Reduce Operating Costs Of Your Thermal Oxidation System

AIMCAL Fall Technical Conference; Myrtle Beach, SC
October 19, 2010
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Over the past few years new materials have been developed to minimize both gas and electrical consumption for Thermal Oxidizer Systems. This presentation will provide examples of how companies can reduce operating costs while in many cases also reduce their carbon footprint and increase system performance. The presentation will also discuss equipment upgrades with cost sharing from utility companies and the potential for emissions credits.

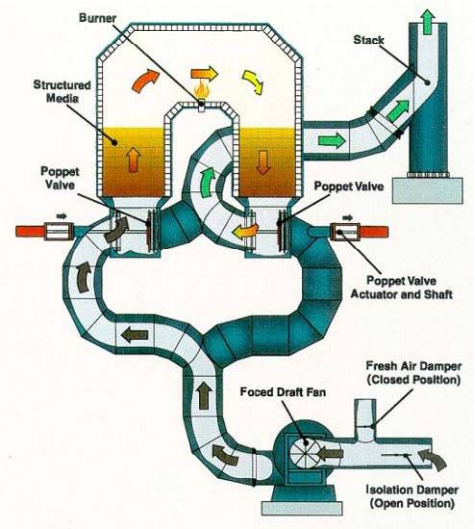
Thermal Oxidation Technologies

- Direct Fired Thermal Oxidizer
- Recuperative Thermal Oxidizer
- Catalytic thermal Oxidizer
- Regenerative Thermal Oxidizer

Recuperative Catalytic Oxidizer

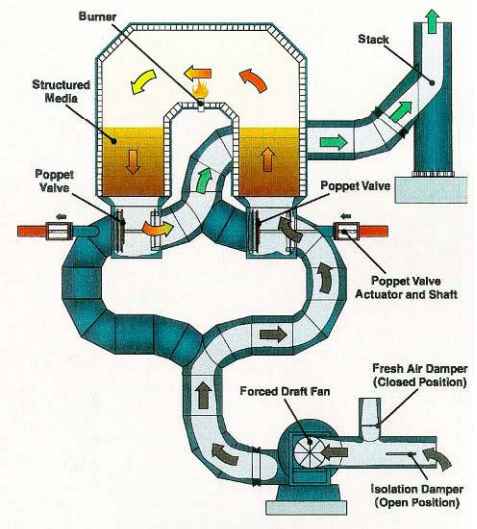
Gas Flow Through the RTO

Cycle 1: 3 Minutes



Left chamber Inlet mode: Process air is preheated through media

Right chamber Exhaust mode: Hot air gives it's heat energy to the media, cooling the exhaust air to a temperature slightly above the process inlet air steam



Cycle 2: 3 Minutes

Right chamber Inlet mode: Process air is preheated through the recently heated media

Left chamber Exhaust mode: Hot air now gives it's heat energy to the media in the left chamber, and is cooled prior to exhaust

Fuel Saving - Equipment Upgrades

- Burner system
  - Upgrade to modern burner for higher turndown.
    - Also creates less NOx for future emission credits.
  - Upgrade gas and air control to minimize temperature swings, fire more reliably on ratio, and minimize flame-outs.
  - Evaluate system for NFPA compliance.

Fuel Saving - Equipment Upgrades

Continued

Fuel usage comparison for turndown for 4:1 vs. ON/OFF operation.

RTO Size – 20,000SCFM

VOC loading – 5% LEL (RTO self sustaining)

TER – 95%

Burner Size – 3MM BTU/HR

4:1 gas usage at min fire – 750,000BTU/HR

RTO above set-point temperature – 0.0BTU/hr

Cost savings - $5.25/hr (based upon $7.0/MMBTU) or $45,990.00/yr @ 8760 hrs/yr.

Fuel Saving - Equipment Upgrades

- Upgrade heat exchanger based upon new or different process conditions.
- Evaluate the process to verify if the current TER is optimum for your current process conditions.
  - For RTO systems this could mean adding more ceramic media or changing the type of media used.

Upgrade TER

- TER (Thermal Energy Recovery can be achieved by;
  - Changing out the heat exchanger
    - Plate vs. Shell and Tube.
  - Changing the type of ceramic heat recovery media
    - Random packing vs. structured

Metal Heat Exchangers

- Both Plate and Shell and Tube have practical maximum heat recovery of 80%.
- Operation of oxidizer will dictate which design is a better fit.
- The upgrade options will be to increase the TER with a replacement heat exchanger of higher TER or to add a secondary heat exchanger to pre-heat the inlet process gases.
- Space and access for replacement are considerations.

Ceramic Heat Recovery Media

- Eight (8) feet of random packing equals roughly five (5) feet of structured media for equivalent TER.
- Existing RTO systems with low TER may have recovery chambers less in height than 8 feet. Providing there is 5 feet available, maximum TER can be achieved.
- Even if the RTO is designed for 95% TER there are energy savings related to lower pressure drop to realize.
- Additional benefits related to a monolith upgrade include, ability to run up to 30% higher process volume, or a 30-50% decrease in differential pressure across the recovery beds yielding lower HP and electrical consumption.

Fuel Consumption Comparison

- Chart Showing Fuel Costs vs. TER

		Flow - SCFM			
		5,000	**10,000**	**20,000**	**30,000**
	95%TER	0.478	0.956	1.91	2.87
	$7.00/MMBTU	**$3.35**	**$6.70**	**$13.40**	**$20.10**
Fuel Usage	**90%TER**	0.956	1.91	3.82	5.73
MMBTU/HR	$7.00/MMBTU	**$6.70**	**$13.40**	**$26.80**	**$40.20**
	85%TER	1.43	2.86	5.72	8.58
	$7.00/MMBTU	**$10.01**	**$20.02**	**$40.04**	**$60.06**
	80%TER	2.21	4.42	8.84	13.26
	$7.00/MMBTU	**$15.47**	**$30.94**	**$61.88**	**$92.82**
	50%TER	7.56	15.12	30.24	45.36
		$52.92	**$105.84**	**$211.68**	**$317.52**

Electrical Savings

- Upgrade heat exchanger based upon new or different process conditions.
- Upgrade Heat recovery media from random packing to structured monolith
- Install new or upgrade VFD to reduce motor speed and improve the power factor (Many utilities will give rebates for this upgrade).

Maintain your Thermal Oxidizer

- Change thermocouples yearly
- Inspect burner system for proper operation.
- Prove alarms.
- Repair worn internal refractory
  - Failure of the internal refractory can cause severe hotspots on the shell which can lead to metal failure and damage to external components.
    - wires in conduit can melt and generate false signals which can lead to a total system failure.
    - Safety concerns related to high temperature exposure.

Failure of RTO Resulting From Internal Refractory Failure

Chart Recorder Showing Thermocouple Failure

Old Thermal Oxidizer Panel With Outdated Components

Modern Control Panel

Tax Credits; Utility Companies, State, and Federal

- **Sales and use tax exemptions for pollution prevention equipment**
- Manufacturers and other commercial enterprises receive exemptions from state sales and use taxes for the purchase of pollution control equipment certified by the agency requiring the equipment as a permit condition. Applicability of this exemption to a specific project can be determined during project planning when preliminary discussions are held between the permit applicant and the pollution control agency. Please contact the DEQ regional office where the facility is located for more details at: http://www.deq.virginia.gov/regions/homepage.html

Tax Credits (Continued)

- Private entities may take a tax credit for installing state mandated air pollution controls. Credits are available for control equipment which is permitted, installed and operated in compliance with local air district regulations. A State Certification is a prerequisite for applicants to receive a tax credit from the Internal Revenue Service and is issued pursuant to Section 169 of the Internal Revenue code of 1954, as amended.
- As the clearinghouse for all requests for California sources, the ARB receives all air pollution-related applications, forwards them to the applicable local air district, receives the district's comments, and issues the State's certification. This certification is then forwarded to the U.S. EPA for further processing.