ODOR CONTROL TECHNOLOGY SUMMARY

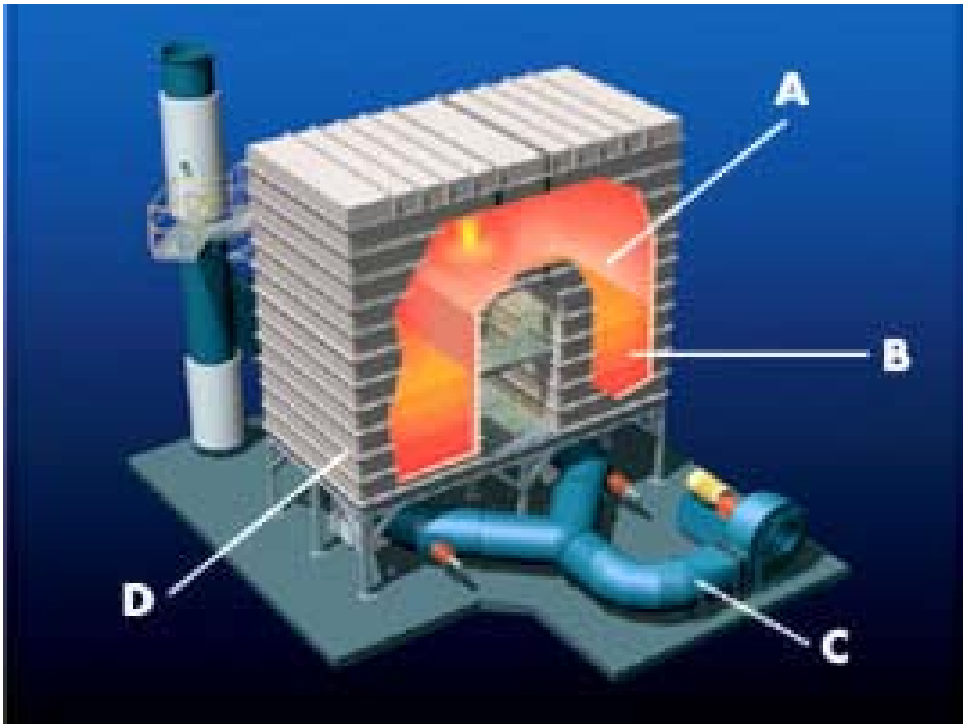
Technology: THERMAL OXIDATION

Description:

Thermal oxidation uses oxygen or air at very high temperatures to destroy odorous compounds and/or volatile organic compounds (VOC's). The process works by subjecting the odorous air stream to the high temperatures in the presence of oxygen long enough to oxidize the odorous compounds. The process requires sufficient concentrations of combustible reactants in the air stream to sustain the combustion process in the thermal oxidation unit. Air streams with hydrocarbon concentrations less than LEL require external fuel to sustain combustion. Fuel oil, natural gas, and propane are often used to supplement the combustion process.

Regenerative Thermal Oxidizers (RTO's)

Odor destruction is determined by time, temperature, and turbulence in the reaction chamber. Sufficient time for the oxidation to occur must be provided at the proper temperature to achieve high destruction efficiencies. Thermal oxidizers typically heat air streams to approximately 1,400^{o}F for 1 – 2 seconds. Turbulence in the reaction chamber provides mixing and more uniform detention time.



RTO Cutaway View

Thermal oxidizers can be very expensive to operate if fuel consumption is not minimized. There are several fuel-reducing technologies available. The most common is the Regenerative Thermal Oxidizer (RTO). RTO's reduce fuel consumption by preheating incoming air before routing through the reaction chamber. They use multiple beds of ceramic media, through which the incoming air is preheated. Valving is sequenced so that each media bed captures heat from the exiting treated air in one cycle, and preheats the inlet air in the next cycle.

Ideally, RTO's convert odorous compounds to carbon dioxide and water. In practice, the reactions are usually less than complete. Also, adding fuel to supplement the combustion process may add slightly odorous inorganic compounds such as nitrogen oxides (NO_x) and sulfur oxides (SO_x). Odor removal efficiencies are typically in the 90 – 99% range.

Advantages of this technology include broad-spectrum control for all types of odor, performance is independent of inlet odor intensity, atmospheric dispersion is enhanced by warm exhaust. Disadvantages include potential high fuel costs, potential NO_x and SO_x emissions, different equipment than WWTP operators are accustomed to operating.

Applicable Treatment Processes:

Sludge processing, such as dryers and storage vessels

Typical Design Criteria:

Air flow rate	dependent on volumes to be treated
Required treatment temperature	1,400^{o}F – 1,500 ^{o}F
Retention time	1 – 2 seconds
Odor removal efficiency	90 – 99%

Major Design Considerations:

a. Heat capacity of air stream

Air stream must contain relatively high heat capacity to ensure operating efficiency.

b. Supplemental fuel source

A supplemental fuel source typically must be available to assist combustion.

c. Particulates

Particulates must be removed prior to the RTO to prevent plugging of the media.

d. Materials

Stainless steel inlet components should be specified because of potential corrosion in hydrogen sulfide laden air streams.