

VOC Destruction Generates Auxiliary Steam For In-Plant Process Heating.

To comply with stringent Environmental Protection Agency (EPA) air-pollution regulations, a mid-western coatings producer needed to find a maximum achievable control technology (MACT). Controlled Environment Equipment, North Prairie WI, was contracted to provide the air-pollution control and energy recovery system for the coating producer's plant expansion. The twin-bed regenerative thermal oxidizer was designed to achieve EPA compliance while generating auxiliary steam for in-plant process heating.

CEE selected the twin-bed regenerative oxidizer "due to the flexibility it provided for energy-efficient operation between zero and 26% lower explosive-limit (LEL) solvent concentrations from the coatings and mix-room process sources" said David Swinehart, VP of engineering at CEE. In addition, "the system provides 99% volatile organic compound (VOC), hydrocarbon and odor control for the entire range of coatings formulations, as well as loadings and flow rates from 1,000 to 13,300 standard cubic feet per minute."



A variety of solvent vapors, including xylene, methyl ethyl ketone, heptane, phenolics, aromatics, toluene and alcohols, are oxidized in the combustion chamber of the oxidizer system at 1,600°F to 2,000°F with a one-second retention time.

The flow of VOCs is automatically cycled through a twin bed of ceramic heat-transfer media, where it is preheated before reaching the combustion chamber. At that point, the British thermal units (BTUs) of solvents are released to preheat the second bed and the now-purified exhaust exits the stack as harmless water vapor and carbon dioxide. The purified and preheated exhaust is then diverted and directed into an integral-waste heat-boiler system, which generates steam and hot water for the process and for plant energy demand.

"The higher the solvent loading, the higher levels of steam are generated", says Swinehart. "For example, at VOC inlet loadings of approximately 245 pounds per hour, one million BTUs of steam are generated from the preheated and purified exhaust without any auxiliary energy input. At approximately 600 pounds per hour of inlet solvent loadings, the secondary waste heat boiler generates in excess of five million BTUs per hour of steam."

What truly makes this air-pollution control and energy-recovery system efficient is that it requires auxiliary fuel input at initial, cold startup for the burner. Since the twin heat exchanger beds are composed of durable, high temperature, inert ceramic media it provides 95% primary heat recovery and fuel-free operation at 3%LEL, as well as greater LEL inlet solvent loadings.

The integrated incinerator and waste heat-boiler system provide low operating costs combined with extremely high VOC/hydrocarbon destruction to meet both current and future environmental air-pollution control regulations. "The system is designed for minimal maintenance without any periodic catalyst, carbon or biological compost additives that other air-pollution technologies require" Swinehart says.