ASAP™

Aeration System Analysis Program

An Environmental Technologies Design Option Tool™

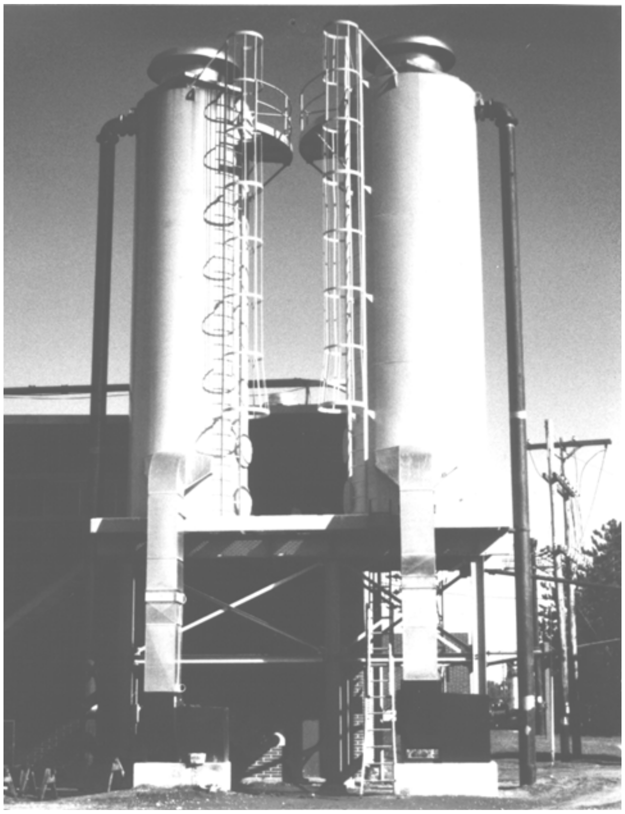
ASAP provides design engineers with the capability to evaluate and design counter current packed tower, bubble, and surface air stripping processes for the removal of volatile organic compounds (VOCs) from water.

ASAP Features:

- **Practical and Easy to Use Air Stripping Models for VOC Removal**
- **Extensive Vendor Tower Packing Database**
- **Design and Rating Mode Options**
- **Henry's Law Database and Parameter Estimation Methods**
- **Physical and Chemical Properties Database Including Compounds From U.S. EPA's Title III Consolidated Chemical List**

ASAP Applications:

- **Municipal Water Treatment**
- **Municipal Wastewater Treatment**
- **Environmental Remediation**
- **Pollution Prevention Assessment**
- **Educational Resource**



Full-Scale Air Stripping Towers operating in Wausau, WI, designed using the packed tower model (Hand, et al., 1986).

ASAP Capabilities

Air stripping is widely used for removing volatile organic compounds (VOCs) from aqueous solution. Carefully controlled pilot plant studies are usually used in the design of air stripping processes. However, these studies can be expensive and time consuming if they are not properly planned.

The use of a mathematical model is a complimentary approach to laboratory and pilot plant experimentation since it can simulate the dynamic behavior of the air stripping process and can select the optimum process design.

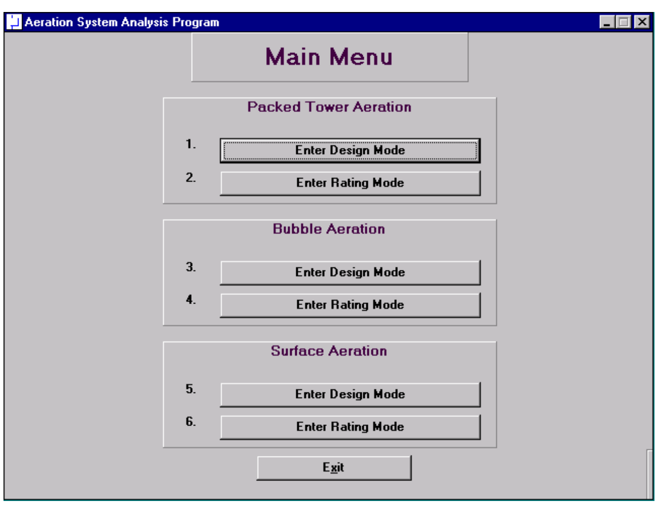
The mathematical models contained in ASAP can be used to:

- **Assess the Preliminary Design and Feasibility of Using Air Stripping Processes**
- **Plan Pilot Plant Studies and Interpret Their Results**
- **Provide Process Design when Site Specific Model Parameters are Available**

ASAP Models

ASAP contains mass transfer models that can be used to evaluate and design air stripping processes. The models include:

- Packed Tower Aeration Model
- Bubble (diffused) Aeration Model
- Surface Aeration Model



Sample ASAP Model Option Window

ASAP - Physical and Chemical Properties Database

Air stripping design calculations require many chemical properties such as molecular weight, normal boiling point, molar volume at the normal boiling point, liquid density, Henry's law constants, liquid and gas diffusion coefficients, and aqueous solubility. Consequently, ASAP is linked to a program called Software to Estimate Physical Properties (StEPP). StEPP provides these properties at the specified temperature. StEPP contains the physical and chemical properties for over 600 compounds, many of which are covered on U.S. EPA's list of priority pollutants.

ASAP – Packed Tower Model

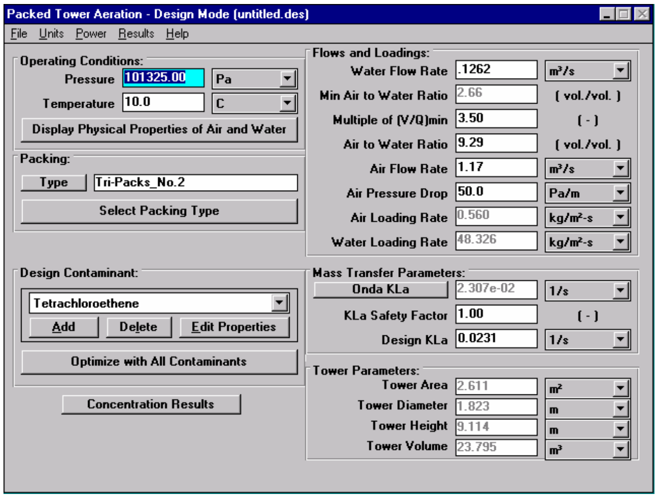
The packed tower aeration model is designed to predict the performance of a counter-current packed tower air stripper (Kavanaugh and Trussell, 1980; Ball, et al., 1984, Hand, et al., 1986). The packed tower model assumes:

- Steady state plug-flow conditions prevail in the air and water streams.
- The influent air stream contains no VOCs.
- Henry's law described equilibrium between the air and water phases.
- Reduce the number of compounds to be specified in mass transfer model calculations.

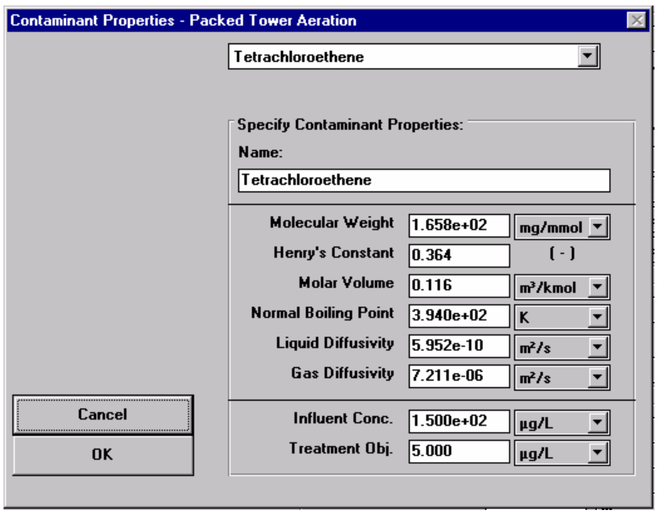
Packed Tower Software Features

The packed tower model software calculations can be performed in the design or rating modes. In the design mode, the user can specifies required removal efficiencies and packed tower is sized in order to meet the treatment objectives of all components. ASAP reports the optimum design for the limiting component and predicts the effluent concentrations of the other components.

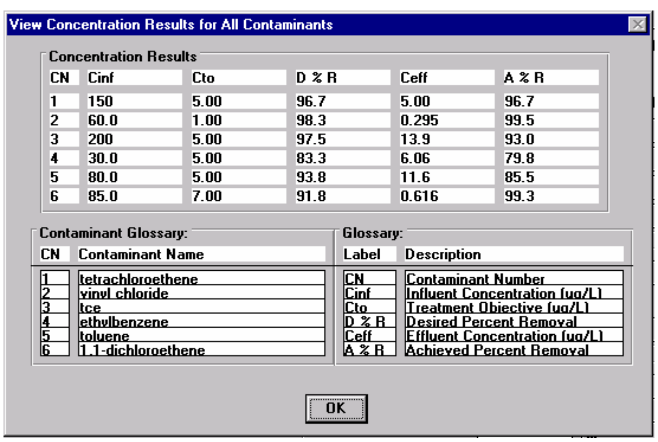
In the rating mode, the performance of an existing packed tower can be evaluated by varying the operating parameters and observing whether the desired removal efficiencies are met. Other convenient software features include database of commercially available packing materials and mass transfer estimation techniques.



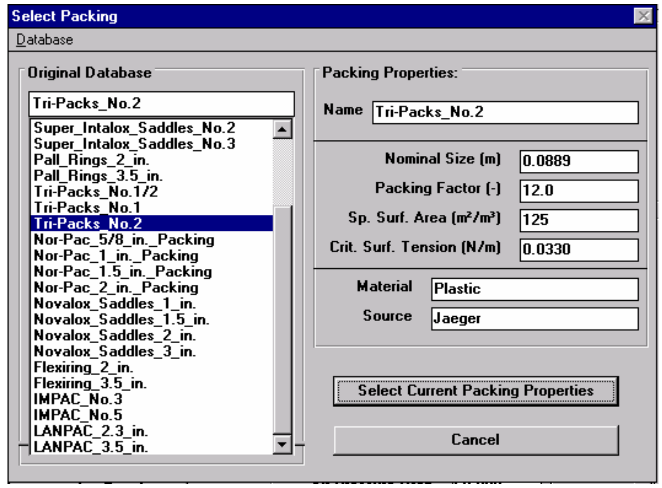
Sample Packed Tower Design Mode Calculation Screen



Sample Contaminant Property Screen



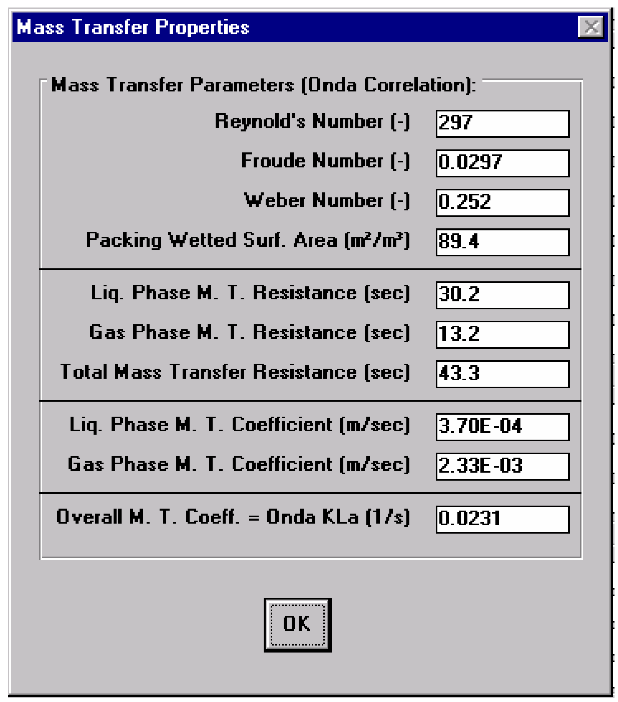
Sample Packed Tower Performance Results



Sample Window of Tower Packing Database

Packed Tower Kinetic Parameter Estimation Techniques

The overall mass transfer coefficient, K_La, can be entered or ASAP can provide a value through the use of the Onda, et al. (1968) correlation. A factor of safety option for the K_La is provided in the software.



Packed Tower Kinetic Parameter Window

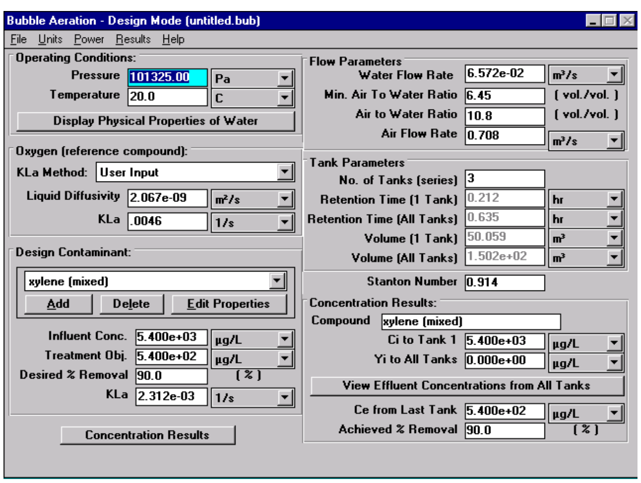
ASAP – Bubble Aeration Model

The bubble aeration model is designed to predict the performance of a diffused aeration system (Munz and Roberts, 1982; Roberts, et al., 1984; and Hokanson, 1996). The model equations incorporate the following assumptions:

- Single or multiple tanks in series.
- Completely mixed liquid phase.
- Plug Flow in the gas-phase.
- Henry's law described equilibrium between the air and water phases.
- The inlet VOC gas concentration is zero in all the tanks.

Bubble Aeration Software Features

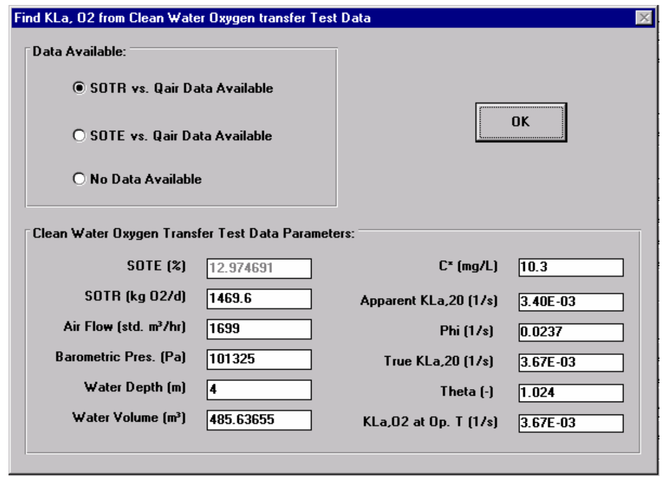
Bubble aeration model calculations can be performed for waters containing single or multiple volatile compounds in both the design and rating modes for single and multiple tanks in series. The design mode enables determination of the tank sizes for a specified treatment objective. The rating mode provides determination of the treatment objective for a specified design or existing tank system.



Sample Output Screen for a Bubble Aeration Design Mode Calculation

Bubble Aeration Kinetic Parameter Estimation Techniques

Mass transfer coefficients for bubble aeration can be determined directly from laboratory or pilot plant experiments or estimated based on the mass transfer coefficient of a reference compound. ASAP provides a mass transfer correlation developed by Munz and Roberts (1989) which uses oxygen as a reference compound. The mass transfer coefficient for oxygen is estimated from clean water oxygen transfer test data (Brown and Baillod, 1982; and Baillod, et al., 1986).



Bubble Aeration Clean Water Oxygen Transfer Test Data

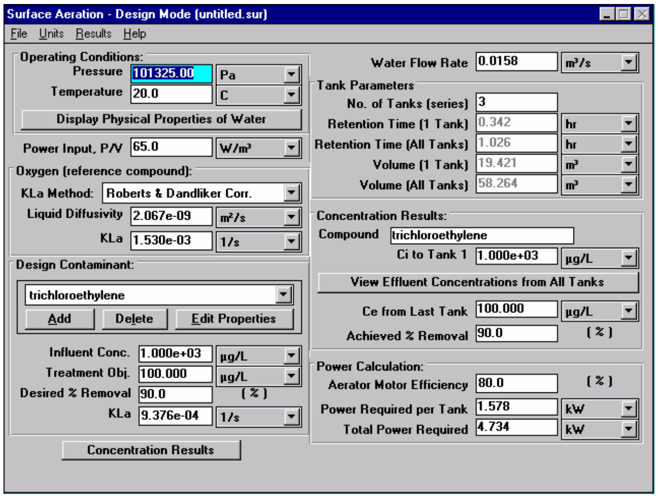
ASAP – Surface Aeration Model

The surface aeration model is designed to predict the performance of a surface aeration system. The surface aeration model equations that are contained in the software incorporate the following assumptions (Munz and Roberts, 1982; Roberts, et al., 1984; and Hokanson, 1996):

- Single or multiple tanks in series.
- Completely mixed liquid phase.
- Gas-phase concentration in the tank(s) is equal to zero.
- Henry's law described equilibrium between the air and water phases.
- The process is at steady state.

Surface Aeration Software Features

Surface aeration model calculations can be performed for waters containing single or multiple volatile compounds in both the design and rating modes for single and multiple tanks in series. The design mode enables determination of the tank sizes for a specified treatment objective. The rating mode provides determination of the treatment objective for a specified design or existing tank system.



The mass transfer coefficient for surface aeration can be user input or estimated from the literature correlation of Munz and Roberts (1989).

Other ASAP Options

- Choice of English or System International Units of Expression
- Power Requirement Calculations
- Flexible Printing Options

Graphical User Interface

ETDOT is designed for the Microsoft Windows environment with a graphical user interface (GUI) to maximize user-friendliness. Making use of the Microsoft Windows interface, with its built-in file and hardware control features, frees the engineer from concerns over printer drivers and other "machine" issues and allows more attention to the computational algorithms. The GUI consists of a Microsoft Visual Basic front-end shell that calls FORTRAN subroutines to perform the calculations.

System Requirements

The minimum ETDOT system requirements are as follows:

- English-language version of Microsoft Windows 95, Microsoft Windows 98, or Microsoft Windows NT 4.0; in the case of Microsoft Windows NT 4.0, Service Pack 3 or more recent is required
- 50 MB of hard disk space
- 32 MB of RAM is recommended
- A Pentium or more recent processor is recommended
- A graphic VGA or more recent video display
- A mouse or other pointing device is recommended

Product Information

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