

## Three Ways to Treat Fumes

### *Determine the right way to solve your chemical fume emissions problems*

In today's environmentally conscious society, many corporations are seeking to lower levels of emissions from plant sites and protect workers from hazardous fumes. This article introduces a variety of technologies available to reduce gaseous chemical emissions.

Three main ways exist to remove entrained chemicals from gas streams:

1. Scrub—using a packed tower or wet scrubber
2. Burn—using a thermal oxidizer
3. Filter—using a charcoal filter or dry scrubber.

#### **Scrubbers**

Are useful when the pollutant is soluble in water. Efficiency removals of up to five nines (99.999%) are easily obtained, making scrubbers the primary selection for toxic chemicals that can be neutralized.



#### *Types of scrubbers*

A packed tower is a column, filled with a depth of packing, with a sump at the bottom, a spray header at the top and a pump for the recirculating scrubbing liquid. If sufficient gas pressure exists to force the gas through the column and out the stack, a fan is not required. Otherwise, an exhaust fan can be added to provide additional pressure.

A venturi scrubber is similar to a packed tower, except that the pumped liquid provides the motive force for the gas. Additionally, part of the neutralizing reaction takes place in the venturi nozzle, reducing the need for packing. Venturis can be staged in series to completely eliminate the need for a fan, or can be fan-assisted.

#### **Thermal Oxidizers**

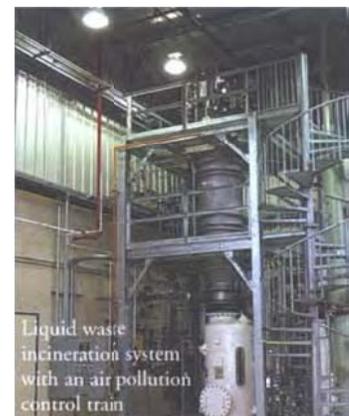
Another type of chemical emissions are volatile organic compounds or VOCs. They are destroyed through burning, typically in a thermal oxidizer.

#### *Types of thermal oxidizers*

The basic type of thermal oxidizer is a direct flame thermal oxidizer where the burner fires into the gas stream, and all heat is lost to atmosphere. A direct flame oxidizer can provide organic destruction efficiencies in excess of 99.99 %.

Regenerative and recuperative types are designed to recover the heat generated by combustion. A regenerative TO uses multiple beds of ceramic media, while a recuperative uses air-to-air heat exchangers to heat the incoming air. Typically, a regenerative TO offers better heat recovery (approximately 95%), with lower destruction efficiency (99%) than a recuperative TO (75% and 99.9% respectively).

Another option, the flameless TO, heats ceramic media to high temperature using electrical resistance or gaseous fuels, resulting in very low levels of NO<sub>x</sub> formation. A flameless TO can also include heat recovery of approximately 80%, and achieves organic destruction efficiencies in excess of 99.99%



## Filters

Filters are very practical for small, at-source applications, but can also be used in larger plant-wide systems. Particulate is easily filtered using paper mesh filters, and VOCs can be easily filtered through charcoal filters. For other aggressive chemicals, a dry scrubber can be utilized.

### *Types of filters*

Dry scrubbers are relatively new to the market. A typical dry media filter is composed of alumina sulfate. Similar to wet scrubbers, once the neutralizing media is exhausted, it must be replaced.

Paper filters are utilized to remove smoke and particulate fumes down to HEPA standards. Filters can be either cleanable or disposable. Charcoal filters can be emptied and refilled for several cycles, providing an economical choice for solvents.

## Other Considerations

Where will the cleaned gas be emitted? Wet scrubbers saturate the exiting air, and so must exhaust to atmosphere. Gas streams exiting a facility must be made up, placing additional loads on HVAC systems. The hot exiting gasses of a thermal oxidizer can be reused to heat the incoming gas stream or the heat can be recovered in other means.

Filters lend themselves to both inside and outside exhaust. Plants seeking to limit emissions point, roof or wall penetrations, or permitting, can utilize filters or dry scrubbers for chemical removal. Because no air leaves the facility, no additional load on HVAC needs to be considered.

Ducting, power and life cycle costs, particularly for chemical-based neutralization also need to be considered.

## Conclusion

As with all engineering applications, knowledge of available technologies is the engineer's first defense. Methodically sorting through the options will result in the best selection.



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Kriebel Engineered Equipment, Ltd. & Anchor Sales

9 Humphreys Drive - Warminster, Pa. 18974  
info@kriebel-ltd.com                      info@anchorsales.net