DURR Thermal Oxidizer Research

History of Research

- A small group consisting of community members Steve Martinez and Edward Pineda along with Intel employees Peter Clugston, Heath Foott and Bill Westmoreland made progress on their joint research of thermal oxidizers. They met and developed a list of 26 questions for Durr Corporation (the manufacturer of Intel's thermal oxidizers) to ask them about redundancy, stand-by capability and more. They met jointly with Durr on February 18th to discuss the answers. The 26 Questions & Answers are contained in the following slides. These answers are directly from the manufacture (Durr).

1. What are the pros and cons of installing a redundant system? Are there any considerations for pre-existing systems when installing a redundant system?

- The pros of a redundant system are the ability to always maintain desorption flow and oxidation in the event that the primary system goes down, as well as the ability to schedule routine downtimes for cleaning/maintenance on the primary unit. The cons are capital cost, operating cost and system complexity. The main considerations for installing redundancy on an existing system are space availability and the downtime needed to make tie-ins.

2. What are the emission rates of a RCTO on standby and/or hot idle running for back-up?

- Essentially the same NOx and CO as the primary oxidizer.

2a. What is the NOx and CO rate for warm idling a unit at the 700-800 Degree level?

- Low NOx Coen burner cannot be operated below 1250F. The CO emission will be very high. We are not sure about NOx emissions as these burners have never been operated at lower temperature. We do not recommend operating Oxidizers with Coen low NOx burners at lower than 1250 F temperature.

3. What are the benefits of certain types of materials used as a concentrator such as activated carbon and zeolites? Are there other applications for these materials?

- Both are used extensively in separation processes to separate or remove different organics from air or water . The choice of Zeolite or Carbon depends on the types of organics involved.

4. Are there different or improved types of zeolite configurations for concentrators? There are a number of Zeolite types available, and the selection of a specific zeolite depends on the application.

- There is no “improved” Zeolite today compared with 10 years ago.

5. What are the failure rates of zeolite media on systems currently in industry?

- Zeolite media fails only because of contamination by some high boiling point compound that cannot be desorbed and builds up on the zeolite. This build-up results in a gradual reduction of adsorption efficiency.

6. What is the expected adsorption rate for zeolite wheel if the desorb cycle stops functioning?

- This depends on the type and concentration of organics involved. For inlet concentrations < 50 ppm, we would guess that it would be 4 hours or so before a gradual reduction in efficiency is noticed.

7. Is there an industry average for recorded down time?

- We do not know, as we do not operate plants, but would guess 99% or so.

8. Are there redundant zeolite media systems for thermal oxidizers?

- You cannot use a redundant zeolite bed to back up the thermal oxidizer. First, the air coming to the thermal oxidizer is too hot to adsorb, and would have to be cooled. Second, the thermal oxidizer supply's heat to desorb the main zeolite wheel. If the oxidizer is taken down and air fed to a zeolite bed, there will be no source of waste heat for primary wheel desorption

9. Will the cooling loop still function if the oxidation system goes down? Will an auxiliary cooling system work?

- The cooling system and the desorption systems would go down at the same time if the oxidation system goes down. Also, there is no need for cooling if the desorption system is down.

10. Can redundant/back-up thermal oxidizers run in a standby mode or do they need to be completely off? Is there a range of operation for standby vs. online modes?

- Can be done both ways. If completely off, we recommend a heat-up rate of 400F /hr. Therefore, including a 15 min. purge cycle, from cold start to 1400 F combustion chamber temperature will take 3 hrs. 45 min.

11. What is the start up time of a redundant system on idle or standby to adequate abatement concentration temperatures?

- We recommend a heat-up rate of 400F /hr. Therefore, including a 15 min. purge cycle, from cold start to 1400 F combustion chamber temperature will take 3 hrs. 45 min.

12. Will additional insulation of the unit on standby allow for a quicker start up?

- No. These units are always insulated

13. Are there companies that have a 100% uptime for their RCTO's? If yes, what are they doing? Would they be willing to share information for benchmarking purposes?

- 100% uptime on a thermal oxidizer is impossible. The only way to have approx. 100% uptime is to have a redundant system, and even then there is some switch over or ramp-up time involved.

14. Are there companies that have 100% redundant systems? If yes, what are they doing? What are the pros and cons for doing so?

- Some companies purchase 100% redundant systems , probably because of local / permit conditions. To the best of our knowledge, the only place requiring 100% redundancy is Taiwan (for certain industries?)

15. Is there a system to control customer pressure requirements during switchover?

- Very slow moving dampers are used in some places, along with large pressure equalization boxes. There is no real way to totally eliminate this pressure bounce.

16. How do you deal with fluctuations (flow rate/concentrations) to the intake? Are there updates or controls for this to make the system run more efficiently?

- The systems are designed to operate within a certain window of flow/temp/concentrations. Outside of this normal operating range, it is possible to further adjust things like rotor speed, desorption temp or both for a specific condition

17. What are the different design sizes for DURR units?

- The units are custom designed. Maximum single module sizes(limited by ability to ship) are 50,000scfm on concentrators and 20,000 scfm on thermal oxidizers.

18. If redundant units considered, what capacity is standard in industry? For example is it 100% redundancy? Or is it 50% redundancy and the systems run at >100% when a system fails?

- We only know of a few companies that have purchased 100% redundancy due to local/permit conditions, except for Taiwan.

19. What is the coast time of the zeolite bed once the RCTO goes down? How long is the zeolite media effective? Does it dependant on the intake concentration level?

- As mentioned earlier, this depends on the inlet concentration/type of organics. We guess at <50 ppm, about 4 hours before a noticeable reduction in adsorption efficiency.

20. Can thermal oxidizers be put in series? Are there benefits for multi stage configuration, like heat from primary unit?

- This is not technically feasible. We don’t see how such a system could be designed to operate.

21. Can you use absorption beds as back-up, does that exist? Are there any other types of back-up devices, such as direct oxidation or collection devices?

- You can use a static bed of carbon or zeolite, but they have a limited ability to capture and store organics, then need to be disposed of or regenerated thermally. A back-up direct oxidation unit would be extremely large and generate huge amounts of NOx and CO if used to treat the full airflow.

22. What other methods is industry using for VOC removal?

- Adsorption and oxidation are the two technologies primarily in use for VOC removal worldwide.

23. Is anyone in industry utilizing alternate fuel treatment for cleaner burning for natural gas injection? How much of a role does the composition/quality of the fuel play on the operation on a RCTO? Do impurities, such as H2S have an affect?

- Natural gas is as clean a fuel as anything else. Impurities such as H2S , if present, could result in corrosion of the burners and oxidizers.

24. Is the composition of the inlet (System design/Concentration/Compounds) important? Do the newer designs out perform or do better than the older models?

- The inlet solvent type/concentrations are important to allow the concentration systems to be properly designed. Newer designs are primarily better packaged for better economy. There is no fundamentally “better” zeolite system designs compared with 10 years ago.

25. What are the stack configurations for additional RCTO that may be added to existing systems?

- A stand-by unit would presumably be tied into the same stack, provided that it runs only when the primary unit is down. If not, a second stack would be needed

26. Can induction fans be added to an existing system to force dilution air into the stack, therefore making the velocity faster and getting the air higher into the atmosphere?

- Yes. Noise may be an issue , though!