



**15-30 BTU/CF vs. 105+ BTU/CF**

<b>Oxidizer / Internal Combustion Engine (ICE) Comparison:</b> average 50,000 PPMv VOC Concentration In Process Flow During Typical Tank Degassing Event						
<b>Equipment Type</b>	<b>Max PPMv (as Toluene) after dilution air</b>	<b>Btu/hr to operate system at zero PPMv</b>	<b>Process Flow (SCFM)</b>	<b>Dilution Air (SCFM)</b>	<b>Lbs/hour (as Toluene) Oxidized</b>	<b>Gallons/hr "make up fuel" (Propane)</b>
<b>Thermal Oxidizer-Furnace</b> 1000 SCFM System	2,656	1,805,080	53	947	38.73	12.9
<b>Internal Combustion Engine (ICE)</b> 300 SCFM (model V4 dual engine w/load)	22,810	1,784,979	137	163	99.77	0.3
<b>Assumptions:</b>						
Mass removed = (ug/L * Flow (SCF/M) * 28.3L/SCF * 60 Minutes/Hour * 2.2 Pounds/Kg)* 1/10 <sup>9</sup> Toluene at 92.1 mole weight; 17601 Btu/lb, LEL 1.25% (12,500 PPMv) 20.9% Oxygen in process stream Dilution Air = Process Capacity - Process Flow One gallon of propane (vaporized) is equal to 91,500 Btu 594,993 BTU/hr per 100 SCFM throughput for stoichiometric burn for ICE oxidation (105 Btu/cubic foot) 90,254 to 180,508 BTU/hr per 100 SCFM throughput for thermal oxidation (15 to 30 Btu/cubic foot) Thermal Oxidizers shown operating at 85% of NFPA LEL recommendations (see footnote 1) Energy to raise ambient temperature (60 degrees F) to 1400 degrees F using: SCFM x 1.08 factor x delta temperature rise Energy to raise ambient temperature (60 degrees F) to 600 degrees F using: SCFM x 1.08 factor x delta temperature rise with 15% heat loss Oxidizers' burner have a 30 to 1 turn down ratio with no heat exchanger installed 0.0%						
$\text{This amount TRIPLES with ProGreen® Chiller Unit on site!}$						
<sup>1</sup> Furnace type oxidizers normally operate safely below the LEL so that an explosion does not occur within or outside of the oxidizing chamber. The National Fire Protection Association (NFPA) recommends that oxidizers operate at a maximum of 25%, (as shown in chart above), or up to 50% of the LEL depending on the safety control features of the system. Oxidizers are limited to this safe operating range in order to have adequate time to respond to fluctuations in the input flow rates and/or VOC concentrations. Common practice for refinery or tank farm use is to operate at less than NFPA recommendations. Above chart assumes 85% of NFPA recommendations.						
This spreadsheet model is for estimation purposes only. Actual condition heat loss will vary from site to site. There are no express or implied warranties for fitness of use for any purpose. Copyright RSI 2009. All rights reserved.						