



CATALYTIC COMBUSTION

Case Study – U.S. Air Force DOD project Flame-Ox 3-in-1 High BTU Thermal Oxidizer

Environmental Issues

Controlling the off-gas from a remediation project, where high concentrations of petroleum hydrocarbons are present, can be a difficult if not dangerous process when utilizing internal combustion engines and conventional oxidation technology.

In more recent years, the use of high vacuum pumps to accomplish both liquid and gas phase extraction — sometimes referred to as multi or dual phase extraction (MPE or DPE) — has further complicated the design requirements for safely applying off-gas treatment equipment.

The MPE technology relies upon the ability to maintain sufficient vacuum on the subsurface to accomplish the multiphase principle. Therefore the off-gas treatment system must process 100% of the hydrocarbon load. In many cases, this load is well above 50% of the lower explosive limit (LEL) and often has limited oxygen in the fume stream.

To date, conventional technologies, including internal combustion engines, thermal oxidizers and catalytic oxidizers, have all been applied with limited success on these hot sites.

The following case study represents real time experience in dealing with these different and difficult situations. The end result of this project was the development of a hybrid off-gas treatment system designed to take the difficult and dangerous realities out of the equation.

Project Background

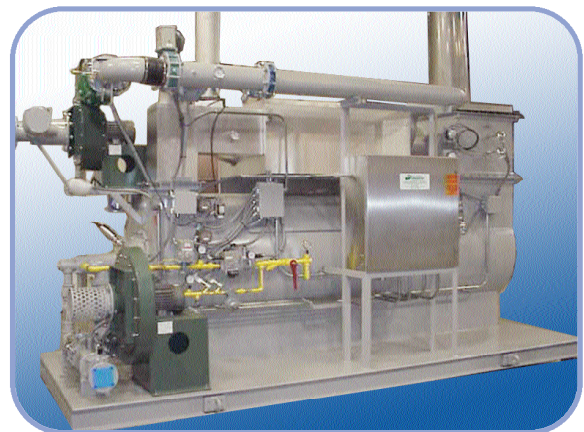
An MPE system had been installed and was operating at a Department of Defense project for the U.S. Air Force. Free product on the site consisted of various jet fuels, diesel range organics and gasoline range organics. Concentrations in the effluent from the MPE ranged between 50,000-75,000 ppmv.

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The off-gas from the MPE was being directed to an internal combustion engine (ICE). The ICE was having difficulty processing the hydrocarbon vapors and the unit itself required extensive maintenance, repair and on-site supervision to maintain operation. Overall uptime was poor and due to limited auxiliary fuel supply at the site, the ICE could only be used during the first stages of the project. An oxidizer would eventually have to be purchased for the project's longer-term operation.

Solution

The ICE was replaced with a Flame-Ox high BTU thermal oxidizer developed by Catalytic Combustion



The Flame-Ox 3-in-1 system is one of the first vapor phase treatment systems that can operate through all modes of a heavily contaminated remediation project, without the need for constant attention by an operator. While the multimode operation is simple and effective, the most impressive feature of the system is its safety.

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Corporation. The Flame-Ox is a specially designed oxidizer, which utilizes design concepts from both thermal and flare technologies. Combining these two technologies yields a hybrid thermal oxidizer, which is very effective at destroying hydrocarbon-laden air streams with minimal auxiliary energy requirements, while maintaining high reliability. The Flame-Ox also has the benefit of operating in a high efficiency catalytic mode once hydrocarbon levels have dropped, which eliminates having to purchase a second piece of equipment.

Project Requirements

The Flame-Ox was designed to take emissions from a single liquid ring pump and a groundwater air stripper, with the additional capacity for a second liquid ring pump.

A heat exchange and catalytic module was also integrated for the project’s long-term operational requirements. The overall destruction efficiency requirement was established at 95% inlet vs. outlet concentrations.

Parameters

Type	Air Flow	Concentration
Present MPE	120 SCFM	30,000 ppmv
GW Air Stripper	150 SCFM	<500 ppmv
Future MPE	120 SCFM	N/A

Flexible Operation

The Flame-Ox operation is differentiated between three modes:

Flame: Operation over 50% LEL

Thermal: Operation above 25% but below 50% LEL

Catalytic: Operation below 25% LEL

Each mode optimizes the ability of the Flame-Ox to destroy a central amount of hydrocarbons, meet the DRE requirement and minimize auxiliary fuel consumption.

Project Outcome

Since its start-up in September 2001, the Flame-Ox has performed extremely well despite the hydrocarbon loading being almost double that of the initial design. Measured field results confirm that overall concentration levels from the MPE range between 50,000 and 75,000 ppmv. The Flame-Ox destruction efficiency measured at 99.7%. The auxiliary fuel consumption was essentially 10% of maximum requirement, resulting in minimum fuel use.

For more information on this project or other VOC-abatement technologies, please contact:



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