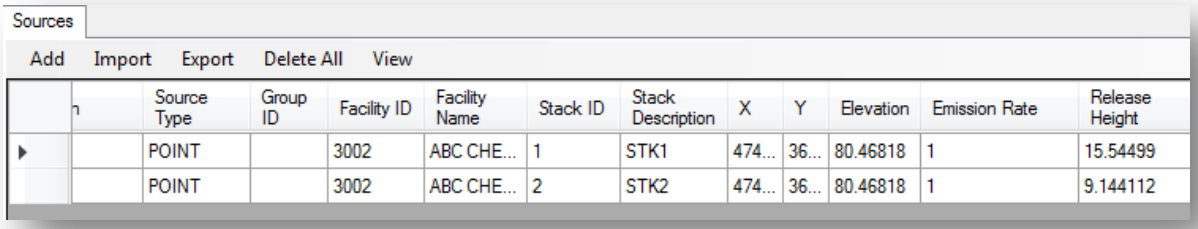


If you click ***View*** you will see two options: ***Show Hot Spot Fields*** and ***Show Source Parameters.***

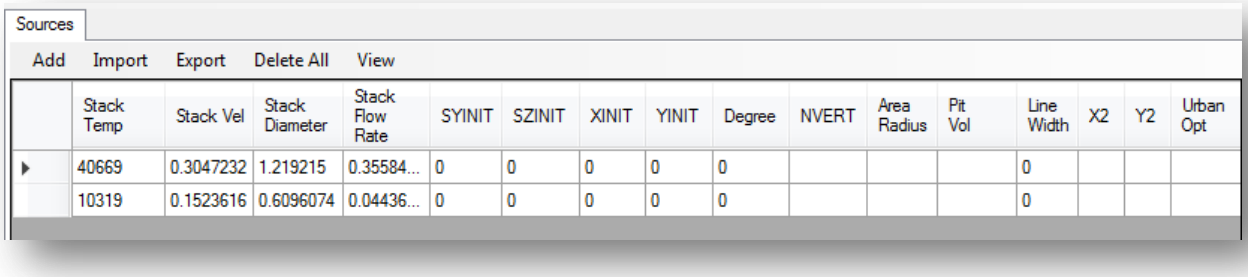


By checking these options you will be able to view all the required data information and parameters for any source type.

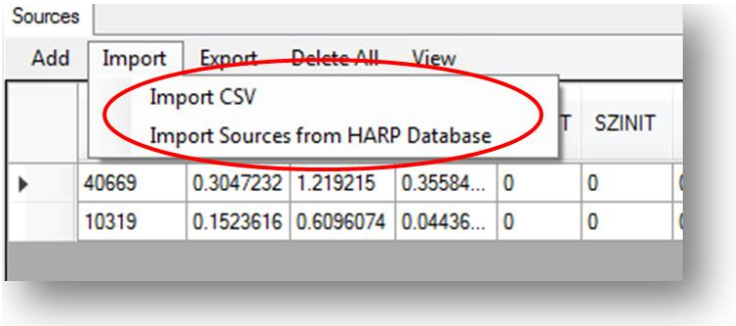
The screenshot below shows the standard information that will be input for EVERY source type:



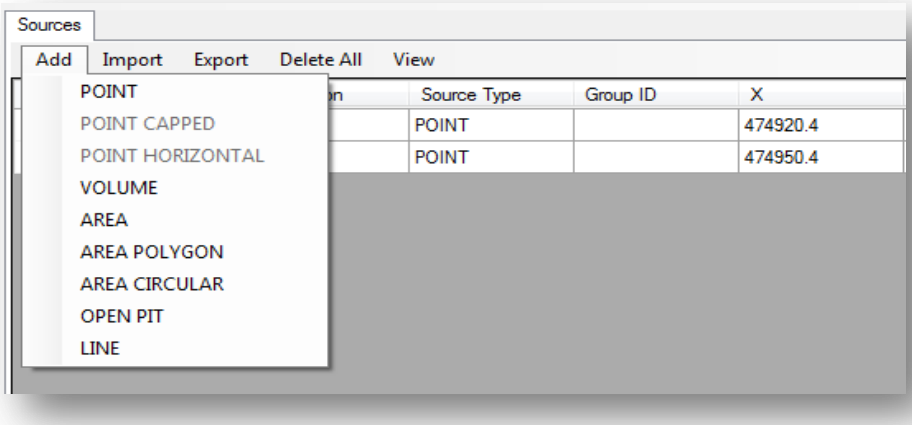
The screenshot below shows the different data options that will be input depending on the source type you choose. For term definitions and applicable sources refer to Appendix A.



There are three options you can choose in order to obtain your source information. The first two options are under the ***Import*** tab, shown below. You may import the data by using a ***CSV file*** (See Appendix B: How to Format a CSV File for Import) or through the ***HARP database*** you connected to in the ***Control Pathway***.

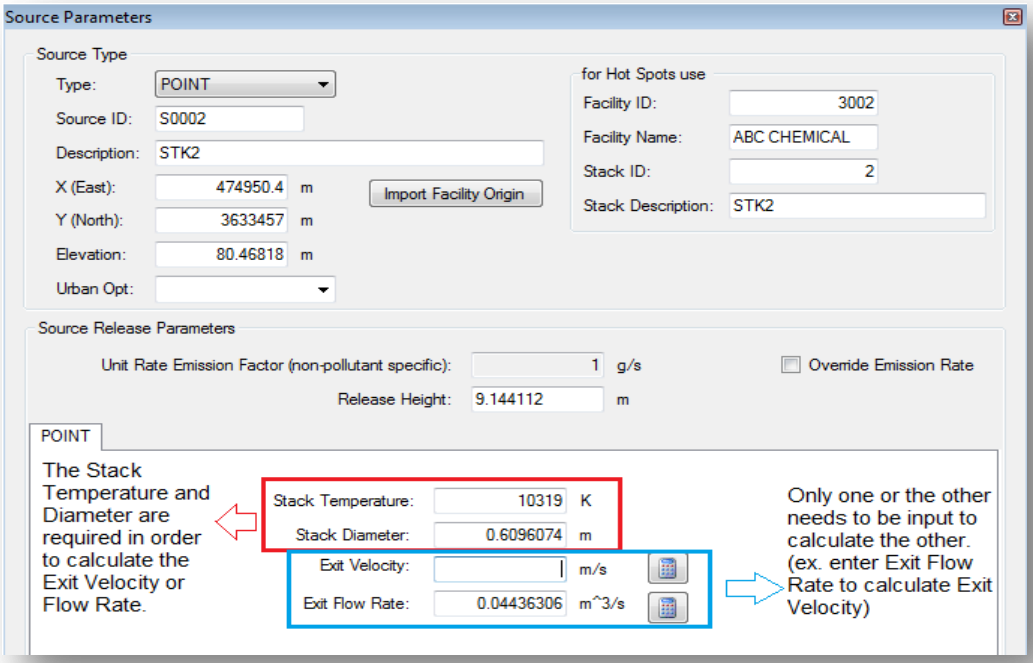


The last option is to manually enter each source into your module through ***Add*** and selecting the source type. The screenshot below shows all source types and variations that you can add. Note that you must mark ***Enable Capped and Horizontal Stack Releases*** in the ***Control Pathway*** under beta options to add ***Point Capped*** or ***Point Horizontal*** sources to your ***Source Pathway***.



i. Point Sources (Point, Capped, Horizontal)

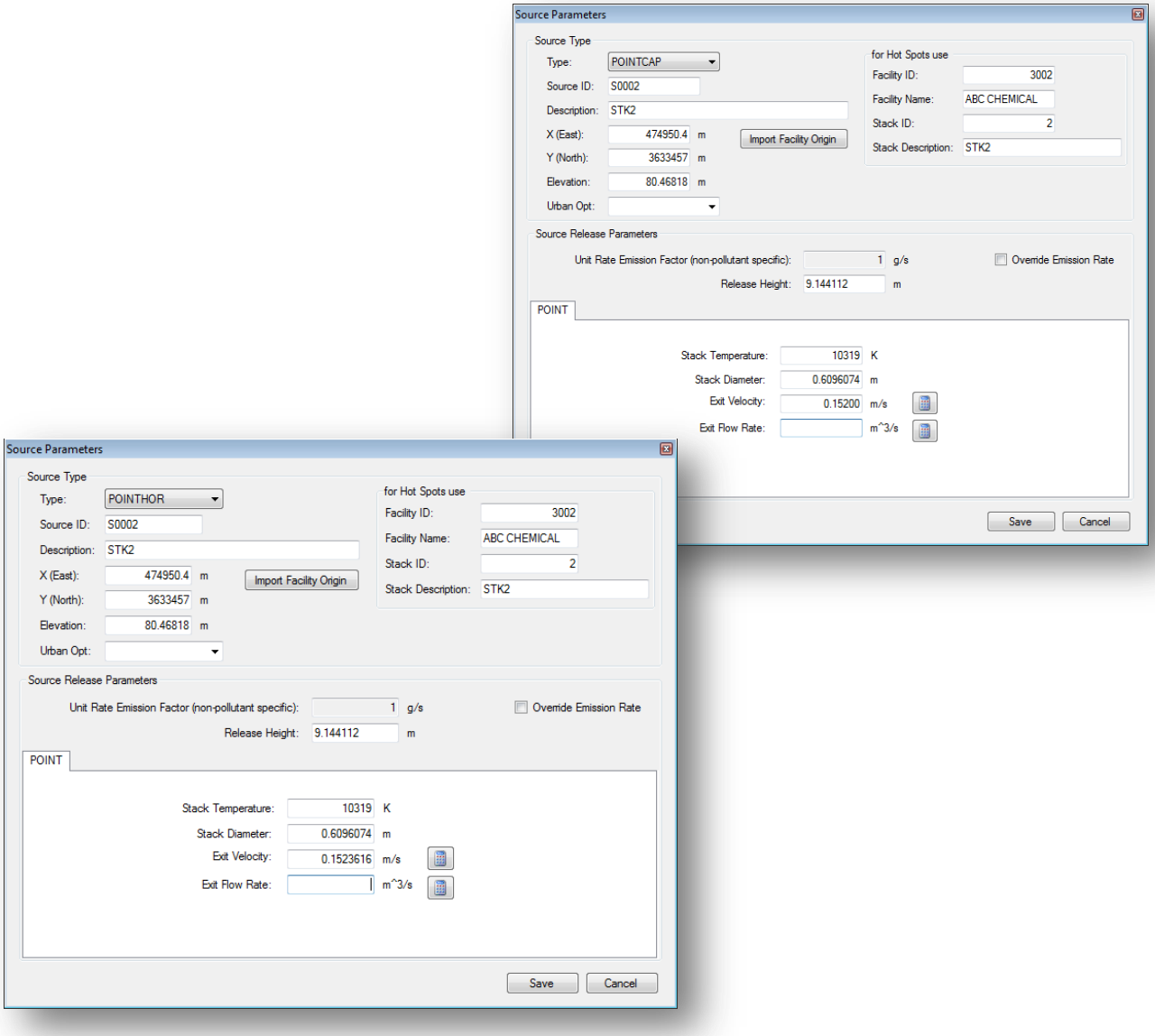
Point sources can be used to model releases from isolated vents, stacks and other sources. The ***Source ID, Description, Stack ID,*** and ***Stack Description*** are all user-defined terms that you create for your own reference. The ***Facility ID, Facility Name, X-Y Coordinates,*** and ***Elevation*** should be standard data that is based on your facility. If you are working with elevated terrain you will use AERMAP to enter the elevations. If you have an urban option, use the ***Urban Opt dropdown*** to select the urban option for that source, which may vary if you choose to do multiple urban options or one overall urban option in the ***Control Pathway***.



The ***Unit Rate Emission Factor*** is preset to 1.0 g/s, however, you can click ***Override Emission Rate*** to the right and enter a different emission rate. The ***release height*** is the point of release above the ground and can vary between sources.

When adding point sources you are required to input BOTH the ***Stack Temperature*** and ***Stack Diameter*** in order to calculate either the ***Exit Velocity*** or ***Exit Flow Rate***. Depending on the information you have you can choose to enter either the Exit Velocity or the Exit Flow Rate to determine the other.

Below are screenshots when adding Point Capped and Point Horizontal sources. The required input data is identical to the ***Point source*** screen, however the ***Type*** dropdown box will vary between ***POINT, POINTCAP*** or ***POINTHOR***. AERMOD will automatically adjust the necessary information during the modeling run based on whether you enter POINTCAP or POINTTHOR.

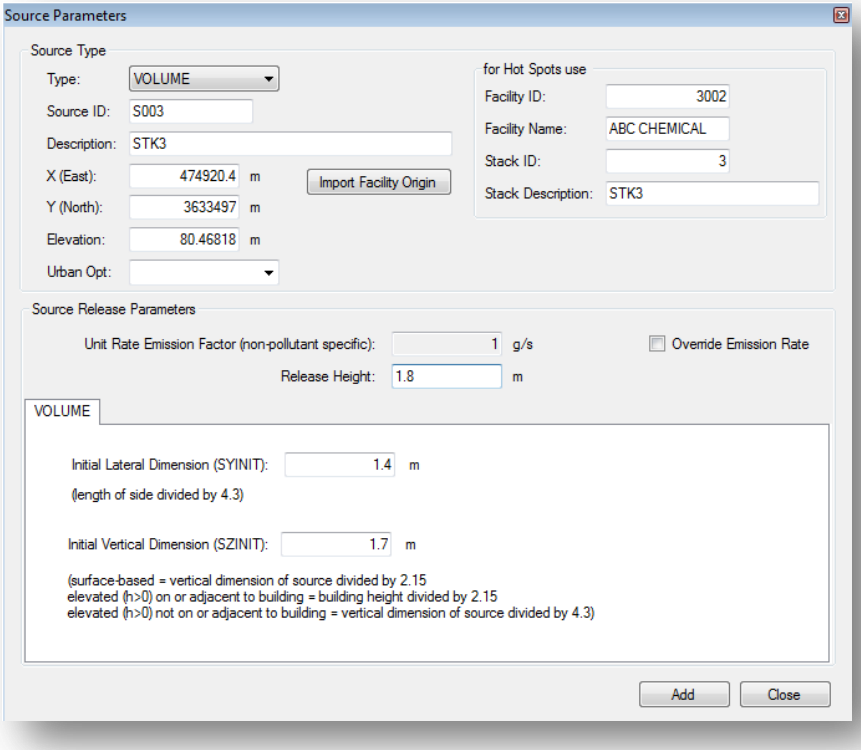


ii. Volume Sources

Volume sources can be used to model releases from a variety of industrial sources including multiple vents, conveyor belts and building roof monitors. The ***Source ID, Description, Stack ID,***and ***Stack Description*** are all user-defined terms that you create for your own reference. The ***Facility ID, Facility Name, X-Y Coordinates,*** and ***Elevation*** should be standard data that is based on your facility. If you are working with elevated terrain you will use AERMAP to enter the elevations. If you have an urban option, you would also use the ***Urban Opt dropdown*** to select the urban option for that source. This may vary if you choose to do multiple urban options or one overall urban option in the ***Control Pathway***.

The ***Unit Rate Emission Factor*** is preset to 1.0 g/s, however, you can click the ***Override Emission Rate*** to the right and enter a different emission rate. The ***release height*** is the point of release above the ground and can vary between sources.

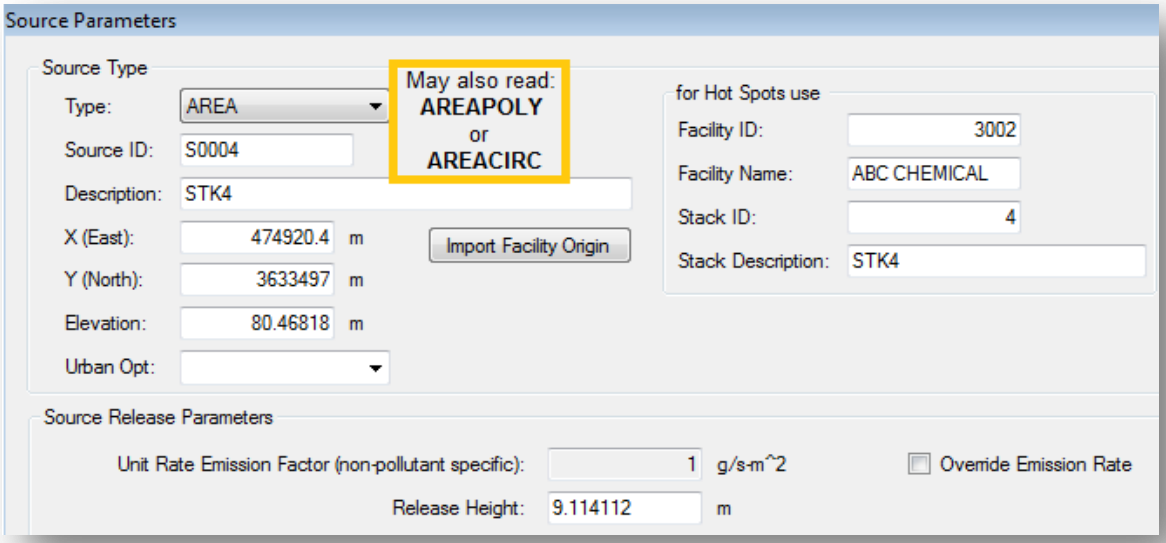
For volume sources you will need to enter the ***initial lateral dimension*** and ***initial vertical dimensions***. The initial lateral dimension is easily calculated by dividing the length of the side, in meters, by 4.3. The initial vertical dimension has several possible calculations depending if the source is at surface level or elevated. If the source is at the surface level or elevated on or adjacent to the building you divide the vertical dimension or building height, in meters, by 2.15. If the source is elevated but not on or adjacent to the building you will divide the vertical dimension of the source, in meters, by 4.3.



iii. Area Sources (AREA, AREAPOLYGON, AREA CIRCULAR)

All three of the ***area source*** types use the same numerical integration algorithm for estimating impact from area sources, and are merely different options for specifying the shape of the area source. AERMOD includes three options for specifying the shape of an area source (U.S. EPA, 2004):

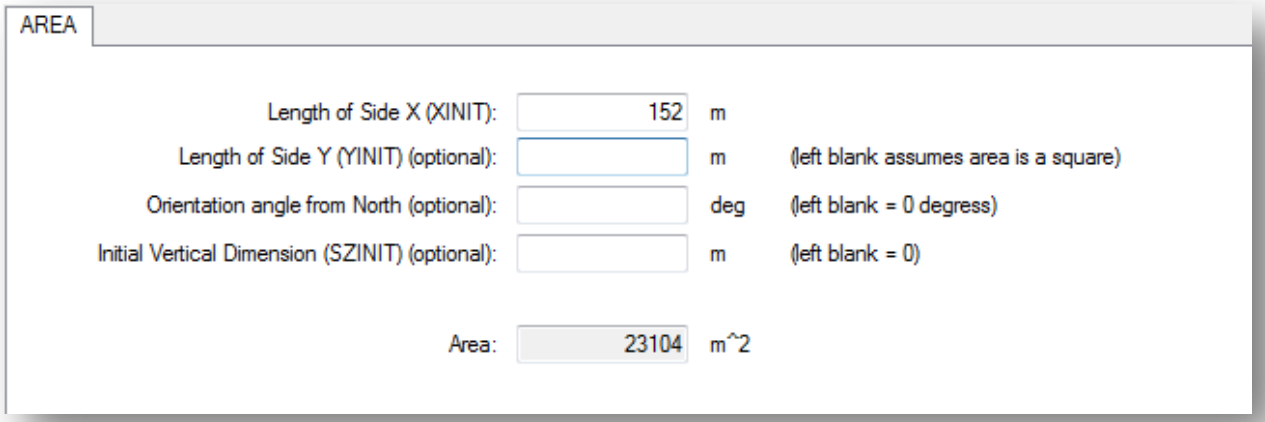
- ***AREA***: used to specify rectangular areas that may also have a rotation angle specified relative to a north-south orientation
- ***AREAPOLY***: used to specify an area source as an irregularly-shaped polygon of 3 sides to 20 sides
- ***AREACIRC***: used to specify a circular-shaped area source



The ***Source ID, Description, Stack ID***, and ***Stack Description*** are all user-defined terms that you create for your own reference. The ***Facility ID, Facility Name, X-Y Coordinates,*** and ***Elevation*** should be standard data that is based on your facility. If you are working with elevated terrain you will use AERMAP to enter the elevations. If you have an urban option, you would also use the ***Urban Opt dropdown*** to select the urban option for that source, which may vary if you choose to do multiple urban options or one overall urban option in the ***Control Pathway***.

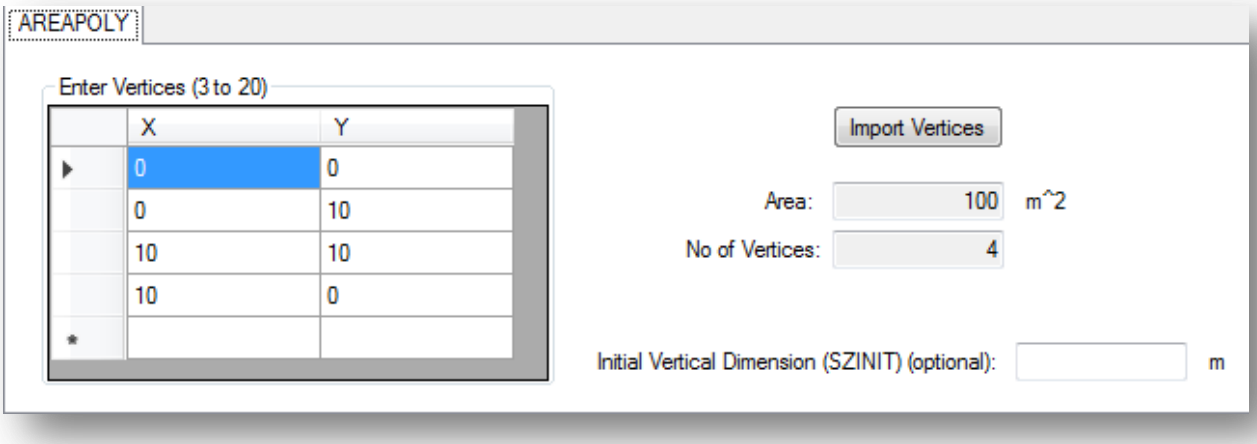
The ***Unit Rate Emission Factor*** is automatically calculated to a 1.0 g/s equivalent. However, you can click ***Override Emission Rate*** to the right and enter a different emission rate. The ***release height*** is the point of release above the ground and can vary between sources.

AREA:



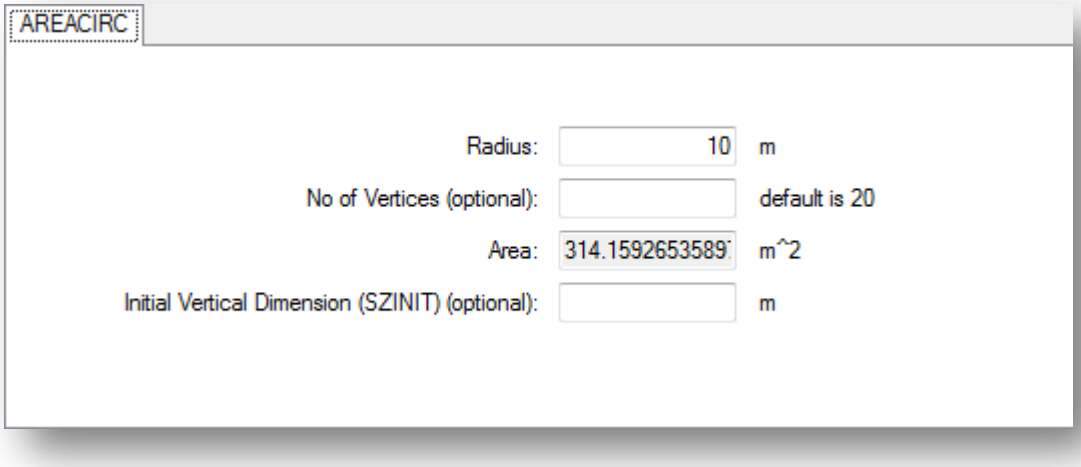
For the ***AREA source*** you will need to designate the dimensions of the area by the ***length of side X and Y***, although Y is optional only if it is a square with equal sides. ***Orientation angle from the North*** and the ***initial vertical dimension*** can be included to make the area more specific, or omitted, whichever you prefer when entering the source. The ***Area*** is automatically calculated from the dimensions you provide in the initial steps. Click ***Save*** and your source will appear under ***Sources***.

AREAPOLY:



For the ***AREAPOLY source*** you will need to designate the ***coordinates (vertices)*** that will make up the points of your polygon area. You may manually enter them or import them from a CSV file. The ***area*** and ***number of vertices*** will update as you enter vertices. The ***initial vertical dimension*** is an optional parameter.

AREACIRC:

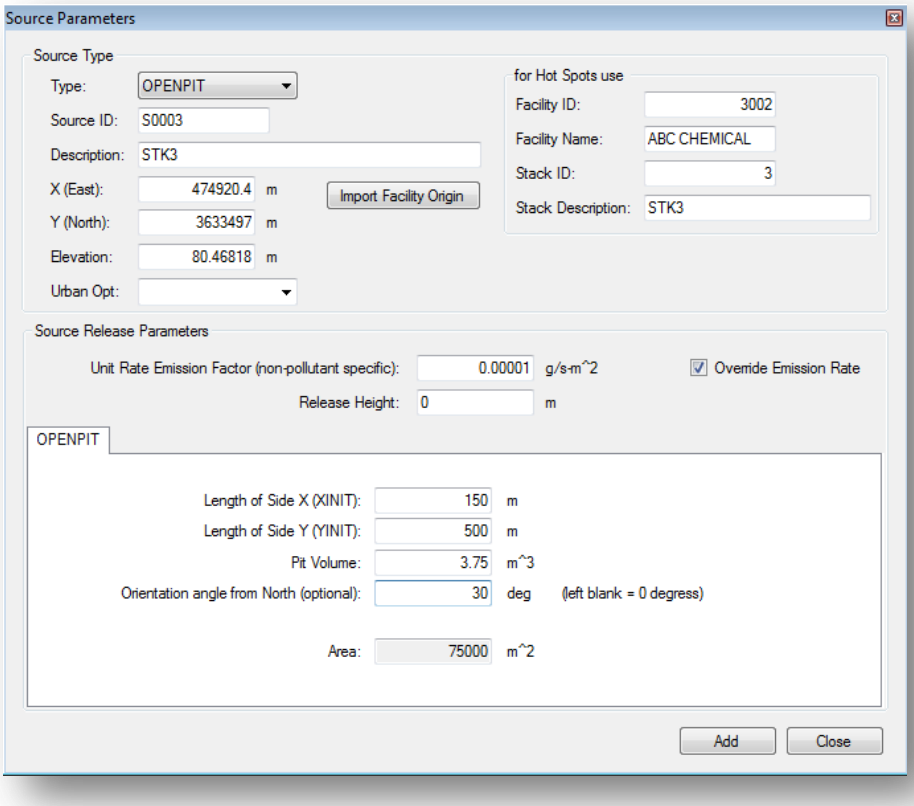


For the ***AREACIRC source*** you will need to designate the ***radius of the circle***. You can also choose to enter the ***number of vertices*** you would like within the circle. The ***area*** will be calculated through the radius input. Similar to the ***AREAPOLY***, the ***initial vertical dimension*** is an optional parameter.

iv. Open Pit Sources

The ***open pit source*** can be used to model particulate or gaseous emissions from open pits that can include rock quarries and coal mines. To effectively model emissions from open pit sources, emissions are based off meteorological conditions and then calculated similar to that of an area source (U.S. EPA, 2004). The ***Source ID, Description, Stack ID,*** and ***Stack Description*** are all user-defined terms that you create for your own reference. The ***Facility ID, Facility Name, X-Y Coordinates,*** and ***Elevation*** should be standard data that is based on your facility. If you are working with elevated terrain you will use AERMAP to enter the elevations. If you have an urban option, you will use the ***Urban Opt dropdown*** to select the urban option for that source, which may vary if you choose to do multiple urban options or one overall urban option in the ***Control Pathway***.

The ***Unit Rate Emission Factor*** is automatically calculated to a 1.0 g/s equivalent, however, you can click ***Override Emission Rate*** to the right and enter a different emission rate. The ***release height*** is the point of release above the ground and can vary between sources.

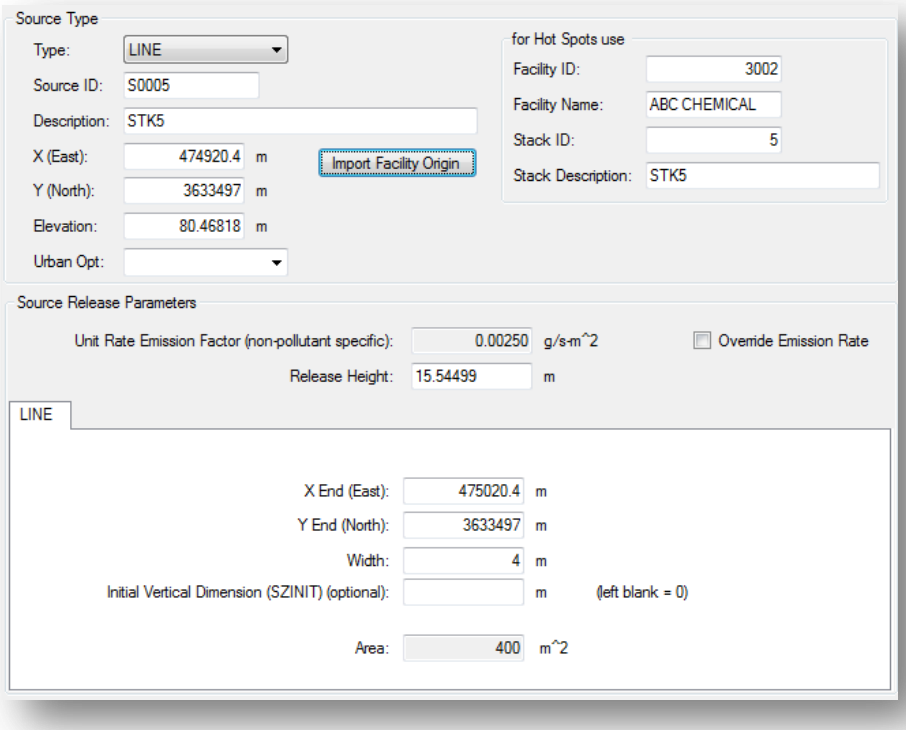


v. Line Sources

The ***line source*** allows you to pinpoint a starting and ending location along with the width of the line. The calculations are similar to the rectangular area source. The line source can account for the initial dilution of the emissions through the initial sigma-z parameter, although this is optional (U.S. EPA, 2004). The ***Source ID, Description, Stack ID,*** and ***Stack Description*** are all user-defined terms that you create for your own reference. The ***Facility ID, Facility Name, X-Y Coordinates,*** and ***Elevation*** should be standard data that is based on your facility. If you are working with elevated terrain you will use AERMAP to enter the elevations. If you have an urban option, you will use the ***Urban Opt dropdown*** to select the urban option for that source, which may vary if you choose to do multiple urban options or one overall urban option in the ***Control Pathway***.

The ***Unit Rate Emission Factor*** is automatically calculated to a 1.0 g/s equivalent, however, you can click ***Override Emission Rate*** to the right and enter a different emission rate. The ***release height*** is the point of release above the ground and can vary between sources.

The ***X End*** and ***Y End*** are the East and North coordinates that will reflect your line. The ***width*** will determine how wide your line source will be in meters. The ***Intial Vertical Dimension*** is optional and if left blank will reflect "0." The ***Area*** will automatically be calculated based on your X-Y End and Width input.



b. Variable Emissions

Variable emission rates allow you to individually select the timeframe that your facility is operating within and the production rate of emissions during that time. There are several options to choose from shown in the screen shot below.

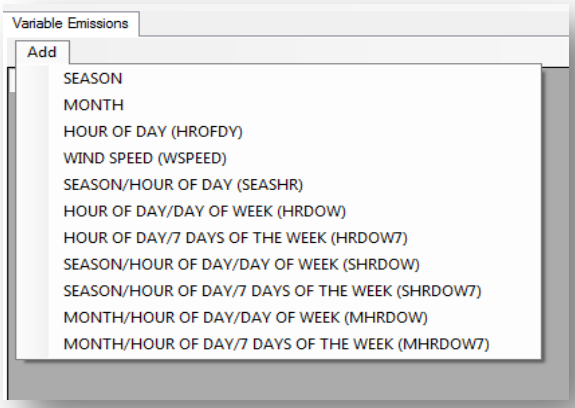


Table 3-1 below defines the variable emission options available for an air dispersion model and the variable emission rate factor needed to complete the run.

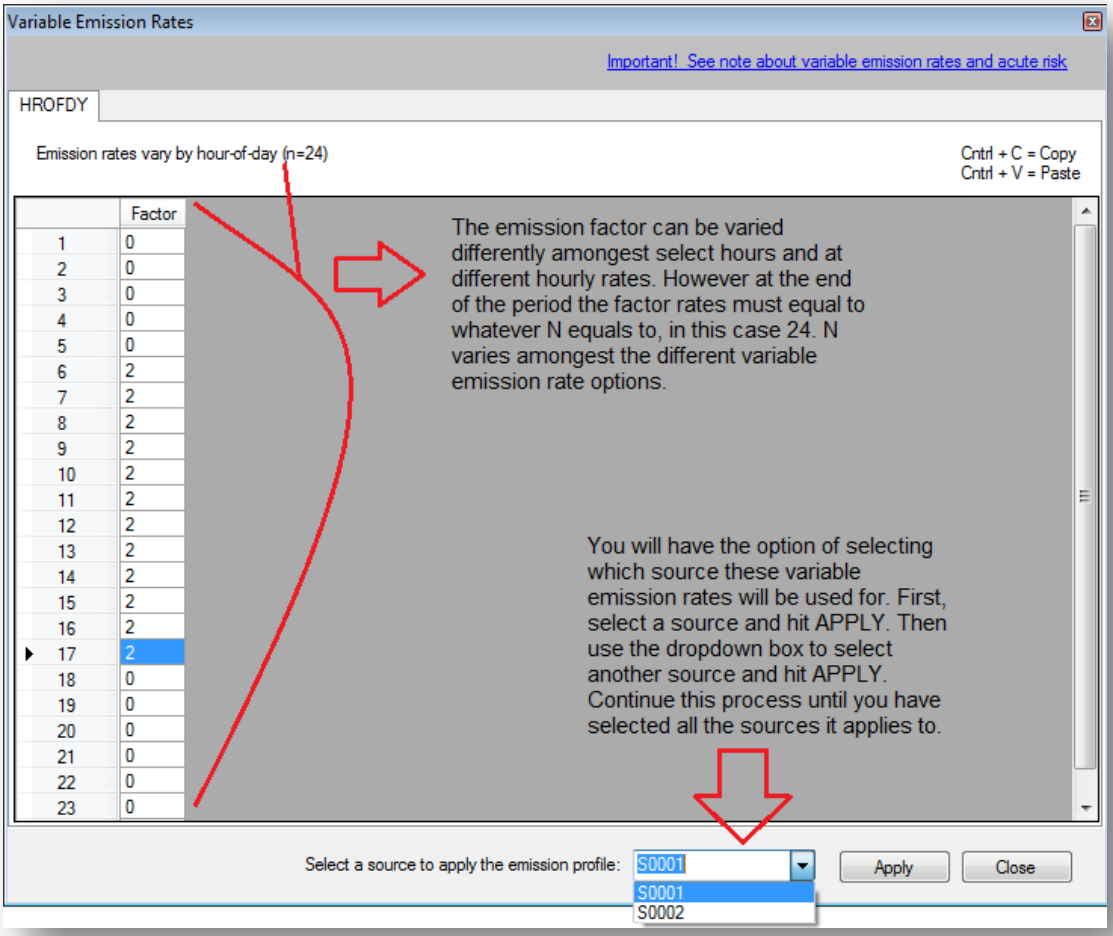
Table 3-1: Variable Emission Options with Emission Rate Factors

Variable Emission Option	Definition	Emission Rate Factor
SEASON	Seasons	n=4
MONTH	Monthly	n=12
HROFDY	Hour-of-day	n=24
WSPEED	Wind speed category	n= 6
SEASHR	Season-by-hour	n=96
SHRDOW	Season by hour-of-day by day-of-week (M-F, Sat, Sun)	n=288
SHRDOW7	Season by hour-of-day by day-of-week (M, Tu, W, Th, F, Sat, Sun)	n=672

In order to maintain a consistent emissions inventory for dispersion modeling inside of HARP 2, certain rules must be followed. Failure to adhere to the following rules will result in either generating or depleting inventory from your analysis.

By default, AERMOD will run your dispersion at an emission rate of 1g/s, 24 hours a day, for 365 days a year. With the variable emissions option you can individually select the hours of operation and the emission rate for each source.

If you choose the ***Hour of Day (HROFDY)*** option you can select the daily emission rate factor for certain hours. Where emissions vary temporally (e.g., hourly or monthly) then the annual emissions are required to sum to 31,536 kg/yr (i.e., 31,536 kg/yr = 1 g/s * 3600 s/hr * 8760 hr/yr). Therefore, hourly emissions must be adjusted accordingly. For example, 2 g/s, 12 hours per day, and 365 days per year.

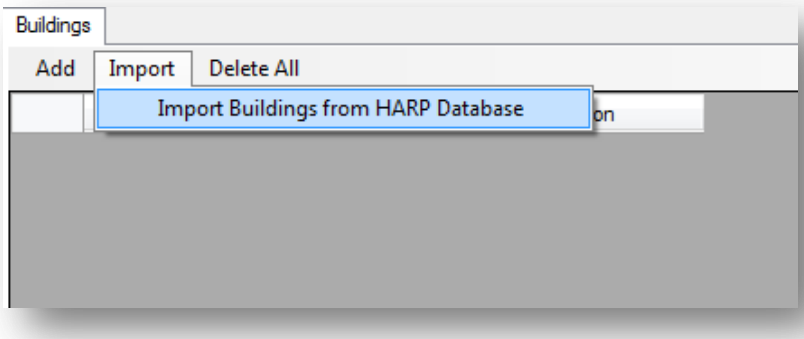


Note that area and line source emissions in model runs are normally entered as g/s-m^2. You are required to adjust your g/s-m^2 to an overall equivalent of 1 g/s for the area or line source.

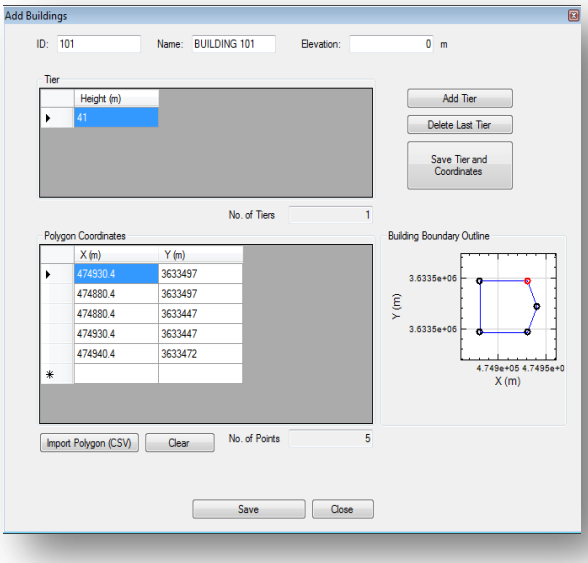
c. Buildings

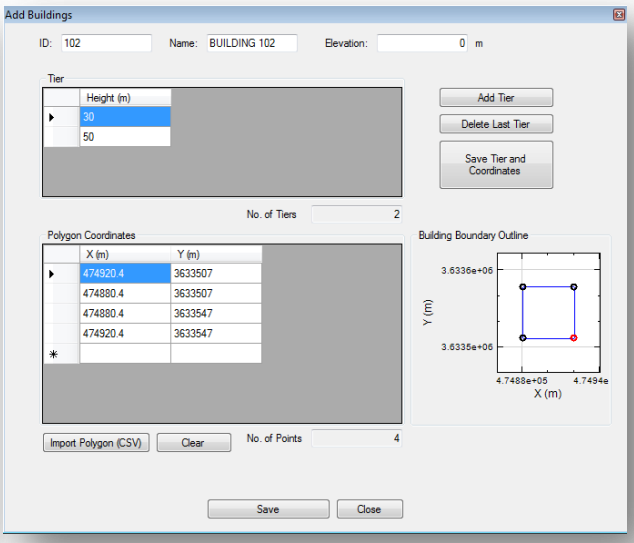
When using AERMOD you must consider nearby ***buildings***. Depending on the height and proximity of the building near the stack there can be increased air dispersion from the plumes emitted from the stacks. This increase in air dispersion is considered building downwash and can have a large impact on a health risk assessment. Therefore, under the ***Source pathway*** you must enter nearby building height dimensions to account for building downwash.

From the building screen you have the option of importing the buildings through the HARP database.



If you choose to manually add in your buildings click ***Add*** to bring you to the following screen:





As shown above, for each building you input you will need ***a user-defined ID, name,*** and ***building elevation***. If the elevation of the building is unknown you may use the ***Run AERMAP to Get Building Elevations*** option in section ***6B. Terrain Options*** to

pull the building elevations from the DEM file. It is automatically assumed the building is one tier. To add additional height (tier), click ***Add Tier***. There is a limitation for the buildings' tier level: when entering building information to the program, all buildings' tier level must start with the same number (e.g. 1). Under the polygon enter the exact coordinates of the building. As shown above on the right diagram the building boundary line is a perfect square, while the one on the left has a different shape. It is important to incorporate the exact dimensions of the building as they can affect how the wind hits the building and then disperses in the air. Once you finish entering the coordinates click ***Save***. Continue this process until all the buildings have been entered. To determine which buildings need to be included in your run, please reference the U.S. EPA's Guidelines for Determination of Good Engineering Practice Stack Height (U.S. EPA GEP).

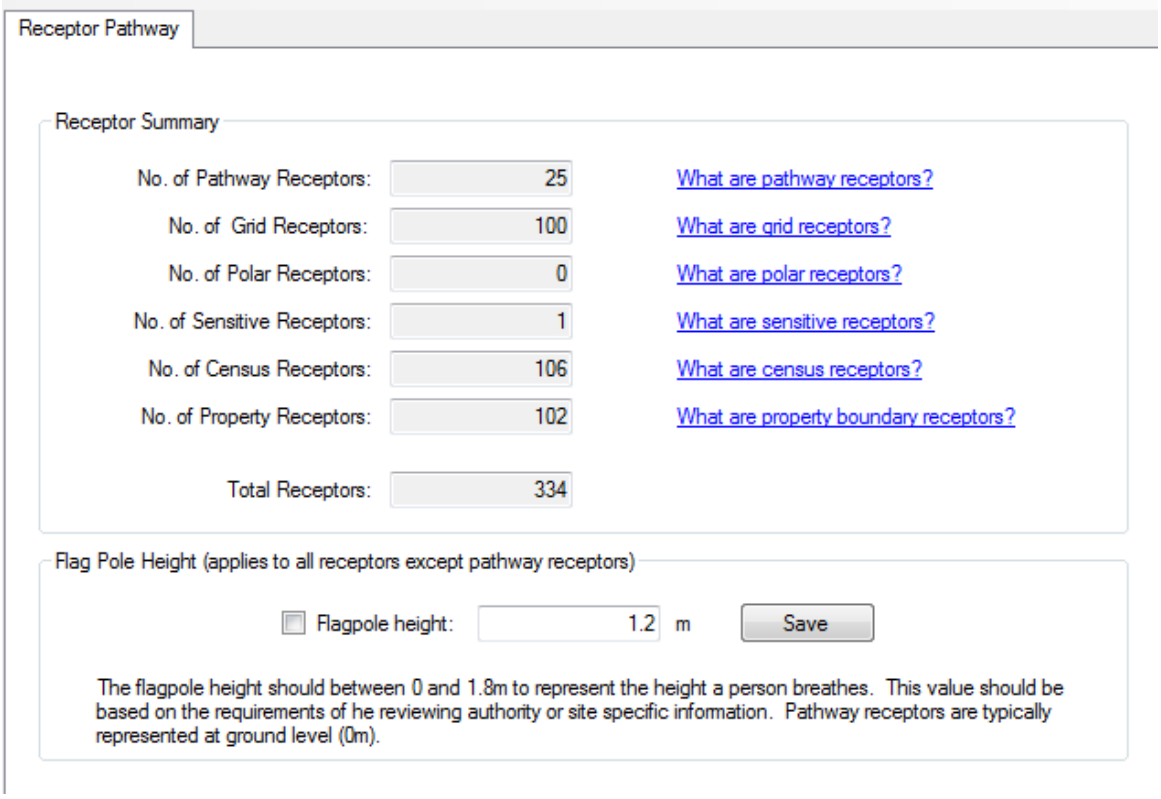
3. Receptor Pathways

In the ***Receptor Pathway*** you will account for ***Cartesian, Polar, and Sensitive Grid receptors, Pathway receptors, Property Boundary receptors, and Census receptors***.

The ***Receptor Summary*** shows the number and type of receptors run in your air dispersion. Initially, this screen will reflect "0" receptors in each category; however as you fill in the receptor data the summary page will update with the number of receptors.

The ***flagpole height*** is set for a recommended default of 1.2 meters. However, you can override the default by checking the ***Flagpole Height*** box and entering a new height. The new flagpole height will be used for all receptors except the ***Pathway receptor***.

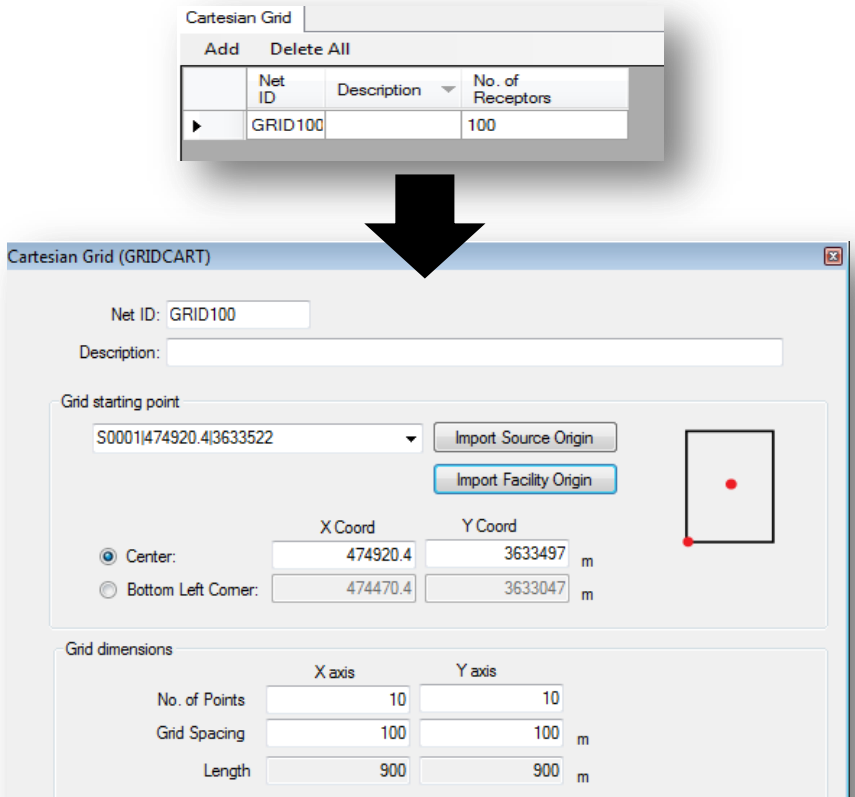
This will be the main screen for ***Receptor Pathways***:



a. Cartesian Grid

Cartesian receptor grids are used to compute the concentration of pollutants over a rectangular geographical region, usually in the vicinity of a particular facility, for the purpose of creating concentration contours and performing a health risk assessment.

The ***Cartesian grid*** is based off its directional coordinates. This is the screen you will see once you click ***Add*** under Cartesian grid.



The ***Net ID*** and ***Description*** are user-defined names to define each grid individually. To begin, select any one of your sources under ***Grid starting point***. You can choose to enter the ***Source location coordinates*** or the ***Facility origin coordinate***; however, it is typically more convenient to define a receptor grid location with respect to the facility origin. You can manually enter these location coordinates or select to import them from the HARP database.

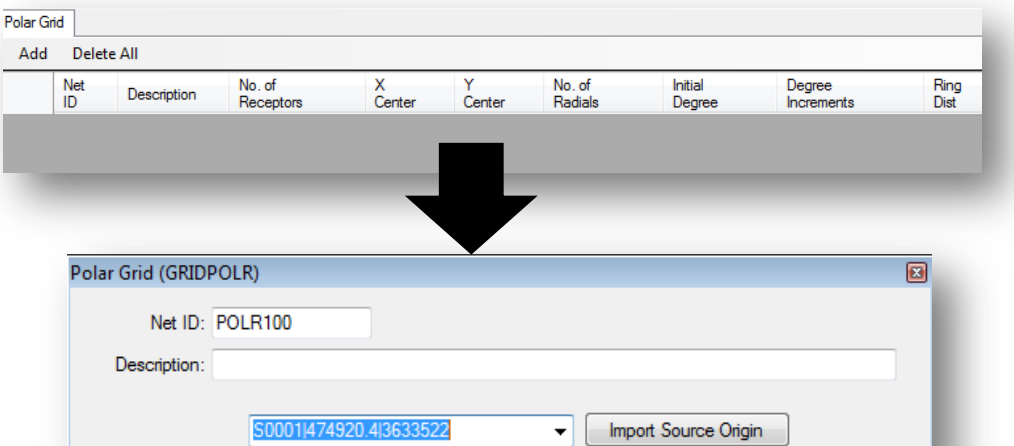
For the ***grid dimensions*** specify the ***number of points*** and ***grid increments*** for both the ***X (East) and Y (North) axis***. The ***length*** (in meters) will automatically be calculated depending on what you enter for the grid spacing and number of points. After saving you will return to the Cartesian grid main page and repeat the steps for as many Cartesian grids as needed.

*** Note: In the Cartesian grid you also have the ability to create “discrete receptor” points that will model impacts at specific points of interest such as locations of schools or houses, nearby Class I areas, or locations identified as having high concentrations by previous modeling analyses (U.S. EPA, 2004). We have identified these discrete receptors as Sensitive, Pathway, Property Boundary and Census Receptors. Each of these will be discussed in further detail later in this section.

b. Polar Grid

Polar grids are used to compute the concentration of pollutants over a circular geographical region, usually in the vicinity of a particular facility, for the purpose of creating concentration contours and performing a health risk assessment.

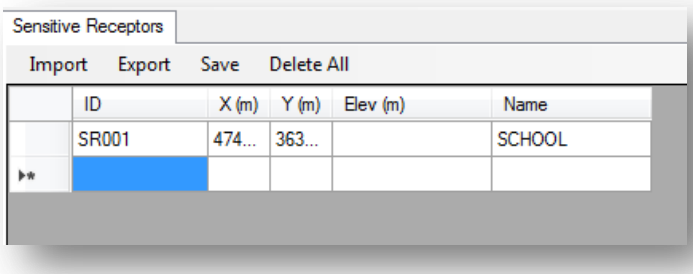
This is the screen you will see once you click ***Add*** under polar grid.



The ***Net ID*** and ***Description*** are user-defined names to define each grid individually. From the dropdown menu, select a source to apply to the polar grid. From there, either chose to ***Import Source Origin*** to have the exact source location input for the center coordinate, or select ***Import Facility Origin*** and your facility coordinates will be entered. You can manually enter these location coordinates or select to import them from the HARP database. From there, enter the ***number of directional radials*** and at what degree the radials will start from and increase by. The distance between the ring and the starting point will complete the required information for the polar grid. You can put multiple rings on one grid; however, you must separate the distances through the use of commas. Click ***Save*** and repeat the process as many times as necessary.

c. Sensitive Receptors

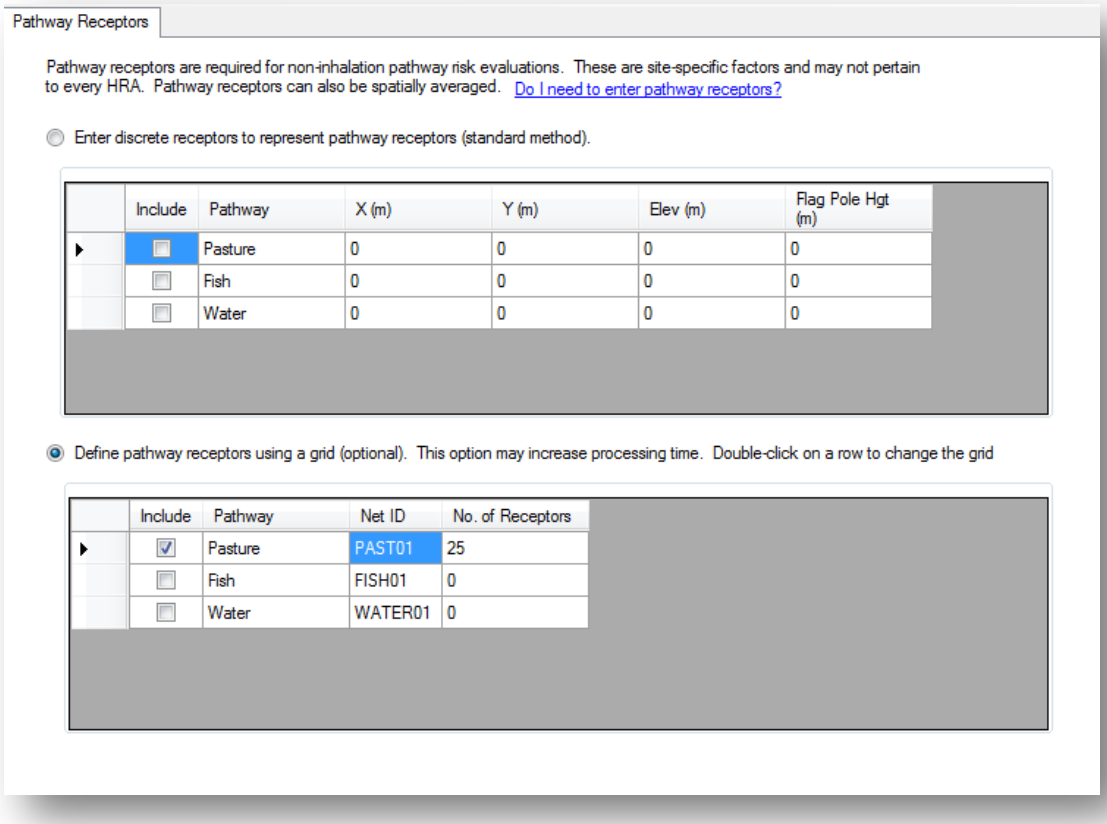
Sensitive Receptors are used to compute the concentrations of pollutants at locations that usually represent a sensitive population such as a school or hospital. The main menu for sensitive receptors looks like this:



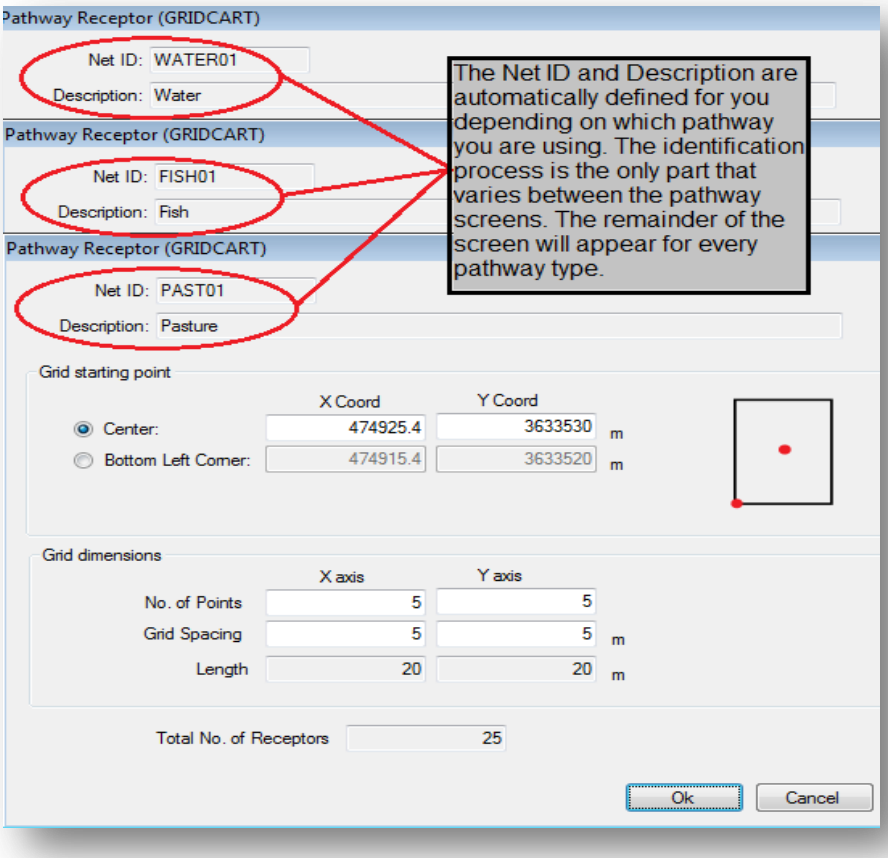
There are three options for adding sensitive receptors to your air dispersion model: ***Importing from a CSV file, importing from the HARP database,*** or ***manually entering the user-defined ID, X-Y coordinates of the receptor, elevation (determined from AERMAP) and the type of sensitive receptor it is (i.e. school or hospital)***.

d. Pathway Receptors

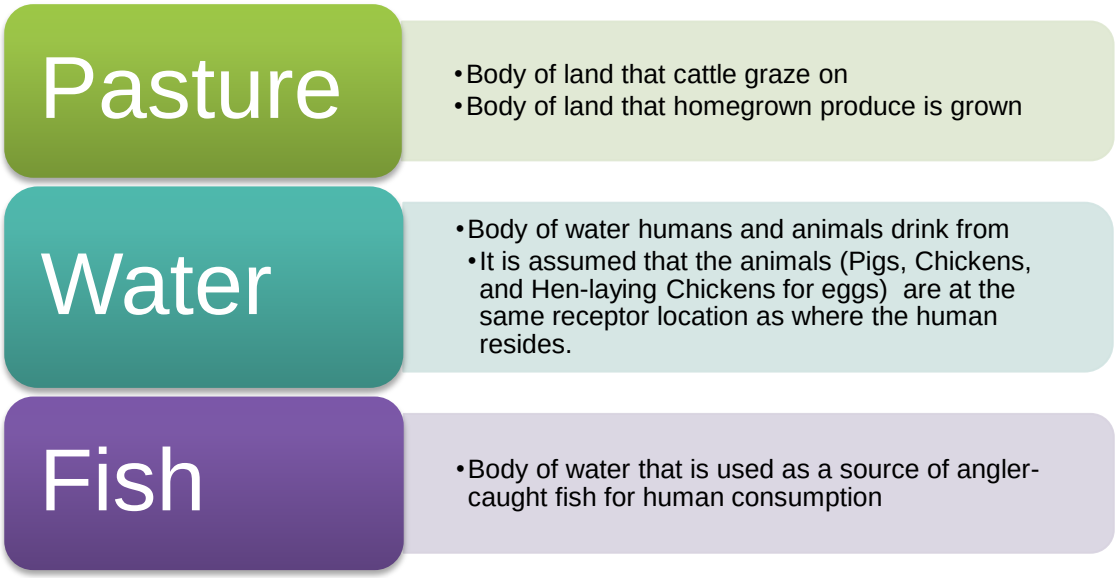
Pathway receptors are used to define the locations of the drinking water, the pasture, and the locally caught fish that may be required for a health risk assessment. If you choose to enter the discrete pathway receptors through the standard method click whichever pathway you intend to run and include the ***X-Y coordinates***, the ***elevation*** (through AERMOD) and the ***flagpole height***. This is all entered manually; nothing can be imported through a CSV file or through the HARP database.



If you choose to define the pathway receptors by using a grid you will use the second pathway receptor box and select which pathways that will be included in your run. This option differs because it is based off spatial averaging of an area; where as the standard method in the first table is done by an exact point location. When you click the ***Include*** button you will then double-click the ***pathway (i.e. Pasture, Fish, Water***).



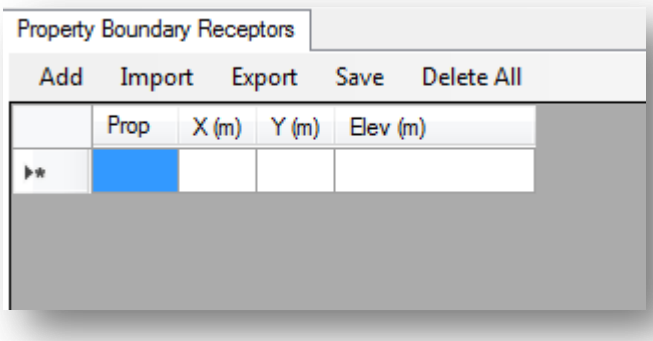
The ***Net ID*** and ***Description*** are automatically defined for you depending on which pathway you are using. The identification process is the only part that varies between the pathway screens. The remainder of the screen will appear for every pathway type. You must manually enter the ***X-Y coordinates for the starting grid point***, either at the center or at the bottom left corner (southwest corner). For the ***grid dimensions*** you will enter the desired number of points on both the X-Y axis as well as the increments of the space. The length will automatically calculate through the number of points and grid spacing. To finish adding the receptor click ***OK***. The ***total number of receptors*** will appear next to the pathway type you were entering. You will repeat this process for each desired pathway. Depending on your facility location you may need to use all or none of the pathway receptors. Refer to the diagram below to determine which pathway receptor(s) apply to your facility.



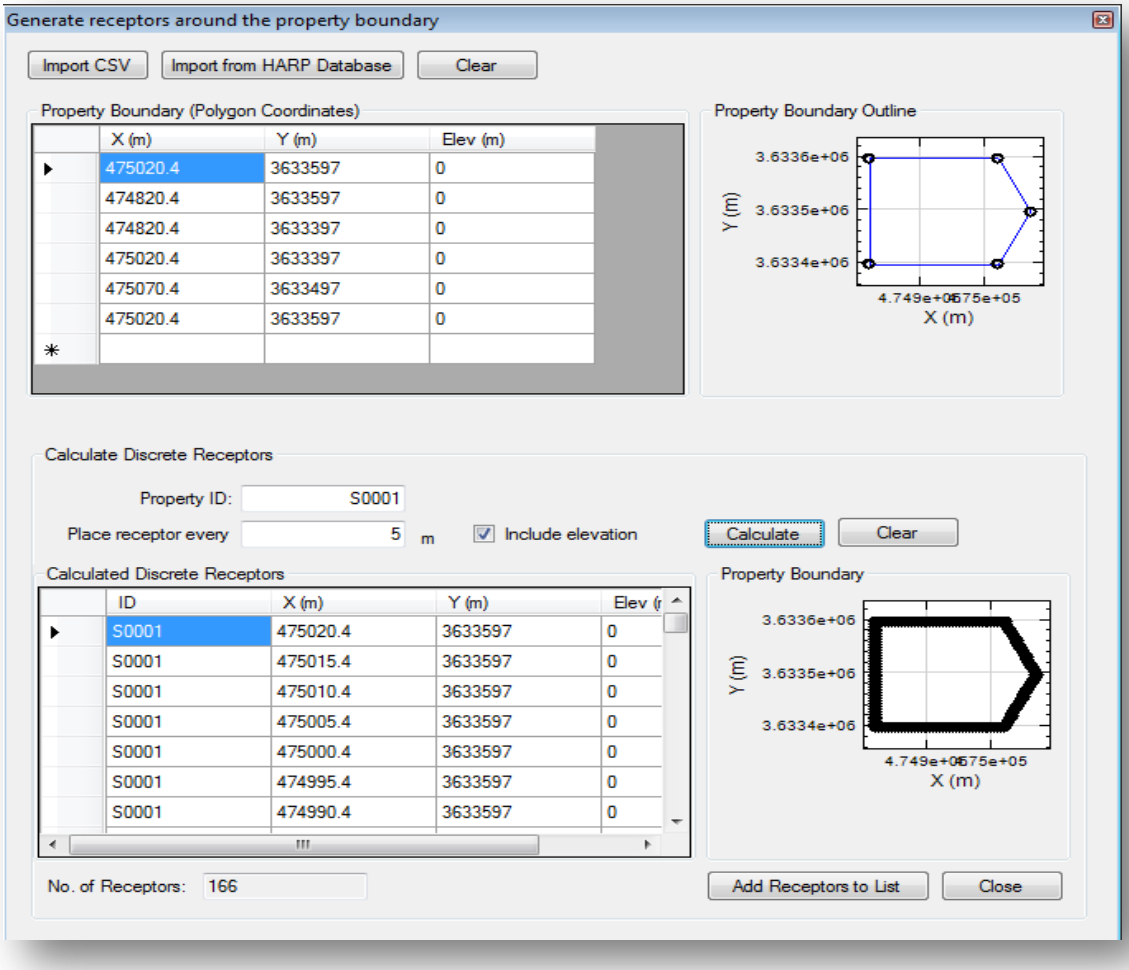
Note: Pathway receptors are placed first in the air dispersion analysis. The receptor index will start at one (1). This information is important when entering the receptor index for selecting the pathway receptor GLCs.

e. Property Boundary Receptors

Property boundary receptors are used to determine the concentration of pollutants along the property boundary of a facility.



You can import the property boundary receptors through a CSV file or by selecting ***Add***. When you select ***Add*** you will be given the following screen to input your data.

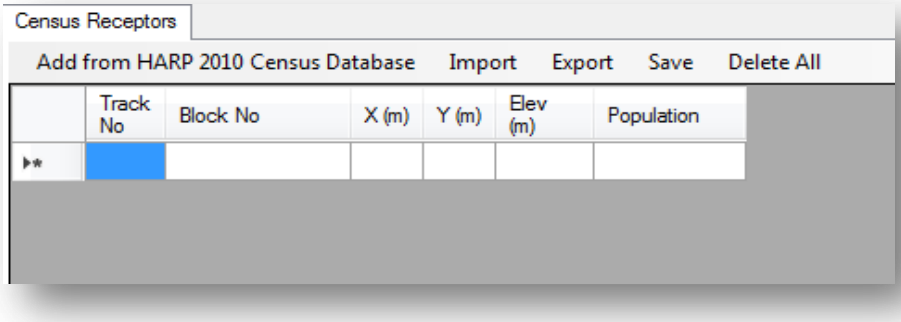


By clicking ***Import from HARP Database*** your property boundary polygon coordinates will be automatically input into the table. If you are working with elevated terrain you will use AERMAP to enter the ***elevations***. The coordinates and property boundary outline is shown to the right of the table. Under ***Calculate Discrete Receptors*** enter a ***user-defined ID*** for the receptor. Then enter a ***value for the distance*** (in meters) between the receptors along the boundary. After clicking ***Calculate*** you will see a list appear in the table with all the discrete receptor coordinates within your specific boundaries. To finish adding the property boundary receptors click ***Add Receptors to List which*** will then appear on the ***Property Boundary Receptors*** main screen.

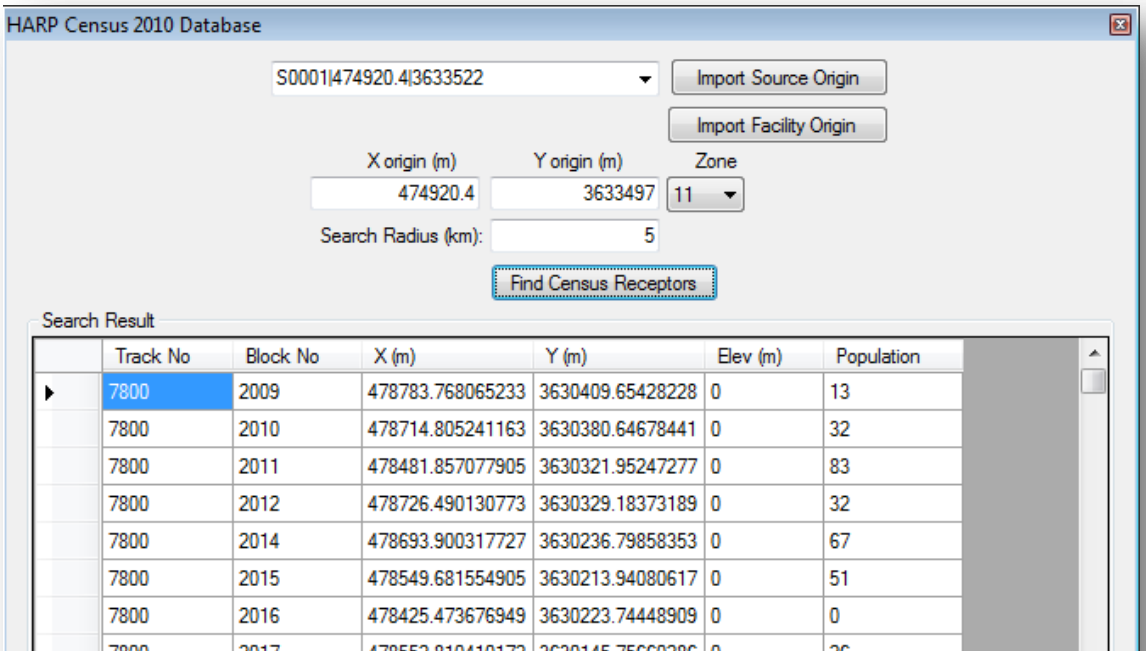
f. Census Receptors

Census block receptors are used to determine the concentrations of pollutants at census block locations to estimate cancer burden.

To define a list of census block receptors you must provide the ***location, elevation and population*** of each census block receptor. Below is the main menu for ***Census Receptors***.



You can choose to import the data through a ***CSV file*** or add it from the ***HARP 2010 Census Database***. If you choose to add it from the database the following screen will appear:

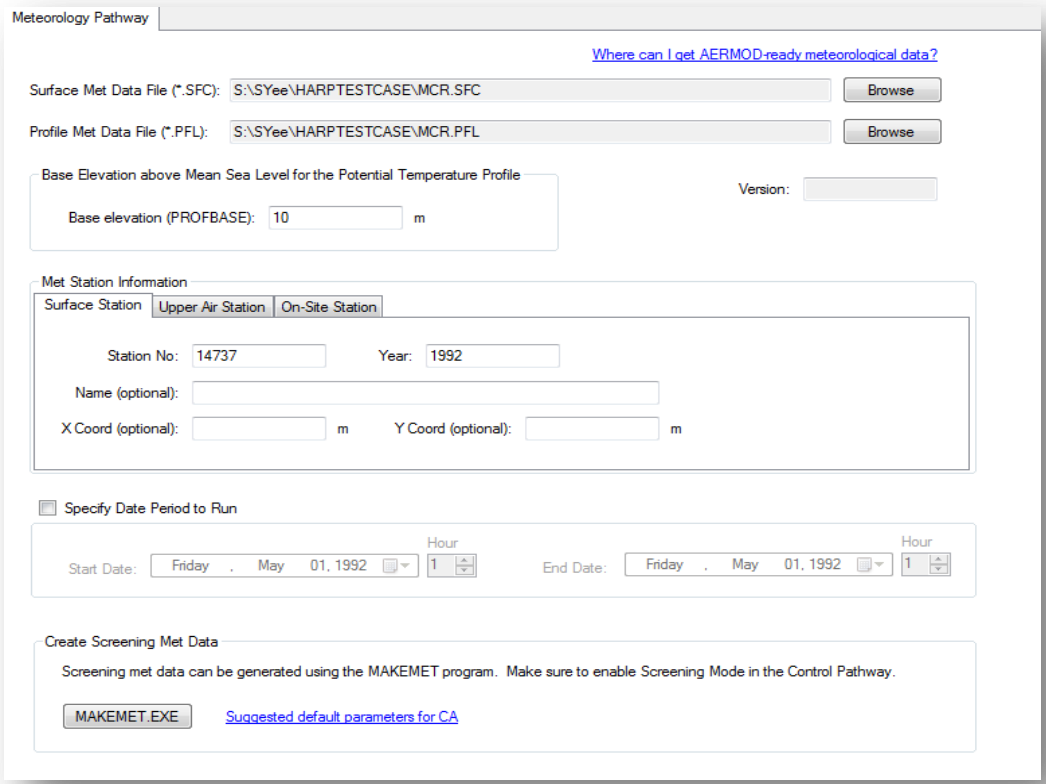


You can either choose to select the ***Import Facility Origin*** to input the X-Y coordinates or you can ***manually enter the data***. Fill in the desired ***search radius***. As shown in the picture above, 5 km was selected. After clicking ***Find Census Receptors*** the search results table reflects all the census receptors located in that radius, totaling to 1010 receptors. To finish, click ***Add Receptors to List***. You will see all the receptors added to the main screen for ***Census Receptors***.

4. Meteorological Pathways

The ***Meteorological Pathway*** contains meteorological data for AERMOD specific to your location.

The ***Meteorological Pathway*** main screen looks like this:



The processed hourly meteorological data is available from the Air Quality Planning and Science Division of the ARB. The ASCII (American Standard Code for Information Interchange) data is in the format specified by AERMOD for standard ASCII input.

The ***Met Station Information*** will be automatically populated by the meteorological data files entered.

You will have the option of choosing specific timeframes for your air dispersion run or keep the default option that will run the timeframe for all available data. The U.S.EPA Guidelines on Air Quality Models recommends that the most recent five years of consecutive meteorological data should be used for air quality modeling studies. The OEHHA Guidance Manual recommends that the most recent five years of consecutive meteorological data should be used for risk assessment analysis. A single year can be used if it is the most conservative year.

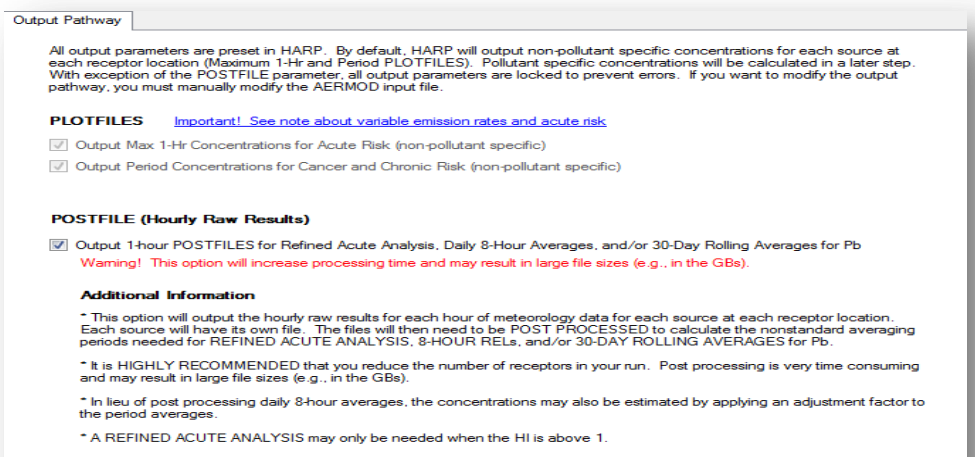
These data are made available for your convenience. ARB will update these data on an "as needed" basis. This means where we have a specific application to include additional processed data for individual projects; the data will also be available at http://www.arb.ca.gov/toxics/harp/metfiles2.htm.

If the meteorological data necessary for your AERMOD run is not available you can create your own using the ***MAKEMET program***. In order to generate your own data the ***Screening Mode (SCREEN)*** beta option must be selected in the ***Control Pathway***.

> Note: The fact that ARB has supplied you with these data does not mean that ARB will place its approval on subsequent applications. The models must be applied properly with appropriate input data which is consistent with their formulation, testing, and assumptions.

5. Output Pathways

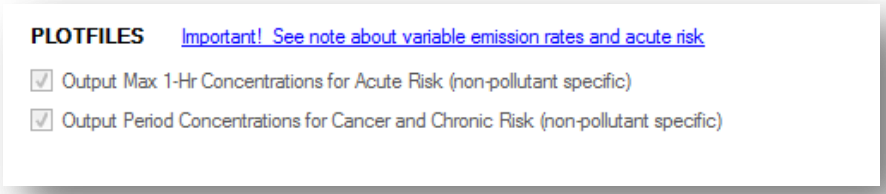
The ***Output Pathway*** has several options that allow you to create output files specific to your modeling needs. The following screen shows the ***Output Pathway***.



All output parameters are preset in HARP 2. By default, HARP 2 will output non-pollutant specific concentrations ***PLOTFILES*** for each source at each receptor location (***Maximum 1-Hr and Period PLOTFILES***). Pollutant specific concentrations will be calculated in a later step. With exception of the ***POSTFILE*** parameter, all output parameters are locked to prevent errors. To modify the output pathway, you must manually modify the AERMOD input file.

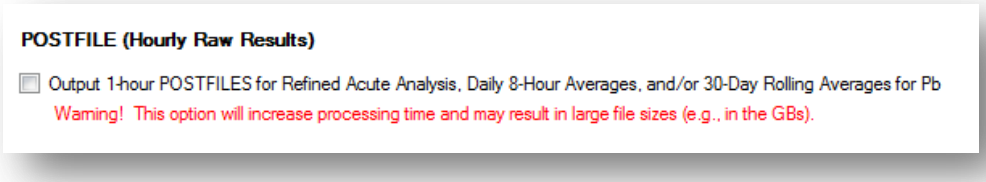
a. PLOTFILES

A ***PLOTFILES*** is a file produced of design values that can be imported into graphics software for plotting contours. By default, both of the following PLOTFILES will be generated for you.



b. POSTFILES

A ***POSTFILE*** is a file of concurrent (raw) results at each receptor suitable for post-processing. This option will output the ***hourly raw results*** for each hour of meteorology data for each source receptor location. Each source will have its own file. The files will then need to be ***POST PROCESSED*** to calculate the nonstandard averaging periods needed for ***REFINED ACUTE ANALYSIS, 8-HOUR RELs,*** and/or ***30-DAY ROLLING AVERAGES for LEAD (Pb).***

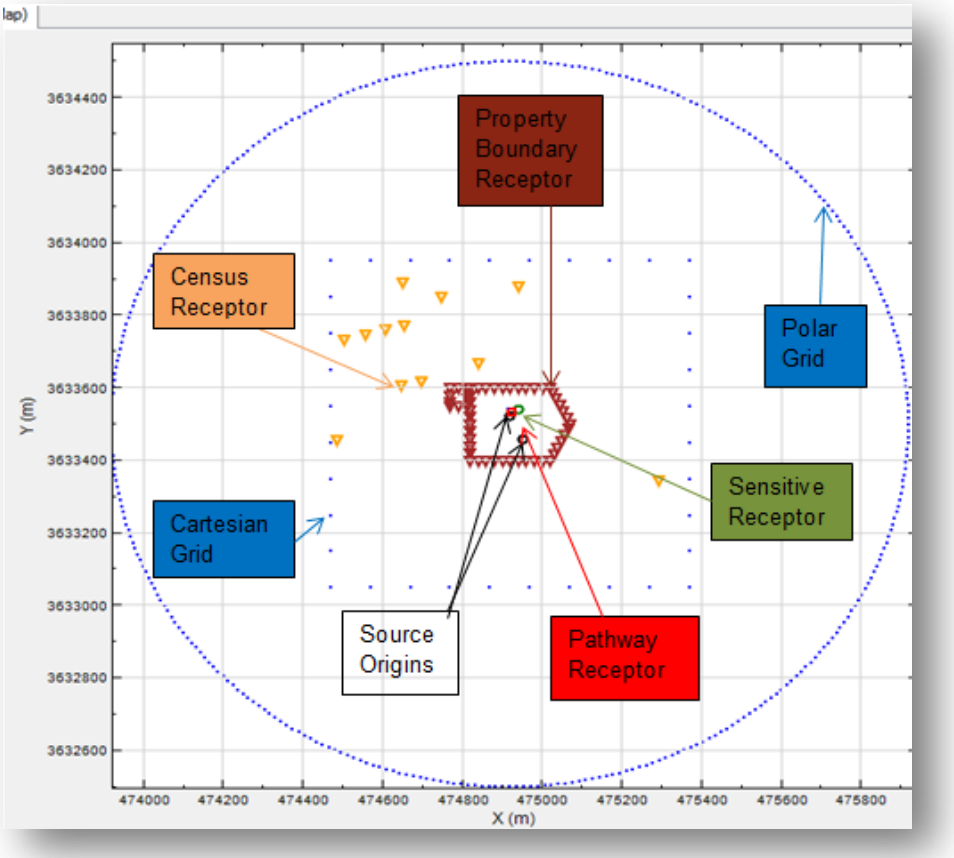


It is HIGHLY RECOMMENDED that you reduce the number of receptors in your run. Post processing is very time consuming and may result in large file sizes (i.e. in the GBs).

- A ***Refined Acute Analysis*** may only be needed when the hazard index (HI) is above 1.
- In lieu of post processing daily 8-hour averages, the concentrations may also be estimated by applying an adjustment factor to the period averages.
- The ***non-cancer chronic impacts*** for Pb are not calculated in HARP 2 but are instead evaluated using the 2001 Risk Management Guidelines for Pb. However, HARP 2 can calculate the maximum 30-day rolling averages required by the risk management guidelines.

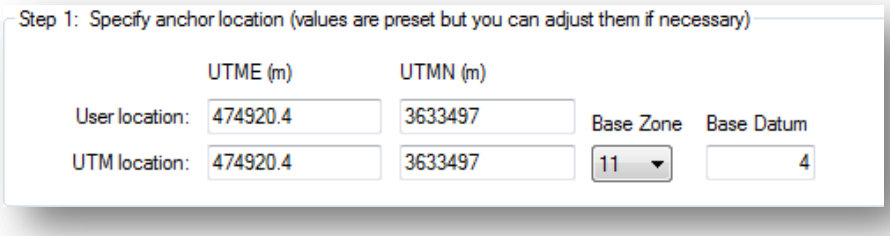
6. Source Receptor Layout

The ***Source Receptor Layout*** maps all your receptors on one grid. You can customize it to include all your receptors or only specific receptors. The ***Export*** option will allow you to export the grid into a KML file that you import into Google Earth and see an aerial image of your receptors and boundaries.

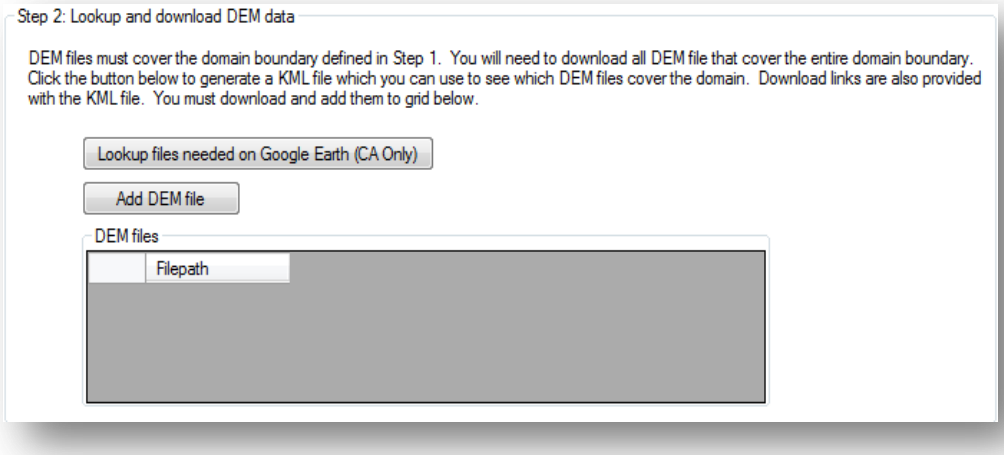


B. Terrain Options

In Step One ***Specifying the Anchor Location*** the values are preset, although you can adjust the values if necessary.



Step Two involves ***locating and downloading DEM*** data into AERMAP. You must cover the entire domain boundary specified in Step One. You may have to download several DEM files depending on the size of your domain boundary.

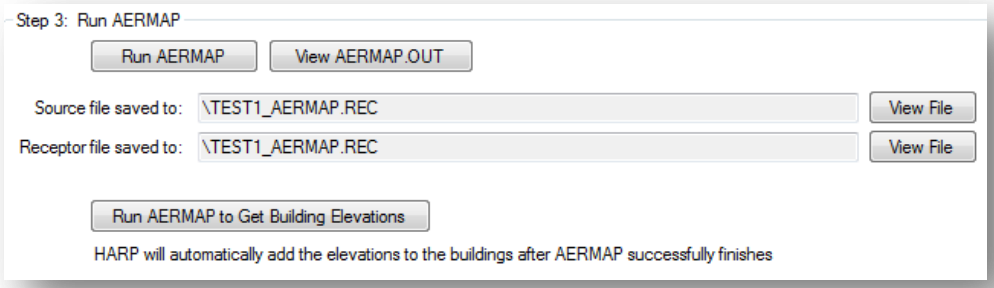


Locate the DEM files by clicking on ***Lookup files needed on Google Earth***. A KML file will be generated so you can import the file into Google Earth to see which quadrants apply to your boundaries. For example, the coordinates we used for La Jolla in Google Earth look like this:

The selected orange region is the specified domain boundaries. According to this map you would need to access two DEM files (La Jolla, La Jolla OE W) to cover all of the domain boundaries.

Once you know which DEM files are needed you can access the DEM files from the HARP website: http://www.arb.ca.gov/toxics/harp/dems.htm.

In Step Three you will run AERMAP by clicking ***Run AERMAP***. Once AERMAP is complete there will be a generated Source and Receptor file that you can view and save.

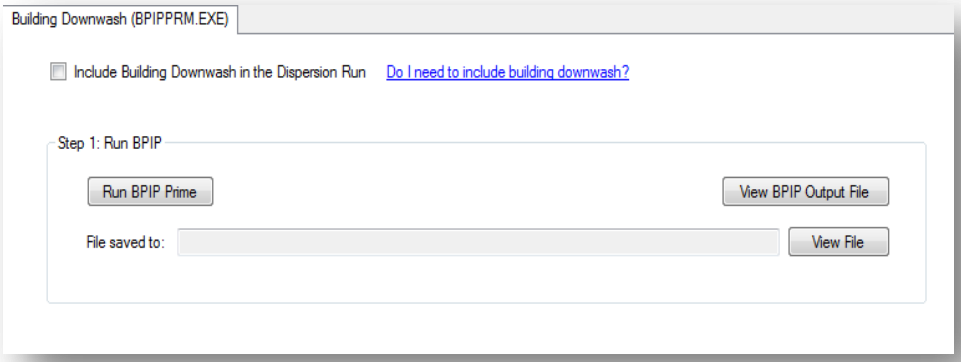


If your air dispersion model incorporates ***buildings*** in the ***Source pathway***, you may use the option of ***Run AERMAP to Get Building Elevations.***

C. Building Downwash

The impact of ***building downwash*** is calculated through a U.S. EPA model called ***BPIP-PRM (Building Profile Input Program Prime)***. Building downwash is the creation of cavity zones by air moving around buildings. BPIP-PRM calculates building heights and projected widths and will determine if a stack is being subjected to wake effects from a structure or structures to calculate building downwash. BPIP-PRM will

then generate a file that is read by AERMOD to simulate the building downwash effects of one or several buildings on a stack.



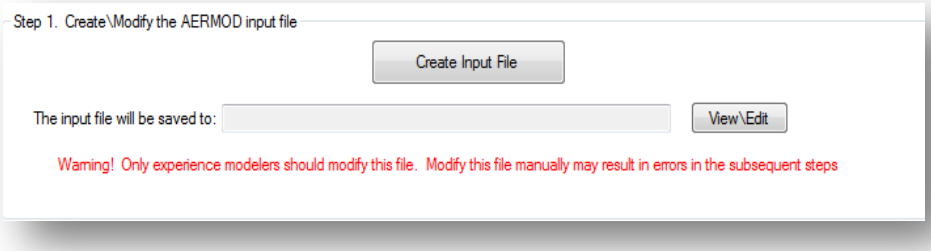
To include building downwash in the AERMOD calculations, running BPIP-PRM is required. Note that building downwash is only calculated for point sources. To locate which buildings need to be included in your run, please reference U.S. EPA's Guidelines for Determination of Good Engineering Practice Stack Height.

To complete the building downwash, check the ***Include Building Downwash in the Dispersion Run box*** and click ***Run BPIP Prime***. The file will automatically be saved to your file location. To see the output data, click ***View BPIP Output File***.

D. Running AERMOD

Running AERMOD is a three step process.

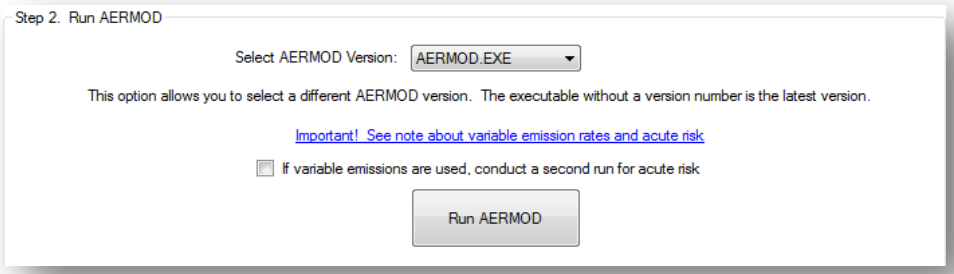
Step One is ***creating or modifying the AERMOD input file***. To create the file, click ***Create Input File***.



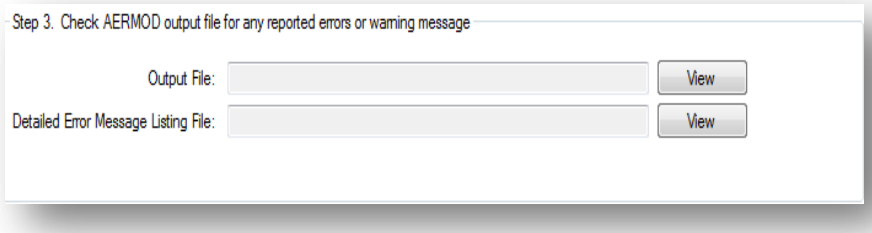
AERMOD will then generate an input file that will be saved to your file location. You can edit the file; however, we recommend this option only for experienced modelers to prevent errors in the remaining steps.

In Step Two select which version of AERMOD to run the data on. The newest version of AERMOD will not have a version number. If you entered ***variable emissions*** under the ***Source pathway*** you will need to check the box marked for variable emissions.

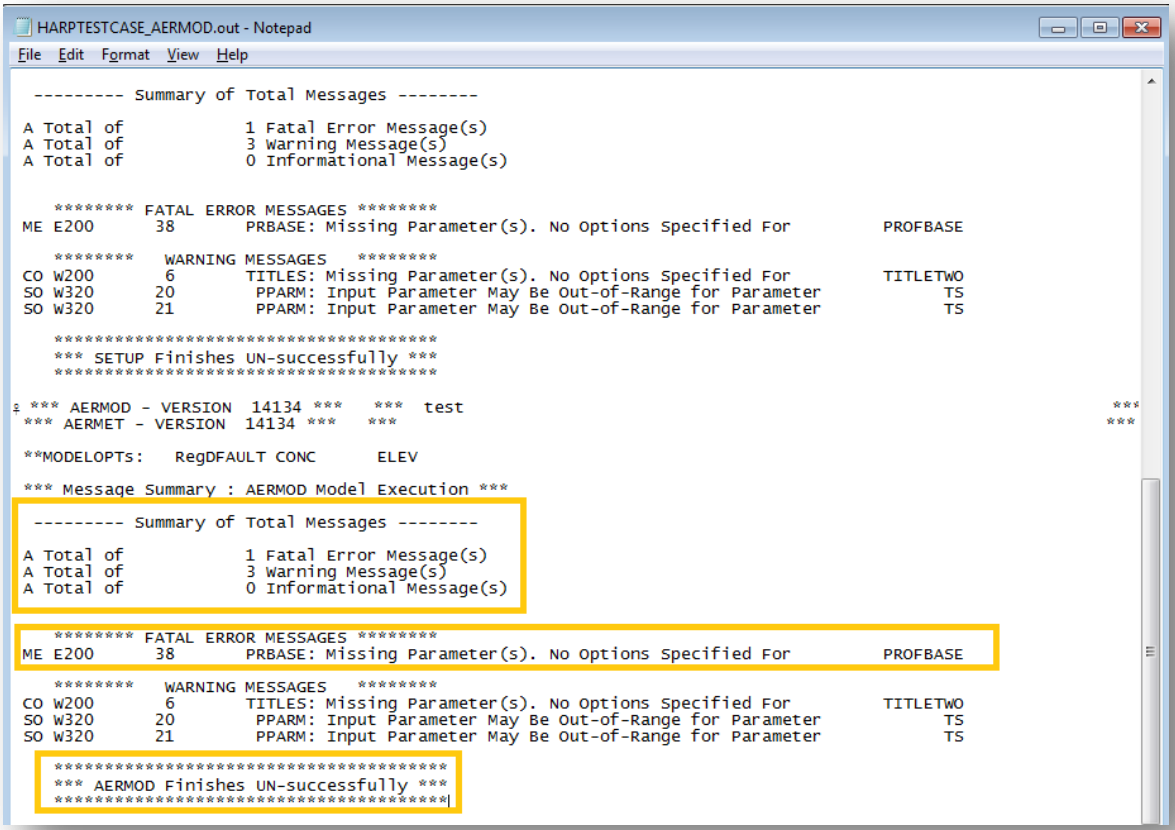
This will calculate a second run for acute risk that will modify the emission factors. Lastly, you will click ***Run AERMOD***.



Step Three will provide the ***AERMOD output files***. You should view the output file in order to check that AERMOD was run successfully with no errors.



At the bottom of the output file you will see a message like the one below. In this example, the AERMOD run was unsuccessful with one fatal error because it was missing data information for the PROFBASE in the Meteorology Pathway.

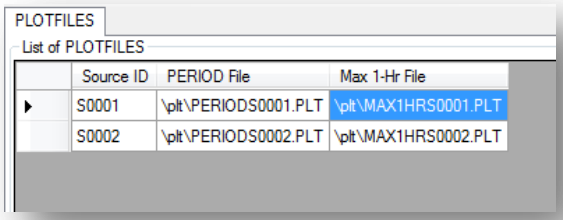


Resolve any errors and rerun the data in AERMOD for an accurate output file.

E. AERMOD Outputs

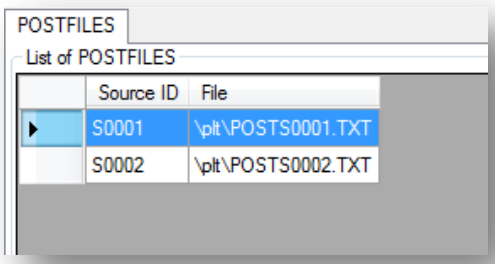
This section provides a list of ***PLOTFILES*** created by AERMOD. The PLOTFILES are treated as non-chemical specific concentrations. HARP 2 calculates the chemical specific concentrations in the next section Import/Calculate GLCs.

A ***PLOTFILE*** is a file produced of designed values that can be imported into graphic software for plotting contours.



The files are separated by ***Source ID's*** into two categories: ***PERIOD file*** and ***Max 1-hr file***.

A ***POSTFILE*** is a file produced of concurrent (raw) results at each receptor suitable for post-processing. Post-processing will be explained further in the next section, ***Importing/Calculate GLCs***.



The lists of POSTFILES are separated by ***Source ID***.

5. STEP TWO: CALCULATING GROUND LEVEL CONCENTRATIONS

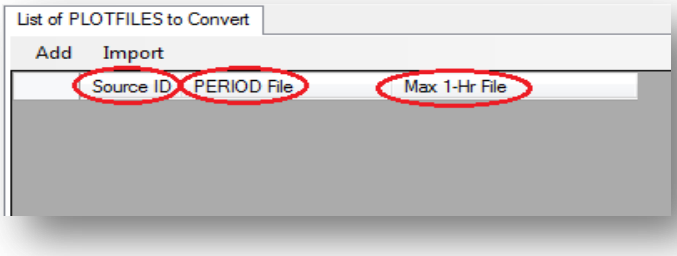
A. Entering GLC Information

Typically, HARP 2 is setup to run the air dispersion analysis using unit emission rates. Using unit emission rates allows multiple pollutants to be scaled from the air dispersion results and saves time. This area is setup to assist you with calculating the pollutant specific concentrations from AERMOD PLOTFILES. Alternatively, if you want to load PLOTFILES that are already pollutant specific from outside of HARP, they can be directly imported into the ***Import/Calculate GLCs*** screen. If the PLOTFILES are not pollutant specific you will continue with the ***GLCs Setup*** screen.

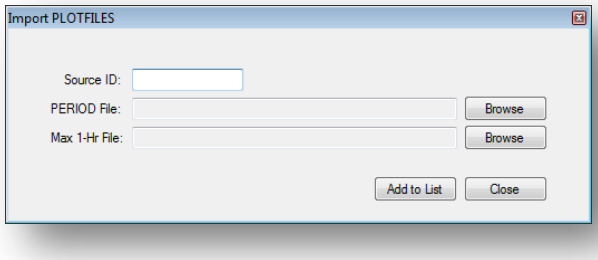
To allow HARP 2 to calculate GLCs successfully, it will need the ***individual PLOTFILES*** for each source from the air dispersion analysis and ***emission inventory*** for each source. After the data is entered, HARP 2 will then calculate (on the ***Import/Calculate GLCs*** screen) the pollutant specific concentrations for each source and sum the combined concentrations into one file for each pollutant. HARP 2 will not output individual source files as it may generate an overwhelmingly large number of files. For example, if there are 100 sources and 10 pollutants in the run, this will generate 1000 files. However, individual source files can be loaded manually.

1. PLOTFILE List

When entering ***PLOTFILES*** you will need to provide a ***Source ID, PERIOD File, and MAX 1-Hr File***. ADMRT gives you the ability to ***Import CSV file*** or ***Import List from Current Run***. If you used ADMRT to run your air dispersion you can upload the current output files for that project.



You may also choose to ***add the files manually***. This option would be best if you ran a program outside of HARP 2 and have PLOTFILES for nonspecific pollutants.



a. Importing PLOTFILES Ran Outside of HARP

HARP 2 can import period and 1-hour PLOTFILES that were run outside of HARP 2 provided they are in the standard format as used by U.S. EPA's compiled version of AERMOD. This requirement is necessary since some of processors (e.g., U.S. EPA's AERPLOT) used by HARP 2 require this format in order to properly read the file.

The file format is typically found in the header of a PLOTFILE. The specification is shown as a FORTRAN expression. It is not necessary to fully understand the expression; however, this information should be used as an indicator that the file you are trying to import may be different. A comparison of the column headers between a standard formatted PLOTFILE and the PLOTFILE that you are trying to import is the best way to see the differences.

i. PLOTFILE Format from U.S. EPA's compiled version of AERMOD

Period PLOTFILE: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
Maximum 1 hour PLOTFILE:
(3(1X,F13.5),3(1X,F8.2),3X,A5,2X,A8,2X,A5,5X,A8,2X,I8)

```
AERMOD ( 14134):  TESTCASE                                                  02/10/15
AERMET ( 14134):                                                            21:47:04
MODELING OPTIONS USED:  RegDFAULT CONC      ELEV
        PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: S0001
        FOR A TOTAL OF  2590 RECEPTORS.
        FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
       X             Y      AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP      NUM HRS   NET ID
_____________ _____________ ____________ _______ _______ _______ _______ ________ ___________ ________
474915.40000 3633520.00000      84.38675   67.10   250.00    0.00  PERIOD  S0001     00009216  PAST01
474920.40000 3633520.00000      88.72726   67.50   250.00    0.00  PERIOD  S0001     00009216  PAST01
474925.40000 3633520.00000      91.37776   67.90   250.00    0.00  PERIOD  S0001     00009216  PAST01
474930.40000 3633520.00000      93.12472   68.30   250.00    0.00  PERIOD  S0001     00009216  PAST01
```

ii. PLOTFILE Format from Third Party Software

AERMOD PLOTFILES from third party software may be slightly different. In these cases, the PLOTFILES must be modified before you can import them into HARP 2. Files can easily be modified using text editors like Notepad. There are more advanced text editors that are free online. Some of these text editors have the ability view the column positions and allow you to select entire columns.

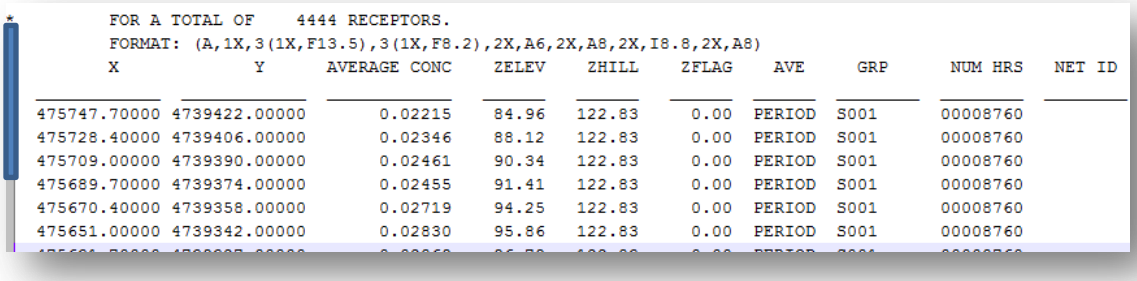
The information below is for some third party software that use AERMOD:

- **PLOTFILES from LAKES AERMOD VIEW**

Files from Lakes do not need to be modified.

- **PLOTFILES from BREEZE**

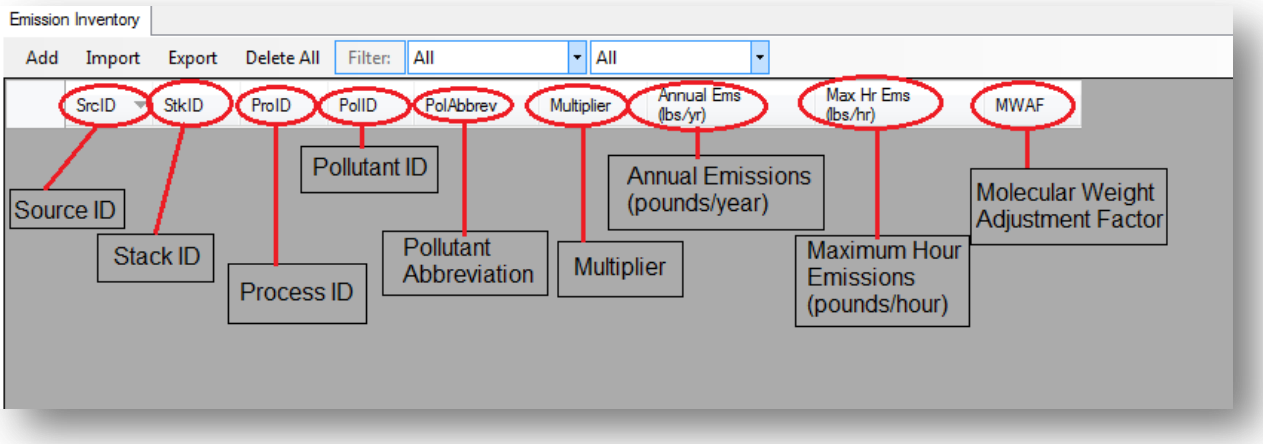
BREEZE files have an extra column at the beginning of each record. Using a text editor, remove the first column at the beginning of each record. If your text editor has a column select mode, you can remove the first column for each record all at once.



```
*       FOR A TOTAL OF    4444 RECEPTORS.
        FORMAT: (A,1X,3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,I8.8,2X,A8)
        X             Y       AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE      GRP      NUM HRS   NET ID
_____________ _____________ _____________ _______ _______ _______ _______ ________ ________ _____
475747.70000 4739422.00000       0.02215   84.96   122.83    0.00  PERIOD   S001     00008760
475728.40000 4739406.00000       0.02346   88.12   122.83    0.00  PERIOD   S001     00008760
475709.00000 4739390.00000       0.02461   90.34   122.83    0.00  PERIOD   S001     00008760
475689.70000 4739374.00000       0.02455   91.41   122.83    0.00  PERIOD   S001     00008760
475670.40000 4739358.00000       0.02719   94.25   122.83    0.00  PERIOD   S001     00008760
475651.00000 4739342.00000       0.02830   95.86   122.83    0.00  PERIOD   S001     00008760
```

2. Emission Inventory

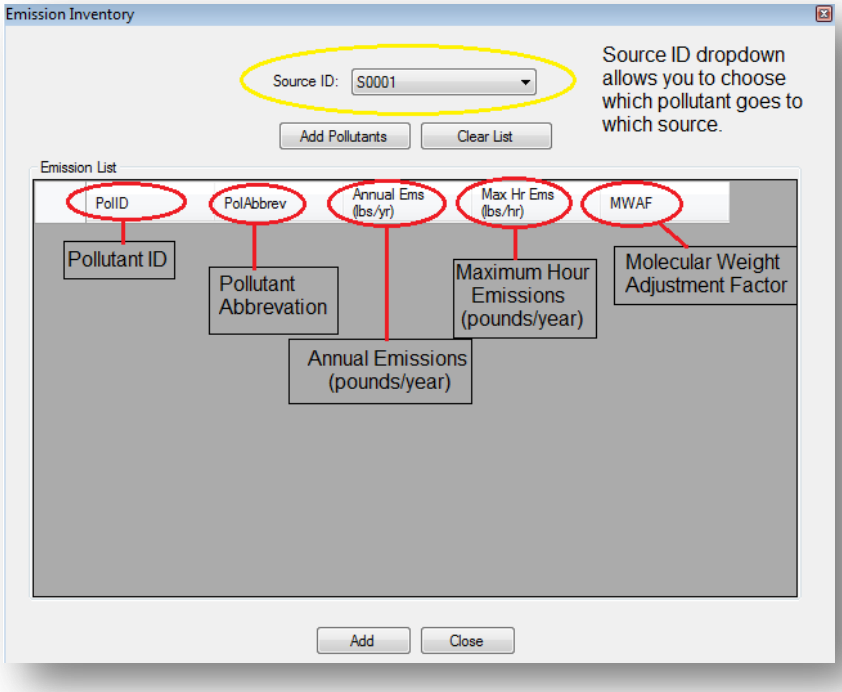
The ***Emission Inventory*** data can be obtained by importing from the ***HARP database*** or from a ***CSV file***. For the CSV file you will need to incorporate all the headings circled below. Note that the Emissions Inventory Module (EIM) will only import pollutants with health values.



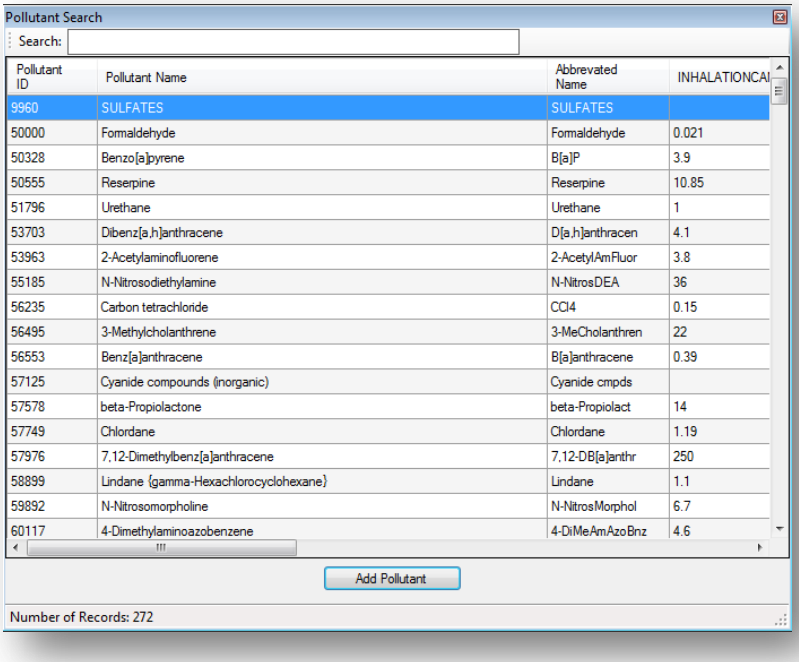
If importing from HARP 2 you must make sure the EIM has all your information populated in order for HARP 2 to populate it correctly in ADMRT.

The ***Molecular Weight Adjustment Factor (MWAF)*** is the adjustment of the total weight of a compound to only include the toxic metal atom. For more information on MWAF please refer to OEHHA Guidance Manual (Section 4.2.1.1.1).

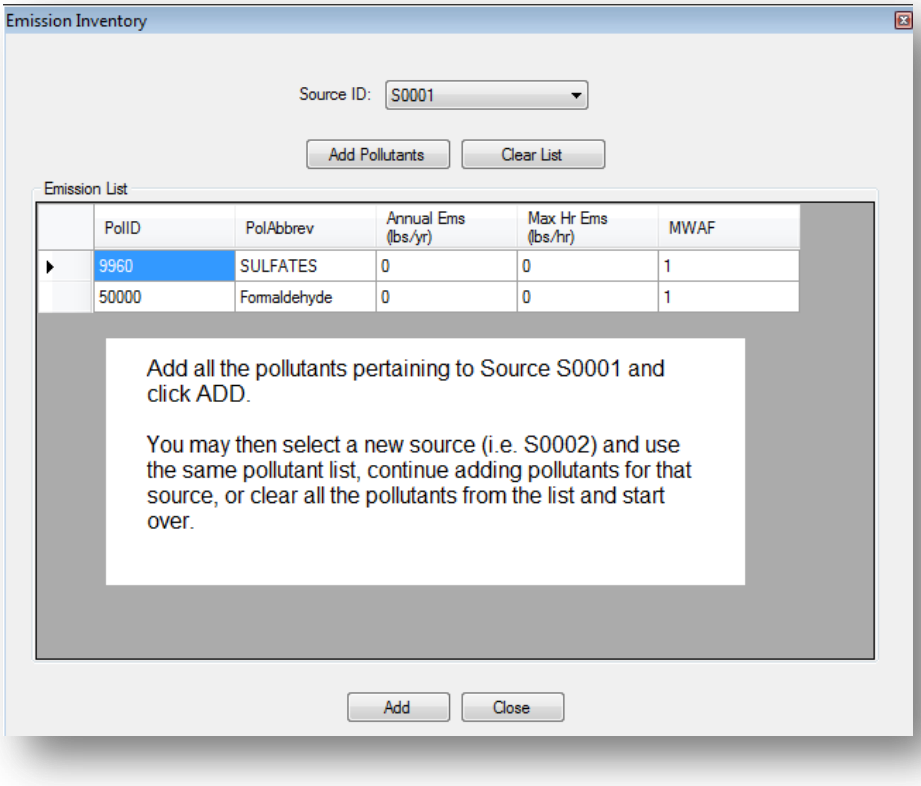
Other than importing from HARP 2 or a CSV file you may elect to ***add your own pollutants into ADMRT***. From the screen below you will select which source you would like to designate for the pollutant and click ***Add Pollutants.***



You will be able to search and select your pollutant from the list.

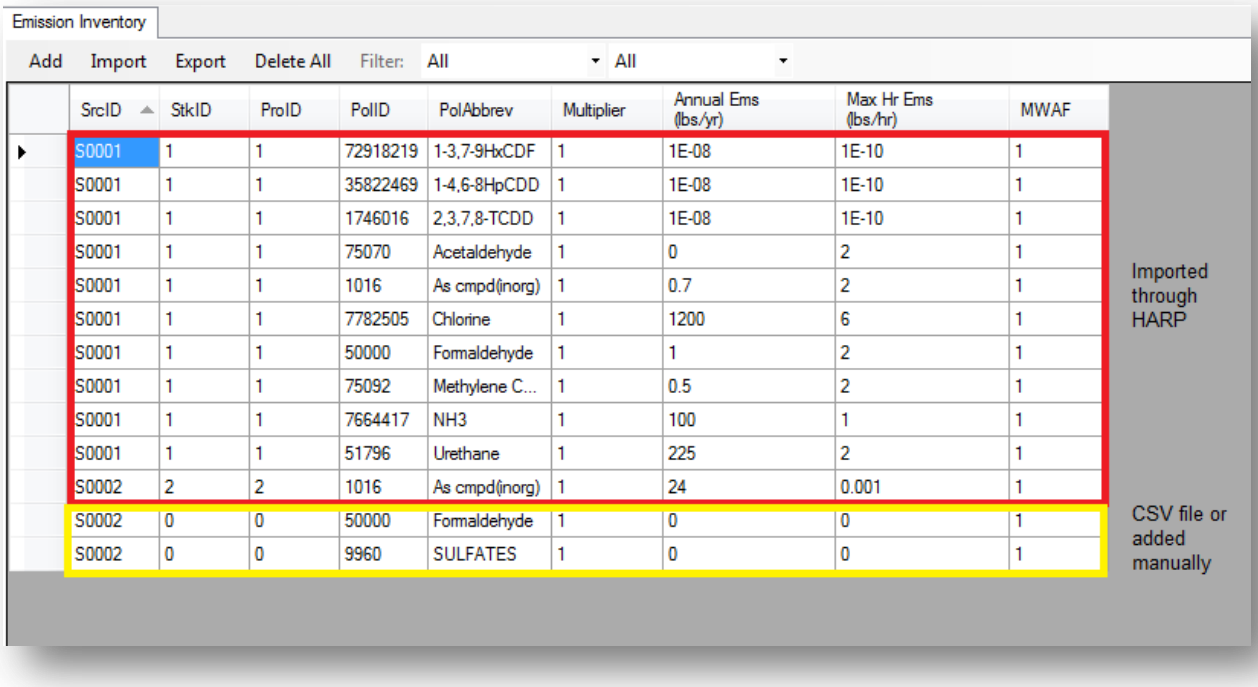


Once you locate the pollutant of interest click ***Add Pollutant***. The pollutant will be added to your list; however, the search screen will still be displayed to easily add more pollutants from the source. When you are done entering all the pollutants for that individual source you may click the red ***Close*** box in the upper right corner. There will be a final display box with the pollutants for that source and you will click ***Add***.



For multiple sources, once you hit ***Add*** on the Emission Inventory screen you can change the source and select the pollutants for that source. The pollutant list from the previous source will remain so if the second source emits the same pollutants you can select ***Add*** again. The same pollutants will be added to the main list for that source. If the second source has additional pollutants from the first source you will select ***Add Pollutants*** and continue adding pollutants to the list. When finished select ***Add***. If the pollutants for the second source are completely different from the first, you may select the ***Clear List*** button and start the list over.

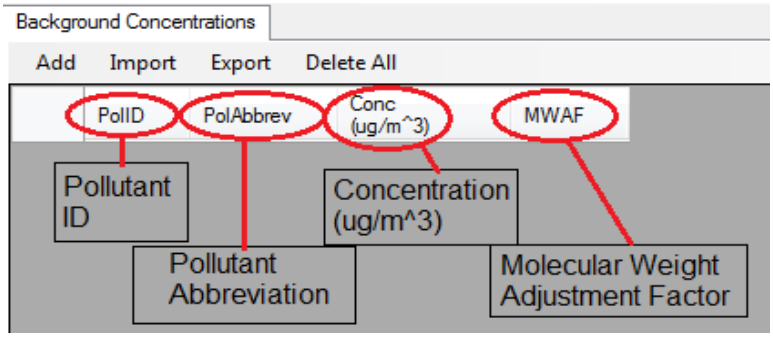
After all pollutants are entered for each source, the final screen should read like the one diagramed below. There is also a ***Filter*** option that allows you to filter your list by source or pollutant.



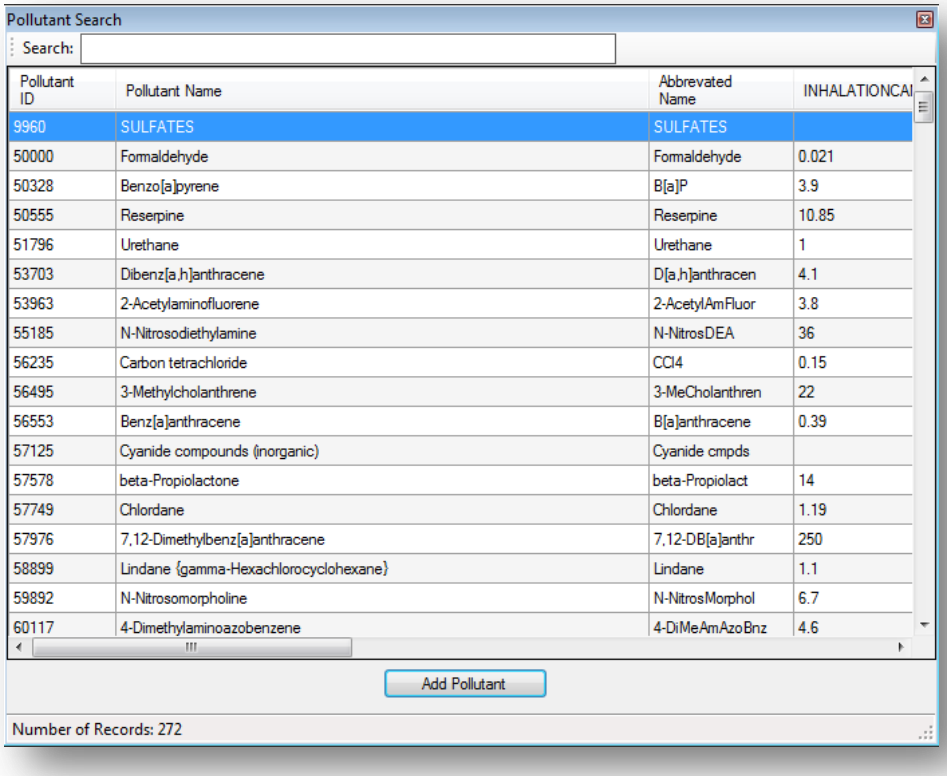
Note that only pollutants imported from HARP 2 will have a Stack ID and Process ID. When manually adding pollutants or importing through a CSV file a “0” placeholder will be used for Stack ID and Process ID, as shown above.

3. Background Concentrations

The District should be contacted to determine if the contribution of background criteria pollutants to respiratory health effects is required to be included in a health risk assessment for the Hot Spots Program. If inclusion is required, the methods for calculating the (HI) from acute and chronic exposure can be found in the OEHHA Guidance Manual (8.3.5). The most recent criteria pollutant concentration data should be obtained from the ARB’s ambient air monitoring network and can be found in the *California Almanac of Emissions and Air Quality* on our web site at www.arb.ca.gov.



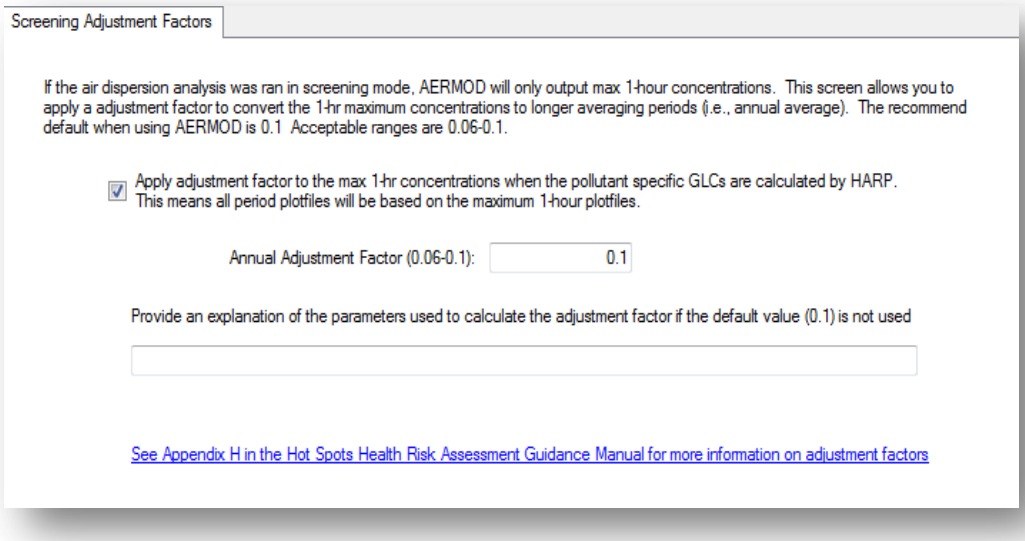
For entering ***background concentrations*** you can either import a CSV file with the parameters circled in the diagram above or manually add them. To manually add a background concentration you will select ***Add*** and the pollutant search screen (identical to the pollutant search screen that appeared in the Emission Inventory step) will appear.



You will select whichever pollutants you would like to incorporate into your analysis and press ***Add Pollutant***.

4. Screening Adjustment Factors

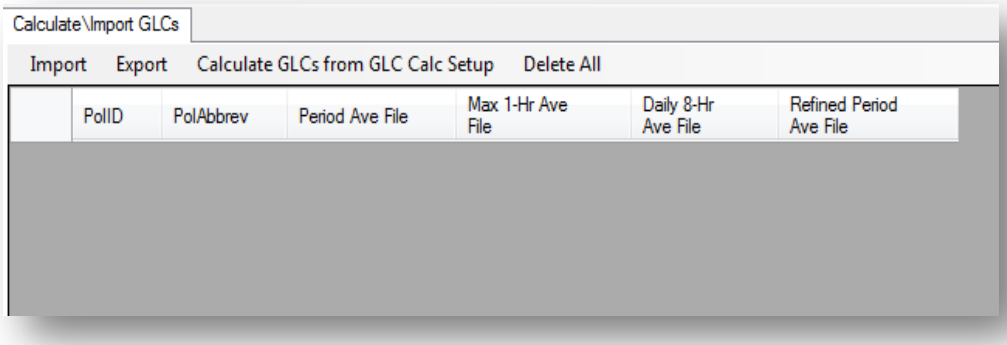
If the air dispersion analysis was run in ***screening mode***, AERMOD will only output max 1-hr concentrations. The screen shown below, allows you to apply an ***adjustment factor*** to convert the 1-hr maximum concentrations to longer averaging periods (i.e. annual average). The recommended default when using AERMOD is 0.1; although acceptable ranges are 0.06-0.1. If the default is not used, there is space to provide an explanation for the parameters used to calculate the adjustment factor.



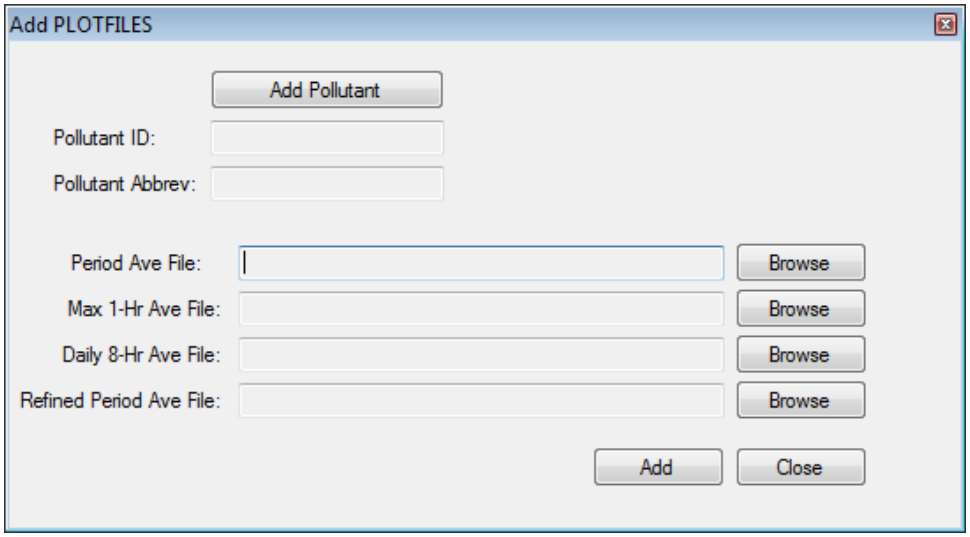
For further information on screening adjustment factors you may reference Appendix H in the OEHHA Guidance Manual.

B. Calculating and Importing GLC

The ***Calculating and Importing GLCs*** home screen appears below. In this tab you will be importing your results to calculate pollutant specific GLCs.

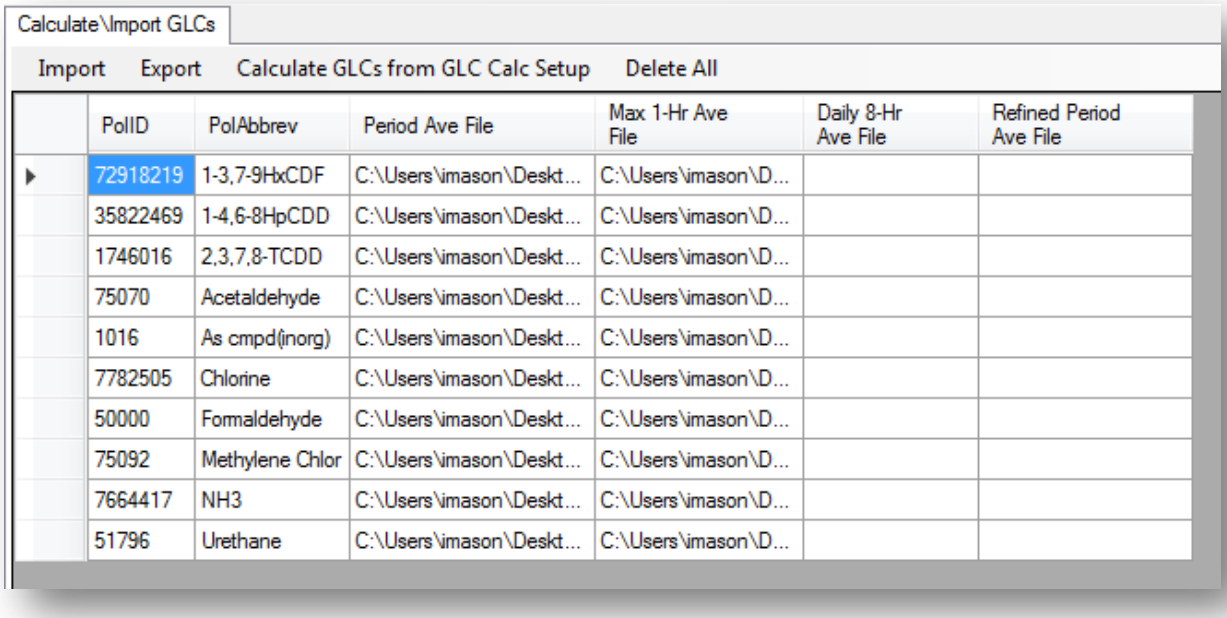


You have the option of importing either a ***CSV file*** or a ***PLOTFILE*** for your pollutants. If importing from a PLOTFILE the screen below will appear.



Note that the ***Daily 8-Hr Average File*** and ***Refined Period Average File*** are added after completing ***Post Process*** discussed later in this section.

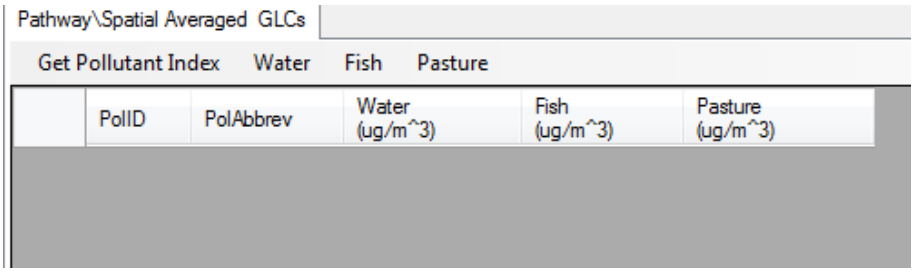
Importing PLOTFILES or CSV files is for users who are inputting pollutant specific GLC data produced outside of HARP 2. For those using HARP 2 to generate pollutant specific data you can click ***Calculate GLCs*** from ***GLC Calc Setup*** and your ***Period Average and Max 1-Hr Average files*** for each pollutant will appear in the list.



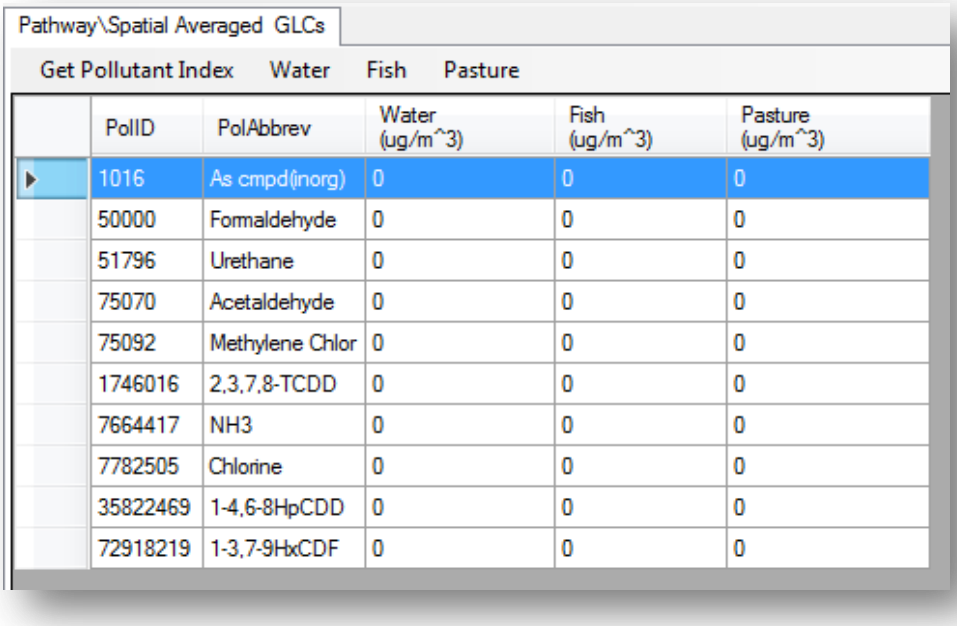
PolID	PolAbbrev	Period Ave File	Max 1-Hr Ave File	Daily 8-Hr Ave File	Refined Period Ave File
72918219	1-3,7-9HxCDF	C:\Users\imason\Deskt...	C:\Users\imason\D...		
35822469	1-4,6-8HpCDD	C:\Users\imason\Deskt...	C:\Users\imason\D...		
1746016	2,3,7,8-TCDD	C:\Users\imason\Deskt...	C:\Users\imason\D...		
75070	Acetaldehyde	C:\Users\imason\Deskt...	C:\Users\imason\D...		
1016	As cmpd(inorg)	C:\Users\imason\Deskt...	C:\Users\imason\D...		
7782505	Chlorine	C:\Users\imason\Deskt...	C:\Users\imason\D...		
50000	Formaldehyde	C:\Users\imason\Deskt...	C:\Users\imason\D...		
75092	Methylene Chlor	C:\Users\imason\Deskt...	C:\Users\imason\D...		
7664417	NH3	C:\Users\imason\Deskt...	C:\Users\imason\D...		
51796	Urethane	C:\Users\imason\Deskt...	C:\Users\imason\D...		

C. Pathway and Spatial Averages

Pathway receptors are required for non-inhalation pathway risk evaluations. These are site-specific factors and may not pertain to every health risk assessment. The Pathway Receptors are separated between Water, Fish, and Pasture.

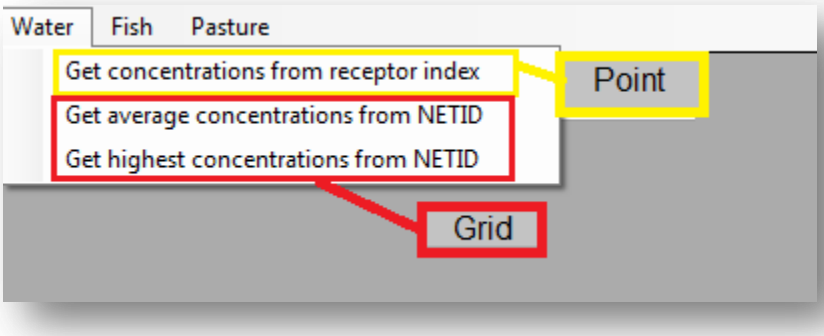


By selecting ***Get Pollutant Index*** the pollutants entered in the previous section from the Emission Inventory and the Background Concentration (if applicable) will be inserted into the Pollutant ID and Pollutant Abbreviation columns.



PolID	PolAbbrev	Water (ug/m^3)	Fish (ug/m^3)	Pasture (ug/m^3)
1016	As cmpd(inorg)	0	0	0
50000	Formaldehyde	0	0	0
51796	Urethane	0	0	0
75070	Acetaldehyde	0	0	0
75092	Methylene Chlor	0	0	0
1746016	2,3,7,8-TCDD	0	0	0
7664417	NH3	0	0	0
7782505	Chlorine	0	0	0
35822469	1-4,6-8HpCDD	0	0	0
72918219	1-3,7-9HxCDF	0	0	0

Note that during this step when the list of pollutants are entered into ***Pathway and Spatial Averaged GLCs*** the pollutants are combined for all sources. For example, if you had the pollutant arsenic for multiple sources, they would be combined and only appear once in the list for this calculation, shown in the diagram above.



The next step is to enter pollutant concentrations for the pathway. The highlighted options above are listed under each pathway (Water, Fish, and Pasture).

The first option ***Get concentrations from receptor index*** is used if you specified a specific point location in ***Receptor Pathways*** (Chapter 4). If you specified a grid location you will use either of the last two options, ***Get average concentrations from NetID*** or ***Get highest concentrations from NetID***.

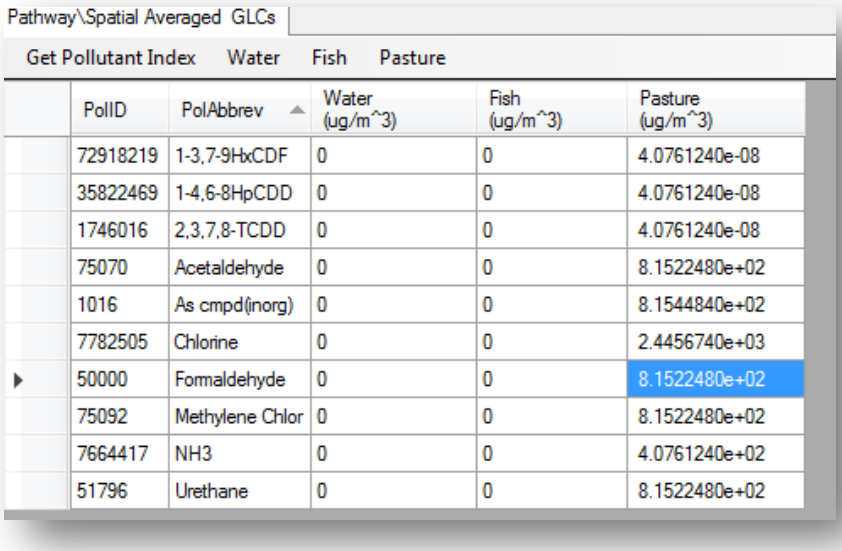
To locate the NetID you can open the HARP generated PLOTFILE under ***AERMOD Outputs***(Chapter 4). The screen below will appear and you will be able to locate the NetID in the last column labeled ***NET ID***.

File Edit Format View Help

*HARP Generated PLOTFILE 2/11/2015 9:31:11 AM
*POLID 50000

* X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	NUM HRS	NET ID
474915.40000	3633520.00000	0.0000000e+00	67.10	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474920.40000	3633520.00000	0.0000000e+00	67.50	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474925.40000	3633520.00000	0.0000000e+00	67.90	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474930.40000	3633520.00000	0.0000000e+00	68.30	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474935.40000	3633520.00000	0.0000000e+00	68.70	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474915.40000	3633525.00000	0.0000000e+00	65.90	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474920.40000	3633525.00000	0.0000000e+00	66.40	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474925.40000	3633525.00000	0.0000000e+00	66.90	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474930.40000	3633525.00000	0.0000000e+00	67.30	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474935.40000	3633525.00000	0.0000000e+00	67.80	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474915.40000	3633530.00000	0.0000000e+00	67.10	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474920.40000	3633530.00000	0.0000000e+00	67.60	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474925.40000	3633530.00000	0.0000000e+00	68.20	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474930.40000	3633530.00000	0.0000000e+00	68.80	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474935.40000	3633530.00000	0.0000000e+00	69.40	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474915.40000	3633535.00000	0.0000000e+00	68.90	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474920.40000	3633535.00000	0.0000000e+00	69.60	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474925.40000	3633535.00000	0.0000000e+00	70.30	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474930.40000	3633535.00000	0.0000000e+00	71.00	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474935.40000	3633535.00000	0.0000000e+00	71.70	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474915.40000	3633540.00000	0.0000000e+00	70.70	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474920.40000	3633540.00000	0.0000000e+00	71.50	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474925.40000	3633540.00000	0.0000000e+00	72.30	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474930.40000	3633540.00000	0.0000000e+00	73.10	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474935.40000	3633540.00000	0.0000000e+00	73.90	250.00	1.20	1-HR	PATHWAY	1ST	PAST01
474470.40000	3633047.00000	0.0000000e+00	41.40	250.00	1.20	1-HR	CARTGRID	1ST	GRID100
474570.40000	3633047.00000	0.0000000e+00	52.50	250.00	1.20	1-HR	CARTGRID	1ST	GRID100
474670.40000	3633047.00000	0.0000000e+00	63.10	250.00	1.20	1-HR	CARTGRID	1ST	GRID100
474770.40000	3633047.00000	0.0000000e+00	69.80	250.00	1.20	1-HR	CARTGRID	1ST	GRID100
474870.40000	3633047.00000	0.0000000e+00	75.70	250.00	1.20	1-HR	CARTGRID	1ST	GRID100
474970.40000	3633047.00000	0.0000000e+00	80.00	250.00	1.20	1-HR	CARTGRID	1ST	GRID100
475070.40000	3633047.00000	0.0000000e+00	85.40	250.00	1.20	1-HR	CARTGRID	1ST	GRID100

Select the average or highest concentration option under your pathway and enter the NetID. The concentrations will be generated in your table as shown in the table below. Continue this process for each applicable pathway.



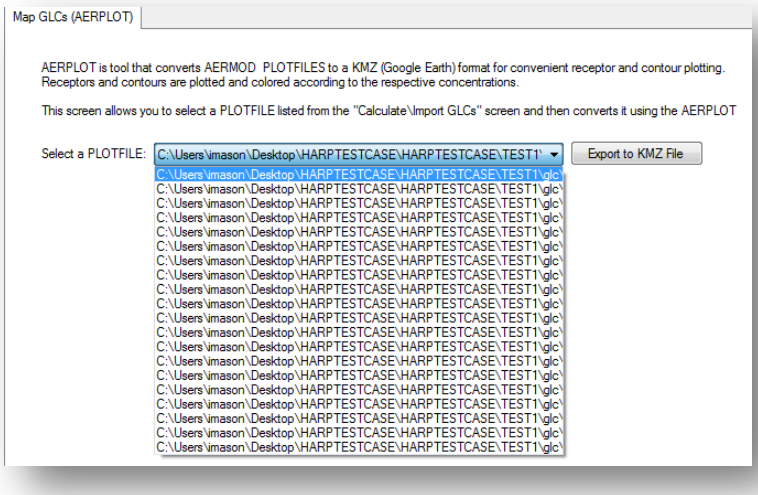
PolID	PolAbbrev	Water (ug/m^3)	Fish (ug/m^3)	Pasture (ug/m^3)
72918219	1-3,7-9HxCDF	0	0	4.0761240e-08
35822469	1-4,6-8HpCDD	0	0	4.0761240e-08
1746016	2,3,7,8-TCDD	0	0	4.0761240e-08
75070	Acetaldehyde	0	0	8.1522480e+02
1016	As cmpd(inorg)	0	0	8.1544840e+02
7782505	Chlorine	0	0	2.4456740e+03
50000	Formaldehyde	0	0	8.1522480e+02
75092	Methylene Chlor	0	0	8.1522480e+02
7664417	NH3	0	0	4.0761240e+02
51796	Urethane	0	0	8.1522480e+02

Note the calculated concentrations will be for ***annual concentrations*** since Pathway Receptors do not apply for Refined Acute Analysis.

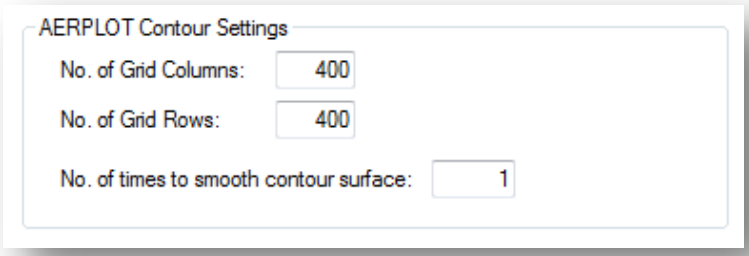
D. Contour GLCs

AERPLOT is a tool that converts AERMOD PLOTFILES to a KMZ (i.e. Google Earth) format for convenient receptor and contour plotting. Receptors and contours are plotted and colored according to the respective concentrations.

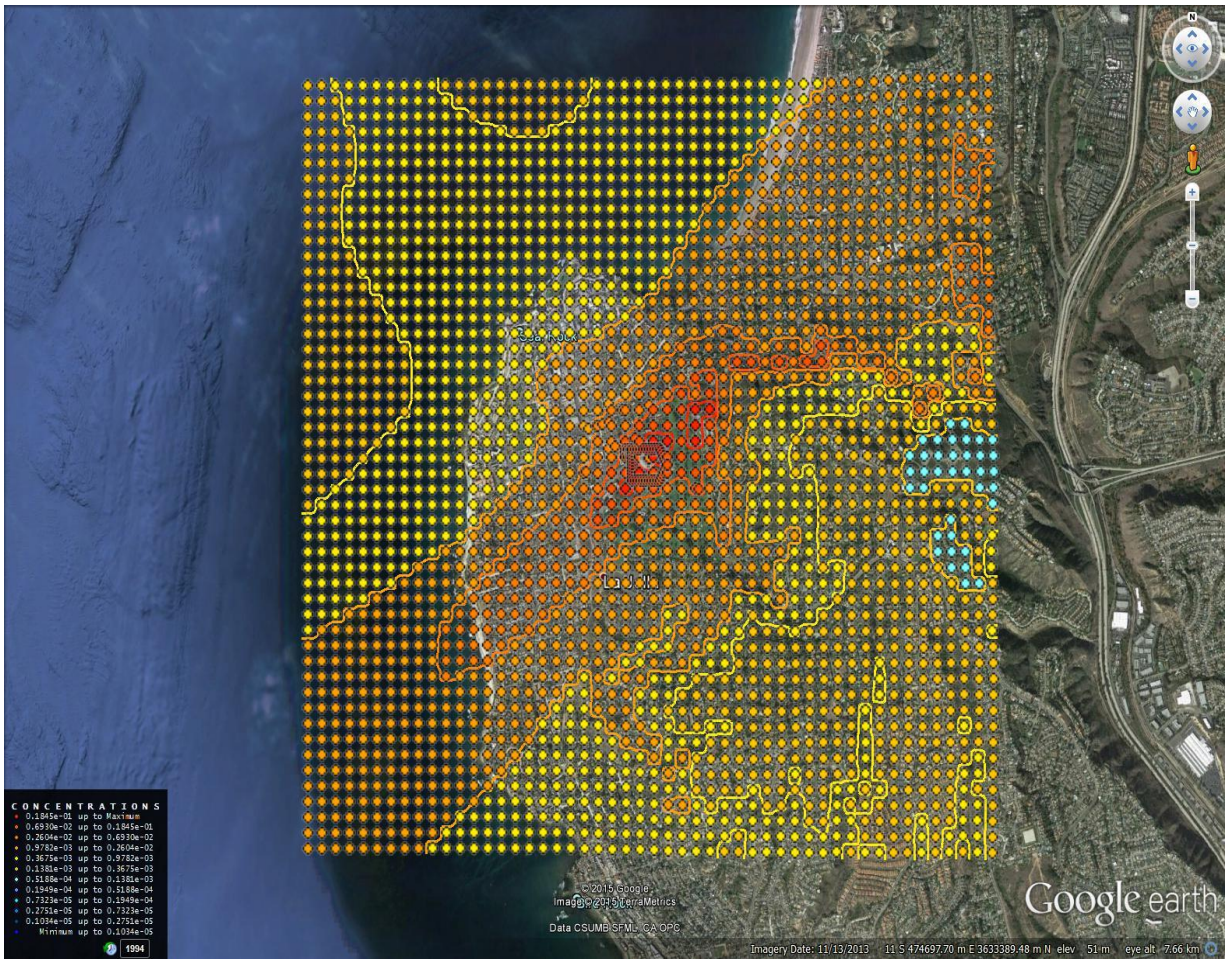
The screen below allows you to select a PLOTFILE listed from the ***Calculate/Import GLCs*** screen and then converts it using AERPLOT.



After selecting a PLOTFILE to convert in AERPLOT you can adjust the contour settings before clicking ***Export to KMZ File***.



Below is an example of the GLCs mapped for La Jolla.



E. Post Process

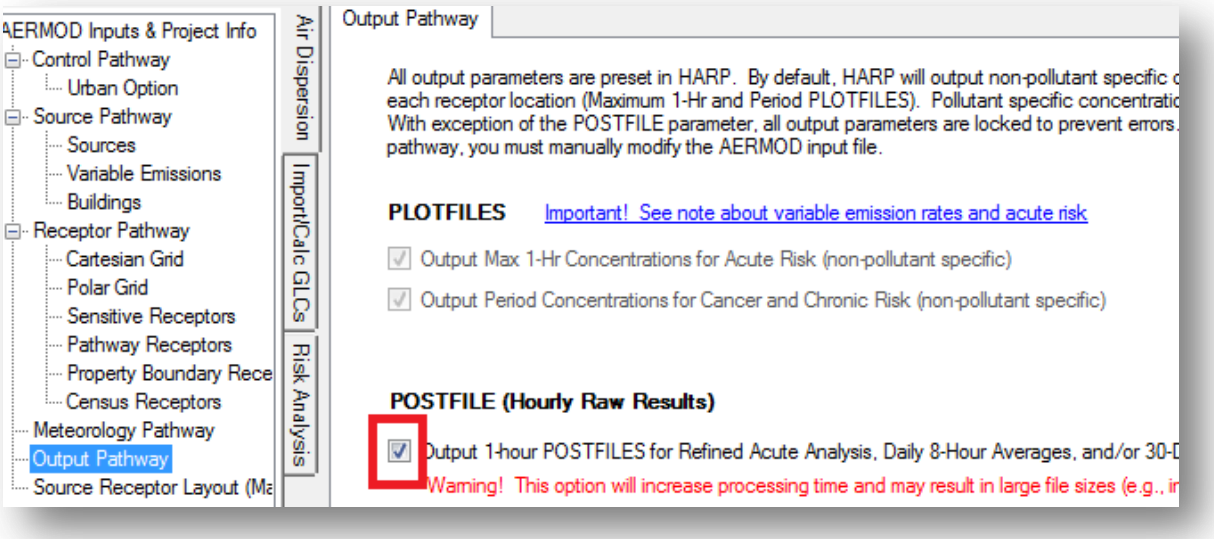
This section allows you to ***post process*** the hourly raw results from AERMOD to nonstandard averaging periods that may be needed for an HRA. Note that post processing is a time consuming process. You may wish to contact the review authority if post processing is required or needed for the HRA.

HARP 2 can post process:

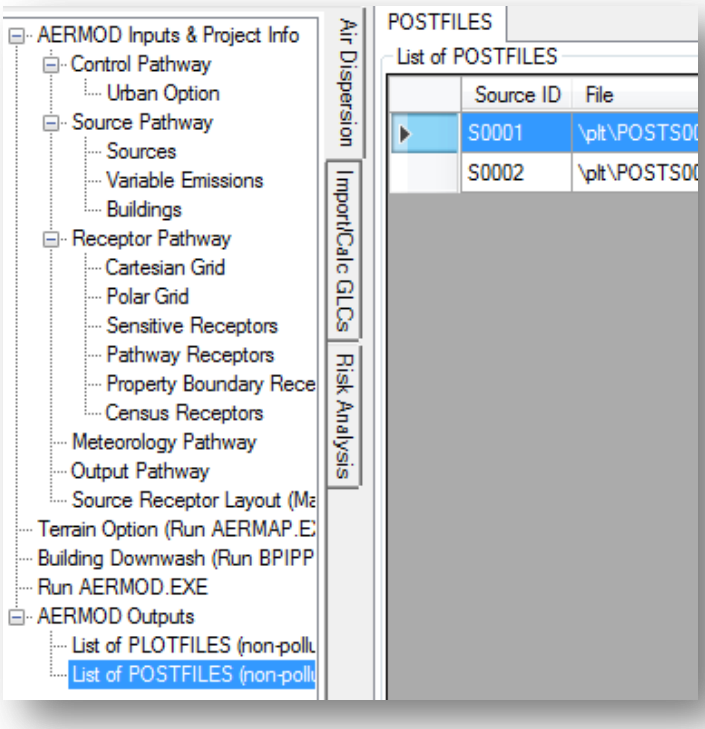
- ***Maximum 30-day averages*** for Pb evaluations under the 2001 Pb Risk Management Guidelines
- ***Daily 8-hour averages for worker scenarios*** and ***chronic 8-hour Reference Exposure Level (REL***) evaluations
- ***Refined period worker concentrations***
- ***Refined acute analysis*** (See "Risk Analysis" section for further information)

For each type of post process you will need to locate the ***hourly raw results (POSTFILE)*** for each source and the ***number of receptors*** in the analysis. The AERMOD error file is an optional feature you can incorporate into your calculations.

The POSTFILE is created during the air dispersion run by selecting the ***Output 1-hr POSTIFLES*** as seen below.

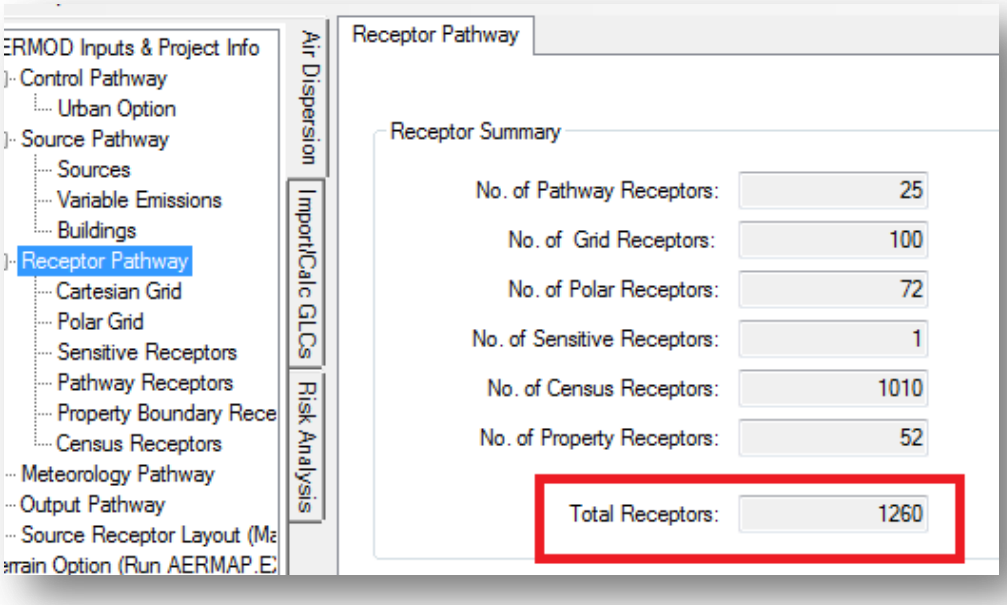


The POSTFILE will be located under ***AERMOD Outputs*** after AERMOD has been run. It will appear under ***List of POSTFILES (non-pollutant specific)***.

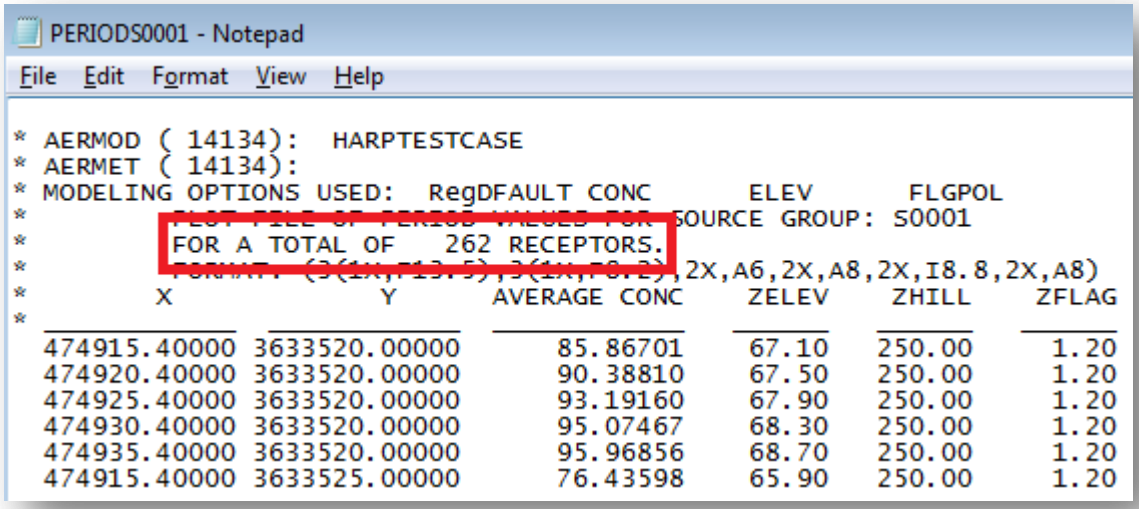


To locate the number of receptors used for your analysis you can look on the ***Receptor Pathway*** screen or in the PLOTFILE header.

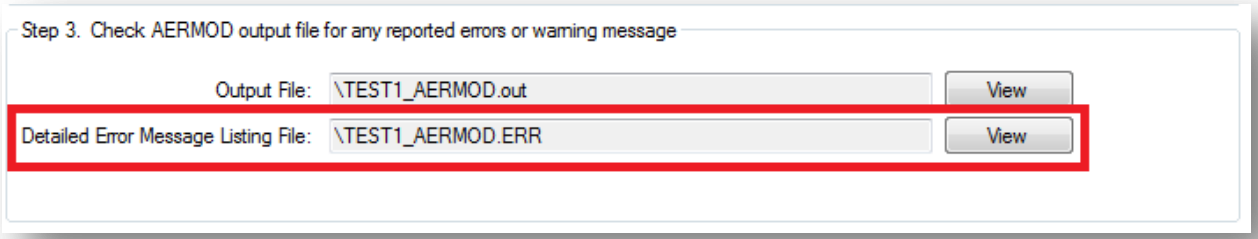
Below is where you would locate the receptors through the ***Receptor Pathway*** screen:



To locate the number of receptors by using the ***PLOTFILE***, open the PLOTFILE results and under the header there is a section for ***total receptors***.



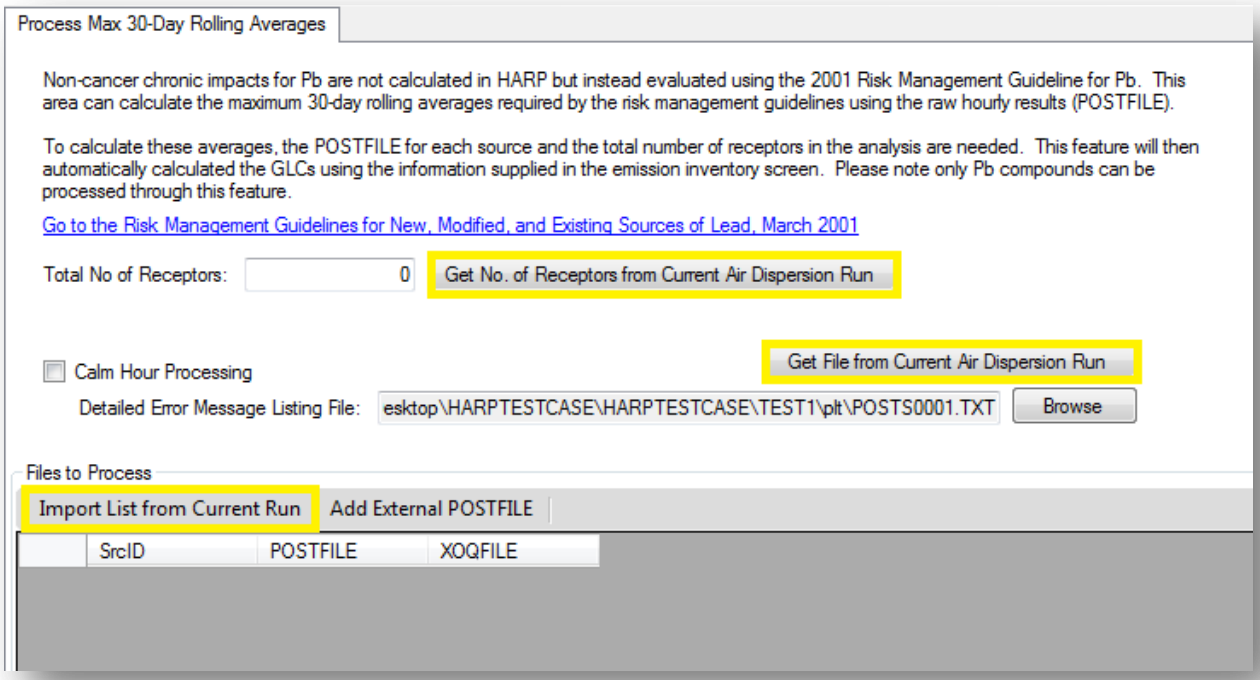
The AERMOD error file is created in the air dispersion run under Step 3 in ***Run AERMOD***. This file is only used if you select the ***Calm Hour Processing*** which would incorporate a list of "calm" or "missing" hours from the Meteorological files used in the air dispersion run. Note this feature is optional.



1. Max 30-Day Rolling Average

Non-cancer chronic impacts for Pb are not calculated in HARP 2 but instead evaluated using the 2001 Risk Management Guideline for Pb. This area can calculate the ***maximum 30-day rolling averages*** required by the risk management guidelines using the raw hourly results (POSTFILE)

To calculate these averages, the ***POSTFILE*** for each source and the ***total number of receptors*** in the analysis are needed. This feature will then automatically calculate the GLCs using the information supplied in the emission inventory screen. Please note only Pb compounds can be processed through this feature.



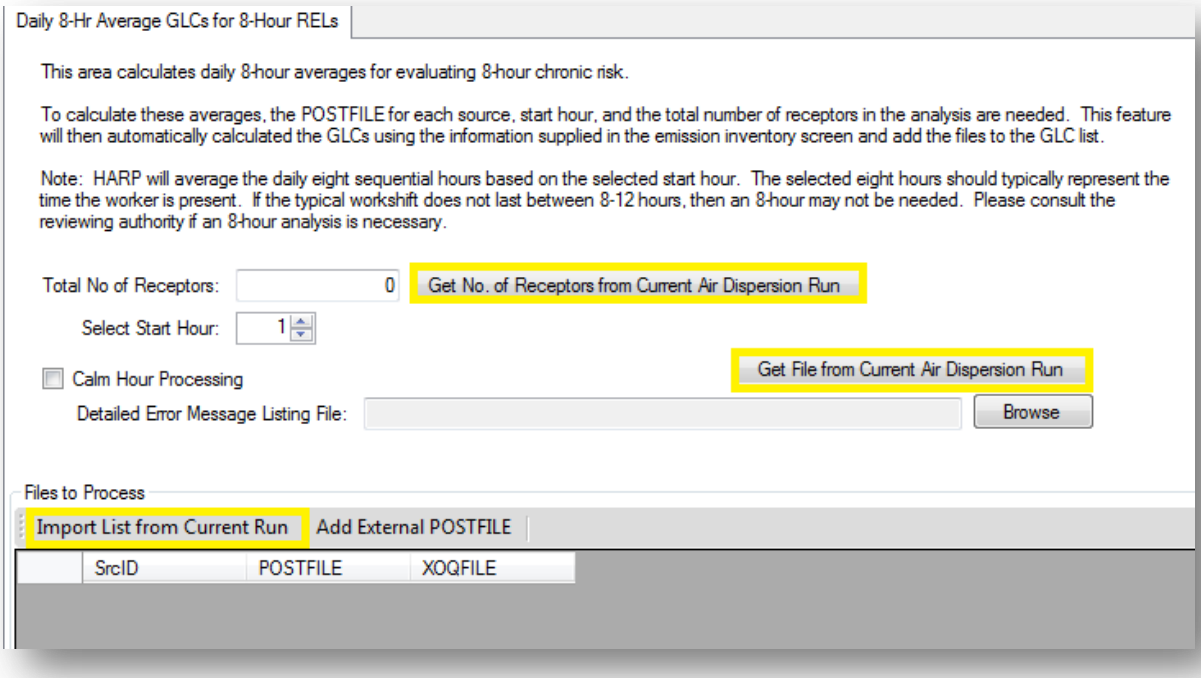
There are “easy” buttons on each screen that will allow the module to pull the necessary information from the current air dispersion run. You may choose to click the button or manually enter the data from using the steps discussed in the beginning of the ***Post Process*** section. After the required data is filled out, select the ***Calculate and Export GLCs*** and designate an area on your desktop for the files to be saved.

2. Daily 8-hr average GLC

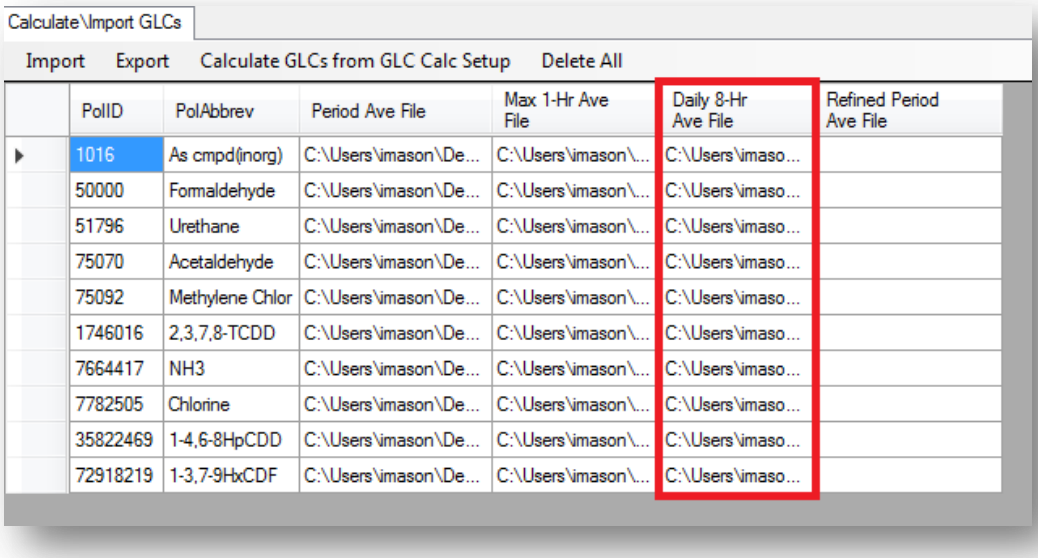
The ***daily 8-hr average GLCs*** are for evaluating 8-hr chronic risk.

To calculate these averages, the ***POSTFILE for each source, start hour, and the total number of receptors*** in the analysis are needed. This feature will then automatically calculate the GLCs using the information supplied in the emission inventory screen and add the files to the GLC list.

Note that HARP 2 will average the daily eight sequential hours based on the selected start hour. The selected eight hours should typically represent the time the worker is present. If the typical workshift does not last between 8-12 hours, then an 8-hr evaluation may not be needed. Please consult the reviewing authority if an 8-hr analysis is necessary.



There are “easy” buttons on each screen that will allow the module to pull the necessary information from the current air dispersion run. You may choose to click the button or manually enter the data from using the steps discussed in the beginning of the ***Post Process*** section. Once the required data is filled out, click ***Calculate and Add to GLC List***. To locate the ***Daily 8-hr Average file*** you will return to the ***Calculate/Import GLCs*** screen and see the calculated files for each pollutant under ***Daily 8-hr Ave File***, shown below.

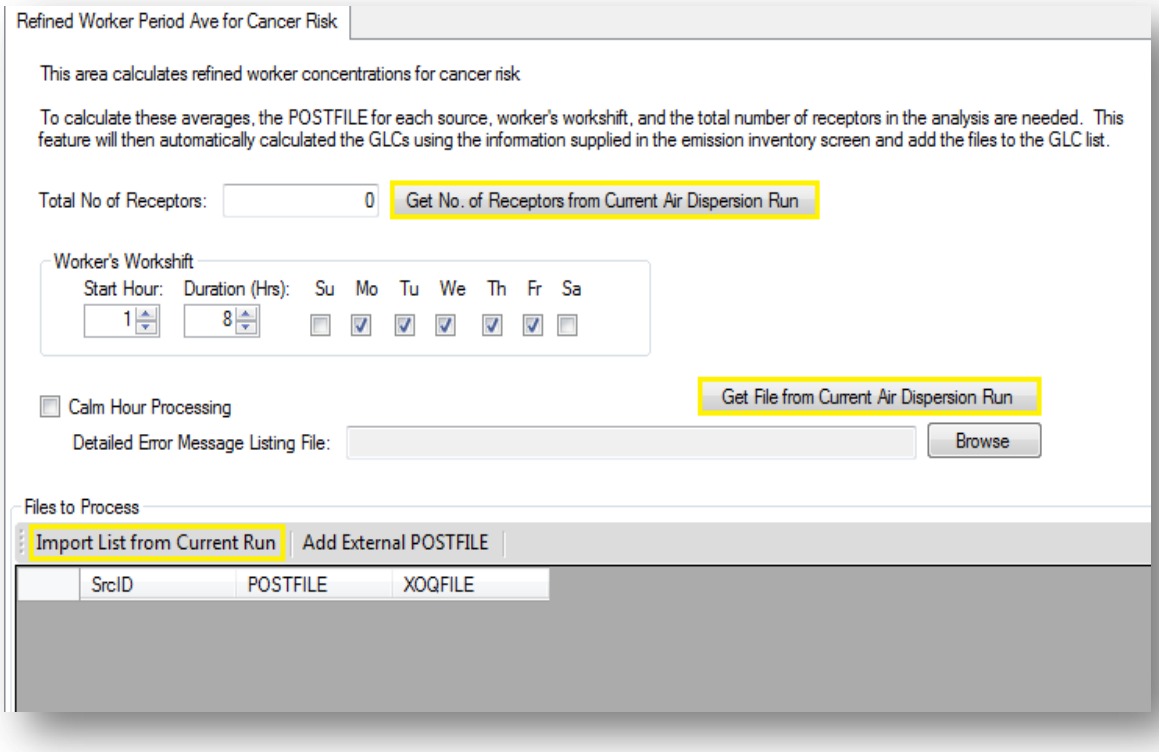


PolID	PolAbbrev	Period Ave File	Max 1-Hr Ave File	Daily 8-Hr Ave File	Refined Period Ave File
1016	As cmpd(inorg)	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
50000	Formaldehyde	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
51796	Urethane	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
75070	Acetaldehyde	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
75092	Methylene Chlor	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
1746016	2,3,7,8-TCDD	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
7664417	NH3	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
7782505	Chlorine	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
35822469	1-4,6-8HpCDD	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	
72918219	1-3,7-9HxCDF	C:\Users\imason\De...	C:\Users\imason\...	C:\Users\imaso...	

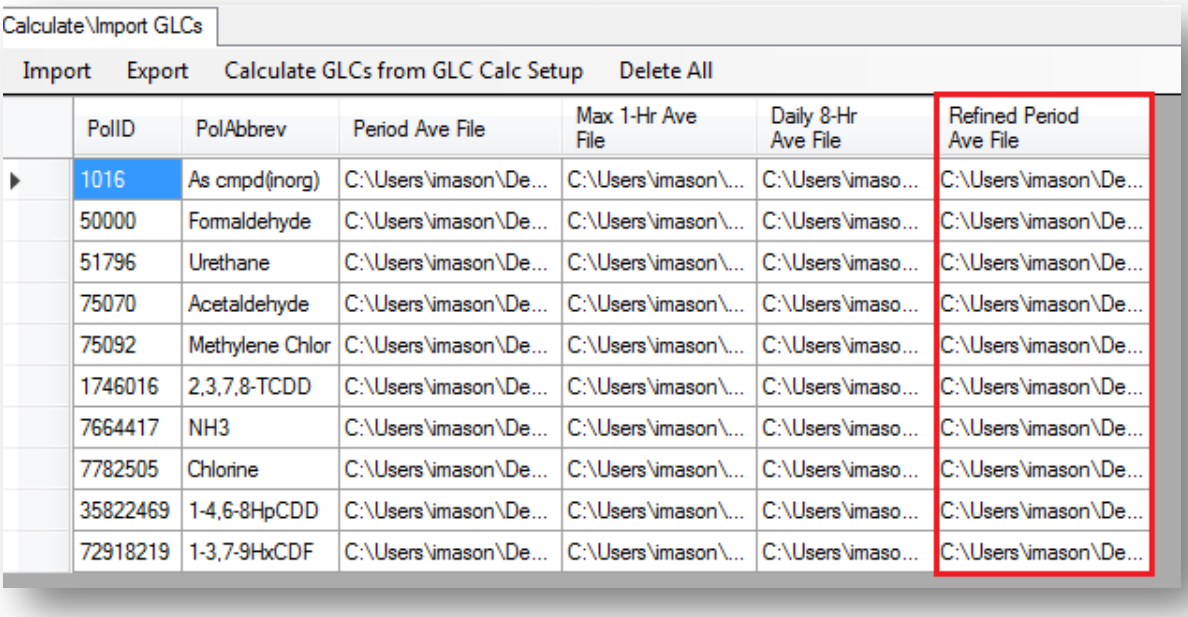
3. Refined Worker Period Average for Cancer Risk

The ***refined worker period averages*** are for calculating cancer risk.

To calculate these averages, the ***POSTFILE for each source, worker's workshift, and the total number of receptors*** in the analysis are needed. This feature will then automatically calculate the GLCs using the information supplied in the emission inventory screen and add the files to the GLC list.

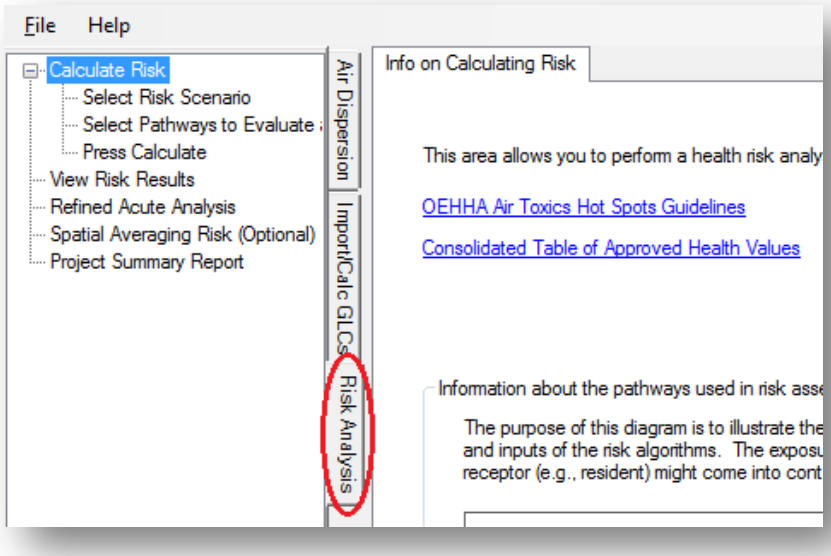


There are "easy" buttons on each screen that will allow the module to pull the necessary information from the current air dispersion run. You may choose to click the button or manually enter the data from using the steps discussed in the beginning of the ***Post Process*** section. Once the required data is filled out, click ***Calculate and Add to GLC List***. To locate the ***Refined Worker Period Average file*** you will return to the ***Calculate/Import GLCs*** screen and see the calculated files for each pollutant under ***Refined Period Ave File***, shown below.

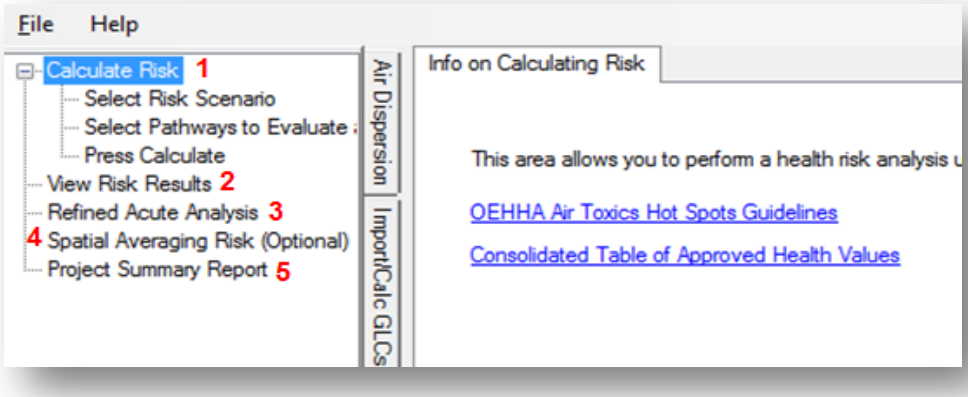

Calculate\Import GLCs
Import
Export
Calculate GLCs from GLC Calc Setup
Delete All
PolID
PolAbbrev
Period Ave File
Max 1-Hr Ave File
Daily 8-Hr Ave File
Refined Period Ave File
1016 As cmpd(inorg) C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
50000 Formaldehyde C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
51796 Urethane C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
75070 Acetaldehyde C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
75092 Methylene Chlor C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
1746016 2,3,7,8-TCDD C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
7664417 NH3 C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
7782505 Chlorine C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
35822469 1-4,6-8HpCDD C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...
72918219 1-3,7-9HxCDF C:\Users\imason\De... C:\Users\imason\... C:\Users\imaso... C:\Users\imason\De...

6. STEP THREE: HEALTH RISK RESULTS AND ANALYSIS

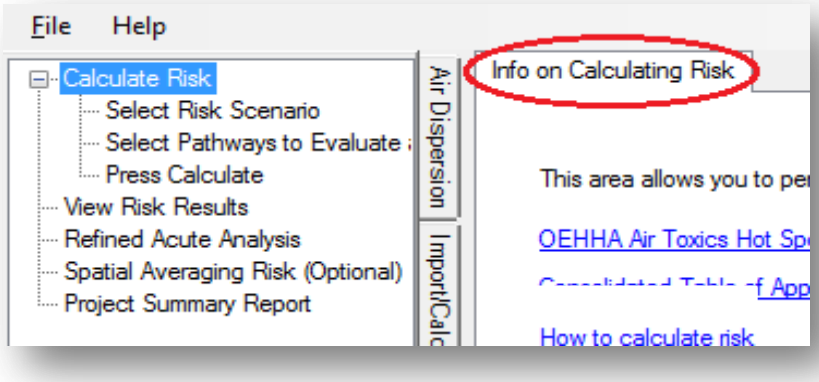
The ***Risk Analysis*** tab is the final part of the ADMRT. It will calculate your cancer and noncancer health impacts, and export reports and files.



Risk Analysis is comprised of five parts: ***Calculate Risk***, ***View Risk Results***, ***Refined Acute Analysis***, ***Spatial Averaging Risk (Optional)***, and ***Project Summary Report***.



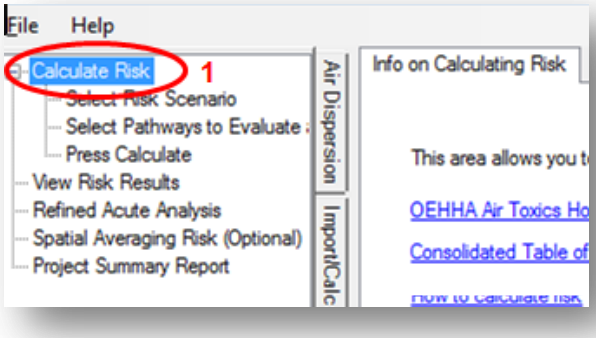
The first screen you will see is the ***Info on Calculating Risk*** tab.



The ***Info on Calculating Risk*** tab includes information on the OEHHA Air Toxics Hot Spots Guidelines, pollutant health values used, and the pathways diagram.

A. Calculate Risk

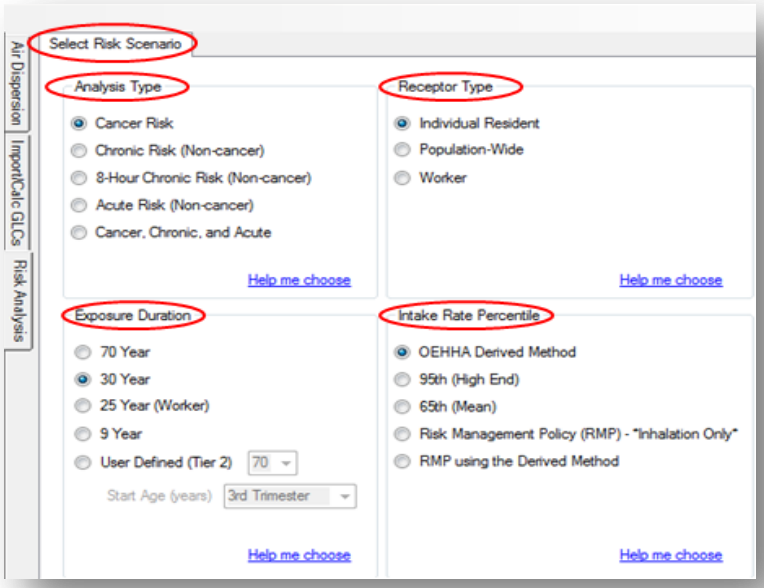
The first step of the ***Risk Analysis*** is ***Calculate Risk***. ***Calculate Risk*** consists of ***Select Risk Scenario***, ***Select Pathways to Evaluate and Define Site Parameters***, and ***Press Calculate***.



In these steps you will provide parameters and data to calculate cancer and noncancer health impacts. The first part of ***Calculate Risk*** is selecting the risk scenario. Click the ***Select Risk Scenario***, underneath ***Calculate Risk***.

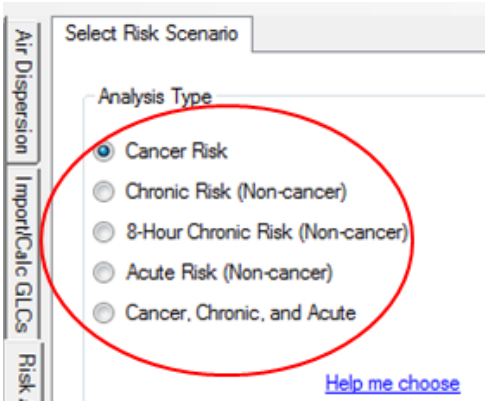
1. Select Risk Scenario

Select Risk Scenario involves providing information about the ***Analysis Type***, ***Receptor Type***, length of time the receptor is exposed to pollutants (***Exposure Duration***), and method used to determine the receptor's exposure rate (***Intake Rate Percentile***).



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: ***Acute*** *and* ***8-Hour Chronic Risk*** *allow for health risk calculations from inhalation only*, 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.

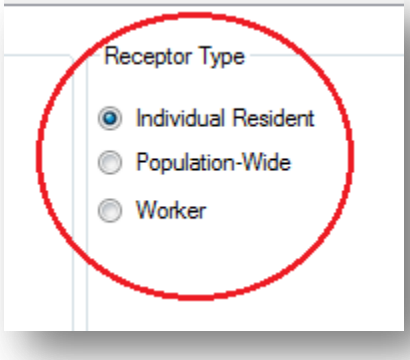


Table 6-2. Receptor Types[1]

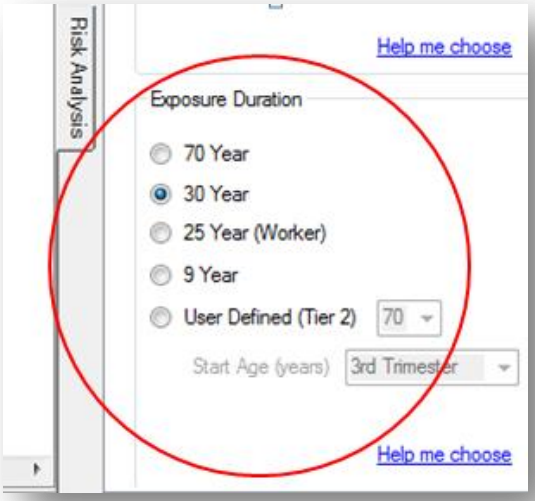
Choosing your receptor type

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, like 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.

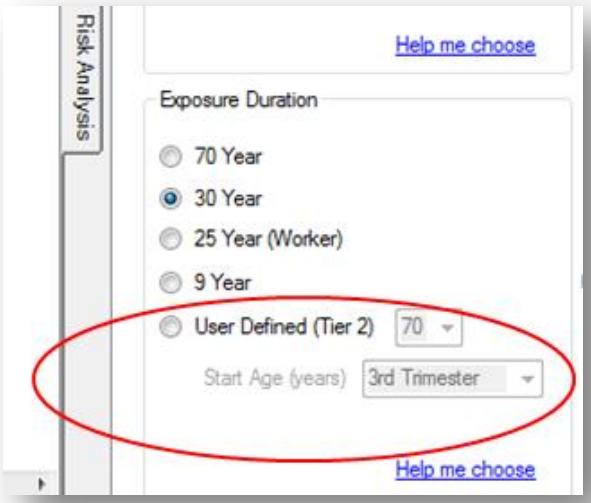
Table 6-4. Recommendations for Exposure Duration for Individual Cancer Risk Assessments at the MEIR and MEIW[1]	
Receptor	***Recommendation***
Resident (MEIR)	9 years 30 years* 70 years
Worker (MEIW)	25 years

[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.

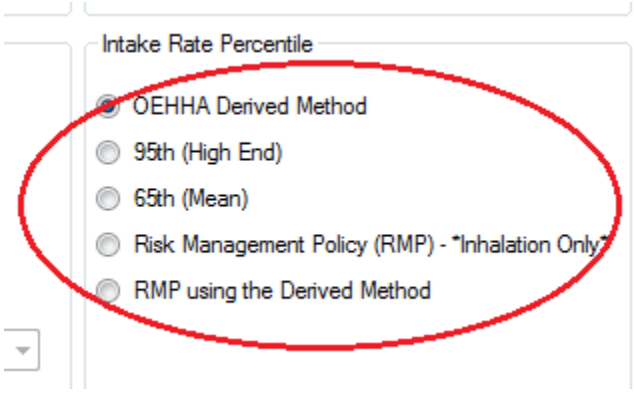
i. ***ADVANCED FEATURE:*** *User-Defined Start Age and Duration*

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.

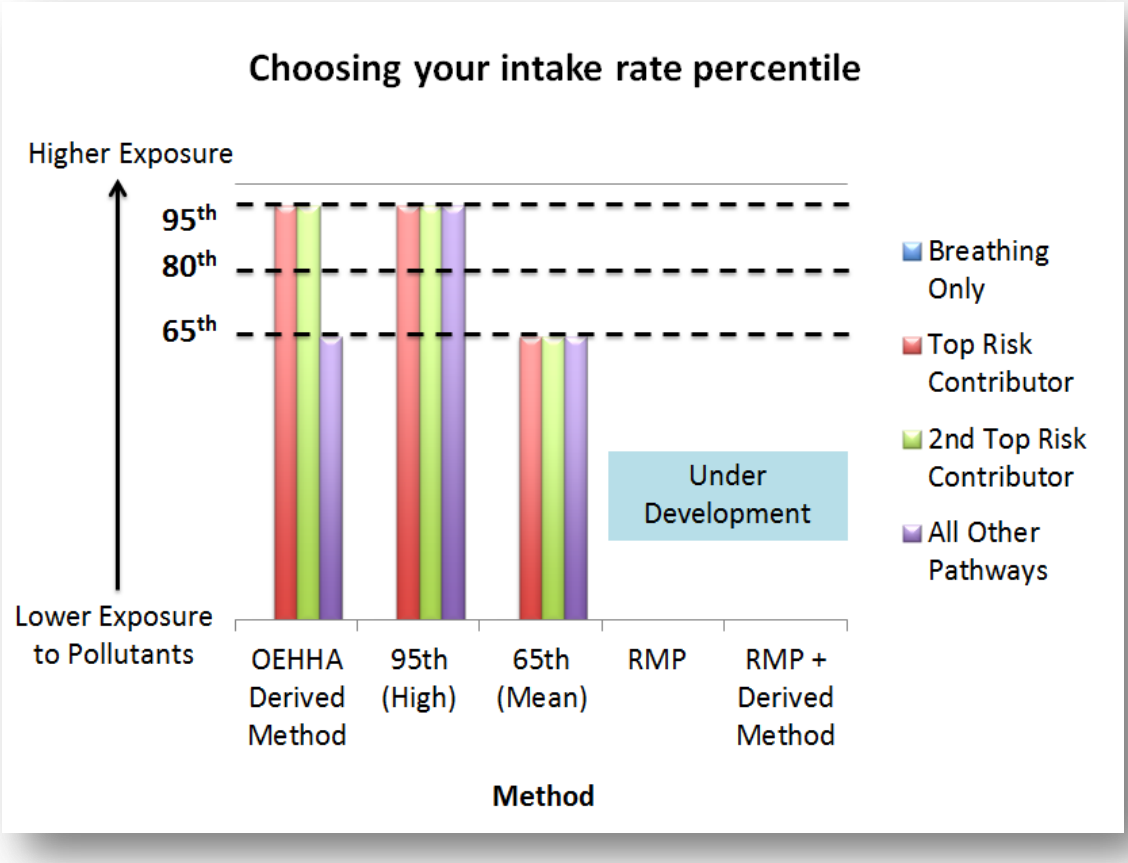
95th Percentile (High End) – Select the high end intake rate to assess risk at the 95th percentile exposure rate for all pathways.

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.

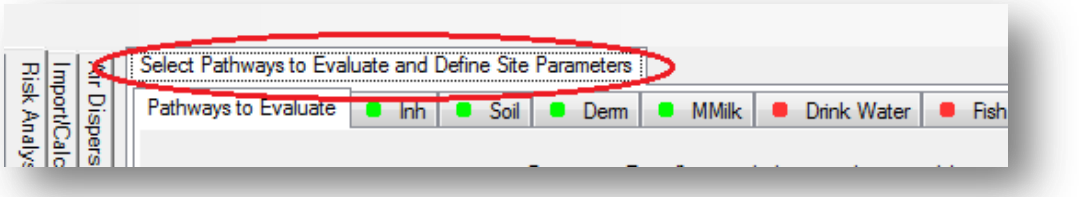
RMP using the Derived Method – This is currently under development. For more information, see http://www.arb.ca.gov/toxics/rma/rma.htm.

Table 6-5. Intake Rate Percentile Methods



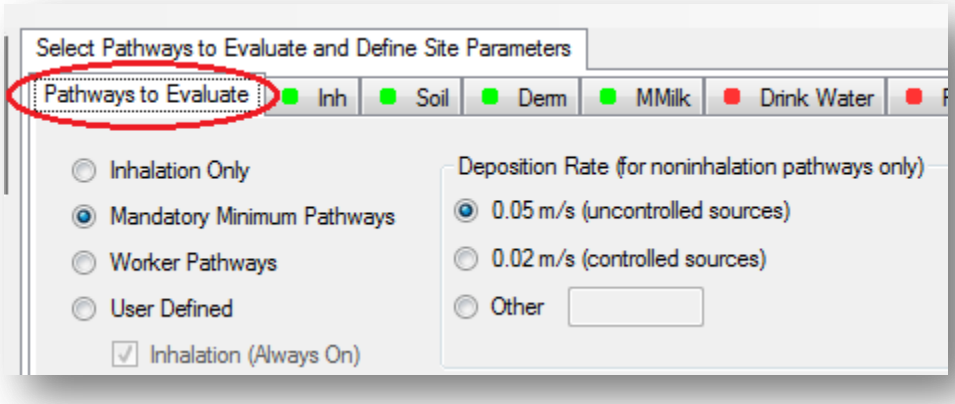
2. Select Pathways to Evaluate & Define Site Parameters

This section discusses the second part of ***Calculate Risk***. Find and click ***Select Pathways to Evaluate & Define Site Parameters*** on the left menu underneath ***Calculate Risk***. .



a. Pathways to Evaluate

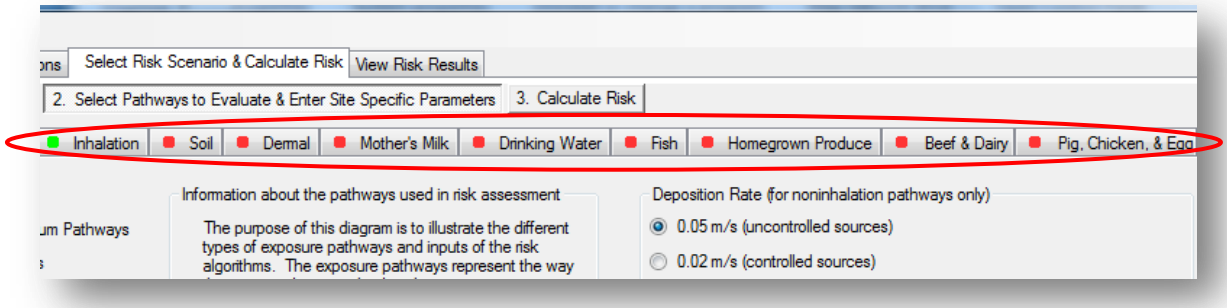
As part of your risk assessment, you will need to determine which pathways to evaluate. Pathways can be turned on and off in this program.



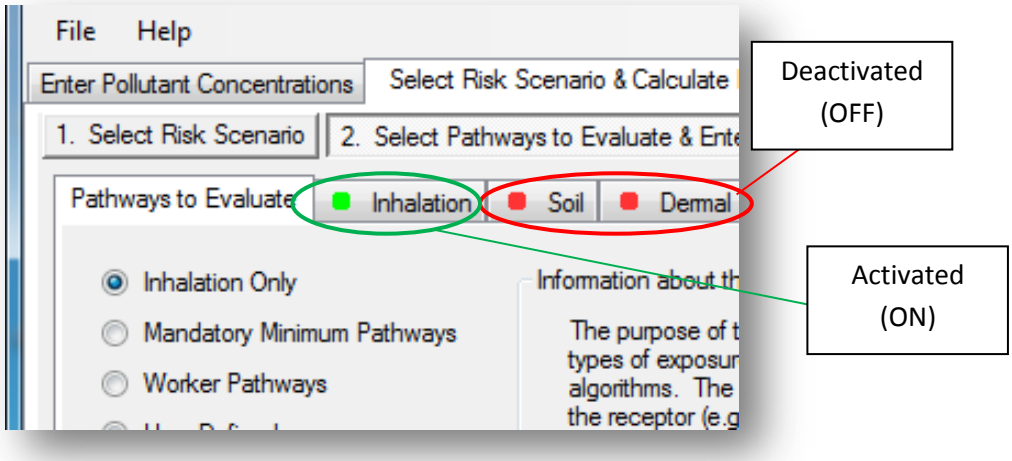
i. Activating and Deactivating Pathways

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, & Eggs***

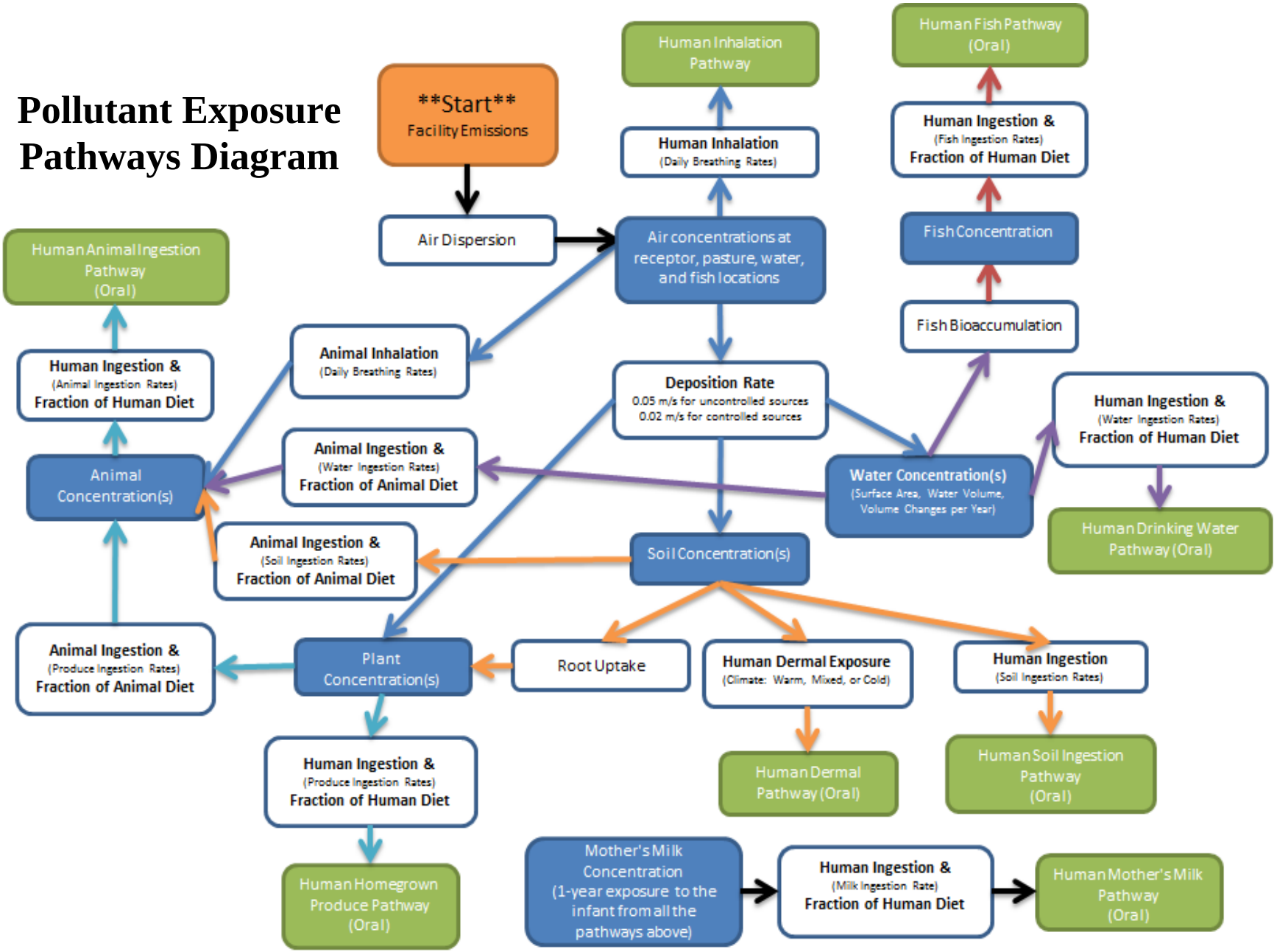


The ***Pathways to Evaluate*** tab allows you to activate and deactivate pathways. A green square means the pathway is ON and a red square means the pathway is OFF.



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 6-6 specifies which pathways may be analyzed for each multipathway substance. The table is also provided in ***Appendix E.***

Table 6-6. 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.

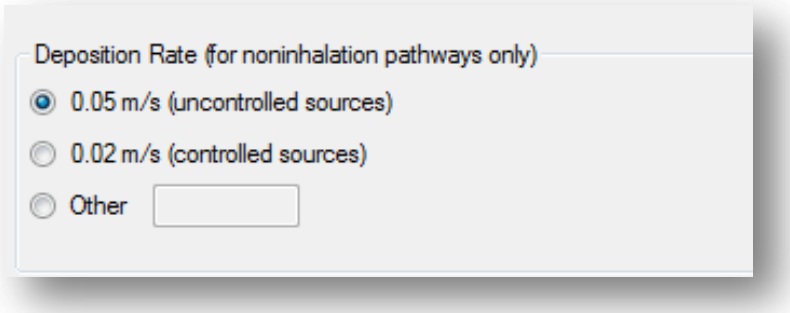
Table 6-7 identifies the residential receptor exposure pathways that are mandatory and those that are dependent on the available routes of exposure. It also identifies the three exposure pathways that are relevant for a worker receptor. While residents can be exposed though several exposure pathways, worker receptors are only evaluated for inhalation, soil ingestion, and dermal exposure using point estimates.

Table 6-7. 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.

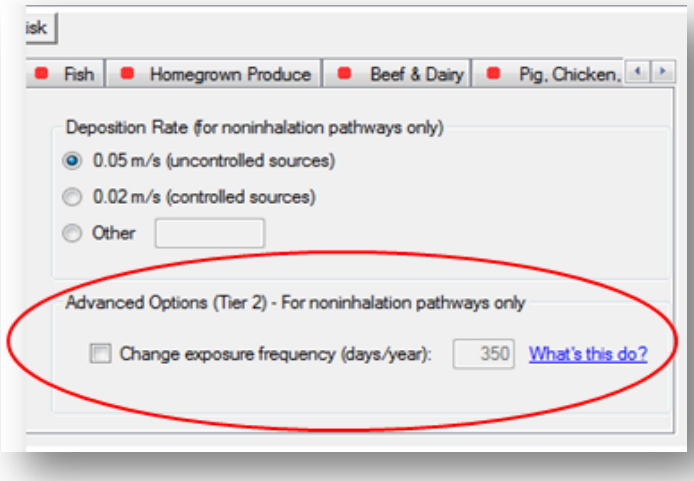


There are two source types:

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).

*vi. **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

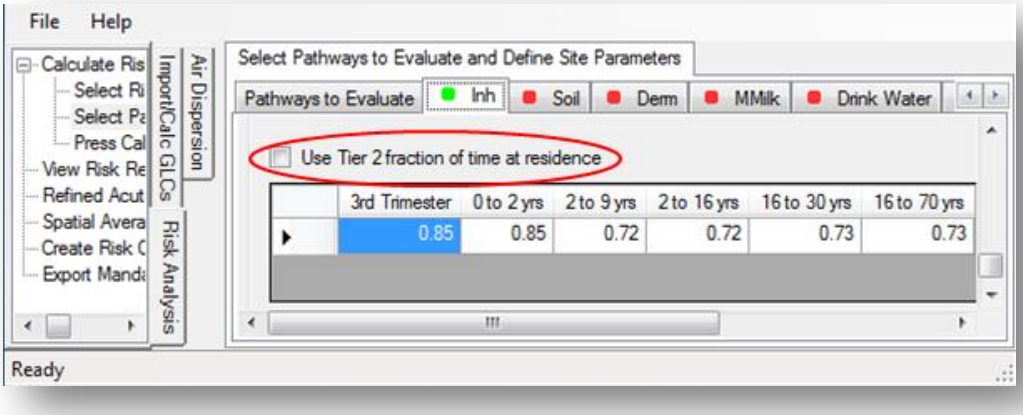
If you are conducting an assessment for a residential receptor, the ***Fraction of time at home*** is used to adjust exposure duration. This is based on the assumption that

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.



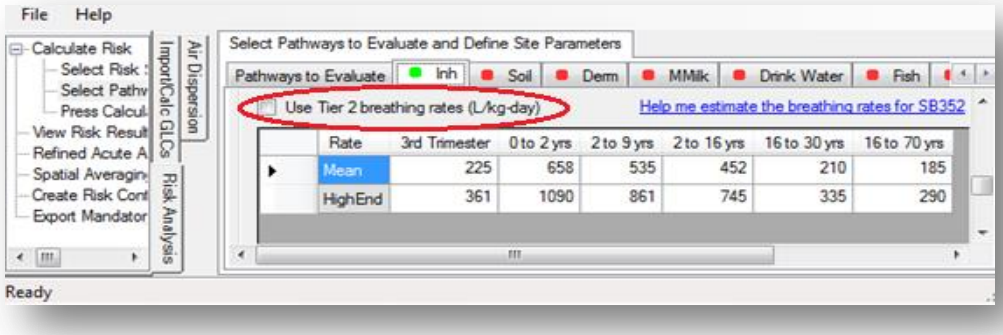
*Numbers in table are default fractions of time at residence by age

iii. 8-Hour Breathing Rate

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.

*vi. **ADVANCED FEATURE:** Breathing Rates for SB 352*

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

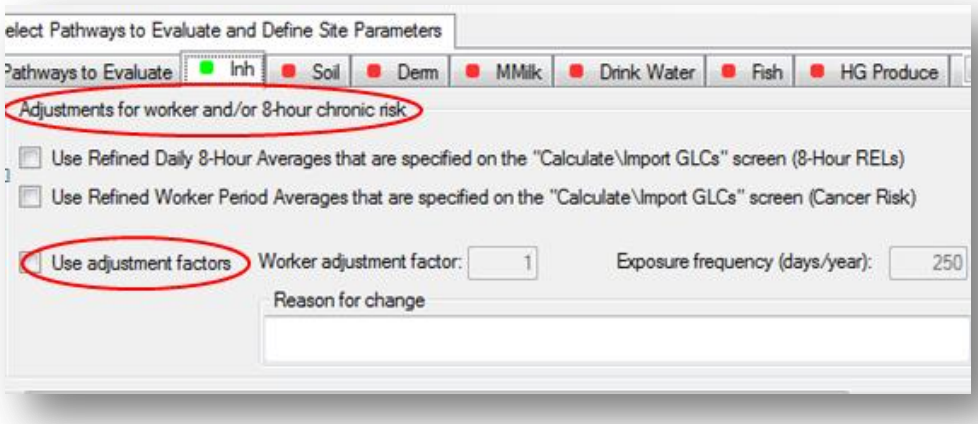


*Numbers in table are default breathing rates by age.

- Note: *The software feature for Tier 2 SB 352 is under development.*

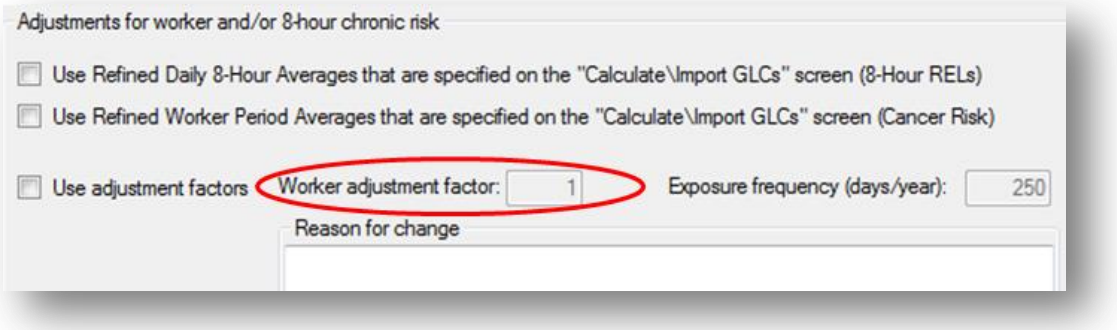
v. Adjustments for Worker or 8-Hour Chronic Risk

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 your ground level concentrations (GLC) submitted from the ***Import/Calc GLCs*** tab. By default, the module 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.

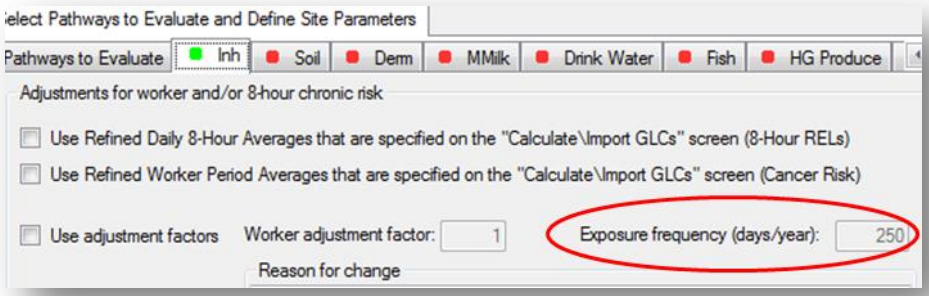


The ***GLC adjustment factor*** is best used for ***Worker*** scenarios when the 24-hour annual average of pollutants you entered does not represent what workers are really exposed to. For example, the average GLC over 24 hours may be too low if the worker is exposed only during peak hours of a facility's 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

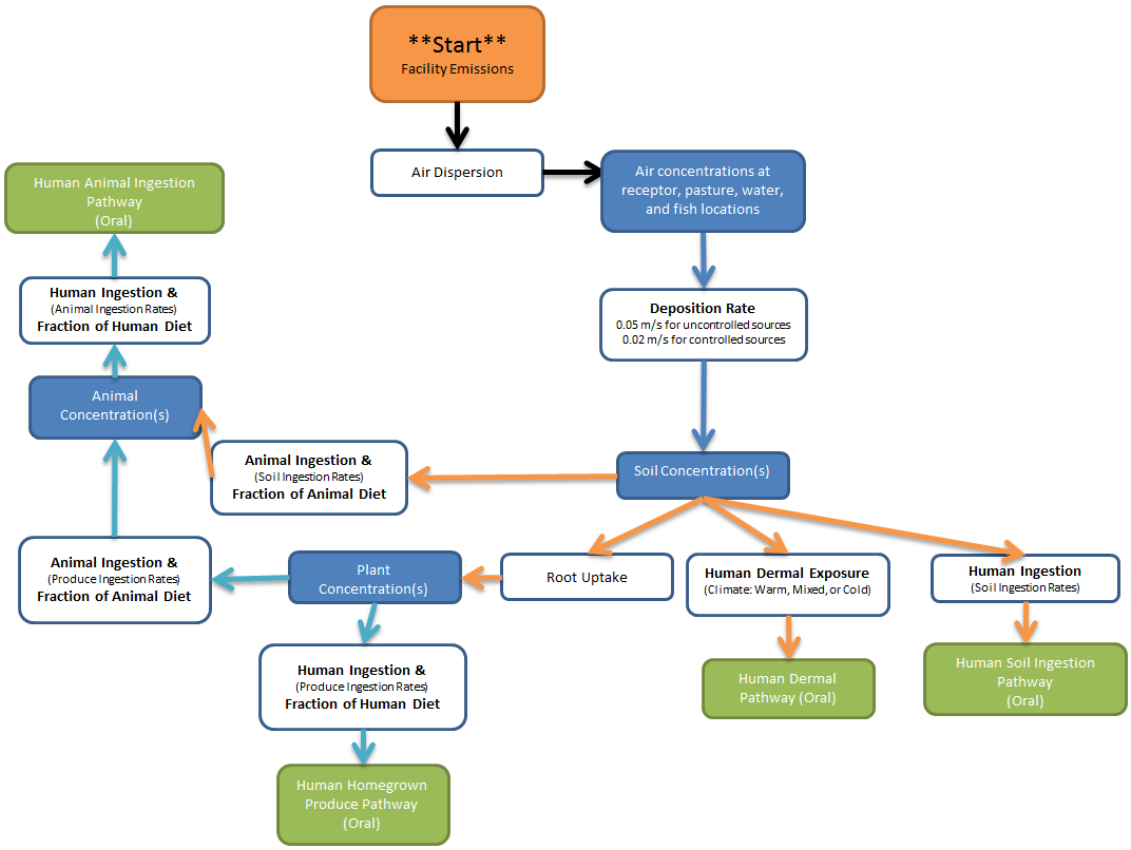
The ***Exposure frequency (days/year)*** takes into account time spent away from the exposure site (e.g., school or work site) for worker and 8-hour noncancer chronic risk assessments.



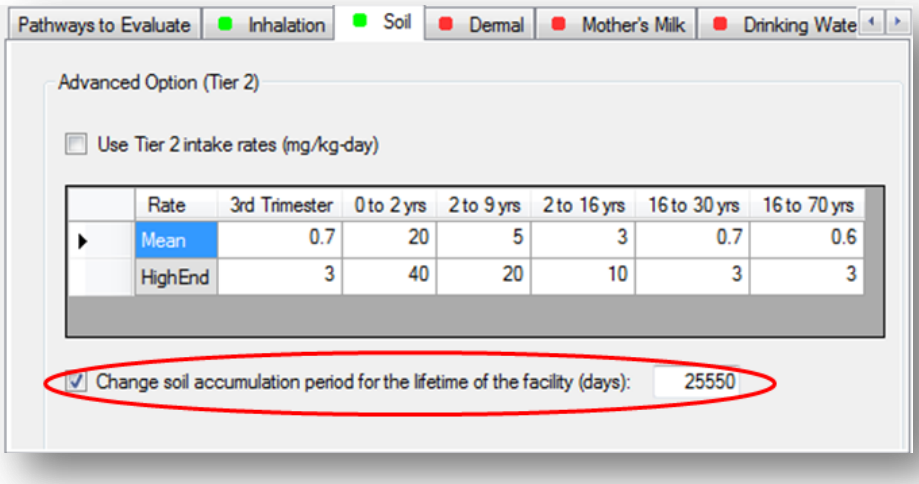
By default, ADMRT assumes ***250*** days out of the year are spent at the receptor site, which may not always be appropriate. For example, if you are evaluating seasonal workers, you may want to use an exposure frequency of less than 250 days.

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.



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.

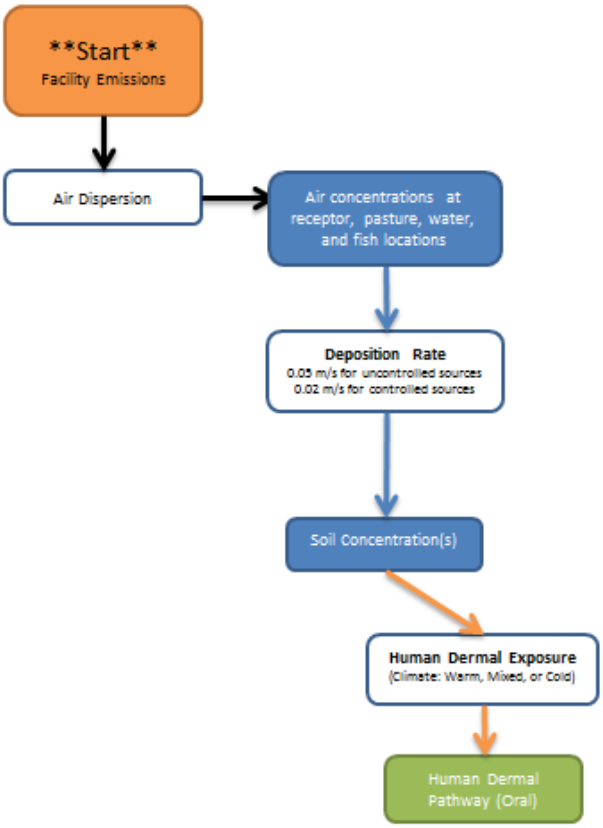


ii. ***ADVANCED FEATURE****: Soil Accumulation Period*

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

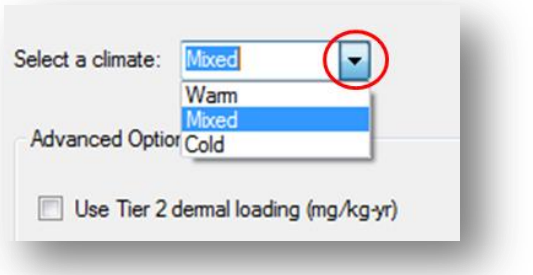
Clothing choice influences dermal (skin) exposure to pollutants through dermal loading, which is influenced by climate. Dermal loading is defined here as the exposure to polluted soil through dermal absorption. It is a function of the soil or dust loading of the exposed skin surface, the amount of skin 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 6-8. Climate Types

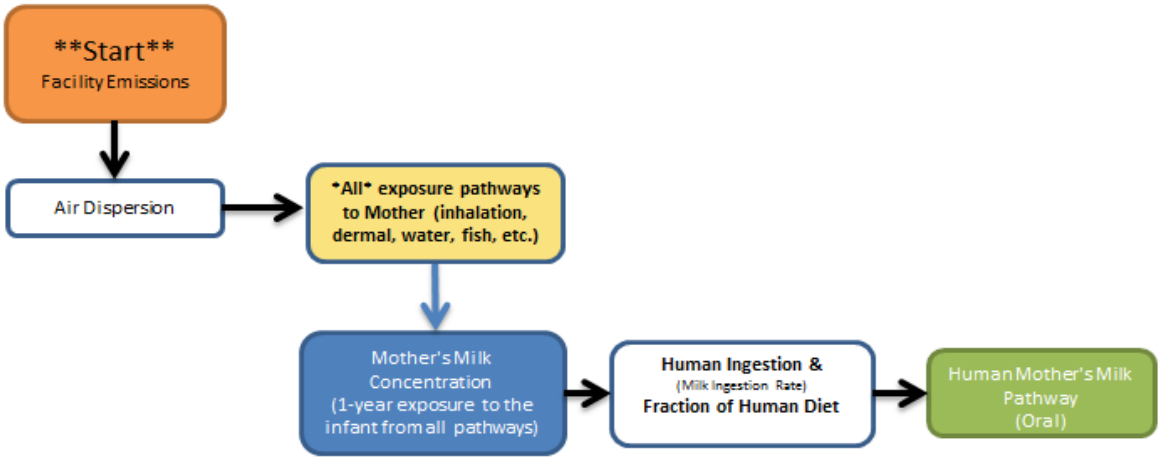
Warm	Mixed	Cold
		
• Warm to hot throughout the year. • Ex: Southern California areas such as Los Angeles.	• April – Oct: ≥ 80 ˚Fahrenheit • Nov – March: ≤ 32 ˚Fahrenheit • Ex: The mountains and central valley are examples of a mixed climate.	• Daily highs < 65 ˚Fahrenheit • Rainy and foggy. • Ex: San 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.



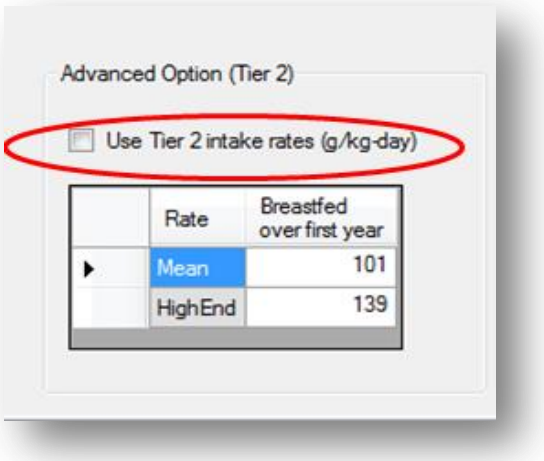
Exposure through ***Mother's Milk*** ingestion is a function of the average concentration of the pollutant in the mother's milk and the amount of mother's milk ingested. The minimum pathways a nursing mother is exposed to include ***Inhalation***, ***Soil*** ingestion, and ***Dermal***. This is because 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*

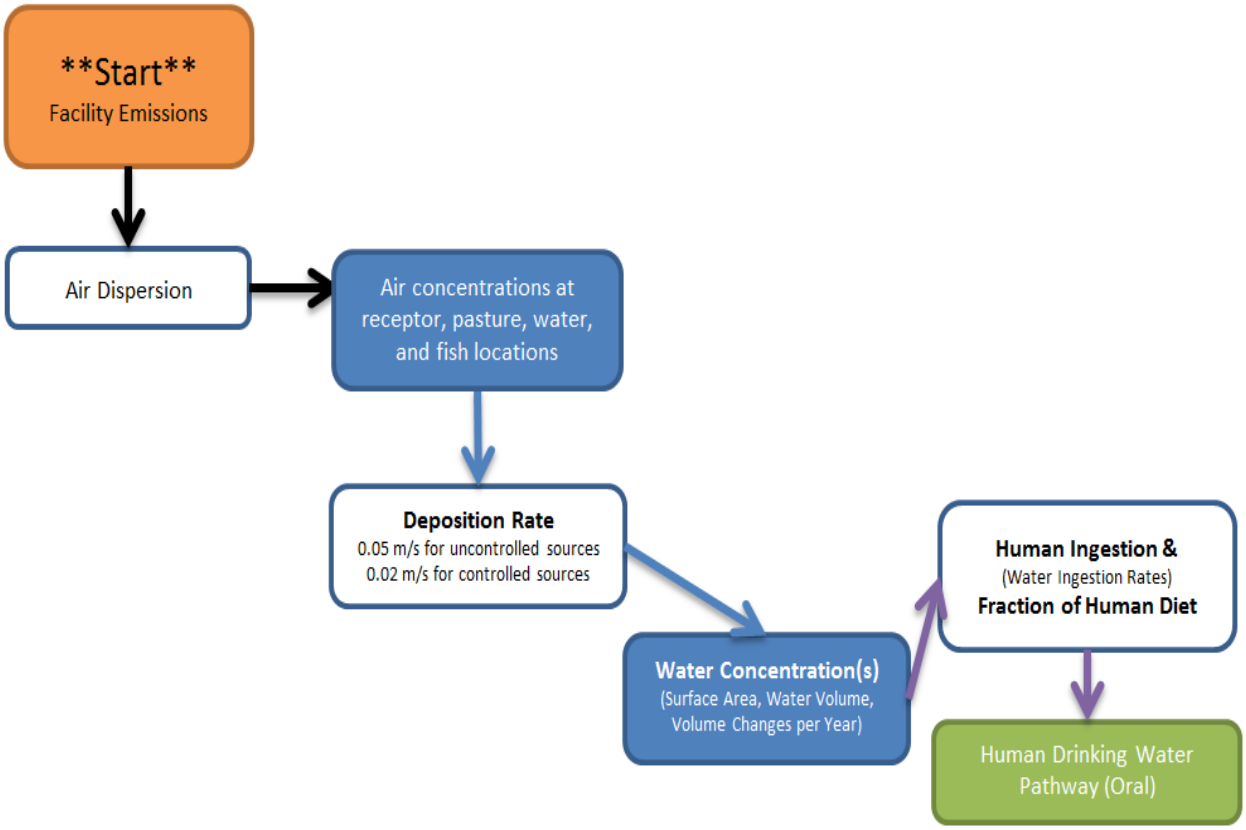
The default intakes of ***Mother's Milk*** by infants are shown in the following screenshot in grams consumed per kg of bodyweight per day. As an advanced feature, click ***Use Tier***

2 intake rates to change them. You may type the new ***Mean*** (65th percentile) and ***HighEnd*** (95th percentile) intake rates of breast milk by infants in g/kg/d.



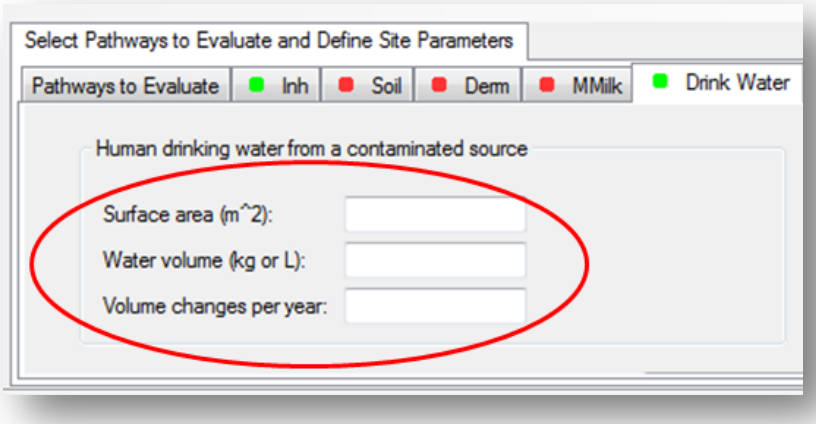
f. Drinking Water

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.



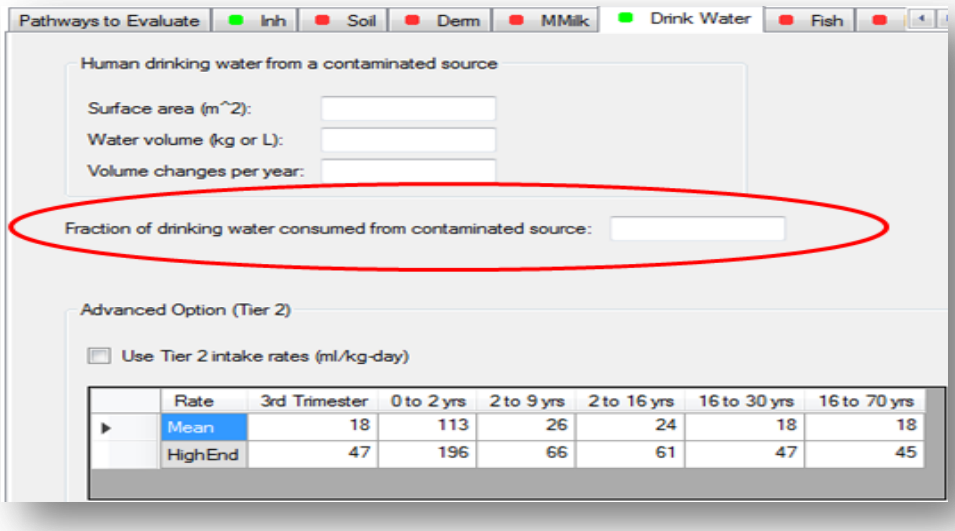
i. Surface Area, Water Volume, & Volume Changes

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.



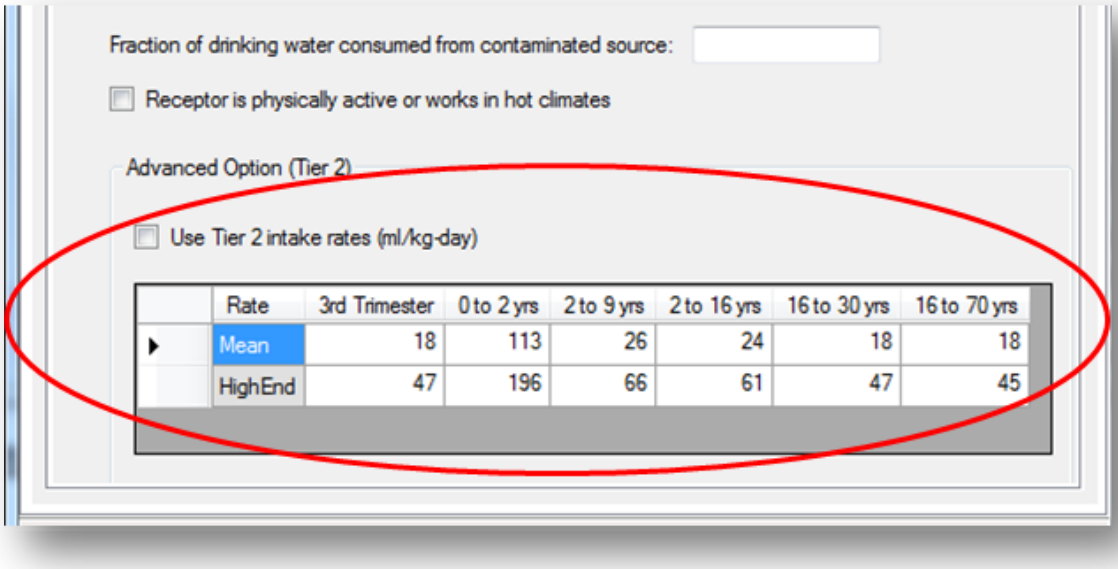
ii. Fraction of Drinking Water from Contaminated Source

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



*iii. **ADVANCED FEATURE:** Average Human Water Consumption*

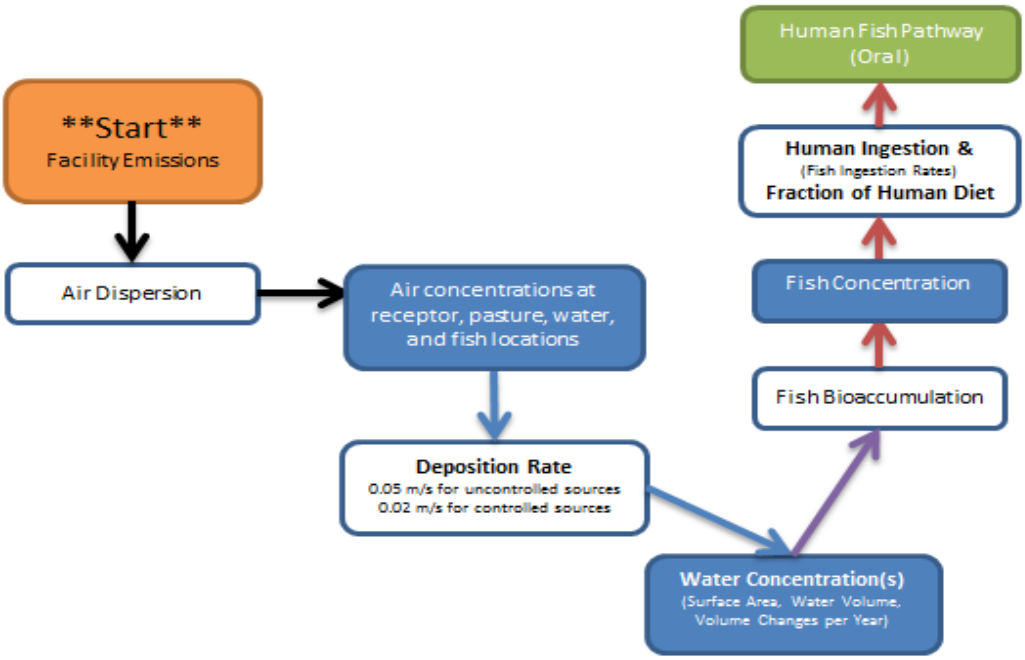
Choose ***Use Tier 2 intake rates (ml/kg-day)*** as an advanced feature to change the average water consumed by humans by age group in milligrams per kilogram of bodyweight per day.



Rate	3rd Trimester	0 to 2 yrs	2 to 9 yrs	2 to 16 yrs	16 to 30 yrs	16 to 70 yrs
Mean	18	113	26	24	18	18
HighEnd	47	196	66	61	47	45

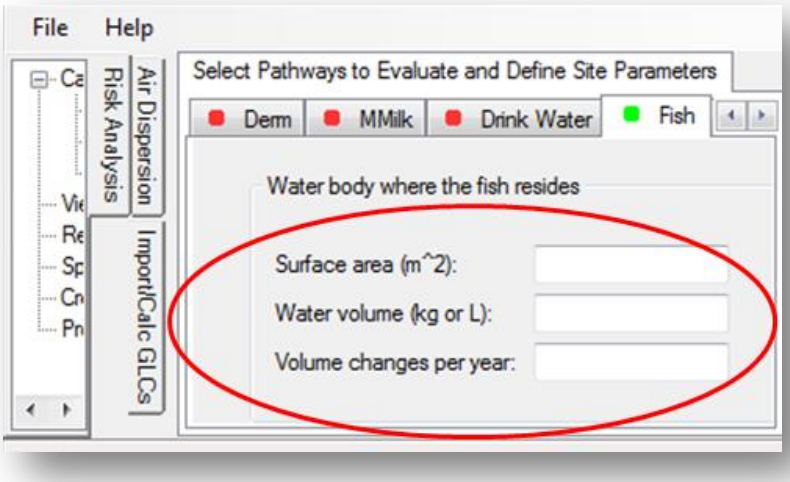
g. Fish

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

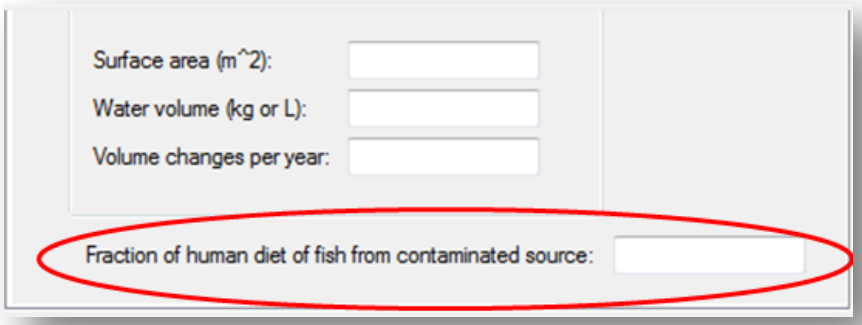
Provide the total ***Surface area*** and ***Volume*** of the water body or bodies. In addition, enter the average number of ***Volume changes per year*** the body or bodies of water undergo at the receptor. Water bodies go through volume changes, in which their water contents turn over through emptying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



ii. Fraction of Fish Consumed from Contaminated Source

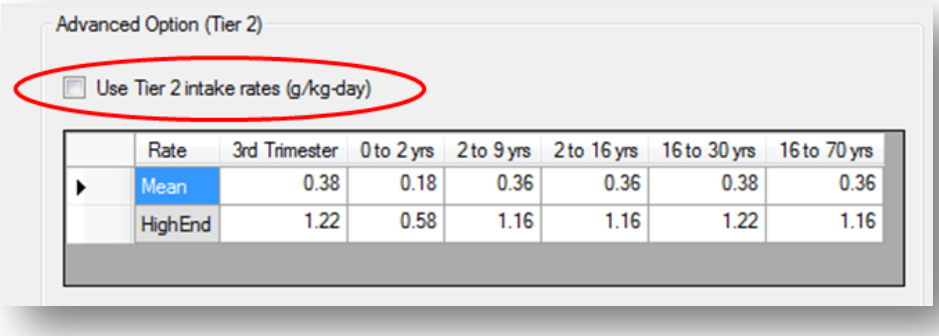
Human exposure to pollutants through ingestion of angler-caught fish is a function of the fraction of fish ingested that is caught in the exposed water body, which differs for each age grouping, and the gastrointestinal absorption factor. Ingestion of angler-caught fish on a milligram per kilogram of 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*

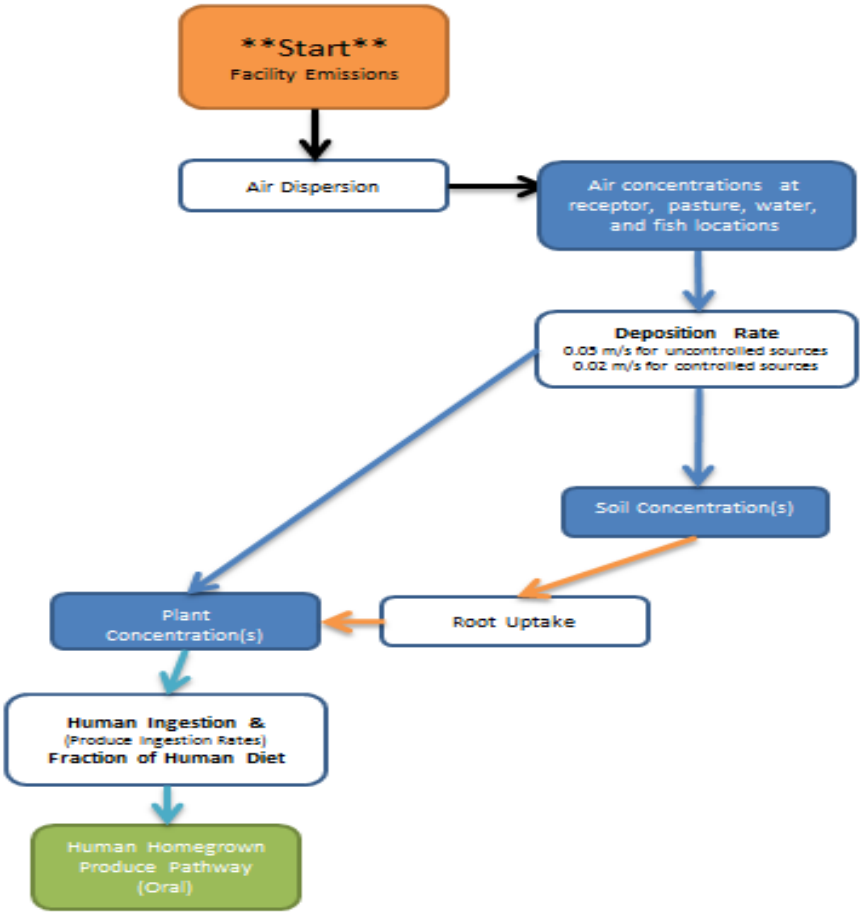
The module takes into account how much fish humans eat on average. Click ***Use Tier 2 intake rates (g/kg-day)*** for the advanced feature.



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 6-9 below presents a list of multipathway pollutants and their respective regions of accumulation in plants.

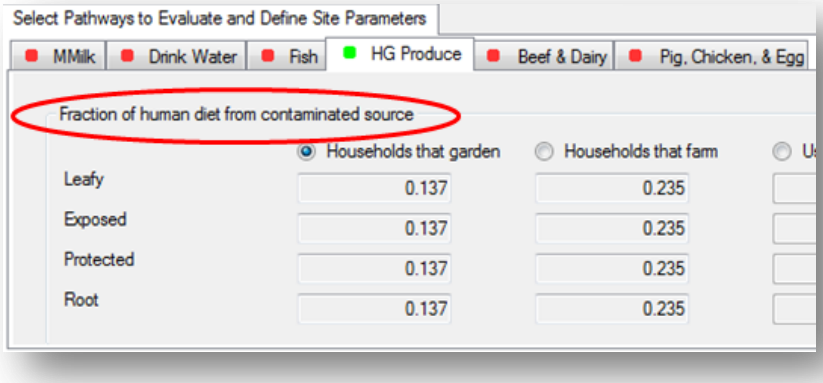
Table 6-9. Multipathway Pollutants and Uptake by Crop Type[1]

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.



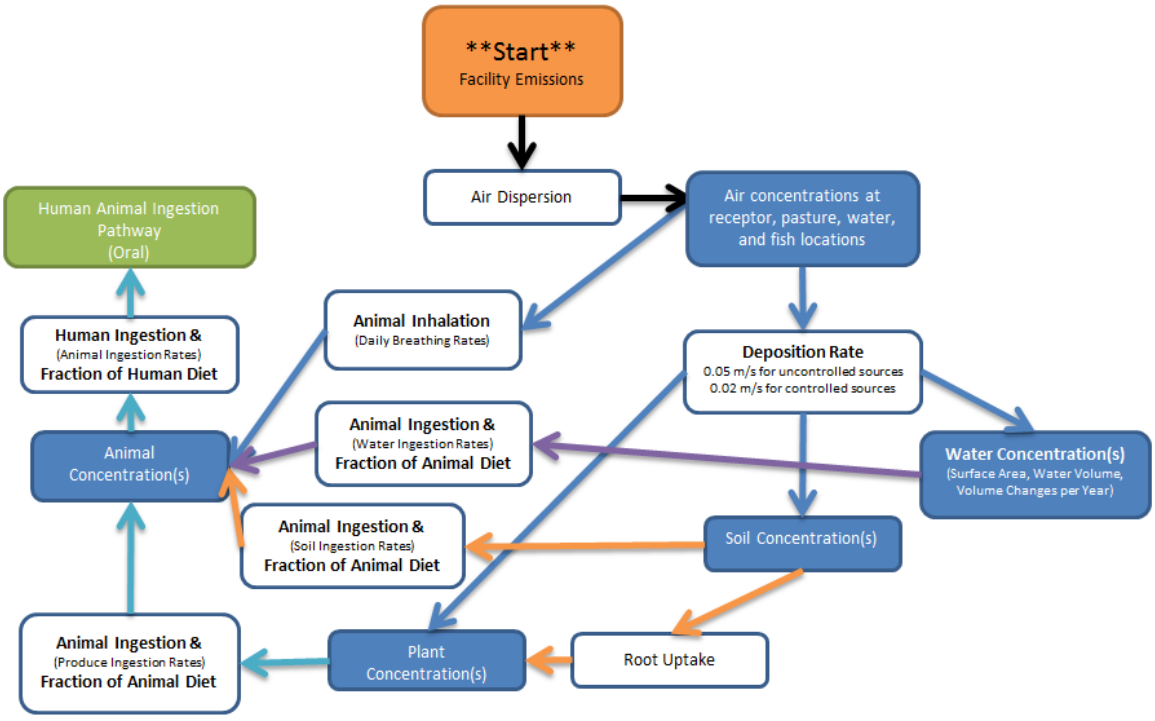
- Note: *The fractions of contaminated leafy, exposed, protected, and root produce eaten may be the same but are independent of one another*.

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.

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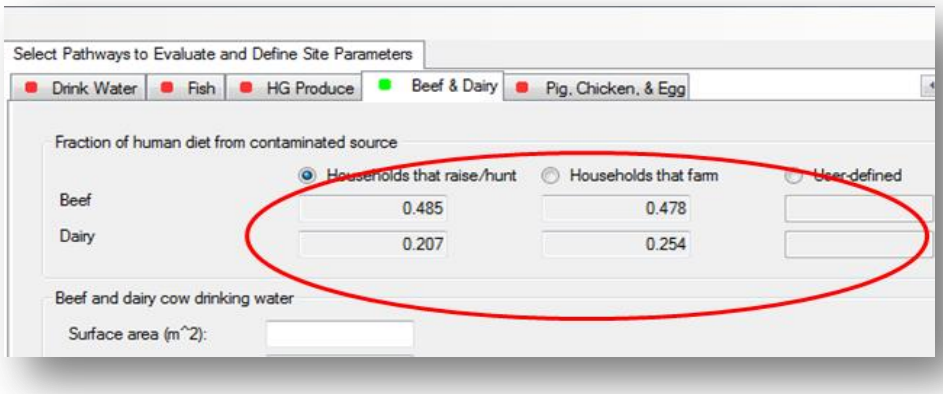
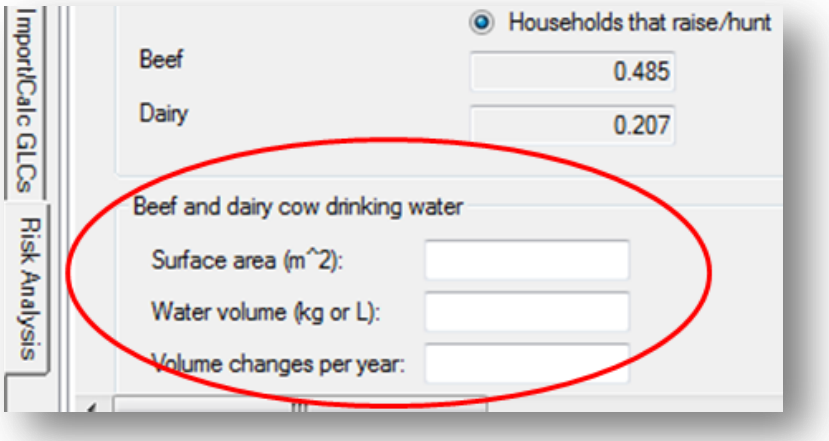
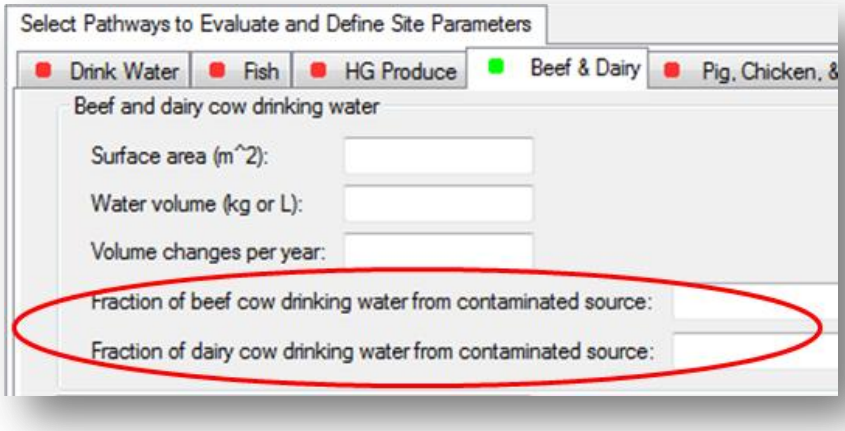


ii. Beef & Dairy Cow Drinking Water

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.

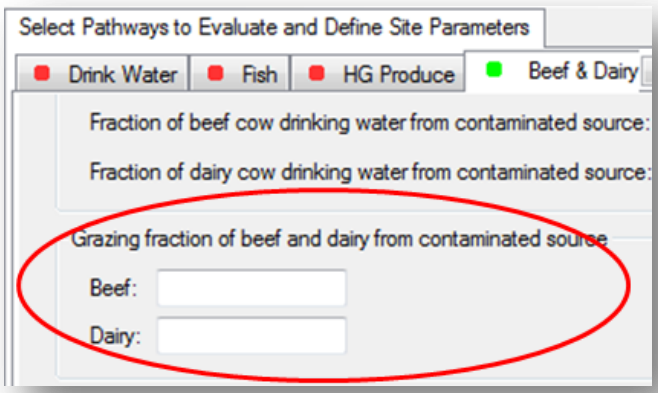


Next, account for the amount the cows may drink from this contaminated water source. Input the ***fraction of (beef cow) drinking water*** and ***fraction of (dairy cow) drinking water*** that comes from receptor contaminated water. If the fraction is none, input 0.



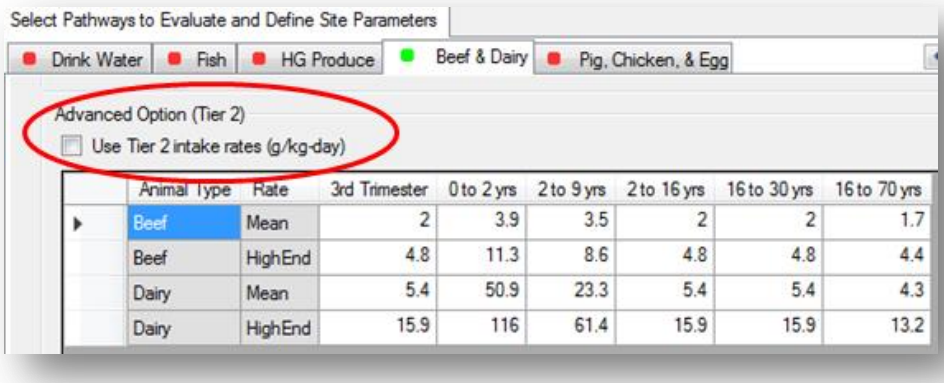
iii. Beef & Dairy Cow Diet

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

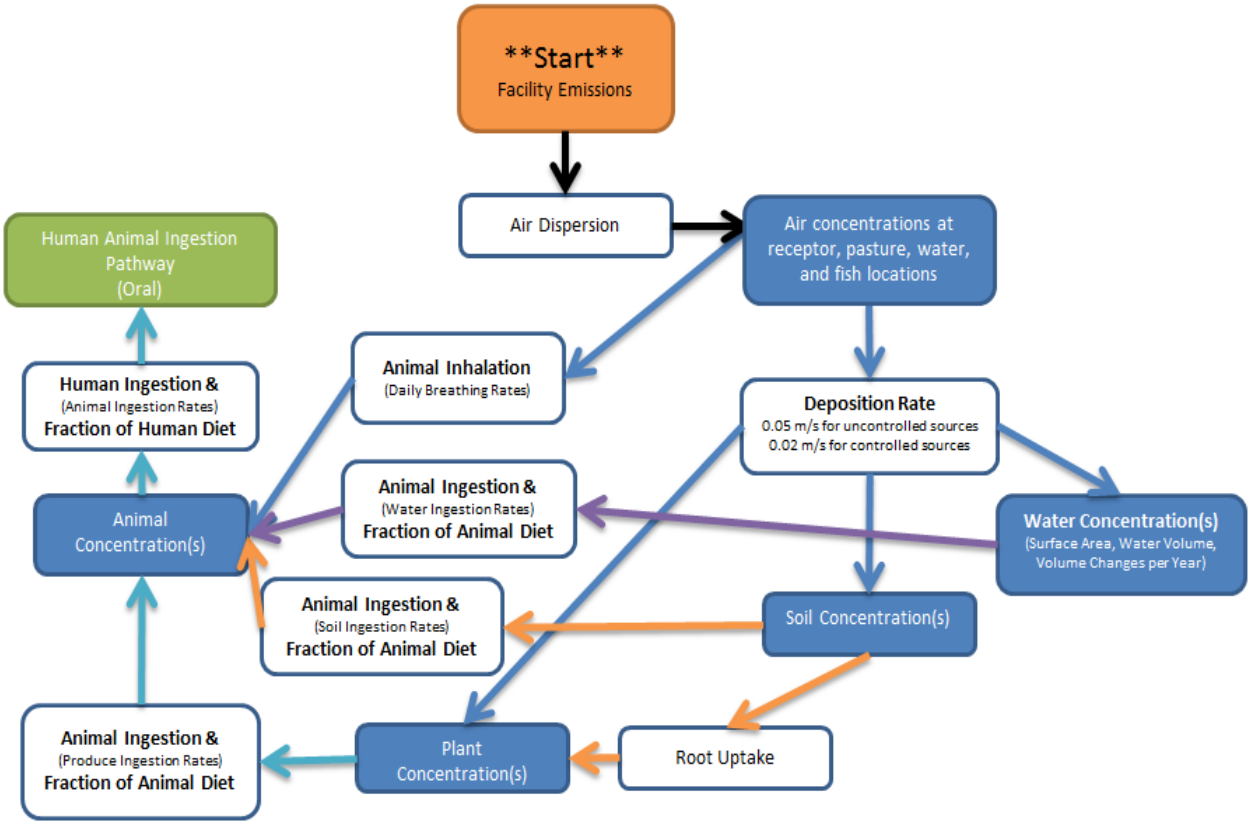
The program uses a default for the average rate that humans eat beef and dairy per day. To change this, check the box ***Use Tier 2 intake rates (g/kg-day)***, and enter your new rates by typing them into the table. By age group, apply the grams of beef and dairy consumed per kilogram of bodyweight per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

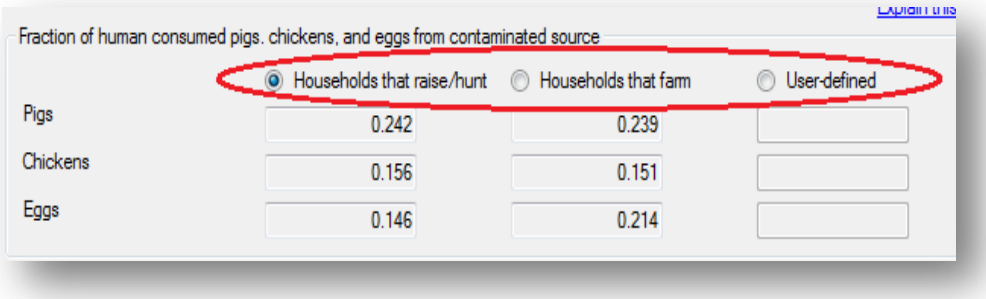
The ***Pig, Chicken, & Egg*** tab is used to account for animal food products impacted by pollutants and eaten by the receptor.



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.

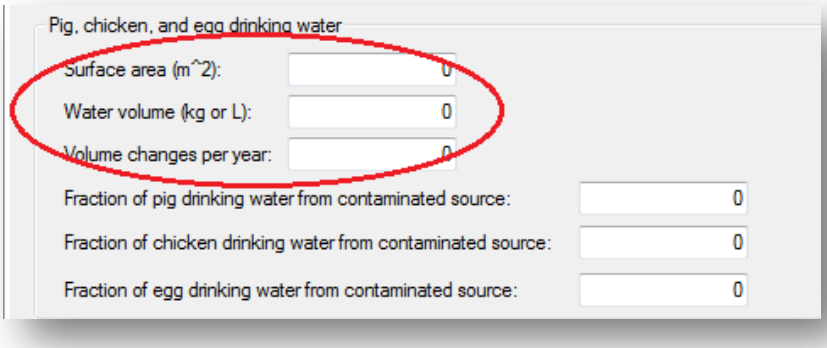


For example, the default fraction for eggs consumed that are contaminated is ***0.146*** (or 14.6%) for households that raise chickens. That means the other 85.4% comes from other sources (e.g., store) and is not impacted.

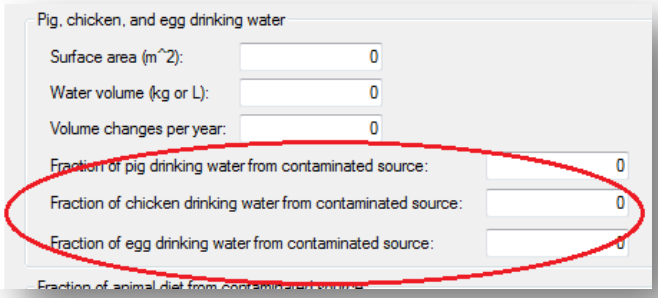
ii. Pig, Chicken, & Egg Drinking Water

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.

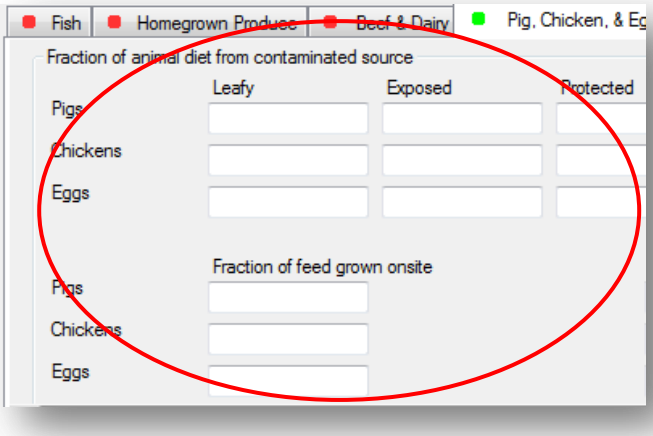


iii. Pig, Chicken, & Egg Diet

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).

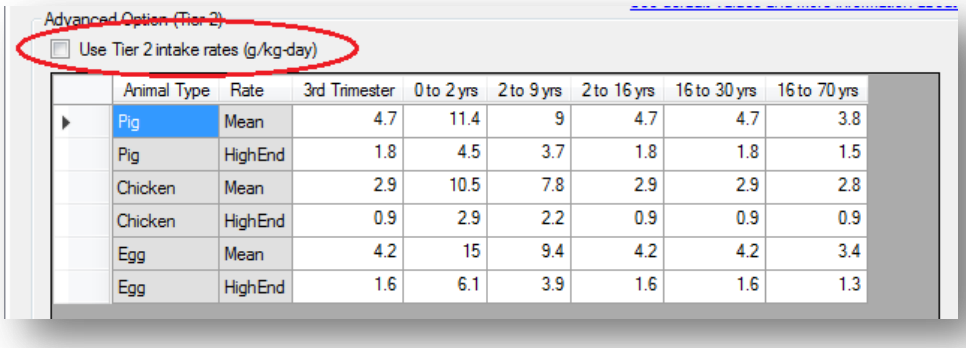
Input the ***Fraction of animal diet from contaminated source***. For the total food intake for pigs, chickens, and egg-producing chickens, the fraction should be the portion coming from crops contaminated by emissions. For example, pigs affected by the facility emissions may receive 1.00 (100%) of their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

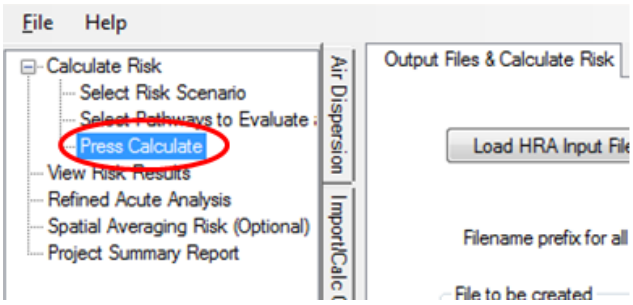
To change the default rates that humans consume pigs, chickens, and eggs, check the ***Use Tier 2 intake rates (g/kg-day)*** box. Input your average human intake rates of chicken, pig, and eggs by age group in grams of animal product eaten per kilogram of bodyweight per day.



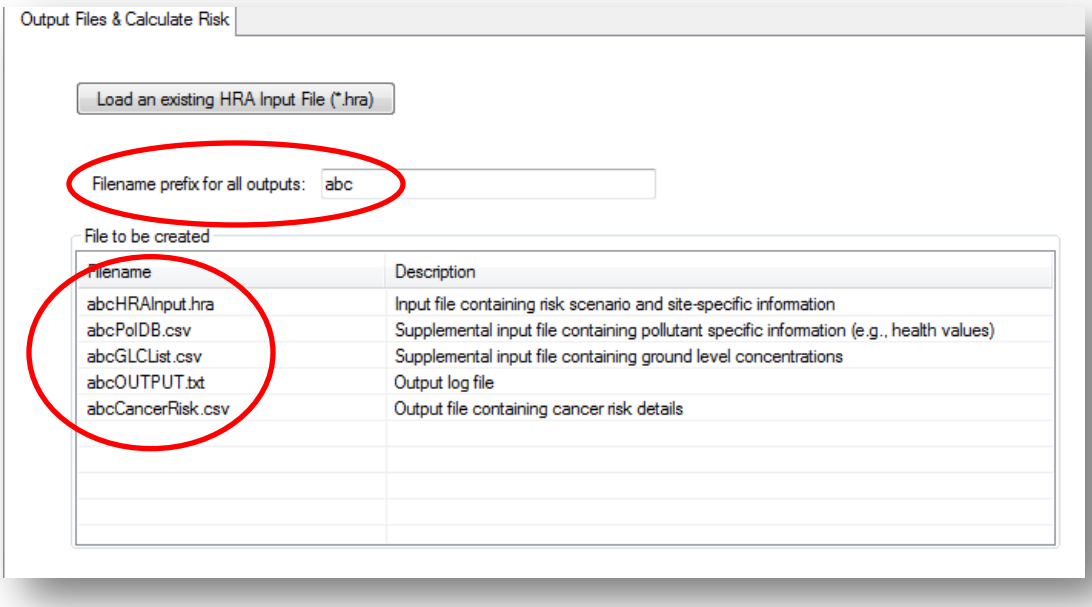
Animal Type	Rate	3rd Trimester	0 to 2 yrs	2 to 9 yrs	2 to 16 yrs	16 to 30 yrs	16 to 70 yrs
Pig	Mean	4.7	11.4	9	4.7	4.7	3.8
Pig	HighEnd	1.8	4.5	3.7	1.8	1.8	1.5
Chicken	Mean	2.9	10.5	7.8	2.9	2.9	2.8
Chicken	HighEnd	0.9	2.9	2.2	0.9	0.9	0.9
Egg	Mean	4.2	15	9.4	4.2	4.2	3.4
Egg	HighEnd	1.6	6.1	3.9	1.6	1.6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

3. Press Calculate

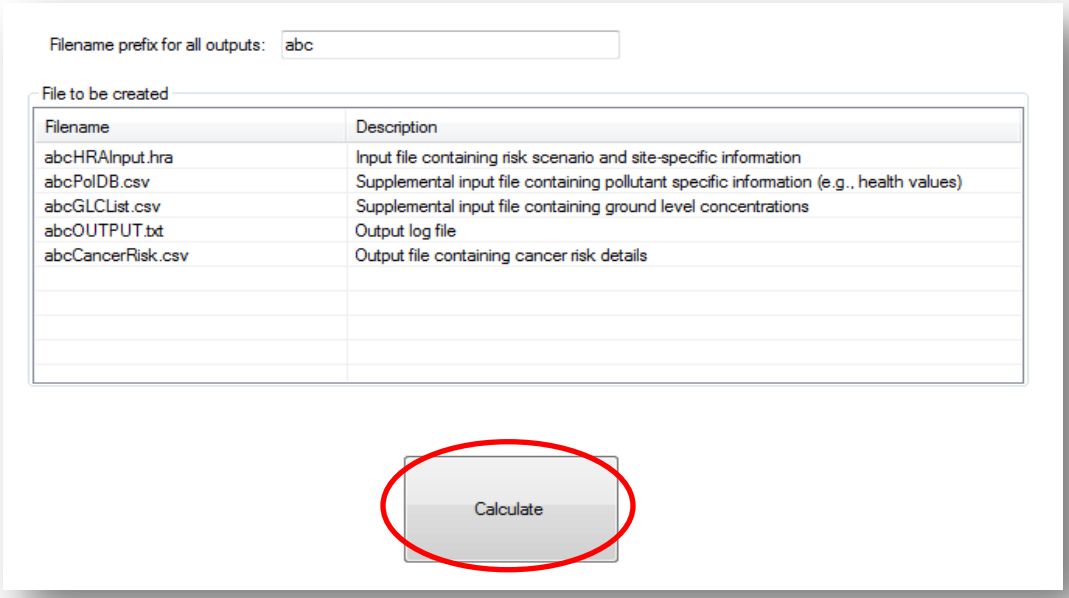
After inputting your risk scenario and parameters, click on ***Press Calculate*** in the left side menu. This is the third and last part of ***Calculate Risk*** of the ***Risk Analysis***, and involves calculating and generating files with your cancer or noncancer risk results. All files will be saved to the Project Output Directory you designated previously in ***AERMOD Inputs & Project Info*** on the ***Project Information*** screen (Refer to 4.A).



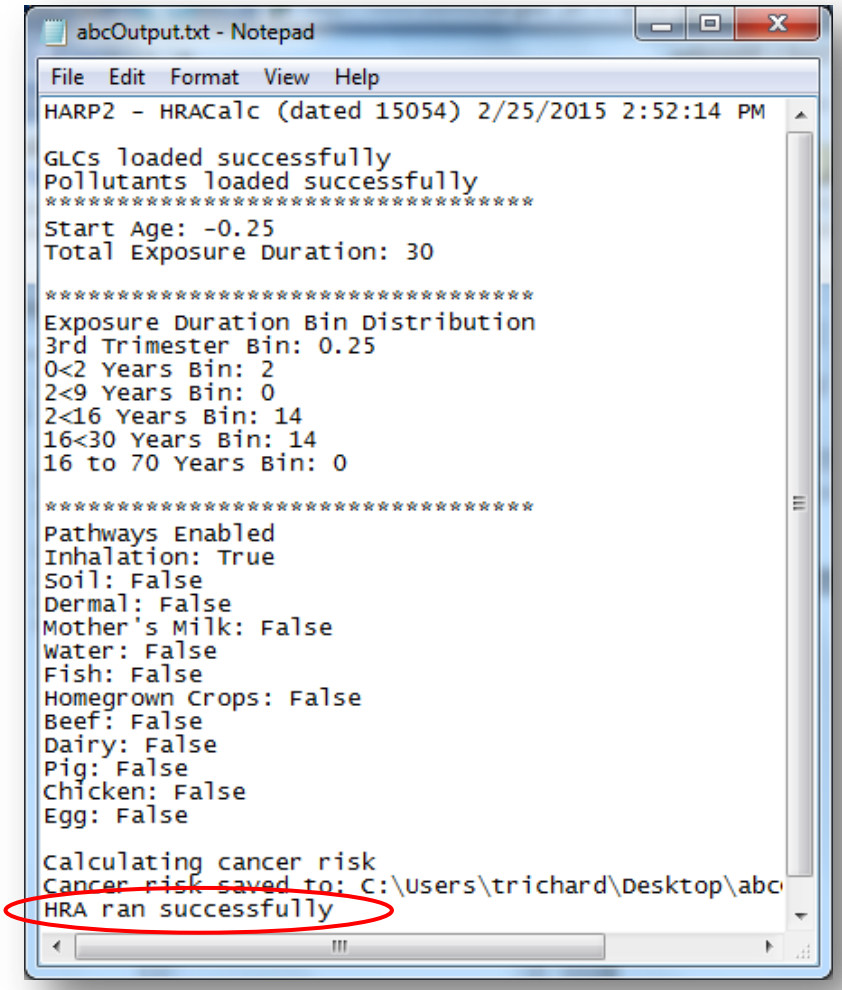
First, indicate the ***Filename prefix for all outputs***. This is the label that will appear at the beginning of all filenames that will be generated for your health risk assessment. As you type, examples of what your filenames will look like are generated in the ***File to be created*** table. Read the ***Description*** for each ***Filenam***e in the ***File to be created*** table to understand what contents that file will hold. For example, the HRAInput.hra file is the input file containing risk scenario and site-specific information that you determined earlier in the module.



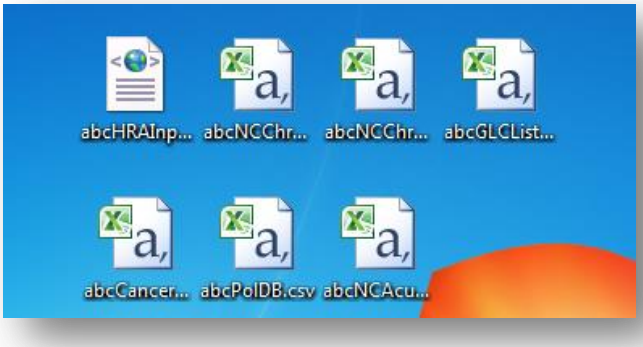
Click ***Calculate***.



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

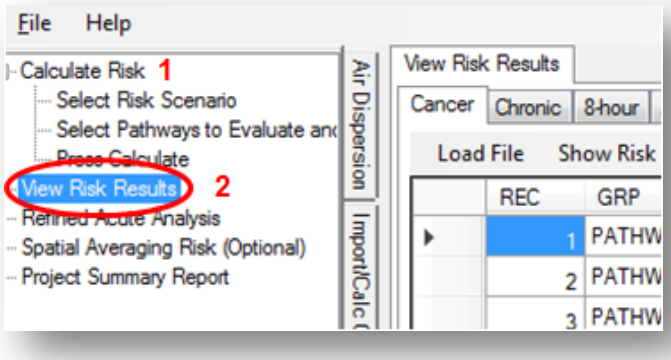


Your exported files will be saved to the destination (e.g., folder, desktop) you chose earlier.



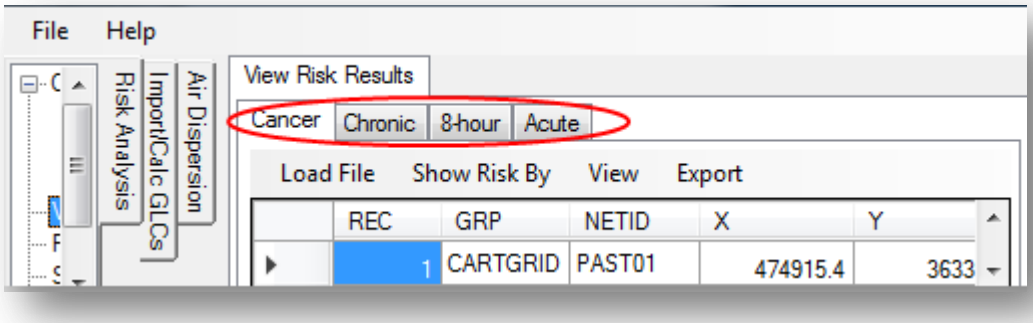
B. View Risk Results

Click on part two of the ***Risk Analysis***, ***View Risk Results***, to see your health impacts.

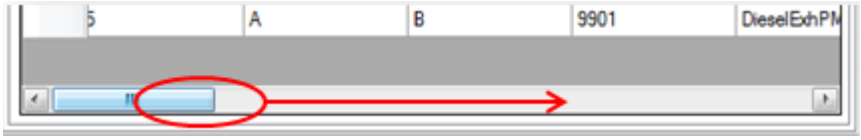


1. Navigating Risk Tables

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.1.a. Choosing the Analysis Type***.

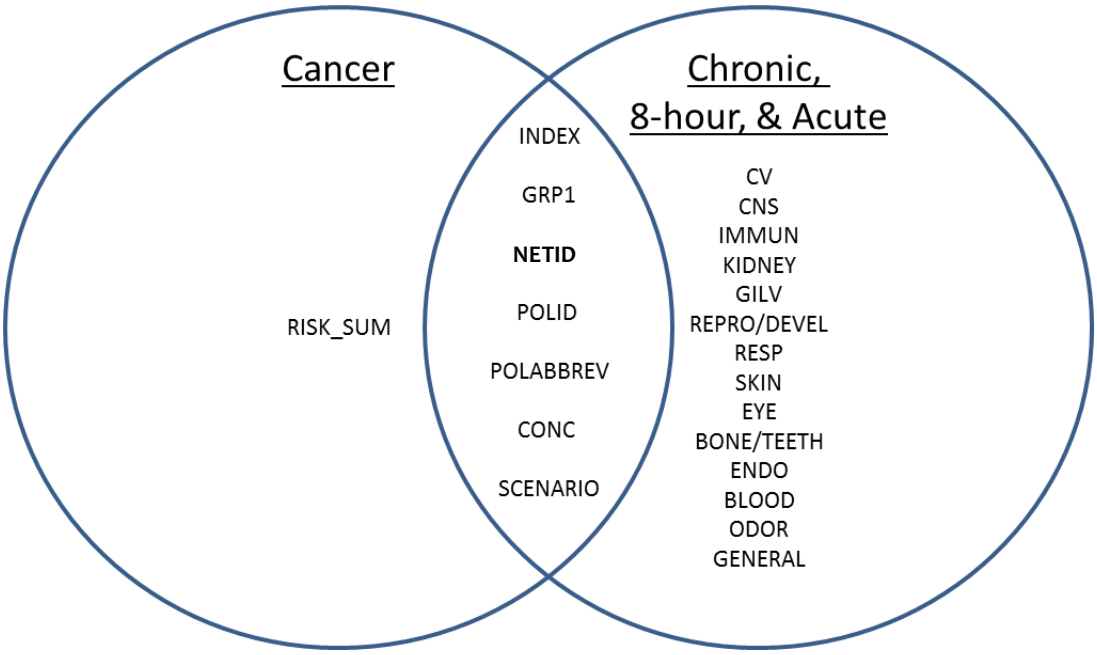


Note: *Scroll the lower bar to see all columns in a table*.



2. Cancer versus Noncancer Results

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 6-10. 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 6-11 below.

Table 6-11. 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.

3. 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.

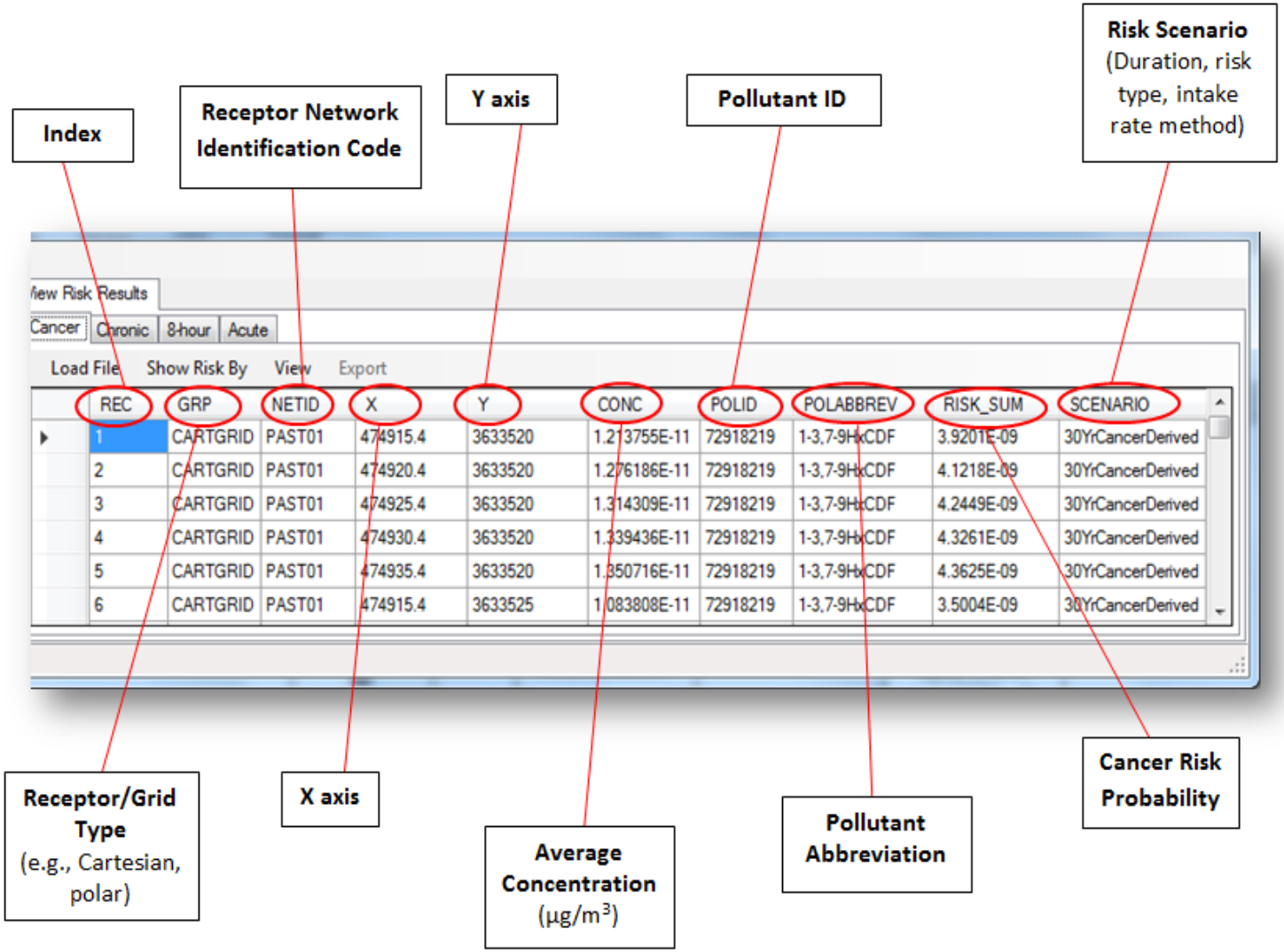
The abbreviations and acronyms ADMRT uses for the target organ systems are shown in Table 6-12.

Table 6-12. Target Organ Systems in ADMRT[1]

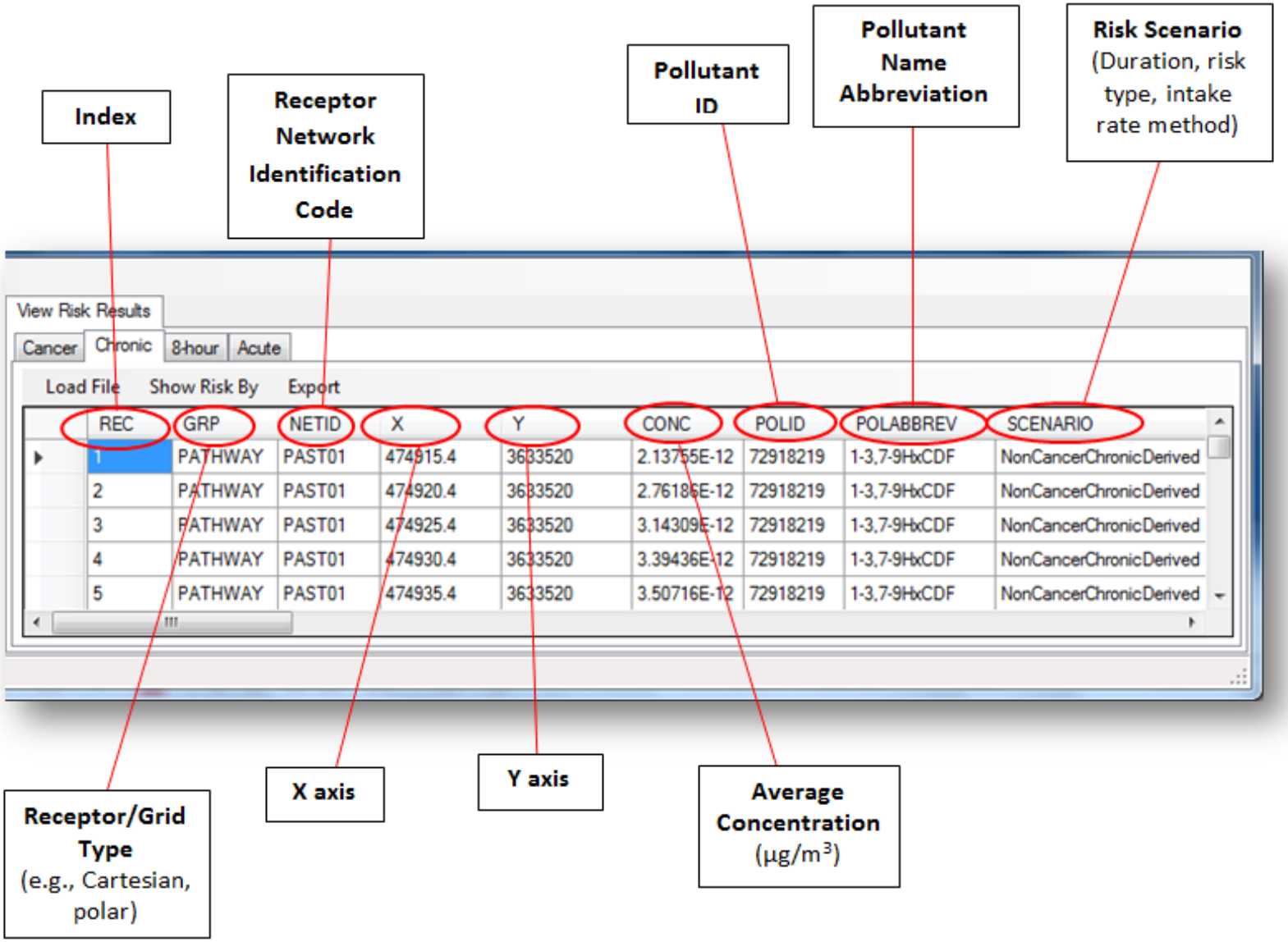
Target Organ Categories	ADMRT Acronyms & Abbreviations
Hematological System	BLOOD
Central Nervous System	CNS
Cardiovascular System	CS
Endocrine System	ENDO
Eyes	EYE
General Toxicity	GENERAL
Alimentary Tract	GILV
Immune System	IMMUN
Reproductive/Developmental	REPRO/DEVEL
Respiratory System	RESP
Skin	SKIN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

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

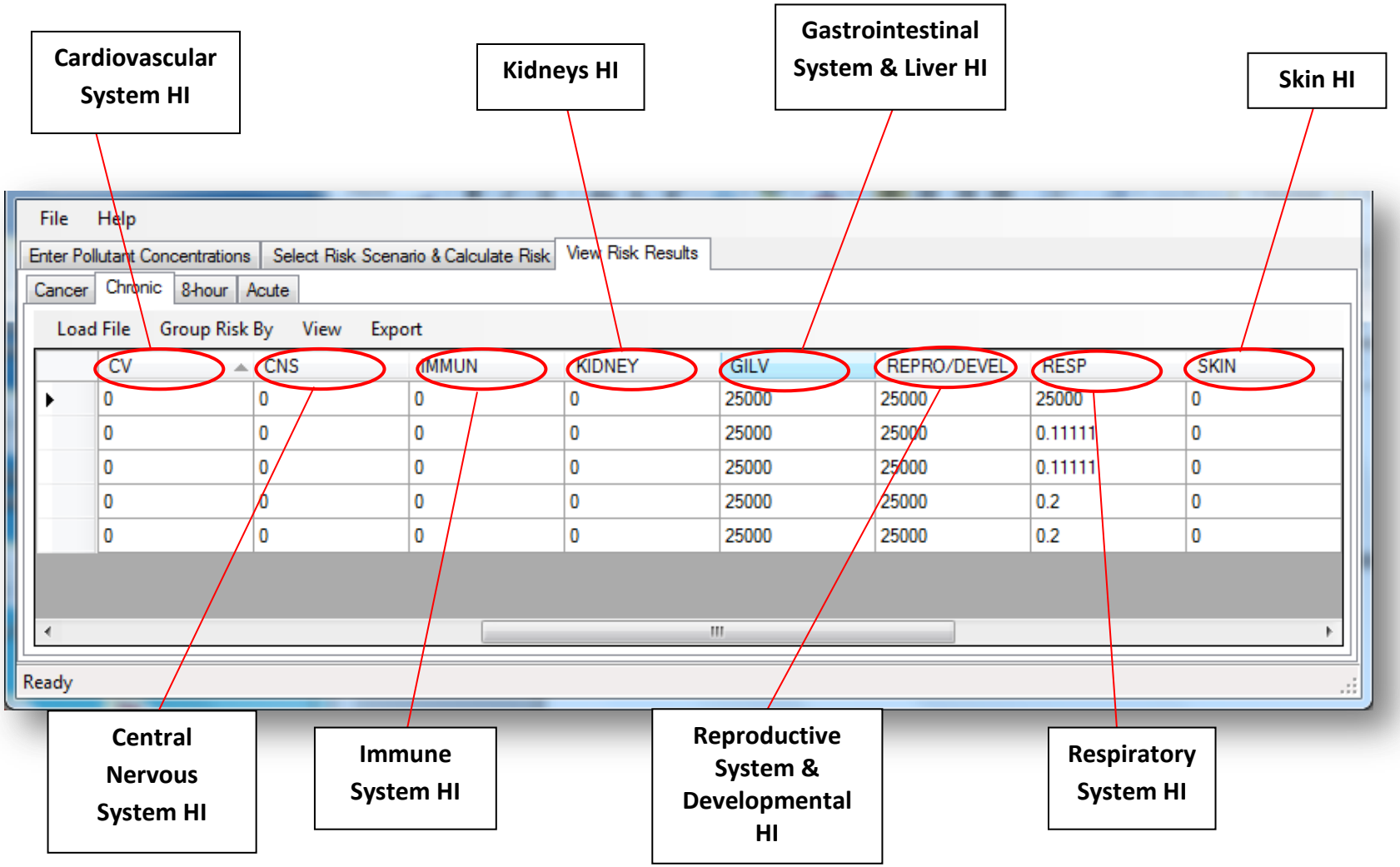
4. Cancer Risk Results Table



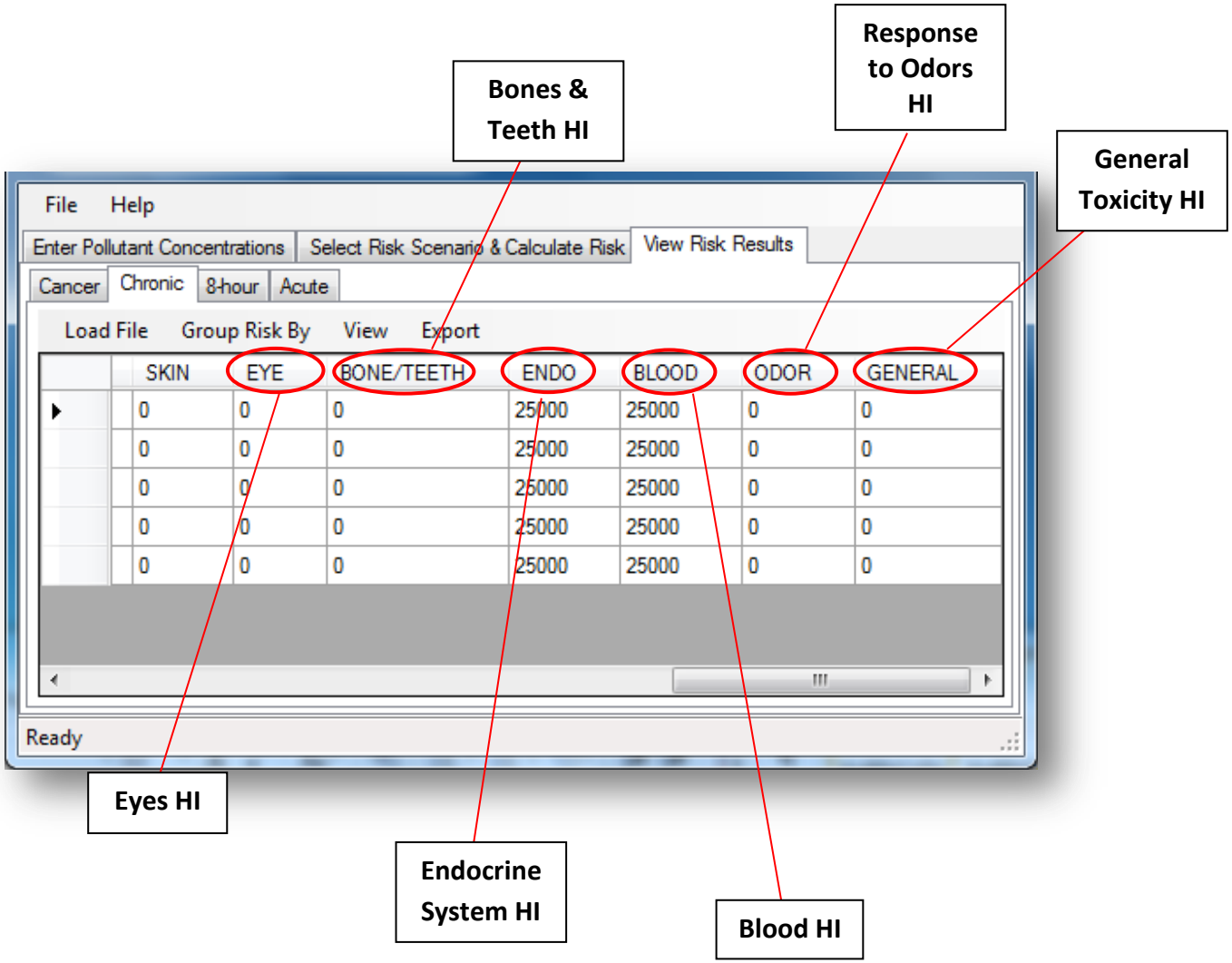
5. Chronic, 8-hour, & Acute (Noncancer) Risk ResultsTable



5. Chronic, 8-hour, & Acute (Noncancer) Risk ResultsTable (Continued)

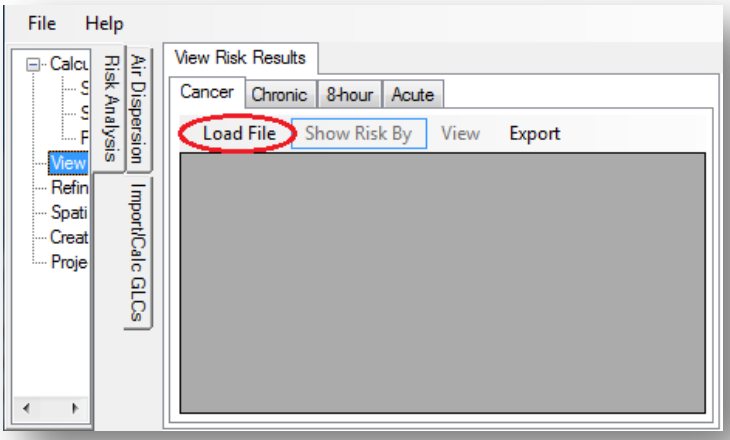


5. Chronic, 8-hour, & Acute (Noncancer) Risk ResultsTable (Continued)

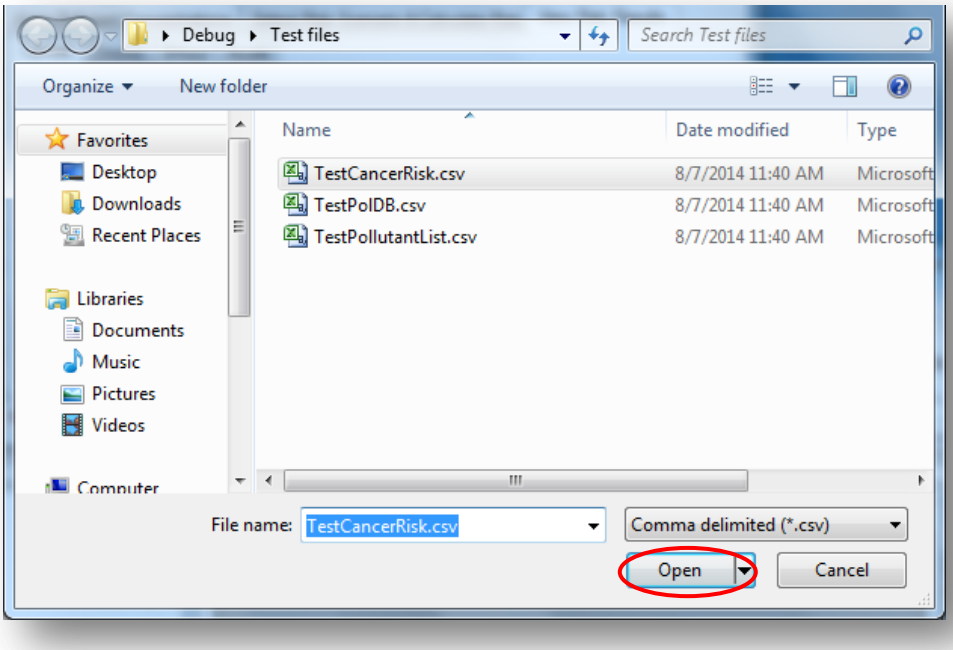


6. Load, Group, View, & Export Risk Data

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

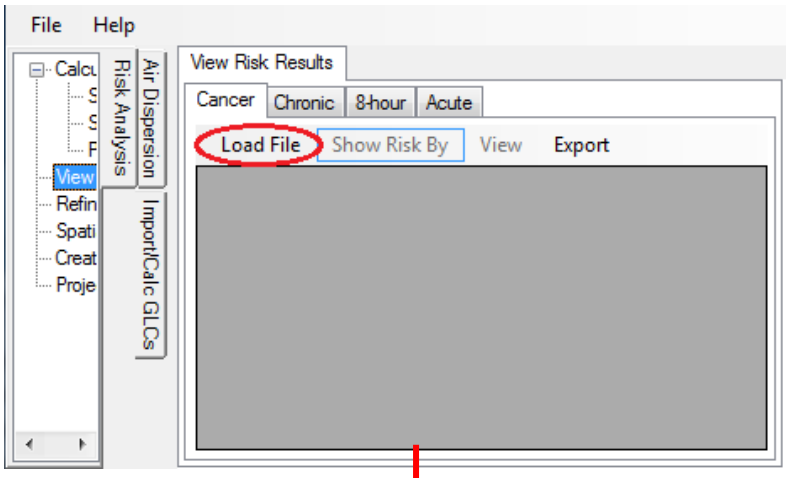


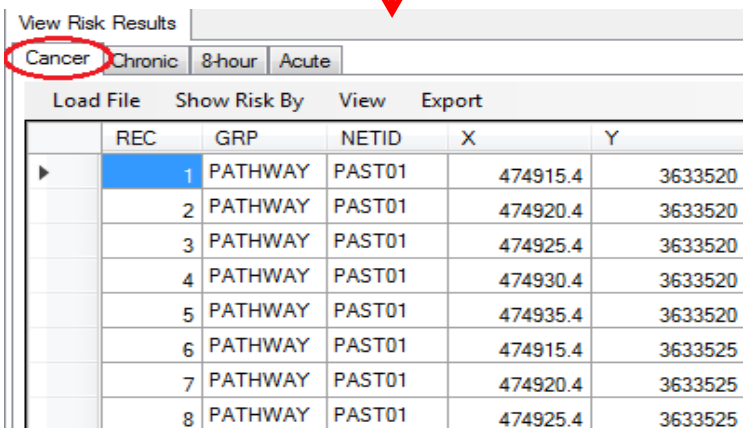
Select the risk results file (in CSV format) you wish to view inside the module and click ***Open***.



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

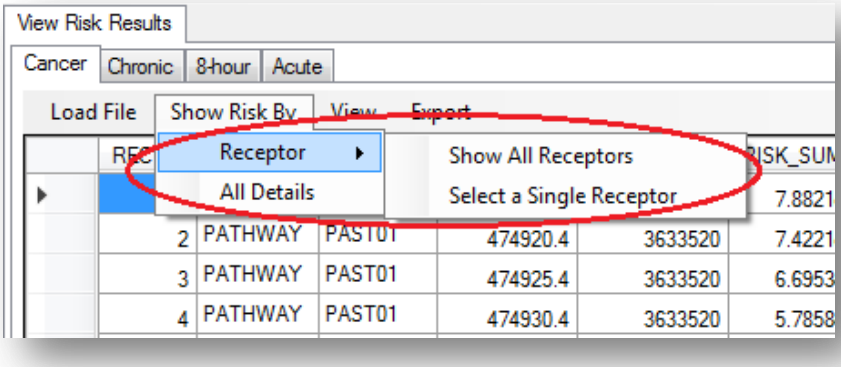
Below is an example of what your screen will look like before and after loading a risk results file.



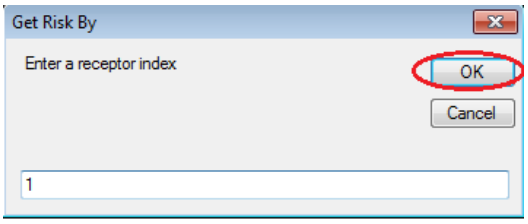


	REC	GRP	NETID	X	Y
▶	1	PATHWAY	PAST01	474915.4	3633520
	2	PATHWAY	PAST01	474920.4	3633520
	3	PATHWAY	PAST01	474925.4	3633520
	4	PATHWAY	PAST01	474930.4	3633520
	5	PATHWAY	PAST01	474935.4	3633520
	6	PATHWAY	PAST01	474915.4	3633525
	7	PATHWAY	PAST01	474920.4	3633525
	8	PATHWAY	PAST01	474925.4	3633525

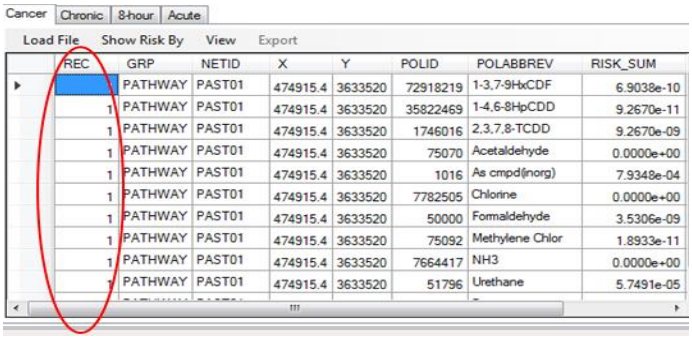
The feature, ***Show Risk By***, allows you view all pathway receptors, a single receptor, or all details of your risk results.



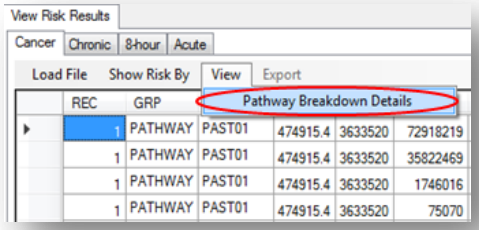
When viewing details for a single receptor, you must enter the receptor's index number (column **REC**). In our example it is record **1**.

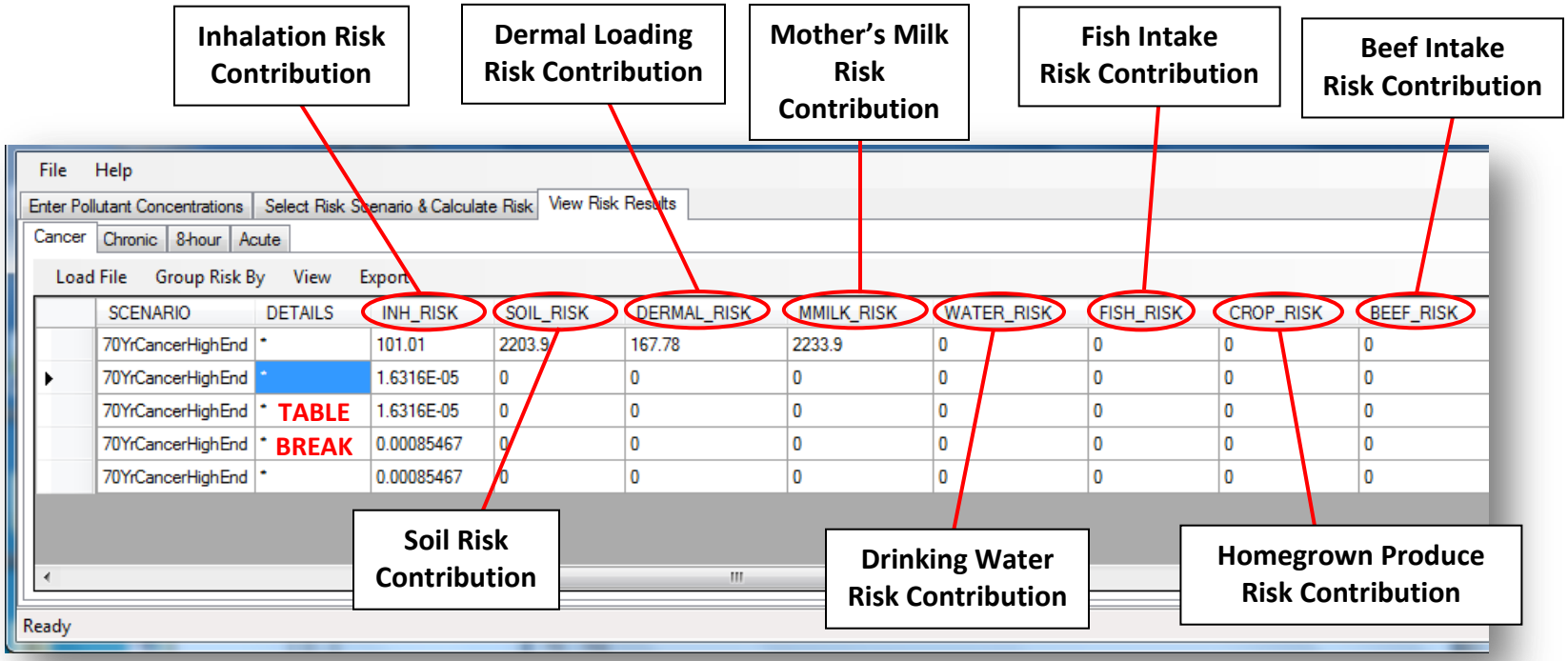


Type the index in and press ***OK***. The table will display pollutant details for that specified receptor. All details belong to the single receptor with index number ***1***.

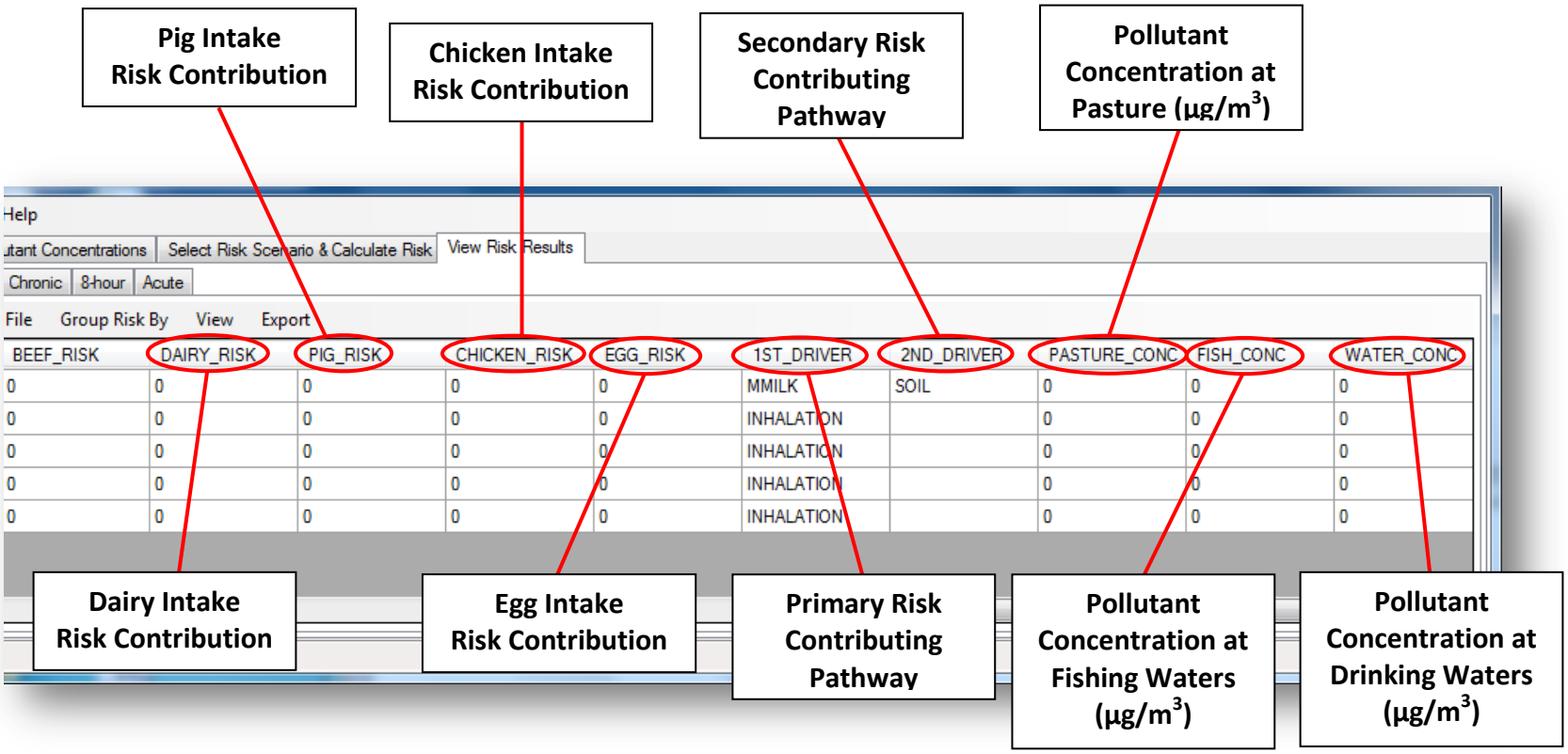


View\Pathway Breakdown Details is available for cancer and noncancer chronic assessments. This feature is not available in the 8-hour and acute tabs, as inhalation is the only measured pathway for these scenarios. Clicking ***View\Pathway Breakdown Details*** will display additional columns that break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





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.

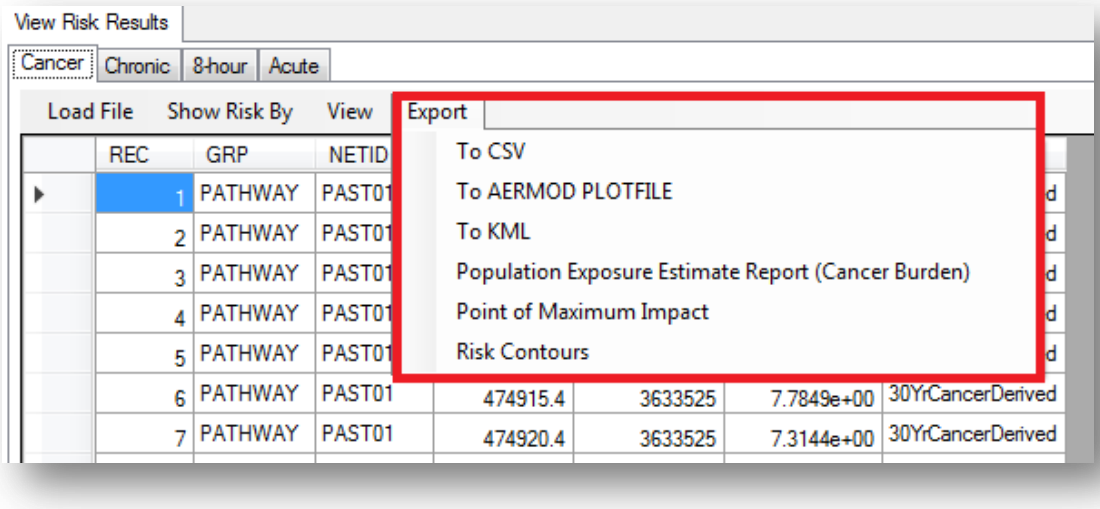


The ***1ST_DRIVER*** and ***2ND_DRIVER*** columns indicate which pathways contribute the first-most and second-most risk to the ***RISK_SUM*** for cancer and hazard index.

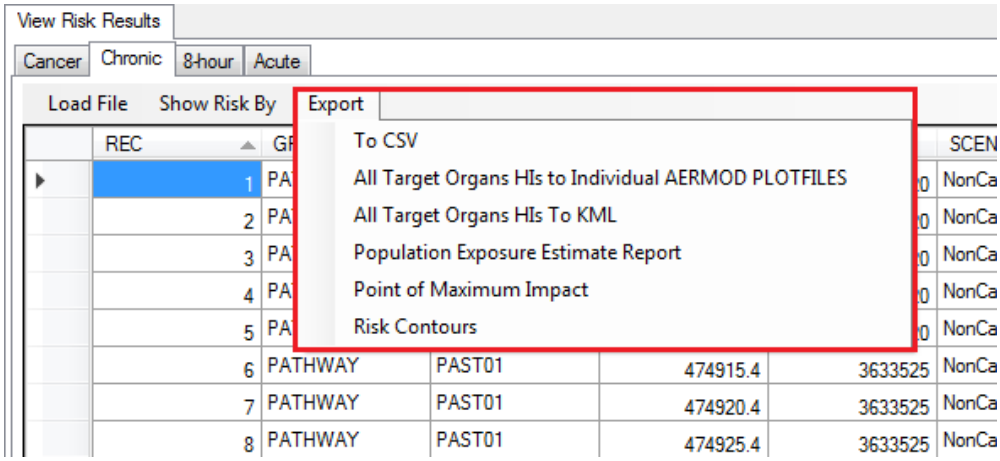
The ***Export*** button will convert your risk results data into a CSV file and save at a designated location to your computer.

The ***Export*** button provides several options in how to convert your risk results into the specific format in which you intend to use the data for.

The ***Export*** options for the cancer risk results are: ***CSV file, AERMOD PLOTFILE, KML file, Population Exposure Estimate Report (Cancer Burden), Point of Maximum Impact, and Risk Contours.***

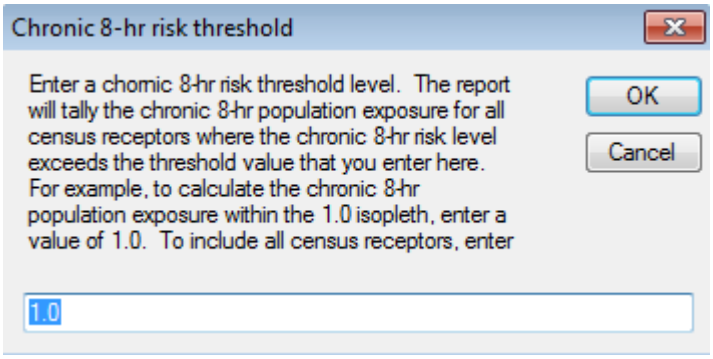


The ***Export*** options for Chronic, 8-hr, and acute are: ***CSV file, All Target Organs His to Individual AERMOD PLOTFILES, All Target Organ His to KML files, Population Exposure Estimate Report, Point of Maximum Impact, and Risk Contours.***

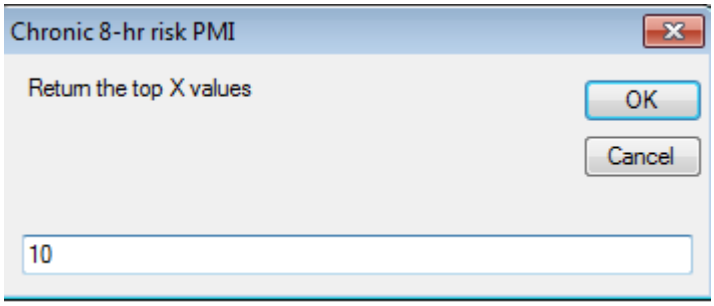


The Chronic, 8-hr, and acute risk results specify target organs for the AERMOD PLOTFILES and KML files while the cancer risk results do not.

The ***Population Exposure Estimate Report*** will require you to input a risk threshold level. The report will consist of a list of all the census block receptors that exceed the threshold level that you specify for that particular risk. Below is an example of the screen that will appear if you chose the ***Population Exposure Estimate Report*** for a ***Chronic*** risk. Note the content will remain the same; however the individual risk will vary between screens.

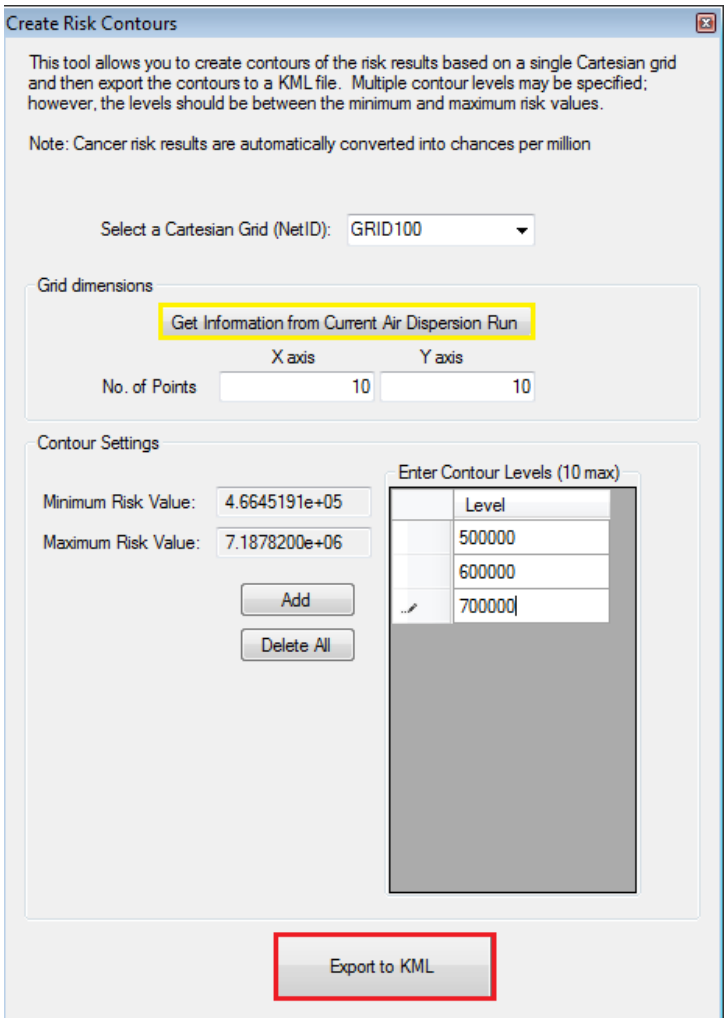


The ***Point of Maximum Exposure*** screen will appear like the one below each risk.



The number you specify for X will be used to report the number of receptors with the highest risk. In this example, we chose to select 10 receptors with the highest risk in a ***Chronic*** risk result.

Risk Contouring allows you to create contours of the risk results based on a single Cartesian grid and then export the contours to a KML file. Multiple contour levels may be specified; however the levels should be between the minimum and maximum risk values. When selecting ***Risk Contouring*** the screen below will appear.

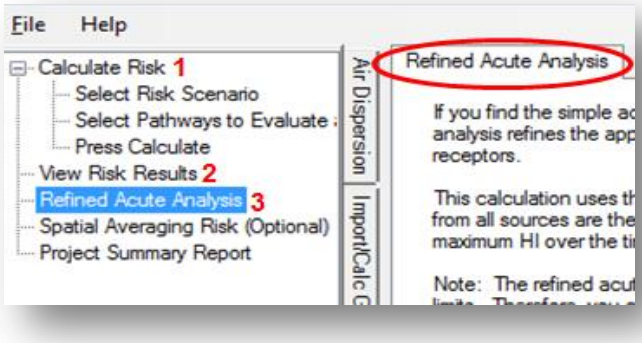


Note that contouring is only available for **Cartesian Grids**.

To get the grid dimensions you may manually enter the number of points on the X-Y axis or select the ***Get Information from Current Air Dispersion Run.***

Select ***Add*** to add up to 10 contour levels. When finished, click ***Export to KML***.

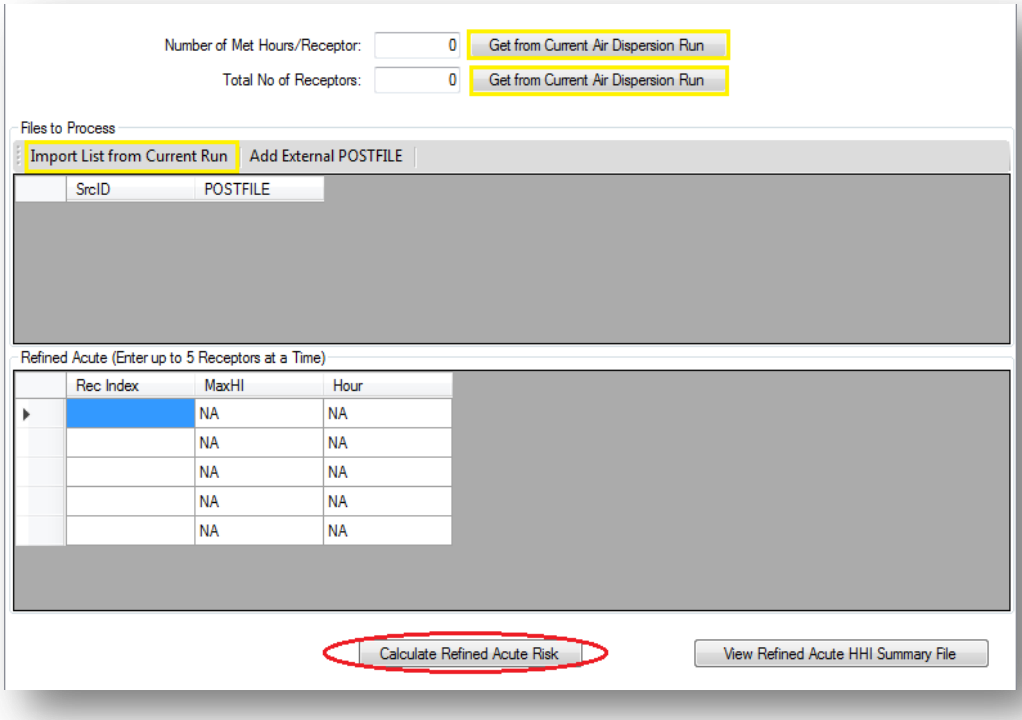
C. Refined Acute Analysis



If you find the simple acute risk is high enough to warrant a more detailed analysis, you should calculate the ***refined maximum hourly acute health impact (HI)***. This analysis refines the approximations used for the simple acute risk. This is a more time consuming calculation, and is therefore usually done for only a few receptors.

This calculation used the ***raw hourly results*** and the ***maximum emission rates*** from each source to calculate a GLC at each receptor location. The GLCs from all sources are then added together to get the total GLC at that hour. From this refined acute HI is calculated. HARP 2 then locates the maximum HI over the time considered for the analysis.

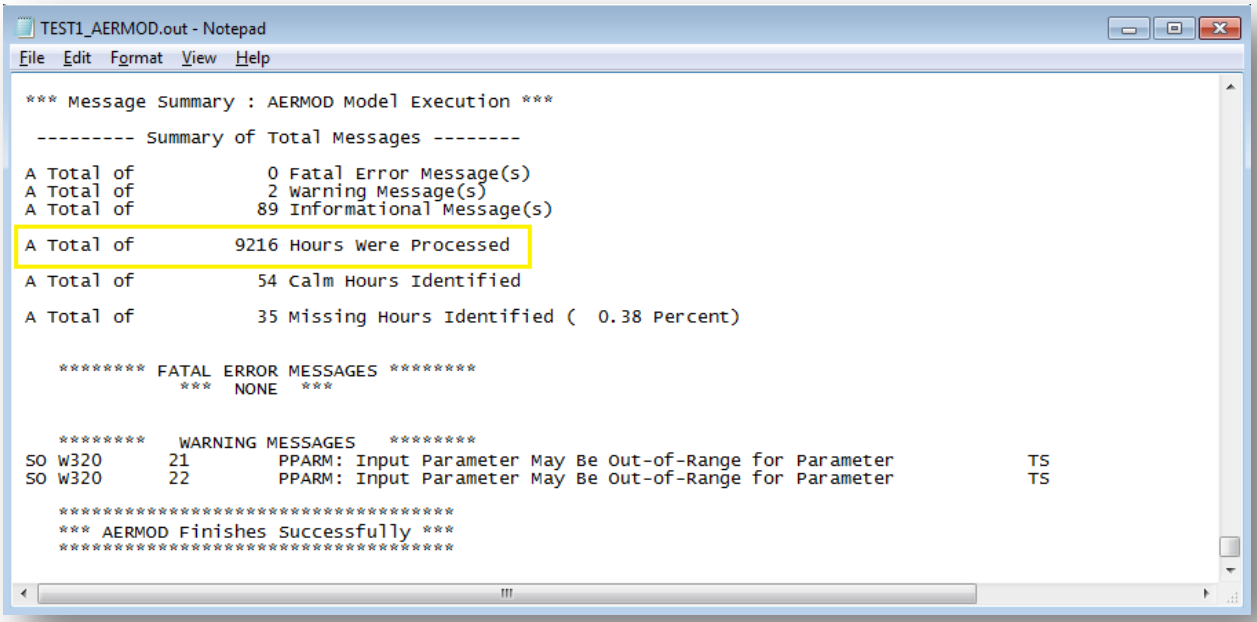
The ***Refined Acute Analysis*** screen is shown below.



In order to run a Refined Acute Risk you will need: ***Number of Met Hours/Receptors, Total Number of Receptors,*** and ***the Source POSTFILE.***

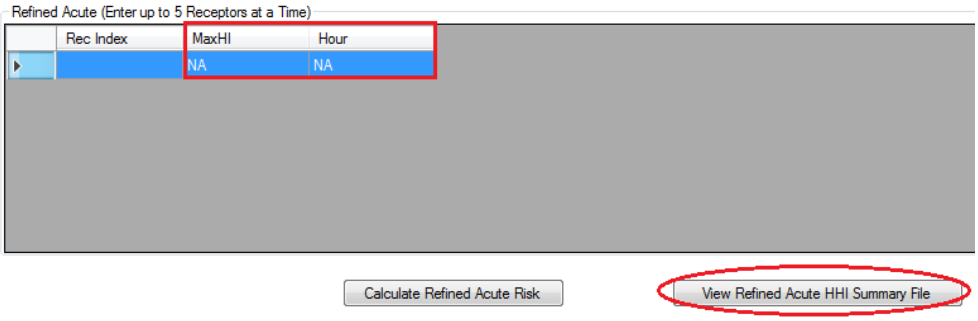
There are “easy” buttons that will allow the module to pull the necessary information from the current air dispersion run. You may choose to click the button or manually enter the data from using the steps discussed in the beginning of the ***Post Process*** section (5.E). Not discussed in the ***Post Process*** section is how to locate the number of Met hours.

To locate the Met hours open the AERMOD output file and scroll to the bottom. At the end of the output file under ***Summary of Total Messages*** you will be able to locate how many hours were processed.



Lastly, you will enter a receptor under ***Receptor Index*** that you would like to evaluate. Note that the refined acute calculation can involve processing enormous amounts of data which can exceed the program memory limits. Therefore, you can only process five receptors at a time. If the analysis exceeds the program memory limit, it may be necessary to rerun the air dispersion analysis using fewer receptors.

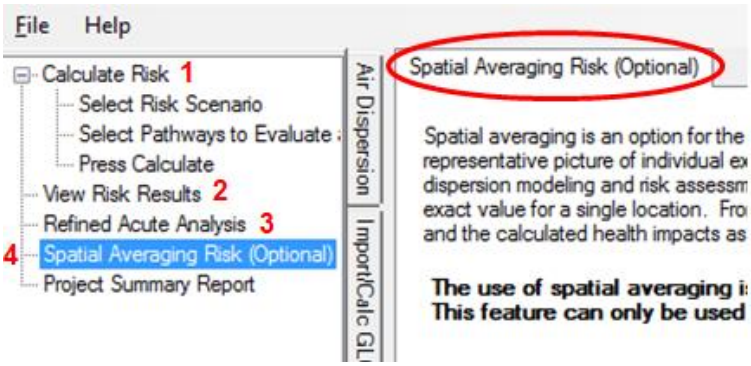
Once the required data is filled out, click ***Calculate Refined Acute Risk***. The refined acute processing is time-consuming. There will be a status indicator on the bottom left corner of the screen to update you on the status of the calculation. When the results are complete a ***Finished*** message box will appear. To locate the Refined Acute Risk results click on the ***View Refined Acute HHI Summary File*** or under the ***Refined Acute*** table select ***MaxHI*** or ***Hour*** for the individual receptor results shown below.



If you would like to run additional receptors delete the previous receptors indices and add in the new receptors. Select ***Calculate Refined Acute Risk*** again and it will process for the new selected receptors. The results will be added to the ***View Refined Acute HHI Summary File*** with the receptor results from the previous run. You can do this as many times as necessary to incorporate as many receptors as you wish.

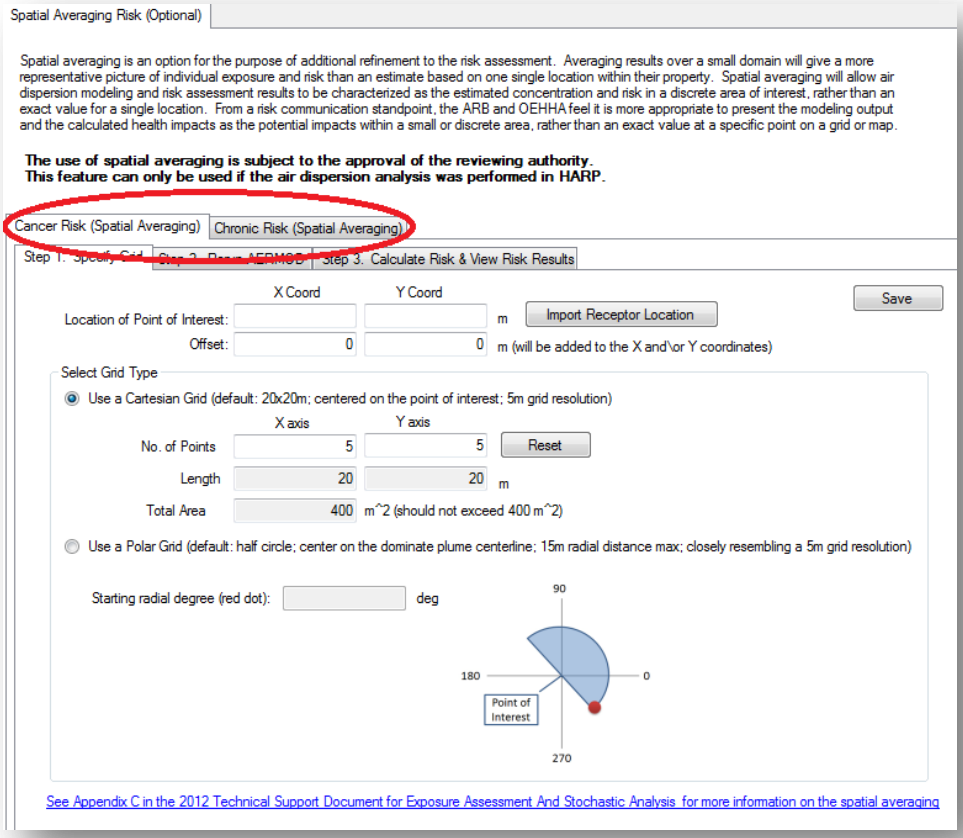
D. Spatial Averaging Results (Optional)

This feature can only be used if the air dispersion analysis was performed in HARP.



Spatial averaging is an option for the purpose of additional refinement to the risk assessment. Averaging results over a small domain will give a more representative picture of individual exposure and risk than an estimate based on one single location within their property. Spatial averaging will allow air dispersion modeling and risk assessment results to be characterized as the estimated concentration and risk in a discrete area of interest, rather than an exact value for a single location.

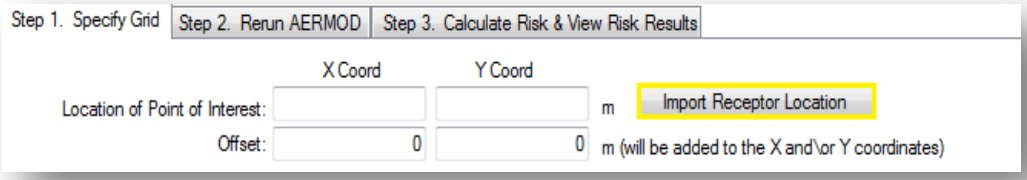
Spatial averaging can be used for long-term averages (i.e., cancer and chronic risk).



To begin a spatial averaging analysis, first select the type of risk (***Cancer*** or ***Chronic Risk***).

After the type of risk has been selected, spatial averaging is a three step process that includes: ***Specifying the Grid, Rerunning AERMOD,*** and ***Calculating Risk & View Risk Results***.

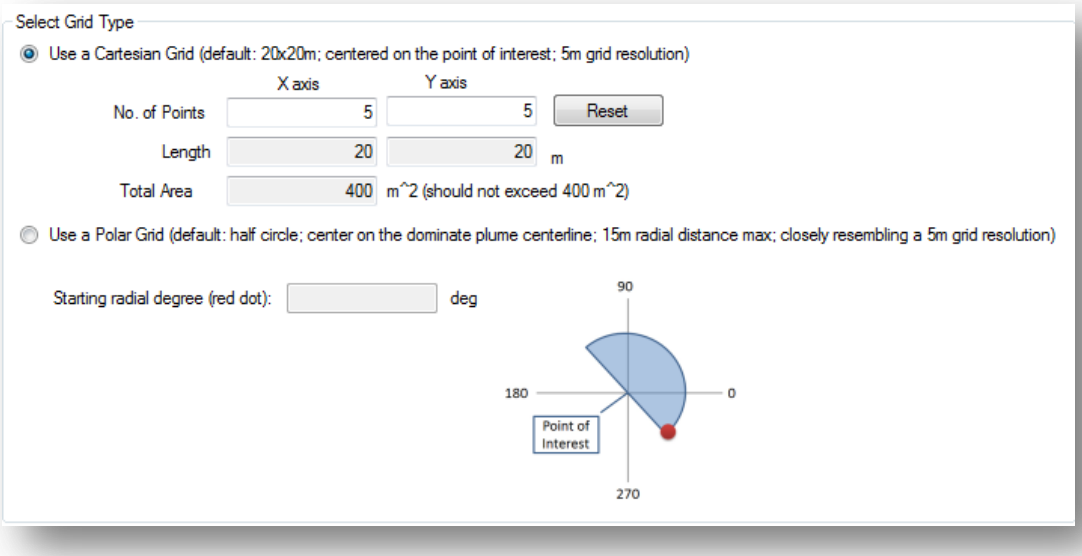
The first step, ***Specifying the Grid***, requires you to enter a ***Point of Interest (POI)***. Examples of these are ***Maximum Exposed Worker (MEIW), Maximum Exposed Resident (MEIR),*** and ***Point of Maximum Impact (PMI)***. You can select the ***Import Receptor Location*** and enter a receptor to use as your POI.



The ***Offset*** feature is used to reposition the center point of the ***Cartesian grid***. This is necessary since the POI is always in the center of the grid area that will be averaged. If a portion of the centered and nested grid falls within the facility boundary and the

receptor location of interest is outside of the boundary, then adjustments to the nested grid to obtain the spatially-averaged concentration for the offsite receptor are reasonable.

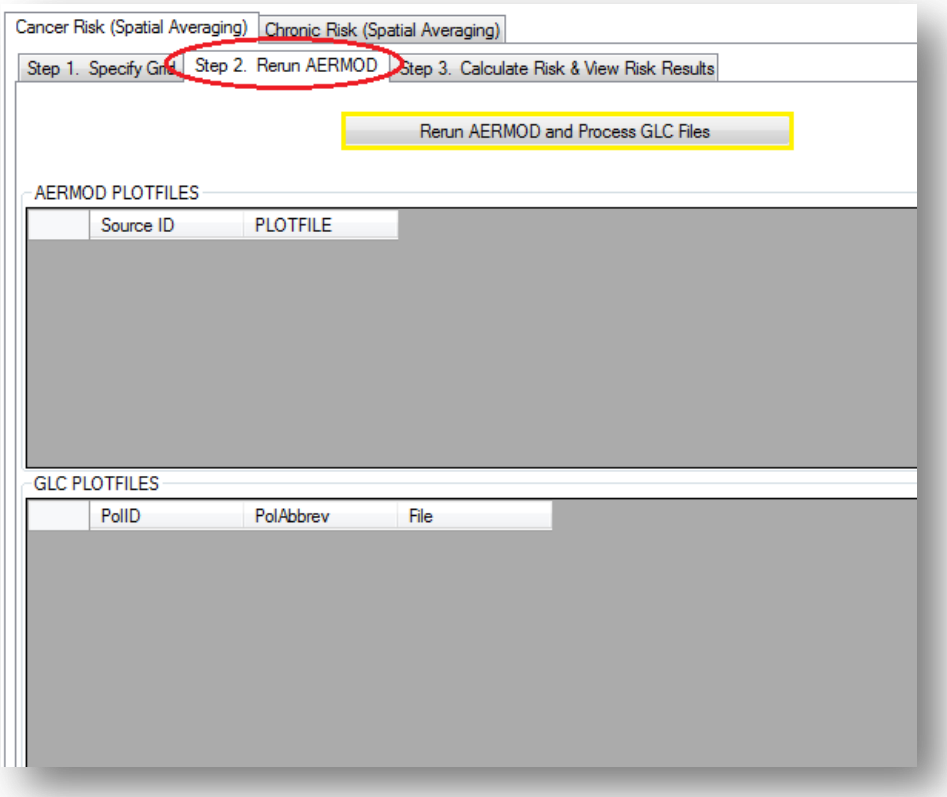
Next, you will be required to select which type of grid you will be using, ***Cartesian*** or ***Polar***.



If you select the ***Cartesian grid*** your default is a 20m x 20m grid with 5m grid resolution and centered at the POI. These grid dimensions can be adjusted; however, per the OEHHA Guidance Manual, the area should not exceed 400m^2.

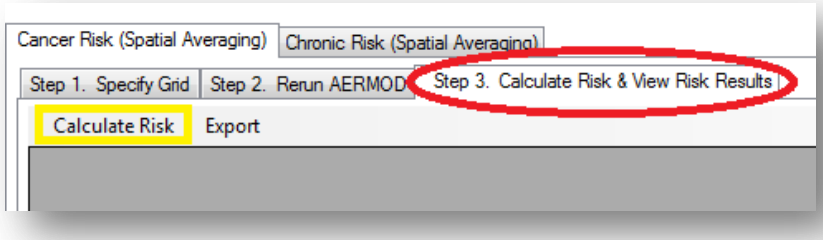
If you select the ***Polar grid*** your default is a 180 degree arc or half circle with a radial distance max of 15m and grid spacing closely resembling 5m. If it is necessary, tilt the nested grid to coincide with the dominant plume centerline. Typically, polar grids are easier to implement than a tilted rectangular grid.

The second step is to ***Rerun AERMOD***.

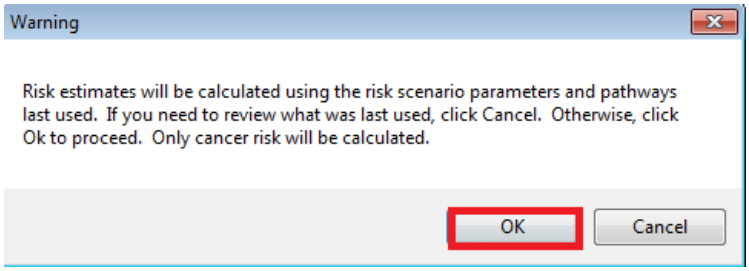


Select the ***Rerun AERMOD and Process GLC Files***. New AERMOD and GLC PLOTFILES will be calculated to be used in the next step.

The last step in the process of ***Spatial Averaging Risks*** is to ***Calculate Risk & View Risk Results***.

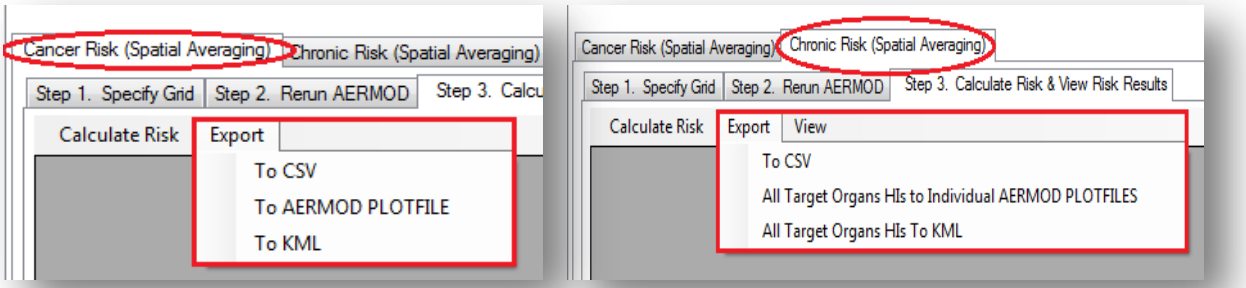


When you select ***Calculate Risk*** the box below will appear.

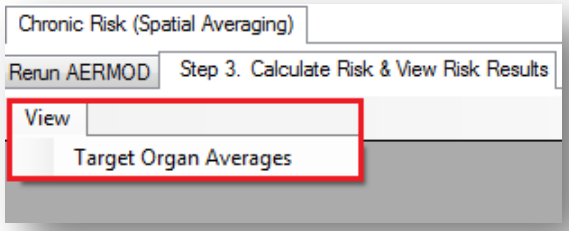


This is to warn you that the scenarios and pathways you selected under ***Calculate Risk*** (6.A.) will be automatically used to recalculate results with the new AERMOD and GLCs PLOTFILES.

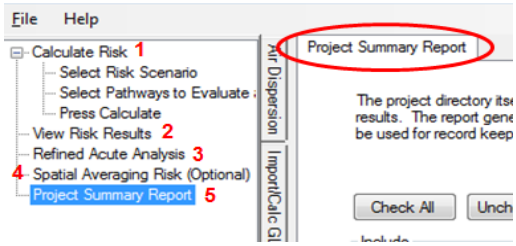
The ***Export*** options for ***cancer risk*** and ***chronic risk*** are similar; however the ***chronic risk*** specifies target organs. The export options include: ***CSV file, AERMOD PLOTFILE, and KML file.***



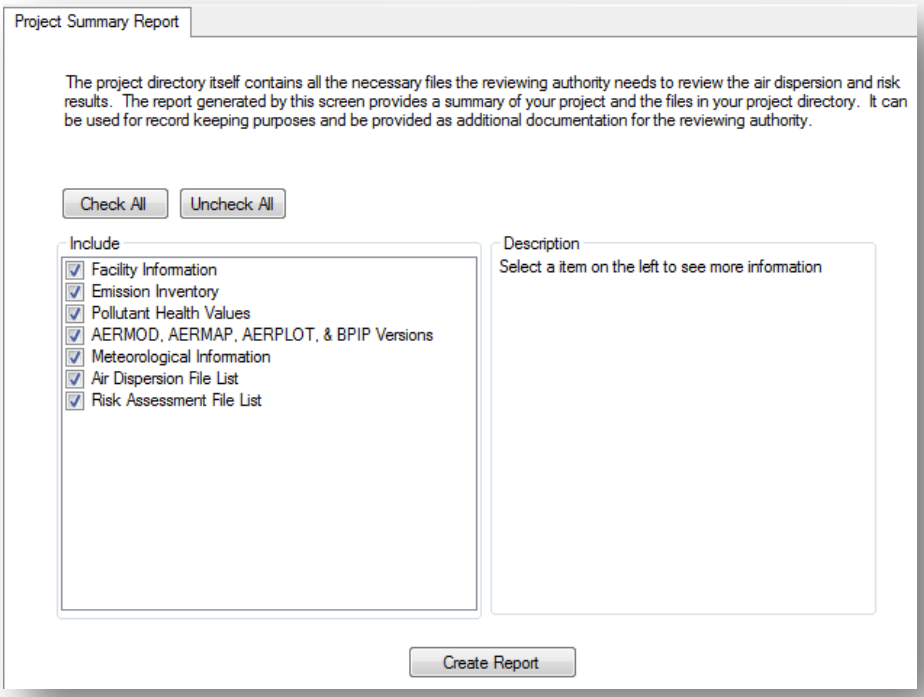
Under ***chronic risk*** you will have the ***View*** option that will allow you to view the ***Target Organ Averages***.



E. Project Summary Report



The project directory itself contains all the necessary files the reviewing authority needs to review the air dispersion and risk results. The report generated by this screen provides a summary of your project and the files in your project directory. It can be used for record keeping purposes and be provides as additional documentation for the reviewing authority. You may check or uncheck files to incorporate select files or all files.


Project Summary Report
The project directory itself contains all the necessary files the reviewing authority needs to review the air dispersion and risk results. The report generated by this screen provides a summary of your project and the files in your project directory. It can be used for record keeping purposes and be provided as additional documentation for the reviewing authority.
Check All
Uncheck All
Include
Facility Information
Emission Inventory
Pollutant Health Values
AERMOD, AERMAP, AERPLOT, & BPIP Versions
Meteorological Information
Air Dispersion File List
Risk Assessment File List
Description
Select a item on the left to see more information
Create Report

7. REFERENCES

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

U.S. EPA GEP (1985). Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document For The Stack Height Regulations. EPA-450/4-80-023R. U.S Environmental Protection Agency, Research Triangle Park, North Carolina.

U.S. EPA (2004). User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA -454/B-03-001. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

U.S. EPA (2009). AERMOD Implementation Guide. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

U.S. EPA (2014). AERMOD Quick Reference Guide – Version 14134. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

Appendix A:
Adapted AERMOD Keywords and Parameters[1]

The purpose of this document is to outline the AERMOD keywords and parameters used in the ADMRT. The keywords and parameters are specified for each type of pathway used in the ADMRT.

The ***Default*** Keywords and Parameters automatically set up in HARP 2 are provided below:

AERMOD Keyword	**Default Parameters**
MODELOPT	CONC
AVERTIME	1 & PERIOD
POLLUTANTID	OTHER
ERRORFIL	[Project name].ERR
SRCGROUP	[Source ID] [Source ID] Repeats for each source in the analysis
RECTABLE	ALLAVE & 1ST
PLOTFILE	PLOTFILE 1 [Source ID] 1ST “MAX1HR + [Source ID].PLT” PLOTFILE PERIOD [Source ID] “PERIOD + [Source ID].PLT” Repeats for each source in the analysis

The **Control Pathway** keywords and parameters are defined below.

Keywords	**Parameters**	
TITLEONE	Title1	
Where:	Title one	First line of title for output; character string of up to 68 characters
TITLETWO	Title2	
Where:	Title2	Optional second line of title for output; character string of up to 68 characters
MODELOPT	Job control and dispersion options	
	DFAULT CONC FLAT and/or ELEV NOSTD NOCHKD or WARNCHKD SCREEN FASTALL or FASTAREA NOURBTRAN LOWWIND1 or LOWWIND2	
Where:	DFAULT	Specifies use of regulatory default options
	CONC	Specifies calculation of concentration values
	FLAT *	Option to assume flat terrain
	ELEV *	Option to assume elevated terrain
	NOSTD	Option to use no stack-tip downwash
	NOCHKD	Option to by-pass date checking for non-sequential meteorological data file
	WARNCHKD	Option of issuing warning messages rather than fatal errors will be used for non-sequential meteorological data files.
	SCREEN	Option to run AERMOD in a screening mode (makes centerline calculations, sets NOCHKD option on, limits averaging period to 1-hour)
	FASTALL	Option to optimize model runtime through use of alternative implementation of horizontal meander for POINT and VOLUME sources; also optimizes model runtime for AREA/AREAPOLY/AREACIRC and OPENPIT sources through hybrid approach
	FASTAREA	Option to optimize model runtime through hybrid approach for AREA/ AREAPOLY/AREACIRC and OPENPIT sources
	NOURBTRAN	Option to ignore the transition from nighttime urban boundary layer to daytime convective boundary layer
	LOWWIND1 **	Option to address concerns regarding model performance under low wind speed conditions. The LOWWIND1option increases the minimum value of sigma-v from 0.2 m/s to 0.5 m/s, and "turns off" the horizontal meander component
	LOWWIND2 **	Option to address concerns regarding model performance under low wind speed conditions. The LOWWIND2 option increases the minimum value of sigma-v from 0.2 m/s to 0.3 m/s, and includes some adjustments to the horizontal meander component.
AVERTIME	Averaging time(s) to process	
	Time1 Time2 Time3 …. TimeN MONTH PERIOD or ANNUAL	
Where:	TimeN	Nth optional averaging time (1, 2, 3, 4, 6, 8, 12, 24-hr)
	MONTH	Option to calculate MONTHly averages
	PERIOD	Option to calculate average for the entire data PERIOD
	ANNUAL	Option to calculate ANNUAL average

URBANOPT	Specifies parameters for urban dispersion option	
	UrbPop (Urbname) (UrbRoughness)	
Where:	UrbPop Urbname UrbRoughness	Specifies the population of the urban area Specifies the name of the urban area (optional) Specifies the urban surface roughness length,meters (optional, defaults to 1.0m)
POLLUTID	Identifies type of pollutant being modeled	
	Pollut	
Where:	Pollut	Identifies type of pollutant being modeled. Any name of up to eight characters may be used, e.g., SO2, NOX, PM10, TSP, OR OTHER.
FLAGPOLE	Specifies whether to accept receptor heights above local terrain (m) for use with flagpole receptors, and allows for default flagpole height to be specified	
	Flagdf	
Where:	Flagdf	Default value for height of (flagpole) receptors above local ground level, a default value of 0.0m is used if this optional parameter is omitted
ERRORFIL	Option to generate detailed error listing file	
	Errfil	
Where:	Errfil	Specifies name of detailed error listing file (default = ERRORS.LST)

*Note that FLAT and ELEV may be specified in the same model run to allow specifying the non-DFAULT FLAT terrain option on a source-by-source basis.

**Note that LOWWIND1 and LOWWIND2 cannot both be invoked in the same model run.

The **Source Pathway** keywords and parameters are defined below. The Source Pathway is defined by three categories: Sources, Variable Emissions, and Buildings.

Sources:

Keyword	**Parameter**	
ELEVUNIT	Defines input units for source elevations	
	METERS	
Where:	METERS	Specifies input units for source elevations of meters
LOCATION	Identifies coordinates for a particular source	
	Srcid Srctype Xs Ys (Zs)	
Where:	Srcid	Source identification code (alphanumeric string of up to 8 characters, user defined
	Srctype	Source type: POINT, POINT CAPPED, POINT HORIZONTAL, VOLUME, AREA, AREA POLYGON, AREA CIRCULAR, OPEN PIT, and LINE
	Xs	x-coord of source location; SW corner for AREA (in m)
	Ys	y-coord of source location; SW corner for AREA (in m)
	(Zs)	Option z-coord of source location (elevation above mean sea level, defaults to 0.0 if omitted)
SRCPARAM	Identifies source parameters for a particular source	
	Srcid Ptemis Stkhgt Stktmp Stkvel Stkdia [POINT sources] Vlemis Relght Syinit Szinit [VOLUME sources] Aremis Relhgt Xinit (Yinit) (Angle) (Szinit) [AREA sources] Aremis Relhgt Nverts (Szinit) [AREAPOLY sources] Aremis Relhgt Radius (Nverts) (Szinit) [AREACIRC sources] Opemis Relhgt Xinit Yinit Pitvol (Angle) [OPENPIT sources] Lnemis Relhgt Width (Szinit) [LINE sources]	
Where:	Srcid	Source identification code
	__Emis	Source emission rate: g/s for Ptemis or Vlemis, g/(s*m^2) for Aremis or Opemis or Lnemis
	__Hgt	Source physical release height above ground (m) (center of height for volume)
	Stktmp	Stack gas exit temperature (K)
	Stkvel	Stack gas exit velocity (m/s)
	Stkdia	Stack inside diameter (m)
	Syinit	Initial lateral dimension of VOLUME source (m)
	Szinit	Initial vertical dimension of VOLUME or AREA source (m) (Optional for LINE source)
	Xinit	Length of side of AREA source in x-direction (m)
	Yinit	Length of side of AREA source in y-direction (m) (optional parameter, assumed to be equal to Xinit if omitted)
	Angle	Orientation angle of AREA source relative to North (degrees), measured positive clockwise, rotated around the source location, (Xs, Ys) (optional parameter, assumed to be 0.0 if omitted) OR Orientation angle for the rectangular open pit in degrees from North, measured positive in the clockwise direction (optional parameter, assumed to be 0.0 if omitted)
	Nverts	Number of vertices used for AREAPOLY or AREACIRC source (between 3 and 20, optional for AREACIRC sources)
	Radius	Radius of circular area for AREACIRC sources
	Pitvol	Volume of open pit in cubic meters
	Width	Width of the source in meters (with a minimum width of 1m)

AREAVERT	Specifies location of vertices for an AERAPOLY source type	
	Srcid Xv(1) Yv(1) Xv(2) Yv(2) … X(i) Yv(i)	
Where:	Srcid	Source identification code
	Xv(1)	X-coordinate of the first vertex of an AERAPOLY source (must be the same as the value of Xs for that source defined on the Source Location card)
	Yv(1)	Y-coordinate of the first vertex of an AREAPOLY source (must be the same as the value of Ys for that source defined on the Source Location card)
	X(i)	X-coordinate for the i^{th} vertex of an AREAPOLY source
	Yv(i)	Y-coordinate for the i^{th} vertex of an AREAPOLY source
URBANSRC	Identifies which sources to model with urban effects	
	Srcid (UrbanID)	
Where:	Srcid	Specifies which source(s) will be modeled with urban effects
	UrbanID	An optional alphanumeric ID defined by the user (up to eight characters) when multiple urban areas are defined
SRCGROUP	Identification of source groups	
	Grpid Srcid's	
Where:	Grpid	Group ID, specifies group including all sources
	Srcid's	Discrete source ID's to be include in group

Variable Emissions:

Keyword	**Parameter**	
EMISFACT	Optional input for variable emission rate factors	
	Srcid Qflag Qfact(i), i=1,n	
Where:	Srcid	Source identification code
	Qflag	Variable emission rate flag: SEASON for seasons MONTH for monthly HROFDY for hour-of-day WSPEED for wind speed category SEASHR for season-by-hour; SHRDOW for season by hour-of-day by day-of-week (M-F, Sat, Sun) SHRDOW7 for season by hour-of-day by day-of-week (M, Tu, W, Th, F, Sat, Sun)
	Qfact	Array of scalar emission rate factors , for: SEASON: n=4 MONTH: n=12 HROFDY: n=24 WSPEED: n= 6 SEASHR: n=96 SHRDOW: n=288 SHRDOW7: n=672

Buildings:

Keyword	Parameter	
BUILDHGT	Building height values for each wind sector	
	Srcid Dsbh (i), i=1,36	
Where:	Srcid	Source identification code
	Dsbh	Array of direction-specific building heights (m) beginning with 10 degree flow vector and incrementing by 10 degrees clockwise
BUILDWID	Building width values for each wind sector	
	Srcid Dsbw(i), i=1,36	
Where:	Srcid	Source identification code
	Dsbw	Array of direction-specific building widths (m) beginning with 10 degree flow vector and incrementing by 10 degrees clockwise
XBADJ	Along-flow distances from the stack to the center of the upwind face of the projected building	
	Srcid Xbadj (i), i=1,36	
Where:	Srcid	Source identification code
	Xbadj (i)	Array of direction-specific along-wind distances beginning with 10 degree flow vector and incrementing by 10 degrees clockwise
YBADJ	Across-flow distances from the stack to the center of the upwind face of the projected building	
	Srcid Ybadj (i), i= 1,36	
Where:	Srcid	Source identification code
		Array of direction-specific along-wind distances beginning with 10degree flow vector and incrementing by 10 degrees clockwise

The **Receptor Pathway** keywords and parameters are defined below.

Keyword	**Parameter**	
ELEVUNIT	Defines input units for receptor elevations (default is in meters)	
	METERS	
Where:	METERS	Specifies input units for receptor elevations of meters
GRIDCART	Defines a Cartesian grid receptor network	
	Netid STA XYINC Xinit Xnum Xdelta Yinit Ynum Ydelta Or XPNTS Gridx1 Gridx2 Gridx3 … Gridxn, and YPNTS Gridy1 Gridy2 Gridy3 … Gridyn ELEV Row Zelev1 Zelev2 Zelev3 … ZelevN HILL Row Zhill1 Zhill2 Zhill3 … ZhillN FLAG Row Zflag1 Zflag2 Zflag3 … ZflagN END	
Where:	Netid	Receptor network identification code
	STA	Indicates STArt of GRIDCART subpathway, repeat for each new Netid
	XYINC	Keyword identifying grid network generated from x and y increments
	Xinit	Starting x-axis grid location in meters
	Xnum	Number of x-axis receptors
	Xdelta	Spacing in meters between x-axis receptors
	Yinit	Starting y-axis grid location in meters
	Ynum	Number of y-axis receptors
	Ydelta	Spacing in meters between y-axis receptors
	XPNTS	Keyword identifying grid network defined by a series of x and y coordinates
	Gridx1	Value of first x-coordinate for Cartesian grid
	GridxN	Value of "n^{th}" x-coordinate for Cartesian grid
	YPNTS	Keyword identifying grid network defined by a series of x and y coordinates
	Gridy1	Value of first y-coordinate for Cartesian grid
	GridyN	Value of "n^{th}" y-coordinate for Cartesian grid
	ELEV	Keyword to specify that receptor elevations follow
	Row	Indicates which row (y-coordinate fixed) is being input
	Zelev	An array of receptor terrain elevations for a particular row
	HILL	Keyword to specify that hill height scales follow
	Row	Indicates which row (y-coordinate fixed) is being input
	Zhill	An array of receptor hill height scales for a particular row
	FLAG	Keyword to specify that flagpole receptor heights follow
	Row	Indicates which row (y-coordinate fixed) is being input
	Zflag	An array of receptor heights above local terrain elevation for a particular row (flagpole receptors)
	END	Indicates END of GRIDCART subpathway, repeat for each new Netid

GRIDPOLR	Defines a Polar grid receptor network	
	Netid STA ORIG Xinit Yinit Or ORIG Srcid DIST Ring 1 Ring 2 Ring 3 … RingN DDIR Dir 1 Dir2 Dir3 … DirN Or GDIR Dirnum Dirini Dirinc ELEV Dir Zelev1 Zelev2 Zelev3 … ZelevN HILL Dir Zhill1 Zhill2 Zhill3 … ZhillN FLAG Dir Zflag1 Zflag2 Zflag3 … ZflagN END	
Where:	Netid	Receptor network identification code
	STA	Indicates STArt of GRIDPOLR subpathway, repeat for each new Netid
	ORIG	Optional keyword to specify the origin of the polar network (assumed to be at x=0, y=o if omitted)
	Xinit	x-coordinate for the origin of the polar network
	Yinit	y-coordinate for the origin of the polar network
	Srcid	Source ID of source used as origin of polar network
	DIST	Keyword to specify distances for the polar network
	Ring1	Distance to the first ring of polar coordinates
	RingN	Distance to the "n^{th}" ring of polar coordinates
	DDIR	Keyword to specify discrete direction radials for the polar network
	Dir1	First direction radial in degrees (1 to 360)
	DirN	The "n^{th}" direction radial in degrees (1 to 360)
	GDIR	Keyword to specify generated direction radials for the polar network
	Dirnum	Number of directions used to define the polar system
	Dirini	Starting direction of the polar system
	Dirinc	Increment (in degrees) for defining directions
	ELEV	Keyword to specify that receptor elevations follow
	Dir	Indicates which direction is being input
	Zelev	An array of receptor terrain elevations for a particular direction radial
	HILL	Keyword to specify that hill height scales follow
	Dir	Indicates which direction is being input
	Zhill	An array of receptor hill height scales for a particular direction radial
	FLAG	Keyword to specify that flagpole receptor heights follow
	Dir	Indicates which direction is being input
	Zflag	An array of receptor heights above local terrain elevation for a particular direction (flagpole receptors)
	END	Indicates END of a GRIDPOLR subpathway, repeat for each new Netid

DISCCART	Defines the discretely placed receptor locations referenced to a Cartesian system	
	Xcoord Ycoord (Zelev Zhill) (Zflag)	
Where:	Xcoord	x-coordinate for discrete receptor location
	Ycoord	y-coordinate for discrete receptor location
	Zelev	Elevation above sea level for discrete receptor location (optional), used only for ELEV terrain
	Zhill	Hill height scale corresponding with a discrete receptor location (optional), used only for ELEV terrain
	Zflag	Receptor height (flagpole) above local terrain (optional), used only with FLAGPOLE keyword
INCLUDED	Option to include data from a separate file in the runstream	
	Incfil	
Where:	Incfil	Specifies name of the files to be included in the runstream data

The **Meteorological Pathway** keywords and parameters are defined below.

Keyword	Parameter	
SURFFILE	Describes input meteorological surface data file	
	Sfcfil (Format)	
Where:	Sfcfil	Specify filename for surface meteorological input file
	Format	Specify format for input file (optional)
PROFFILE	Describes input meteorological profile data file	
	Profil (Format)	
Where:	Profil	Specify filename for profile meteorological input file
	Format	Specify format for input file (optional)
SURFDATA	Describes surface meteorological station	
	Stanum Year (Name) (Xcoord Ycoord)	
Where:	Stanum	Station number
	Year	Year of data being processed (four digits)
	Name	Station name (optional)
	Xcoord	x-coordinate of station location (m) (optional)
	Ycoord	y-coordinate of station location (m) (optional)
UAIRDATA	Describes upper air meteorological station	
	Stanum Year (Name) (Xcoord Ycoord)	
Where:	Stanum	Station number
	Year	Year of data being processed (four digits)
	Name	Station name (optional)
	Xcoord	x-coordinate of station location (m) (optional)
	Ycoord	y-coordinate of station location (m) (optional)
SITEDATA	Describes on-site meteorological station	
	Stanum Year (Name) (Xcoord Ycoord)	
Where:	Stanum	Station number for on-site meteorological data station
	Year	Year of data being processed (four digits)
	Name	Station name (optional)
	Xcoord	x-coordinate of station location (m) (optional)
	Ycoord	y-coordinate of station location (m) (optional)
PROFBASE	Specifies the base elevations for the potential temperature profile	
	BaseElev (Units)	
Where:	BaseElev	Base elevation (above MSL) for the potential temperature profile
	Units	Units of BaseElev: METERS or FEET (default is METERS)
STARTEND	Specifies the start and end dates to be read from input meteorological data file (default is to read entire file)	
	Strtyr Strtmn Strtdy (Strthr) Endyr Endmn Enddy (Endhr)	
Where:	Strtyr	Year of first record to be read
	Strtmn	Month of first record to be read
	Strtdy	Day of first record to be read
	Strthr	Hour of first record to be read (optional)
	Endyr	Year of last record to be read
	Endmn	Month of last record to be read
	Enddy	Day of last record to be read
	Endhr	Hour of last record to be read (optional)

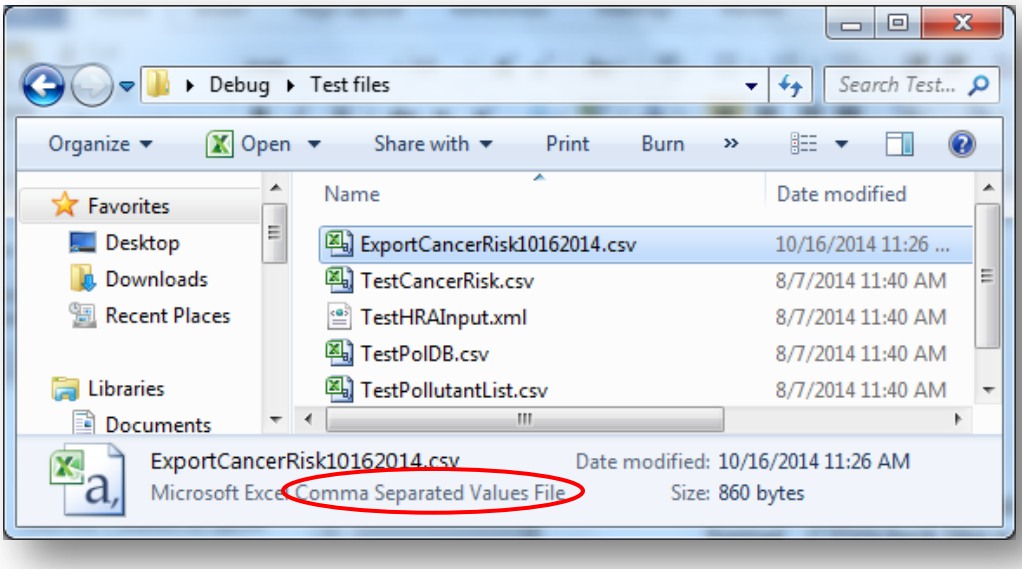
The **Output Pathway** keywords and parameters are defined below.

Keyword	**Parameter**	
RECTABLE	Option to specify value(s) by receptor for output	
	Aveper FIRST SECOND . . . SIXTH or Aveper 1ST 2ND . . . 6TH	
Where:	Aveper	Averaging period to summarize with high values (keywords ALLAVE specifies all averaging periods
	FIRST	Select summaries of FIRST highest values by receptor
	SECOND	Select summaries of SECOND highest values by receptor
	SIXTH	Select summaries of SIXTH highest values by receptor
	1ST	Select summaries of 1ST highest values by receptor
	2ND	Select summaries of 2ND highest values by receptor
	6TH	Select summaries of 6TH highest values by receptor Note: If two keywords are input separated by a dash (e.g. FIRST-THIRD) then summaries of all high values in that range are provided. The number of high values allows is controlled by the BVAL parameter in the computer code (initially set at 3).
POSTFILE	Option to write results to a mass storage file for post processing	
	Aveper Grpid Format Filnam (Funit)	
Where:	Aveper	Specifies averaging period to be output to file, e.g. 24 for 24-hr averages, PERIOD for period averages
	Grpid	Specifies source group to be output to file
	Format	Specifies format of file, either UNFORM or unformatted files or PLOT for formatted files for plotting
	Filnam	Specifies filename for output file
	Funit	Optional parameter to specify the file unit
PLOTFILE	Option to write certain results to a storage file suitable for input to plotting routines	
	Aveper Grpid Hivalu Filnam (Funit) or (Short term values) Aveper Grpid Filnam (Funit) (PERIOD or ANNUAL averages)	
Where:	Aveper	Specifies averaging period to be output to file, e.g. 24 for 24-hr averages, PERIOD for period averages, WINTER for winter averages, etc.
	Grpid	Specifies source group to be output to file
	Hivalu	Specifies high value summary (e.g. FIRST, SECOND, 1ST, 2ND, etc.) to be output to file (must be selected on a RECTABLE card)
	Filnam	Specifies filename for output file
	Funit	Optional parameter to specify the file unit

[1]Keywords and parameters used in these tables are adapted from the U.S. EPA AERMOD Quick Reference Guide.

Appendix B:
How to Format a CSV File for Import

The purpose of this document is to learn to format a ***Comma Separated Value (CSV)*** file, which allows data to be saved in a table structured format. CSVs look like a typical spreadsheet but with a .csv extension. Traditionally, they take the form of a text file containing information separated by commas, hence the name.



CSV is the file format that ADMRT accepts. Knowing how to format a CSV can allow you to more efficiently import data into various sections of ADMRT.

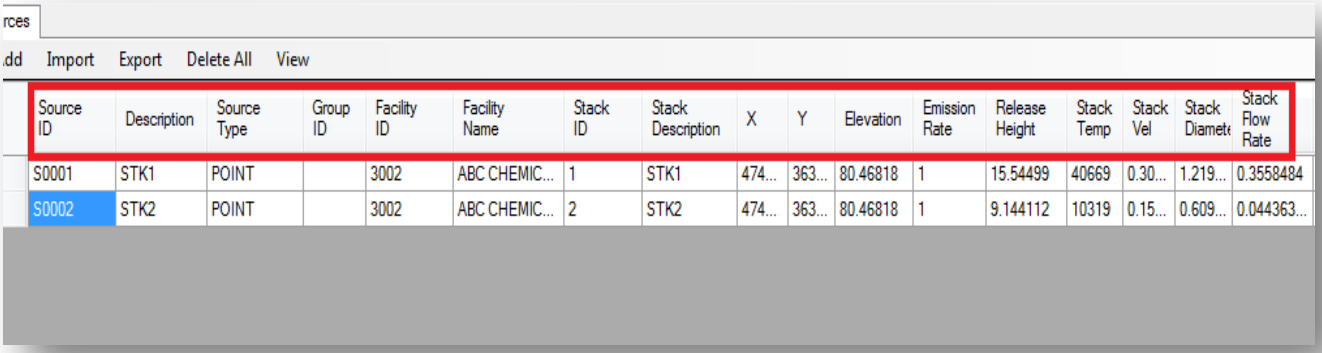
First, choose a spreadsheet application or text editor. Example programs include:

- Notepad
- Microsoft Excel

To convey comma separated values, you will need to open your selected program. For sample purposes we will be using Microsoft Excel. Excel (or your alternative program) will open its editor workspace. This is where your parameter values will be entered.

As implied by CSV, values will be typed and separated by commas in programs like Notepad. For programs like excel, your values will be separated by cells. Your values should be typed in the same order as they appear in the table of the ADMRT. Do not include units, column names, or spaces in between commas or cells. Separate each record with a new line.

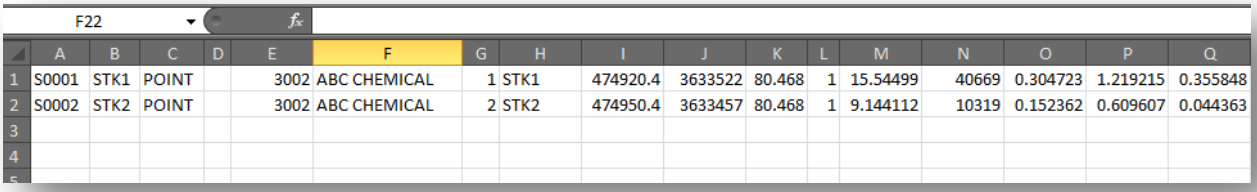
For example, using the ADMRT to add a Source, values should be entered in the following order: ***Source ID, Description, Source Type, Group ID, Facility Name, Stack ID, Stack Description, X, Y, Elevation, Emission Rate, Release Height, Stack Temp, Stack Velocity, Stack Diameter, Stack Flow Rate.***


rces

dd Import Export Delete All View

Source ID	Description	Source Type	Group ID	Facility ID	Facility Name	Stack ID	Stack Description	X	Y	Elevation	Emission Rate	Release Height	Stack Temp	Stack Vel	Stack Diamet	Stack Flow Rate
S0001	STK1	POINT		3002	ABC CHEMIC...	1	STK1	474...	363...	80.46818	1	15.54499	40669	0.30...	1.219...	0.3558484
S0002	STK2	POINT		3002	ABC CHEMIC...	2	STK2	474...	363...	80.46818	1	9.144112	10319	0.15...	0.609...	0.044363...

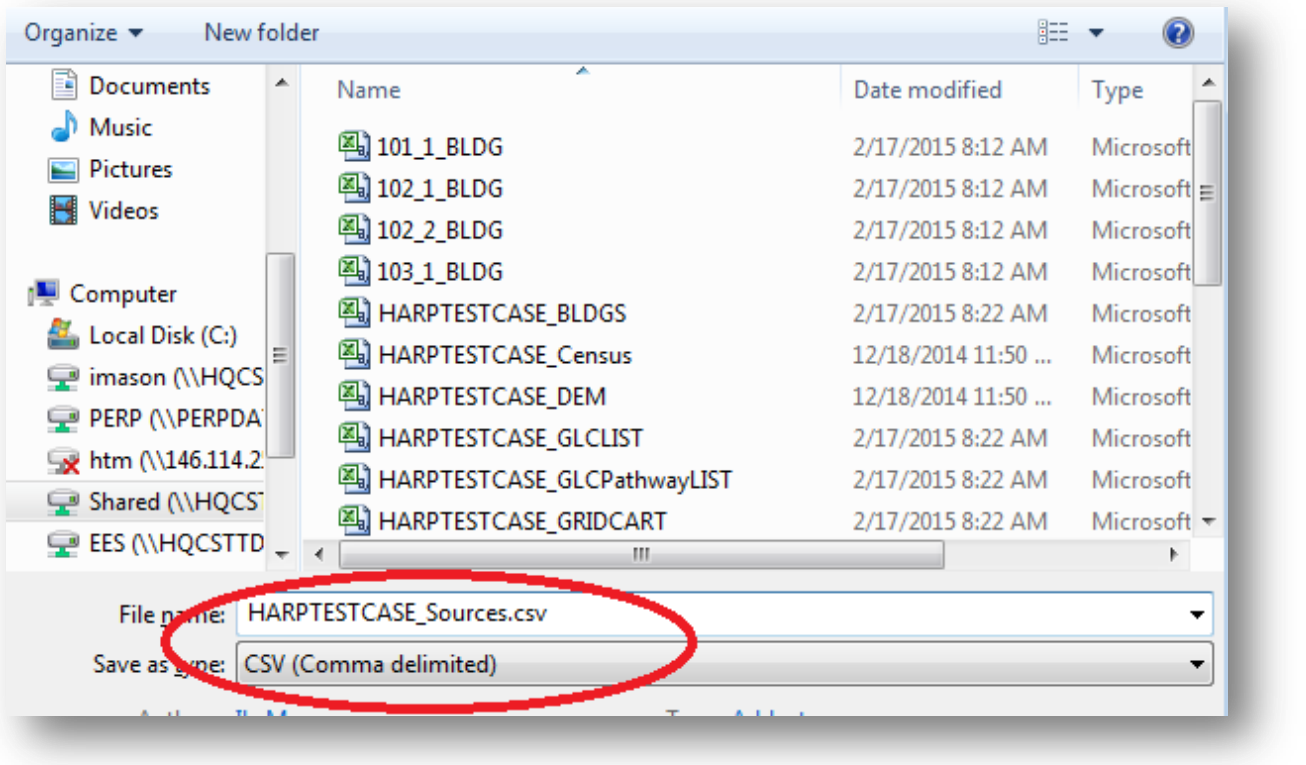
Below is the corresponding data entered into Excel. For items that are optional you may leave blank, as shown in column D below.


F22

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	S0001	STK1	POINT		3002	ABC CHEMICAL	1	STK1	474920.4	3633522	80.468	1	15.54499	40669	0.304723	1.219215	0.355848
2	S0002	STK2	POINT		3002	ABC CHEMICAL	2	STK2	474950.4	3633457	80.468	1	9.144112	10319	0.152362	0.609607	0.044363
3																	
4																	

Note: When using Excel, quotes are not required for values containing special characters. *However, if special characters (. - , * ? ! / &) are included in your group or pollutant name, while using a program like Notepad, quotes are required*. This way, the module will accept and maintain their form. For example, while quotes around ***Formaldehyde*** is optional, ***2,3,7,8-TCDD*** or a group name with special characters would require them.

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 ***HARPTESTCASE_Sources.csv***. Your file is now ready for importing.



There are several instances throughout ADMRT in which you will be able to choose the option to ***Import CSV***. Any time this option appears you will be able to create a CSV file and import it into ADMRT. However, it is imperative for accurate results that your parameters are accurately entered into the cells to match with those of the ADMRT.

Appendix C:
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 D:

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

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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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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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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

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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

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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*

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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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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

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

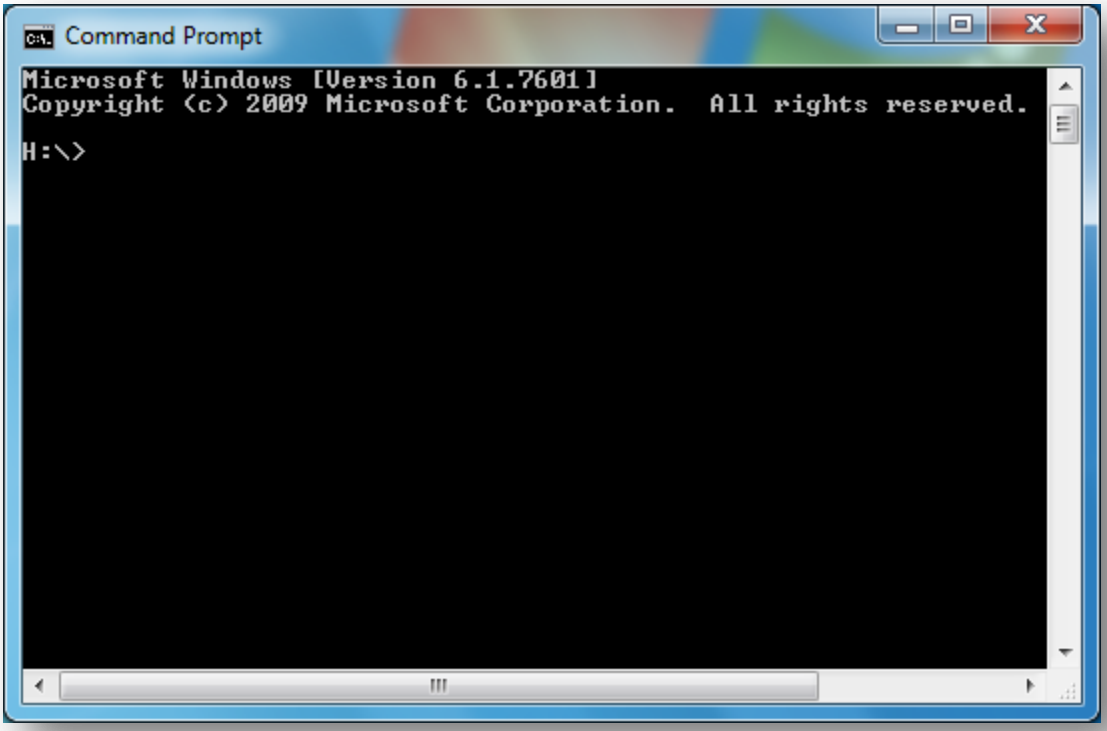
Specific Pathways to be Analyzed for each Multipathway Substance										
Substance	**Soil Ingestion**	**Dermal**	**Meat, Milk, & Egg Ingest.**	**Fish Ingest.**	**Exposed Vegetable Ingest.**	**Leafy Vegetable Ingest.**	**Protected Vegetable Ingest.**	**Root Vegetable Ingest.**	**Water Ingest.**	**Breast 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

[a] Cow's milk only no multipathway analysis for meat and egg ingestion

[b] To be evaluated by pathway

Appendix F:
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 ADMRT 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 ADMRT, you may calculate risk without using the ADMRT user interface, provided the necessary data is available. You will need three components:

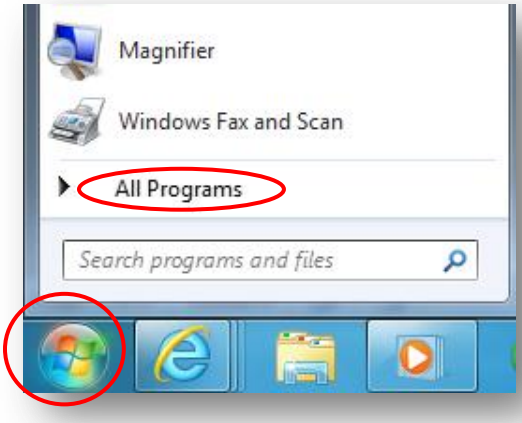
1. The Command Prompt;
2. The ADMRT HRACalc.exe file (calculator);
3. An HRA file with all of your risk scenario inputs.

- 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. For more information see ***Appendix D: Understanding Risk Results Input and Output Files***.

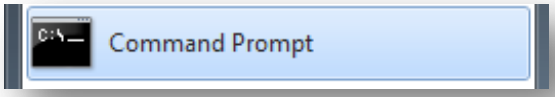
The pollutant and risk scenario inputs you need may come from files exported by ADMRT or another compatible program. The next page is a visual of how the Command Line process works.

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

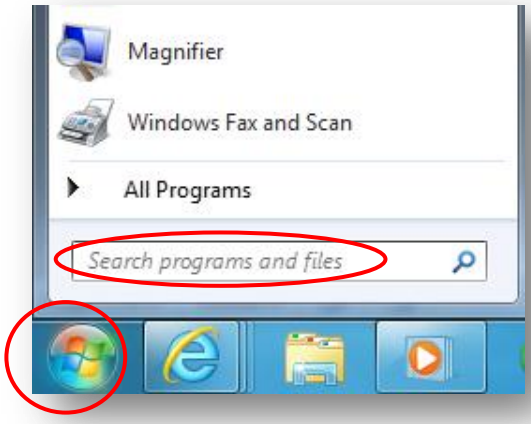
1. From your desktop, click the ***Start*** button, ***All Programs\Accessories***.



Then click ***Command Prompt***.

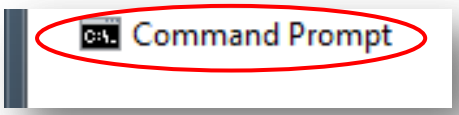


2. You can also click the ***Start*** button and go to the ***Search*** box.

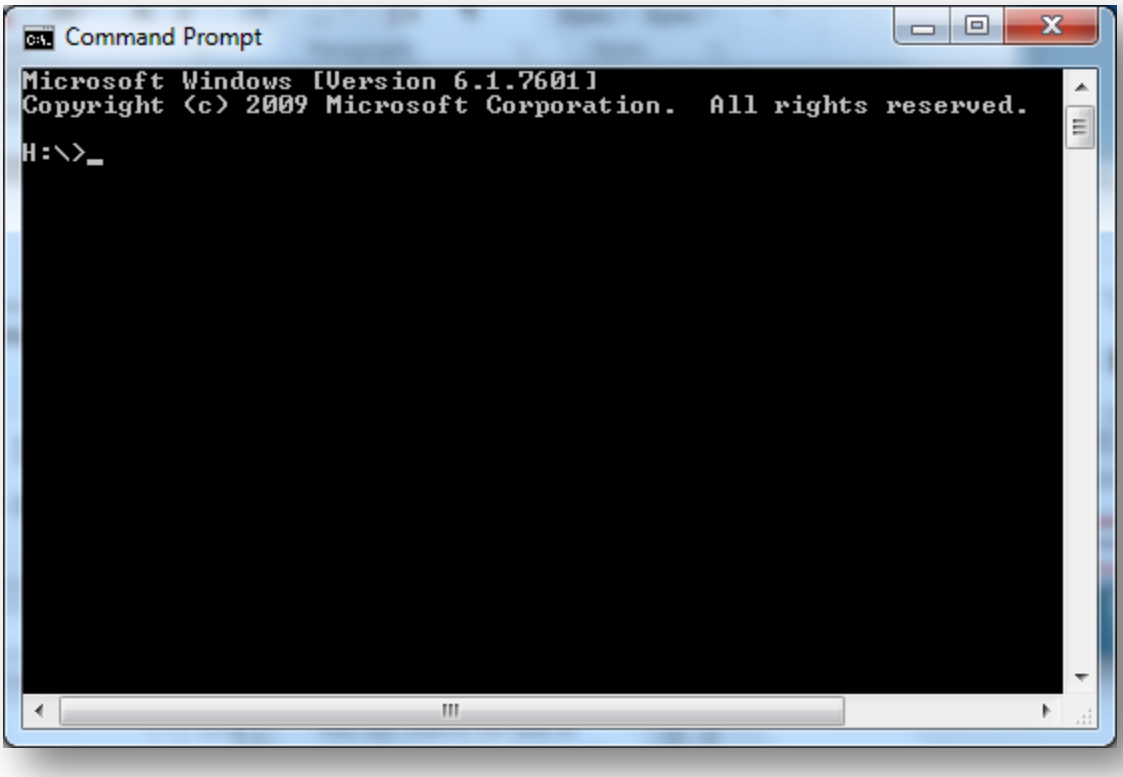


Type ***Command Prompt***.

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

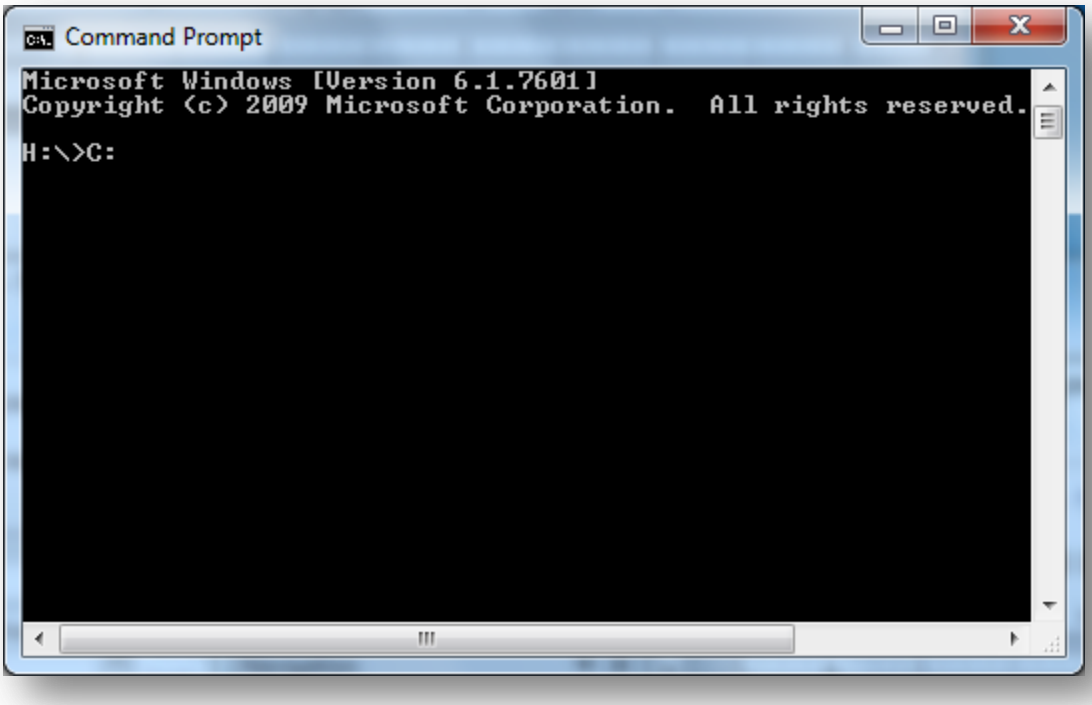


In this example, the Command Prompt opens with drive H, as indicated by ***H:\>***.

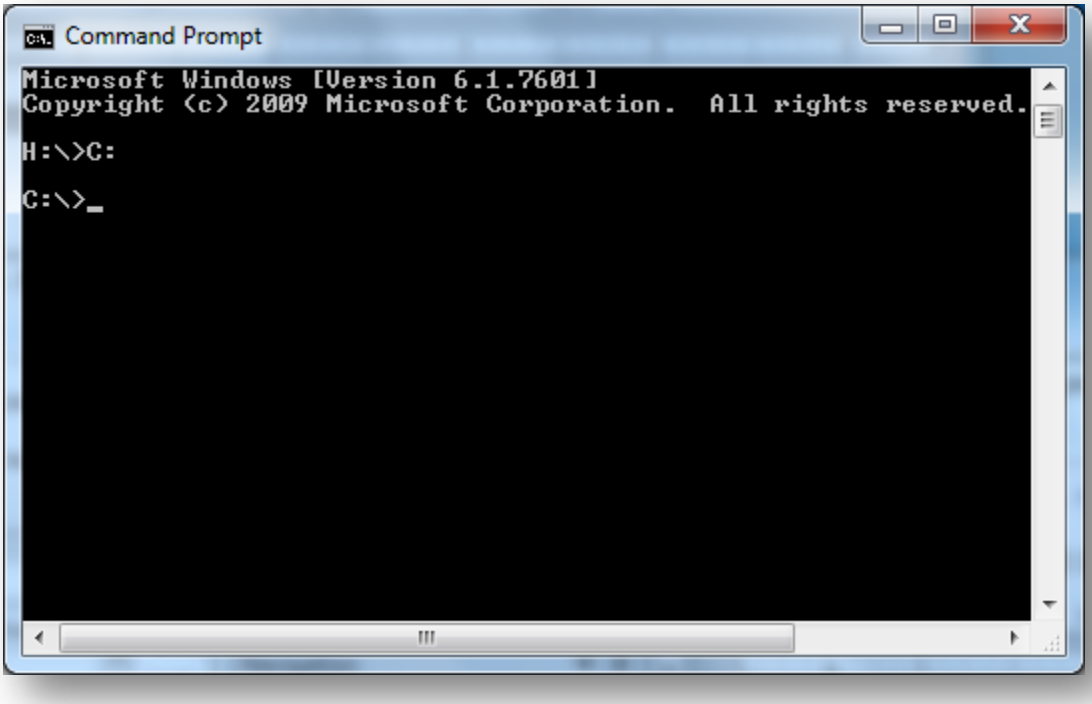


However, the default location of ADMRT is your hard drive, drive C. Upon opening the Command Prompt, if you are not in drive C, do so by typing ***C:*** and hit enter. Likewise, if ADMRT is located in a drive other than C, move to that drive instead. You may double-check which drive the module is located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

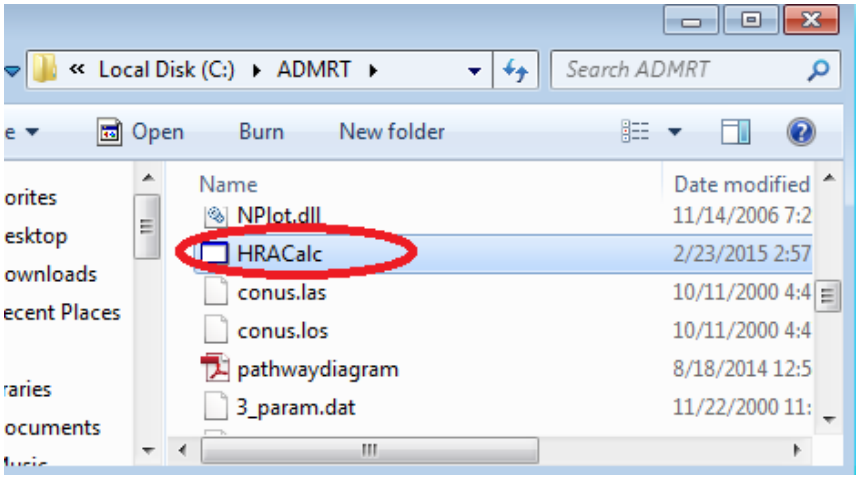
Hard drives can be accessed by clicking ***Start*** ***\Computer***.



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



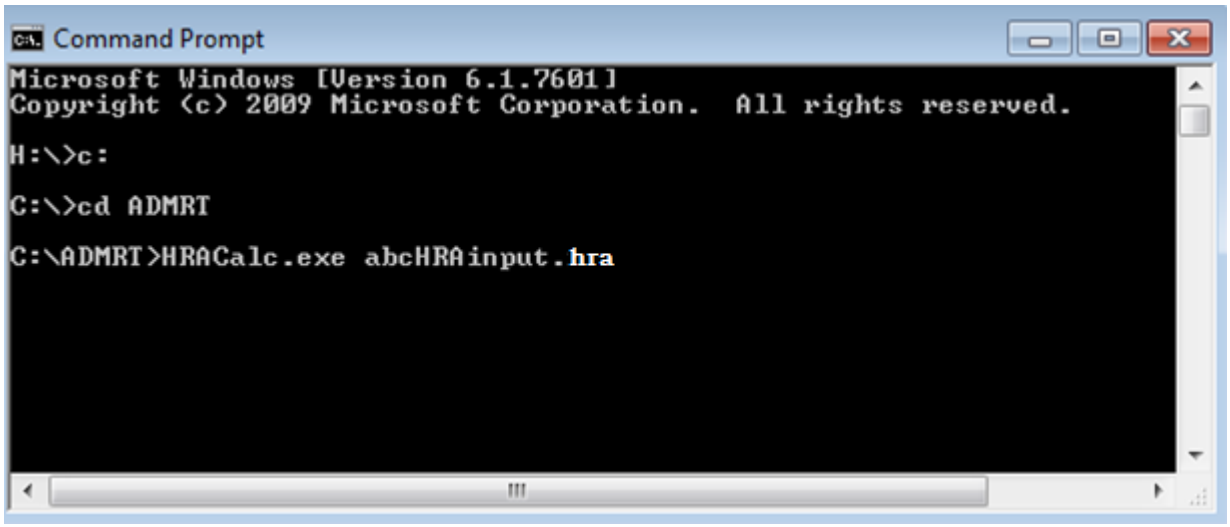
Now that you are in the correct drive where ADMRT is located, determine the calculator's directory, or file pathway. In other words, the folder(s) under which it is located. In this example, the module's directory folder is ***ADMRT***. This can be seen by opening hard drive C, as shown below. Notice 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 (***ADMRT***). Hit enter. ***C:\ADMRT>*** will appear next, and indicate that you are in that directory.

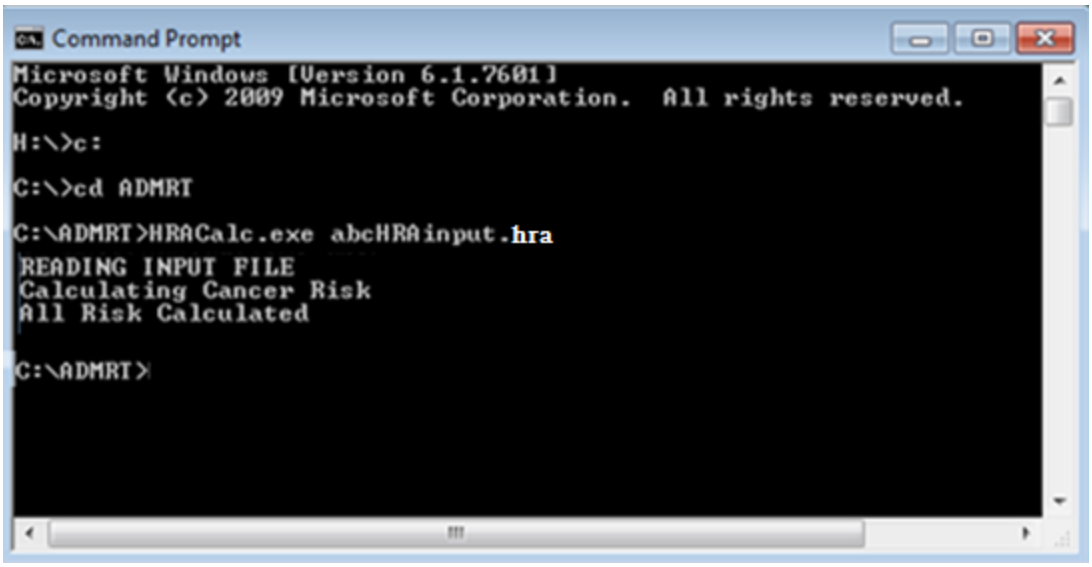
Then, type in the calculator's filename. Unless renamed, recall it is ***HRACalc.exe***. Do *not* hit enter yet, because the calculator will look for files that are not yet specified.

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:\ADMRT***.

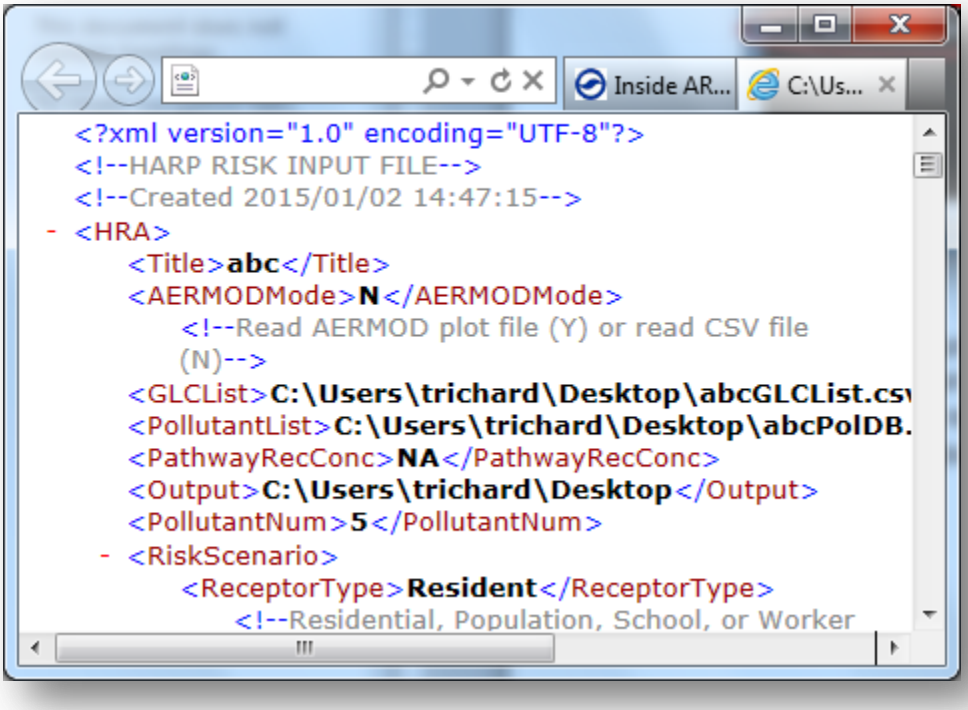


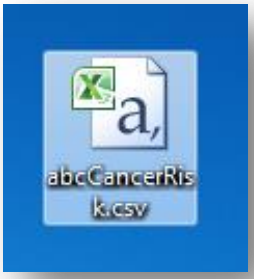
Thus, ***abcHRAinput.hra*** should be typed next to HRACalc.exe, with or without quotes.

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. To discover where your risk results have been saved, reopen the HRA input file and find the **<*Output*>** pathway. In the standard ADMRT Input.adm file, the output pathway is found close to the top.





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.