5.5.2 Vapor Recovery Control Devices

Additional information regarding control devices can be found in Control Devices and Closed Vent Systems presentation from the March 2002 EPA Region 4 RCRA Organic Air Emission Standards Permit and Compliance Training.

A control device involving vapor recovery must be designed and operated to recover the organic vapors vented to it with an efficiency of 95 weight percent or greater. If the total organic emission limits for all affected process vents at a facility are maintained at an efficiency of greater than 95 weight percent, the vapor recovery device may be operated at an efficiency of less than 95 weight percent. Examples of vapor recovery units include condensers and carbon adsorbers. These units are discussed in more detail in the following table and Section 5.5.6.

Examples of Vapor Recovery Units

Condenser
A condenser is a heat-transfer device that converts a gas or vapor to a liquid by reducing the temperature. Condensers are simple, relatively inexpensive devices that usually use water to cool and condense a vapor stream. However, these devices are usually not capable of reaching low temperatures (below 21°C), therefore high removal efficiencies are not obtained unless the vapors will condense at high temperatures (usually above 38°C). The two types of condenser technologies are contact condensers and surface condensers. In a contact condenser, the coolant and vapor stream are physically mixed. The condensed vapor and coolant leave the condenser as a single exhaust stream. In a surface condenser, the coolant is separated from the vapors by tubular heat-transfer surfaces. The coolant and condensed vapors leave the device by separate exits.
Carbon Adsorption
Adsorption is a mass transfer process in which molecules are removed from a fluid stream because they adhere to the surface of a solid such as carbon. In a carbon adsorption system, the waste air stream is passed through a layer (bed) of solid carbon particles. As the air stream passes through the bed of carbon particles, the pollutant molecules adsorb to the surface of the solid adsorbent. The bed of adsorbent carbon will eventually become saturated with the pollutant. The adsorbent bed must then be disposed of and replaced or the pollutant vapors must be desorbed before the adsorbent bed can be reused.