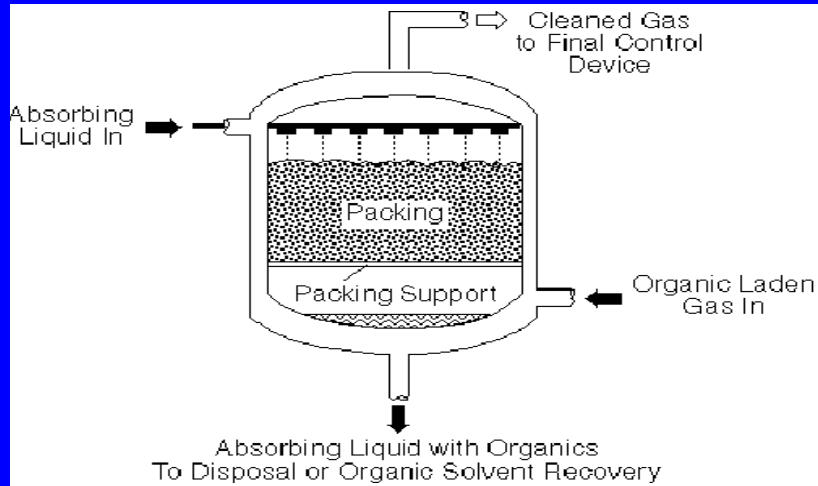


Control Devices and Closed-Vent Systems

Burn, Condense or Capture

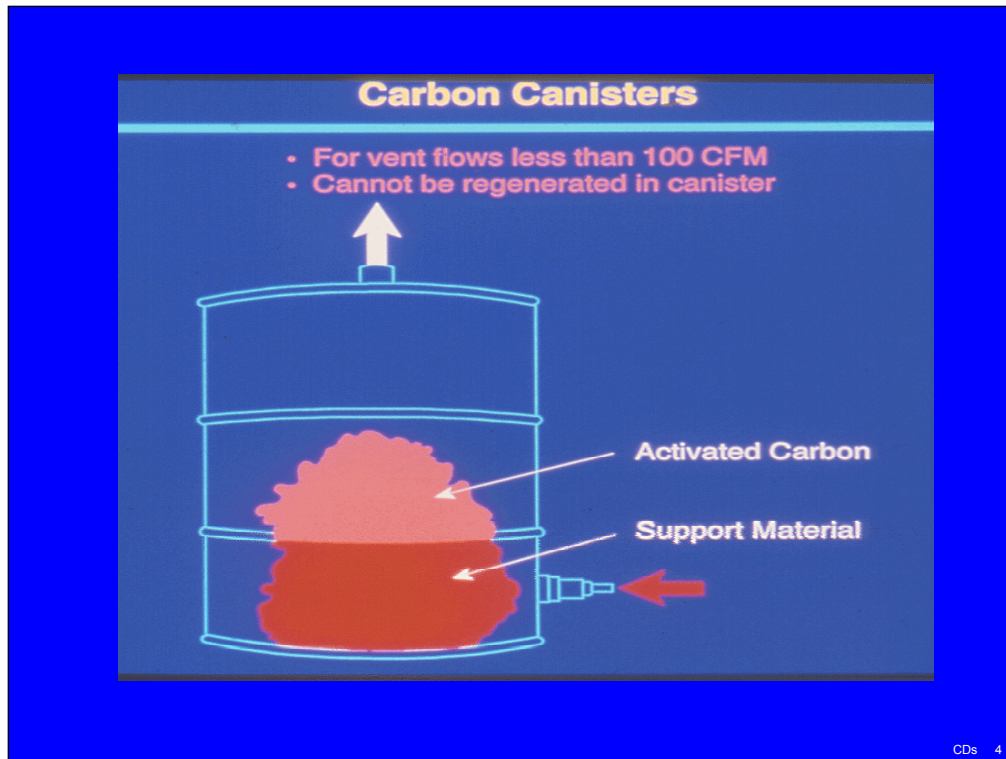


Control Device Requirements

- No specific type of control device required
 - With the exception of an enclosure which is required to be vented to a combustion device
- Individual performance requirements for
 - Vapor recovery/reduction systems
 - Enclosed combustion devices
 - Flares
- Same performance requirements for Subpart CC as specified in Subparts AA and BB

Vapor Recovery/Reduction Systems

- Designed and operated with an organic recovery or reduction efficiency > 95 percent by weight
 - e.g., for vapor influent of 48 ppmw, vapor effluent must be 2.4 ppmw or less
- Examples
 - Condensers
 - Carbon adsorbers
 - Biofilters
- Not allowable for enclosures



Carbon Canister Drawing - drum sized, with approximately 180 pounds of activated carbon.

Organics selectively collected on surface of the adsorbent. High removal efficiency until saturation, when the effluent concentration will jump up in a behavior known as “breakthrough.”

Canisters are nonregenerative.

Canisters can handle up to about 100 scfm of air flow each, although the operational life may become an issue. Also, organic rich air flows may cause excess heat to build up within the adsorbing material.



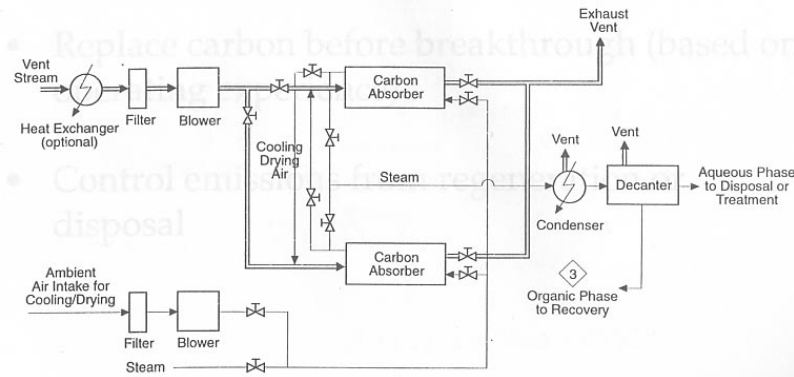
CDs 5

Photo of two carbon canisters installed in parallel.

Common issues with carbon canisters include channeling (resulting from moisture), secondary reactions (resulting in heat which can cause flashback), variations in carbon effectiveness, and generation of heat of absorption (which can also result in flashback). The facility should have a monitoring plan in place to address these issues. Also, if appropriate, flame arrestors should be used.

Note that used carbon shipped off-site is a hazardous waste. Inspectors should review inspection reports, change-out records, and manifests.

Fixed-Bed Regenerative Carbon Adsorption System Process Flow Diagram and Potential Emission Sources



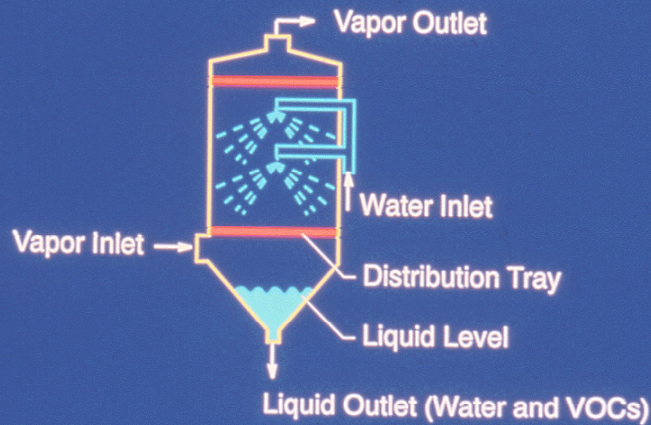
CDs 6

Fixed-Bed Regenerative Carbon Adsorption System Process Flow Diagram and Potential Emission System

Twin carbon adsorber system, to allow for one unit to remain operational while the other unit regenerates. Steam is used for regeneration in this situation, followed by air drying. Note the use of a condenser to remove volatile organics from the steam.

A key issue may be the control of emissions during the regeneration process.

Schematic Diagram of a Contact Condenser



CDs 7

Schematic Diagram of a Contact Condenser.

Process used in spray towers, scrubbers, and packed columns to dissolve vent gas into liquid. Liquid drains off for treatment. Liquid spray may be water, mineral oil, petroleum oil (nonvolatile), or aqueous solution of oxidizing agents.

Commonly used for SO_2 , H_2S , HCl , NH_3 and high organic concentration vent streams.

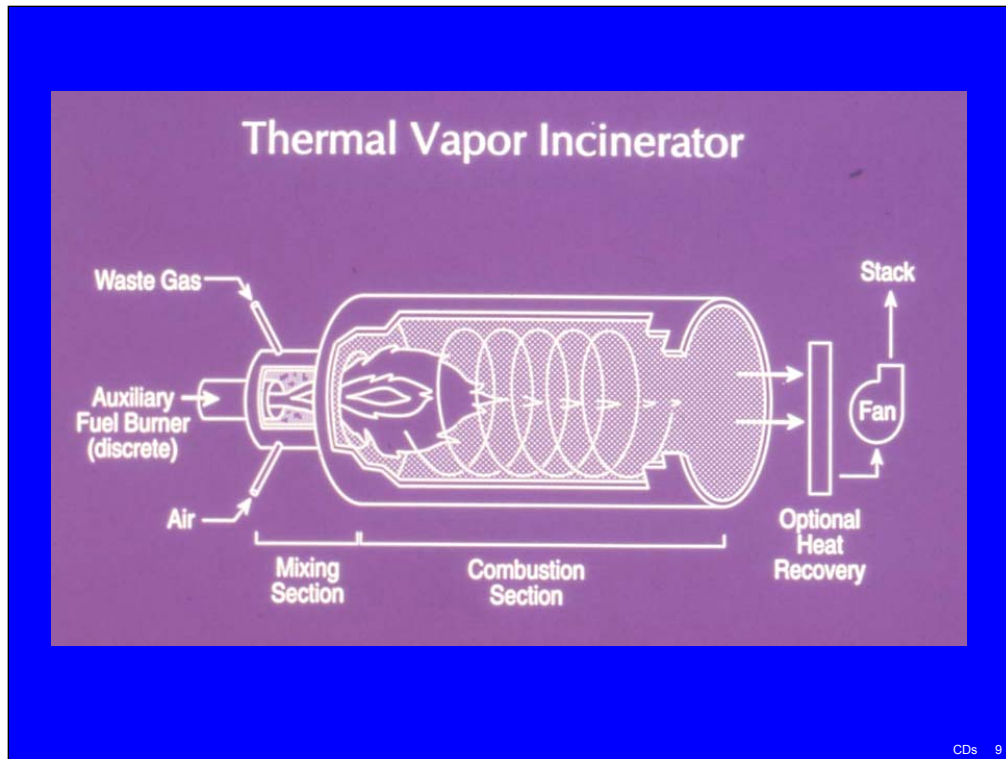
Efficiencies of 60 - 96% are possible, although dependent upon temperature, pressure, solubility and reaction kinetics. Operating conditions often require the use of secondary or polishing processes to reach desired treatment goals.

$$\text{Efficiency} = \frac{\text{Conc}_{\text{in}} - \text{Conc}_{\text{out}}}{\text{Conc}_{\text{in}}} \times 100\%$$

Note that this schematic illustrates a specialty design that is not commonly used.

Enclosed Combustion Devices

- Designed and operated with:
 - Organic destruction > 95 percent by weight, or
 - Residence time > 0.5 seconds and temperature $> 760^{\circ}\text{C}$
- Examples
 - Incinerators
 - Boilers
 - Process heaters
- Alternative requirements may be used for incinerators

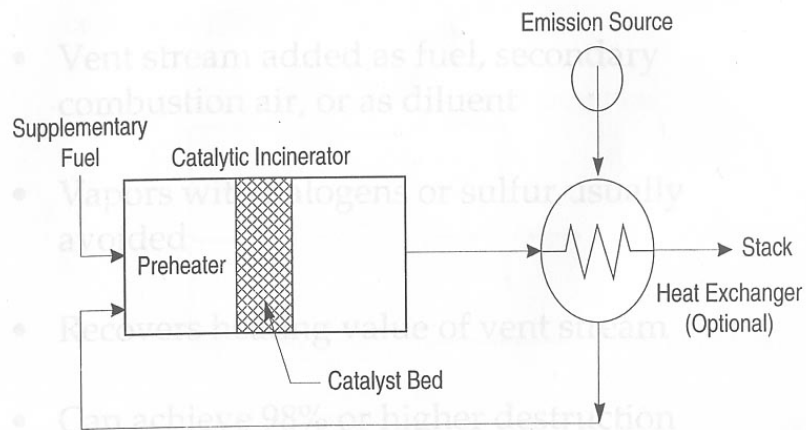


Schematic drawing of thermal vapor incinerator.

Thermal incineration requires high temperature, good mixing, sufficient oxygen and adequate residence time. Auxiliary fuel may be needed if the heating value of the vapor stream is less than 50 Btu/scfm.

Thermal incinerators have capacity of 200 to 50,000 scfm, and are capable of destruction efficiencies greater than 98%. However, below 2000ppm, efficiency decreases as concentration decreases.

Schematic Diagram of a Catalytic Incinerator System

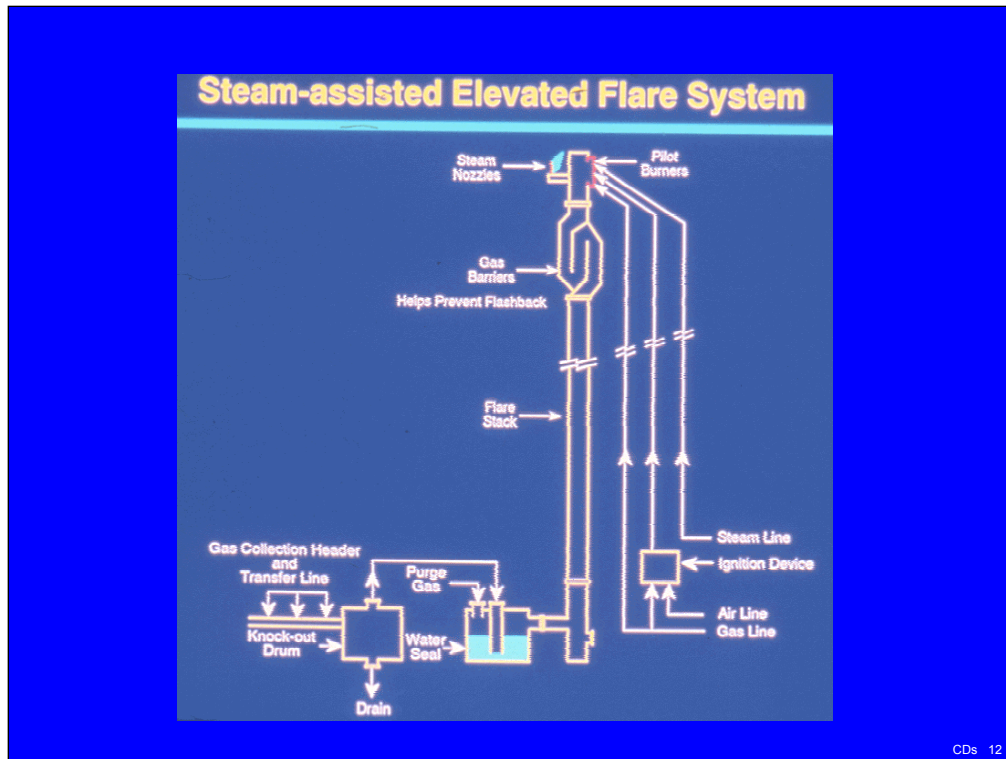


CDs 10

Schematic diagram of a catalytic incinerator system. Supplementary fuel is generally used for startup only. Typical installation achieves 98% VOC destruction, with 95% primary heat recovery. Designs are expandable to over 200,000 scfm flow rates.

Flare Requirements

- No visible emissions
- Flame present at all times
- Net heating value requirements
- Exit velocity requirements



Schematic diagram of steam-assisted elevated flare system.



CDs 13

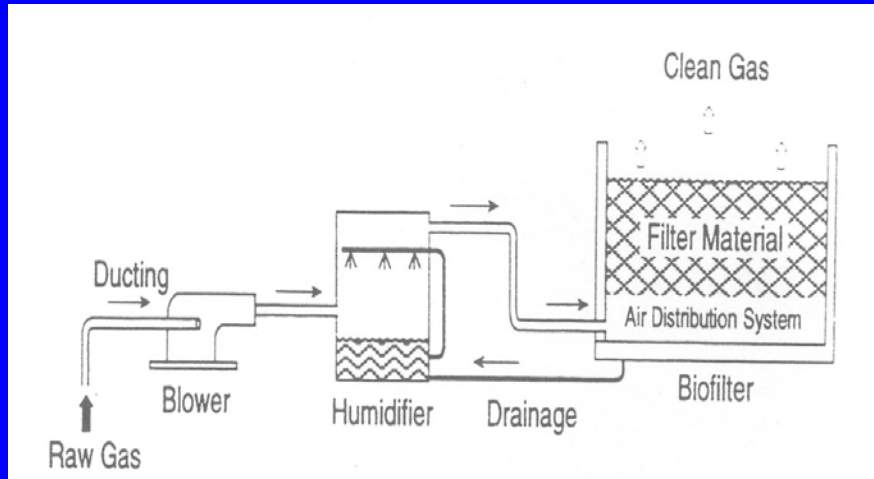
Photograph of steam assisted flare.

Open combustion process, with achievable destruction efficiencies of 98% or more. Requires consistent level of organic vapor, or significant make up fuel. Can handle large volume, highly concentrated flows.

Biofiltration - An Emergent Technology

- Vapors are vented through biologically active material, where microorganisms digest organics to CO₂ and water
- Limited to applications where organic concentrations are 1000 ppm or less (but not allowable for enclosures)
- Control efficiencies greater than 90% may be achieved
 - Start up time required to build microbial ecology
- Low operating costs
 - Economic advantage over other technologies

Schematic Drawing of an Open Single-Bed Biofilter System



Requirements for Operation of All Control Devices

- Properly operate and maintain device
- Continuously monitor appropriate operating parameter(s)
- Inspect readings from each monitoring device daily
- Immediately implement corrective measures, if necessary

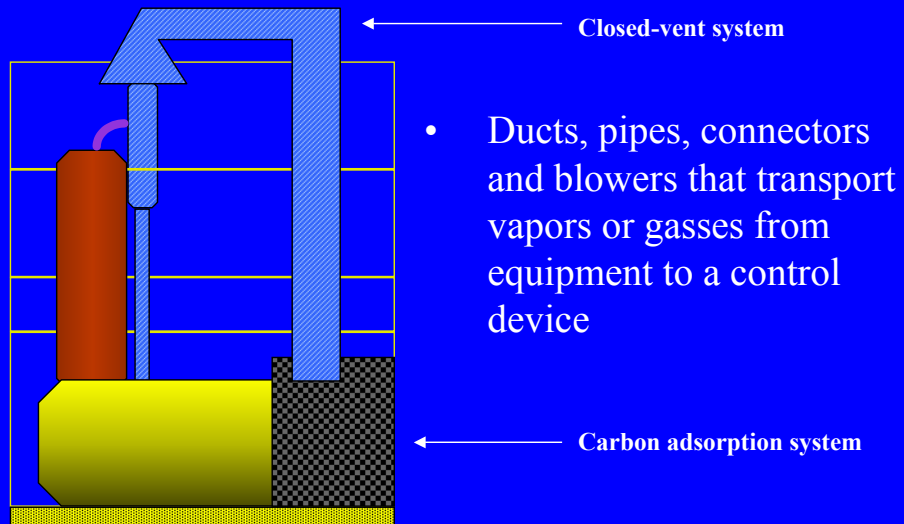
Routine Maintenance and Malfunction Provisions

- Control device performance requirements do not apply during periods of planned routine maintenance
- Periods for planned routine maintenance cannot exceed 240 hours (10 days) per year
- Control device performance requirements do not apply during periods of system malfunction
- Correct malfunctions as soon as practicable

Closed-Vent Systems

- Designed and operated as specified in Subpart AA
 - No detectable emissions, monitored annually
 - No monitoring if operated below atmospheric pressure (equipment with pressure gauge)
- Any bypass devices capable of diverting vapors and gases must have either:
 - Flow indicator (15-minute intervals), or
 - Car-seal or lock-and-key valve

What is a Closed-Vent System?



Recordkeeping and Reporting

- Recordkeeping includes:
 - Control device implementation schedule
 - Design and operating information
 - Control device exceedance records
 - Information on alternative controls
 - Information on periods of maintenance and malfunction
- Semiannual reporting of control device exceedances not corrected within 24 hours

Summary

- No specific type of control device required
 - With the exception of an enclosure which is required to be vented to a combustion device
- Same control device performance requirements as specified in Subparts AA and BB
- Continuously monitor appropriate control device operating parameter(s)
- Semiannual report of control device exceedances > 24 hours