



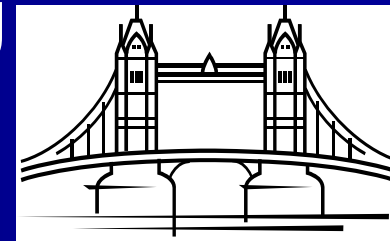
# **Stack Testing: Bridging The Gap Between Testing, Operations and Regulatory Requirements**

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# The World of Stack Testing

- Types of sources needing testing
- Reasons for testing
- Planning test approach for operations, environmental and regulatory considerations
  - Key parameters
  - Test schedule
  - Location
- Considerations for future testing
- (the learning curve)

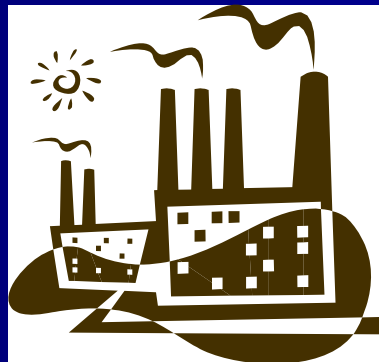


# What Sources Need Stack Tests?



Noise

Combustion source

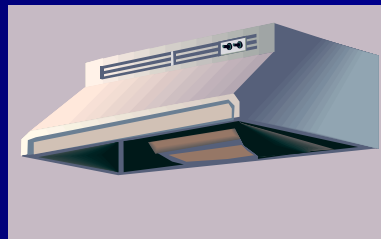


Chemical Reaction



Visibility

Vapor source



Dust source

Odor



# Types of Air Pollution

Opacity

NOx

Fugitive  
Dust

Visible  
emissions

CO

Testing

SO<sub>2</sub>

CO<sub>2</sub>

HAPS

Particulate  
Matter

VOCS

Pb  
Hg

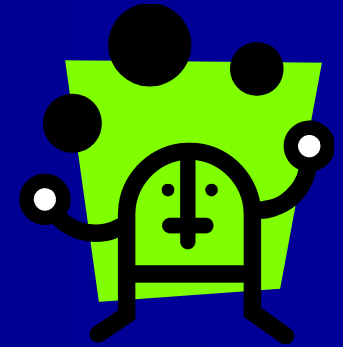


# Project Planning for Testing is Key

- Establish purpose of testing
  - Regulatory Compliance/permit conditions
  - Engineering studies/research
  - Corporate analysis/internal tracking
- Establish qualified project team
  - Plant operations
  - Environmental
  - Stack Testers – Engineers & Scientists
- Consider how test results to be reviewed/used

# Plant Planning Considerations

- Key personnel for test planning team
  - Production support
  - Testing company
  - Regulatory agency staff
- How does timing interact with operations schedule, source and APCD operations?
- How/where will operations and emissions be monitored?
- What limits will be set?
- What product type/quantity will be produced?

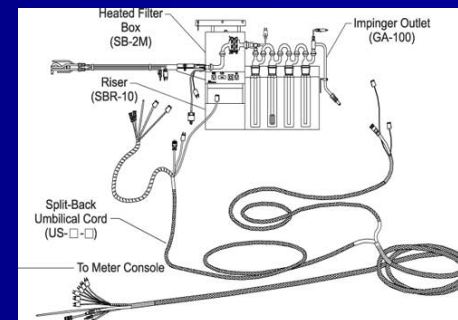
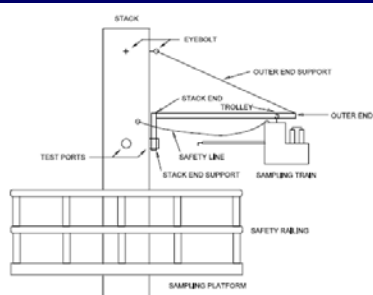


# Environmental Planning Considerations

- Test protocol development and distribution to project team
- Has protocol been submitted to Agency, if required?
- Have appropriate notifications occurred?
- Do results need to be submitted to regulatory agency?
  - By when and type of submittal required
- Do permit conditions need modifying post-testing?

# Test Planning

- What emissions tests will be performed?
  - Gaseous or particulate pollutants
  - Wet chemistry or electronic instrument
  - Isokinetic multiple or single point sampling
  - Is a reference method appropriate for specific application? Or, is modification needed to meet special needs?
  - Will it meet detection limits?

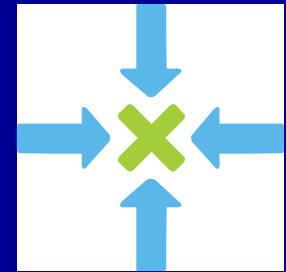




# Location: Where to test?

## ■ Sampling location

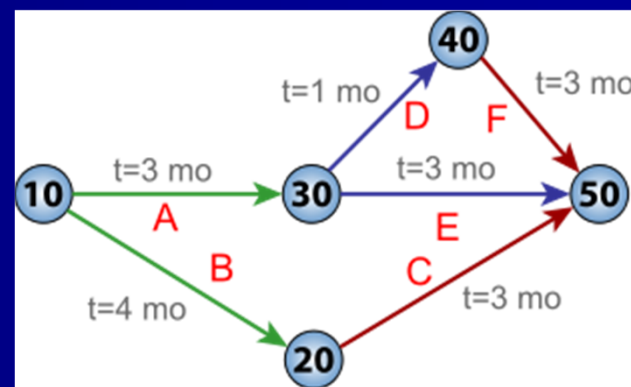
- Safe & accessible? Is location hot, well lit, free of obstacles? OSHA/MSHA compliant?
- Special lift equipment or scaffolding needed? Will it support sampling equipment and personnel?
- Vertical or horizontal? Circular or rectangular?
- Under vacuum or positive pressure?
- Is there steam/vapor plume?
- Where will sample recovery be performed?
- Is adequate power available?



# Test Detail Planning

## Operational readiness

Develop flow diagram of activities



Plant equipment and control device instrumentation

# Determining Test Timing and Schedule



- Plan schedule in detail
  - Mobilization/Testing/De-mobilization - The test Heavy lifting
  - Number and timing of test scenarios and runs per scenario
  - Production data collection
  - Stack samples and laboratory prep

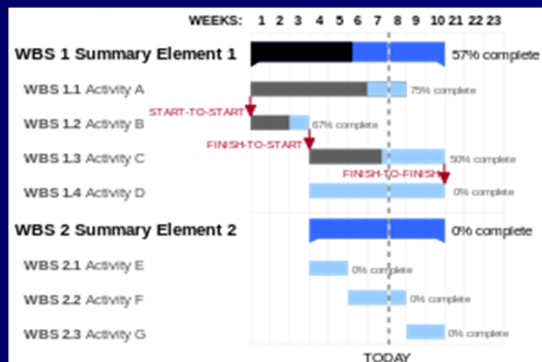
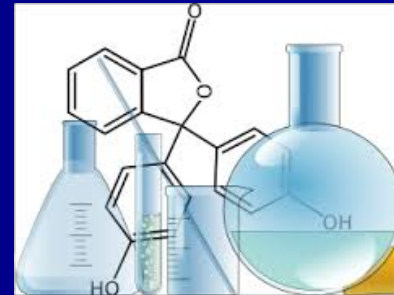


Chart out activities and establish timeline

# Test Results & Reporting

- Laboratory results received
  - What was measured?
  - What units?
- Opportunity for QA/QC heavy lifting
  - Data completeness and accuracy key



$$Y_{qa} = \frac{\theta}{V_m} \sqrt{\frac{0.0319T_m}{\Delta H @ \left(P_{bar} + \frac{\Delta H_{avg}}{13.6}\right)} \left(\frac{29}{M_d}\right)} (\sqrt{\Delta H})_{avg} \quad \text{Eq. 5-15}$$

- Timely report preparation and submittal



# Post Test Considerations

- Document lessons learned
  - What went right? What about next time?
  - How did it go? Cost? Schedule? Quality?
- Were emissions limits achieved successfully?
- Were operating limits established for most efficient long-term operations?
- Will any retesting be needed?
- What about upcoming regulatory requirement changes? (more planning)



# Summary

- Stack testing performed for different purposes
- Establishing team of specialists to plan and conduct testing is key to project success
  - Operational ownership (plant employees)
  - Testing/regulatory expertise (consultants/testers)
  - Regulatory planning and follow-up (Agency interaction)

