



ASTBURY
ENVIRONMENTAL ENGINEERING

AIR | LAND | WATER

Useful Info for Stack Testing

Presentation Given By:

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Basic Stack Emission Calculations

- Stack gas velocity (f/s) = $85.49 \times C_p \times (\sqrt{\Delta P})_{avg} \times \frac{T_s + 460}{M_s \times P_s}$
- C_p = Pitot Coefficient (0.99 for standard pitot tubes or 0.84 for S-type)
- ΔP = Velocity head (inches H₂O)
- T_s = Stack temperature (F)
- M_s = Molecular weight of stack gas (wet basis lb/lb-mole) ≈ 29
- P_s = Absolute stack gas pressure (inches of mercury) ≈ 30
- ACFM = gas velocity (f/s) x area of stack or duct (sq ft) x 60 (sec/min)
- DSCFM (stack gas dry volumetric flow rate at standard conditions)
- = $17.647^{\circ} \text{ R/inch Hg} \times \text{ACFM} \times \frac{P_s \times \text{_____}}{460 + T_s (\text{avg})} \times (1 - B_{ws})$

Pollutant Emission Conversions of ppm to lbs/hr

- $\text{Lbs/hr} = \text{ppm v} \times \text{MW} \times \text{DSCFM} \times (1.554 \times 10^{-7})$
- $\text{NOx lbs/hr} = \frac{\text{ppm} \times \text{DSCFM} \times 60}{8.3755 \times 10^6}$
- $\text{SO}_2 \text{ lbs/hr} = \frac{\text{ppm} \times \text{DSCFM} \times 60}{6.0151 \times 10^6}$
- $\text{CO lbs/hr} = \frac{\text{ppm} \times \text{DSCFM} \times 60}{1.3762 \times 10^7}$
- $\text{VOC lbs/hr (as carbon)} = \frac{\text{ppmC} \times \text{SCFM} \times 60 \times 12}{385 \times 10^6}$

Test Methods

<u>Pollutant</u>	<u>Method</u>
• Total Particulates	Method 5 or Method 17 (in stack filter)
• Condensibles	Method 202/ CTM
• PM10	Method 201A (in certain situations can get total PM)
• Sulfur Dioxide	Method 6 (can be run with Method 5) or 6C (analyzer)
• Nitrogen Oxides	Method 7E (analyzer)
• Carbon Monoxide	Method 10 (can be collected in a beach ball)

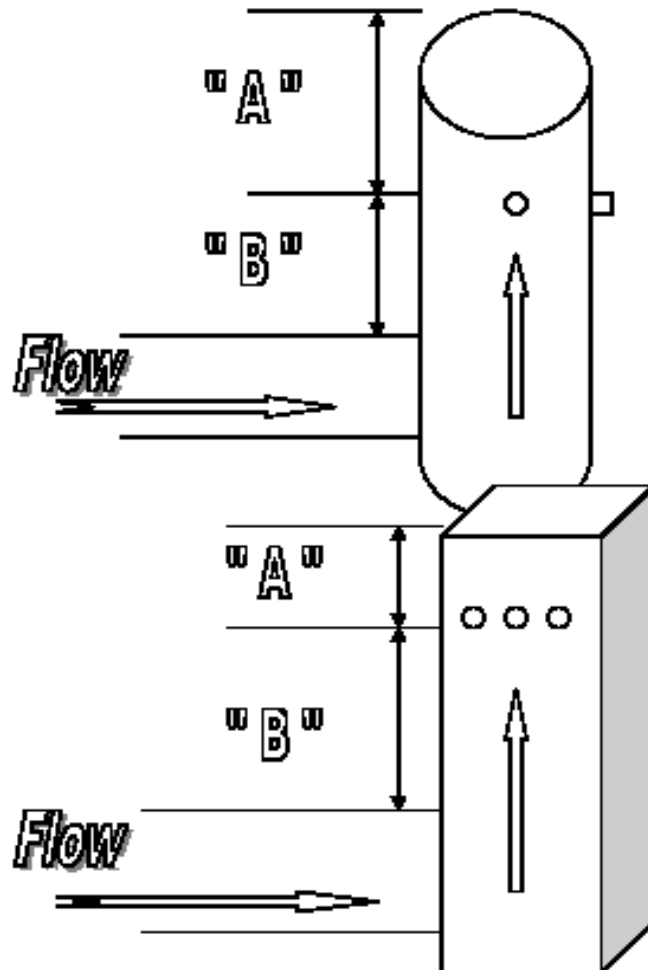
Test Methods, cont'd

<u>Pollutant</u>	<u>Method</u>
• Volatile Organic Compounds	Method 18 (specific organics, GC) Method 25 (collect in cold trap and canister) Method 25A (analyzer –used at less than 50ppmC)
• Lead	Method 12 (equipment and method similar to M5)
• Metals	Method 29 (equipment and method similar to M5)
• Dioxin/Furan	Method 23 (equipment and method similar to M5)
• HCL/HF	Method 26 or 26A

What is Needed for Stack Test?

- Safety scenarios (PPE, chemicals, equipment, emergency scenarios, meeting area)
- Safe parking and access
- Power (basic 110 volts, 15 amps) hopefully close to test area
- Safe access to test ports – man lifts or scaffolds
- How many test ports? Where do we install them? How big must they be?

What is Needed for Stack Test?



- 1) 2 or 4 ports @ 90 degrees
- 2) A Distance > ½ stack dia.
- 3) B Distance > 2 stack dia. from disturbance
- 4) ** Ports must be at least 3" or 6" diameter

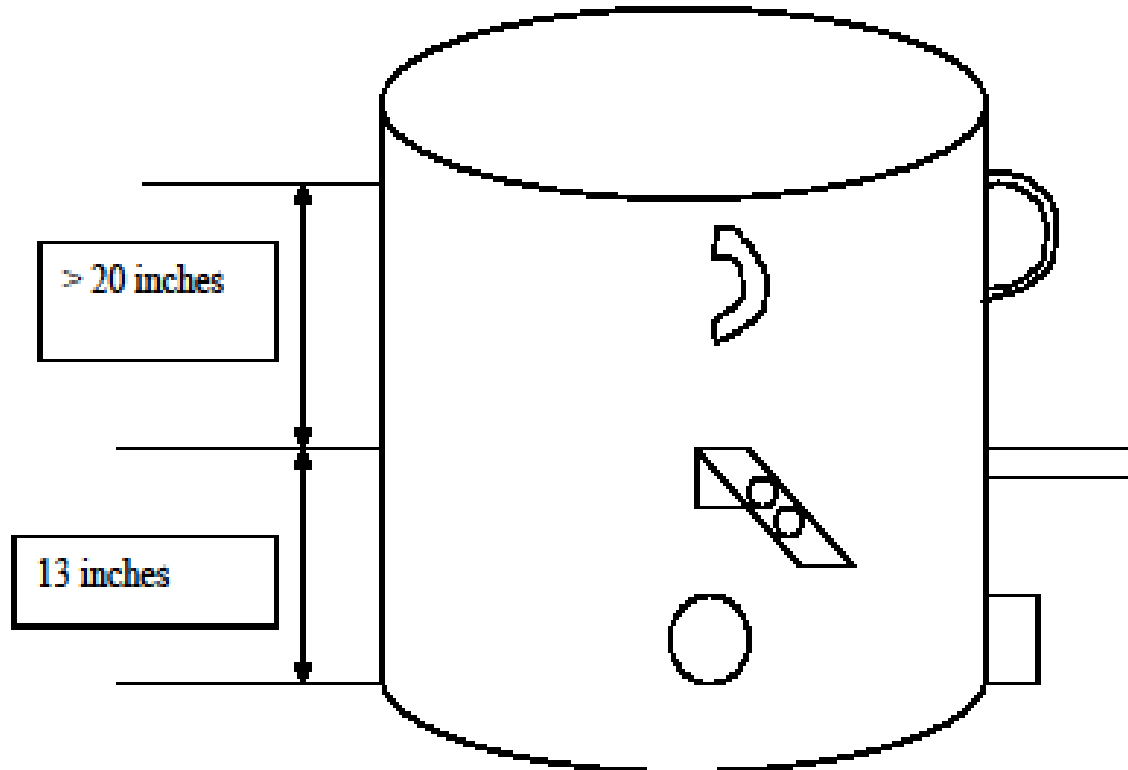
Diameter =

$$\frac{2 \times L \times W}{(L + W)}$$

What is Needed for Stack Test?

- Expectations (communicate)
- Eg: What time do you want to start/finish?
- IDEM & contractor meeting.
 - ** Contractors working for you
 - ** All info is confidential until report is submitted to IDEM

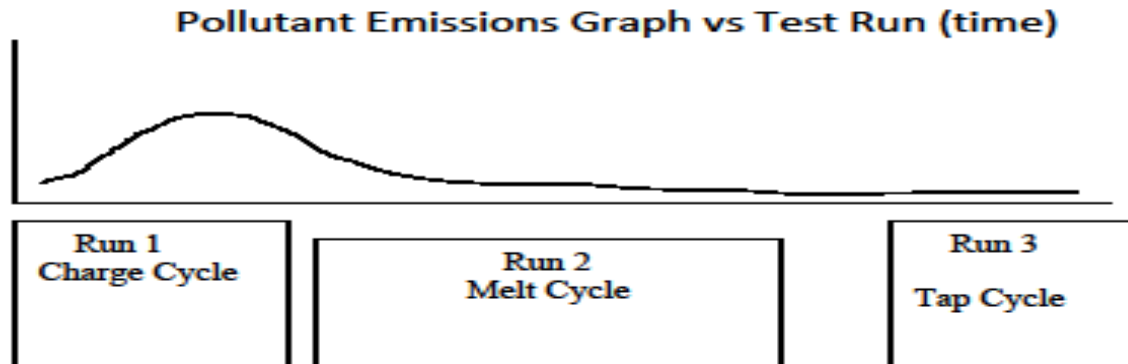
What is Needed for Stack Test?



Common Issues

- Lbs/hr vs. Lbs/Ton (may mean longer test times)

Typical Test



Common Issues, cont'd

Three 'ONE HOUR' runs – typical

- One hour test runs \approx 1.5 hour test runs
- Test length depends on standard, permit wording, control devices (detection limits), test methods, agreements
- One source – one control device
- Two or more sources – one control device (simultaneous test scene)

Common Issues, cont'd

- VOC Tests
- VOC lbs in
- VOC lbs fugitive
- VOC lbs out (after control device)

Control Efficiency = Capture Efficiency x Destruction Efficiency



Prove by: Test or Method 204