

ETHYLENE OXIDE STERILIZING

Date Initiated:

March 11, 1998

Dates Modified / Updated:

PROCESS DESCRIPTION:

Ethylene oxide (EtO) is used to sterilize heat sensitive hospital equipment. EtO readily reacts with biological organisms and is commonly used for sterilizing. The sterilant gas (composed of EtO and sometimes a diluent gas) is injected into a chamber exposing the desired materials to the sterilant gas. After the sterilizing time is complete, the sterilant gas is usually vented to a control device. The diluent gas may be composed of CFC's, HCFC's or CO₂. Most local facilities using sterilizers are required to comply with District Rule 1203 and/or the federal NESHAPS which requires ETO controls.

Emissions of EtO and diluent gases are estimated using mass balance techniques, usage records and control efficiency requirements. Control efficiencies are compound specific (i.e. EtO is always controlled but the diluent gas may not be).

$$Ea = Uh \times N \times Ci \times (1 - ei)$$

$$Eh = Uh \times Ci \times (1 - ei)$$

Where:

Ea = Annual emissions of each listed toxic air contaminant per device, (lbs/year)

Eh = Maximum hourly emissions of each listed toxic air contaminant per device, (lbs/hour)

Uh = Maximum hourly usage of sterilant gas, (lbs/load)

N = Annual amount of sterilizing loads, (loads/year)

Ci = Weight fraction of each listed substance in sterilant gas, (lbs/lb)

ei = Control equipment removal efficiency for each listed substance, (%)

EMISSIONS INFORMATION:

Information regarding sterilant gas composition can be obtained from MSDS documentation. Control efficiencies for each listed substance are determined by the type of control device. Typically, catalytic oxidizers and acid scrubbers will only control EtO. There are some special types of control devices that control both EtO and the diluent gas.

Currently, only Palomar Medical Center has a control device that reportedly captures all sterilant gas. Emissions from this control device are assumed to be negligible.

ASSUMPTIONS / LIMITATIONS:

- Minimum District and/or NESHAP EtO control efficiency requirements are used in the District default calculations. Annual source testing of this control equipment usually demonstrates compliance with the minimum control standards.
- All sterilant gas injected in the sterilizing chamber is assumed to be vented to the control device.
- Residual EtO emissions from hospital equipment and load transfer fugitive emissions are assumed to be negligible.
- Emissions from equipment leaks are assumed to be negligible.
- The amount of EtO that reacts in the chamber is included in the overall control efficiency.
- Stand alone aerator emissions are assumed to be negligible.
- The portion of CFC's or HCFC's converted to hydrochloric acid during catalytic oxidization is assumed to be negligible.

FORMS:

An individual reporting form must be completed for EACH type of sterilant gas used in each specified device. Calculation procedures for standard equipment with typical controls have been added to the database. The default procedures include expected compound specific control efficiencies. Site specific values may be used to override the default factors where appropriate.