



## *Flares: Passive FTIR measurements*



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★ Background



★ Emission Issues related to flares



★ TCEQ Research on passive FTIR to measure combustion efficiency



# *Flares: Passive FTIR measurements*

## *– Background*

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### ★ Emission Estimating Workshop

- TCEQ, EPA, Universities, Consultants, Environmental, Industry
- Question: Confidence in emission estimating protocols
  - Accuracy
  - Adequately supported by science or data
  - Opportunity to improve accuracy of emission estimates





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## *- Issues*

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★ What are the issues related to flares and VOC emissions?

– How much VOC are flares emitting?

- What, when and how much gas is sent to the flare?
  - Routine process vents, and Startup, Shutdown, Maintenance and Upsets
  - Measured or process estimates
- How much is destroyed in the flare flame?





# *Flares: Passive FTIR measurements*

## *- Issues*

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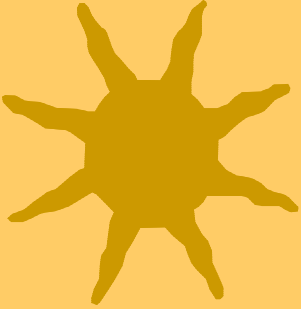


- ★ How much VOC is destroyed in the flare flame?
  - Depends on actual flare operation
  - 40 CFR 60.18 “stable flame”
    - nHV and tip velocity
    - Engineered flare tip
    - 98% to 99% destruction
  - What happens when 60.18 is not satisfied?
  - Is 60.18 satisfied over entire range of operation?
  - What else may affect flare operation?



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## *- TCEQ Research*



- ★ How much VOC is destroyed in the flare flame?
  - ***TCEQ Research work:*** Passive FTIR
    - FTIR signal: Background radiance; Flare radiance, Atmospheric Path radiance and transmission
    - Flare efficiency =  
$$[\text{CO}_2] / \{[\text{CO}] + [\text{CO}_2] + [\text{THC}] + \text{soot}\}$$
    - Radiant signature
      - CO, CO<sub>2</sub> and CH<sub>4</sub> are easy
      - THC assessed using C-H stretch
      - Speciation (<C<sub>5</sub>) above a threshold



# *Flares: Passive FTIR measurements - TCEQ Research*

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## ★ How much VOC is destroyed in the flare flame?

### - *TCEQ Research Technical Team:*

URS Corporation, Industrial Monitor & Control Corporation (IMACC), John Zink Co.

### - *TCEQ Research Phases*

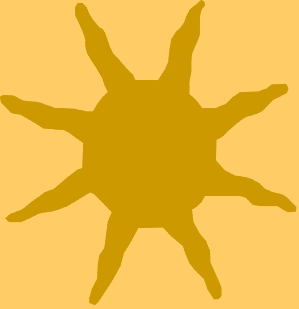
- First Phase –Determine FTIR sensitivity/accuracy
  - August 2003, John Zink Test Facility in Tulsa, Ok
  - Plume Generator –ethylene, propylene, propane, butane
  - John Zink test flare - propane
- Future Phases in future years if funding available
  - Extensive testing on the effect of operating parameters
  - Testing of operating industrial flares in the HGA





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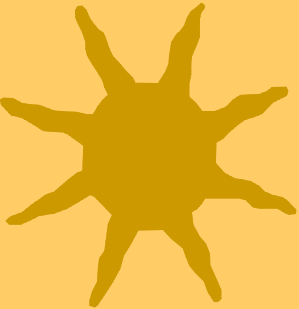
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★ How much VOC is destroyed in the flare flame?

- ***TCEQ Long-Term Research Project Objectives:***

- More accurate emission estimates from flares under a wider variety of actual operating conditions
- Future: commercially available monitoring method for field testing of operating flares to determine actual flare efficiency



★ Questions??

