

EPA's APTI
Course #450/468

***Monitoring Compliance Testing
and
Source Test Observations***

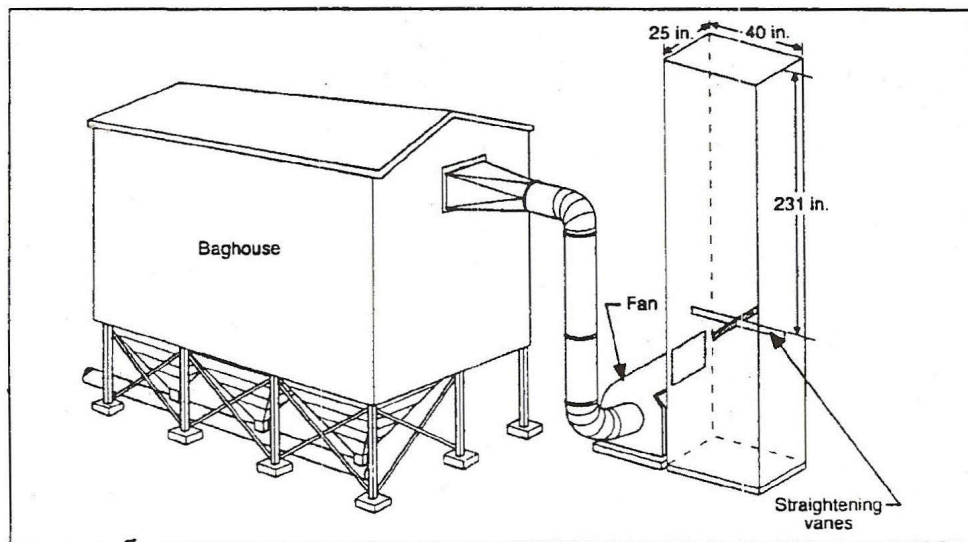
Problem Set 3

1. Given the following pre-test information, estimate the nozzle diameter required to sample at a rate of 0.75 cfm.

| | | | |
|----------------|---------------------------|--------------------|--------------------------|
| $\Delta H_Q =$ | 1.24 | $B_{ws} =$ | 0.112 |
| $C_p =$ | 0.79 | $t_s =$ | 310°F |
| $t_m =$ | 80°F | $M_d =$ | 30.1 lb/lb-mole |
| $P_m =$ | 29.93 in. Hg | $\Delta P_{avg} =$ | 1.5 in. H ₂ O |
| $P_s =$ | -1.1 in. H ₂ O | | |
| $P_{bar} =$ | 29.92 in. Hg | | |

2. You have in your toolbox nozzles with diameters of 0.130, .261, .380, and .523 in. Choose one and calculate the K factor for the isokinetic rate equation.
3. From the result of Problem 2, and using the sampling pump by-pass valve, if you wanted to sample isokinetically, to what orifice meter manometer reading would you adjust the value if the pitot manometer reading was observed to be 1.2 in H₂O?
4. In Problem 3, to what ΔH value would you adjust the system to if $\Delta P_{avg} = 0.86$ in. H₂O? If $\Delta P_{avg} = 1.0$ in. H₂O?
5. Figure 1 represents a duct to be sampled using the Method 5 sampling train. Using Method 1 guidelines, calculate the equivalent diameter of the duct, select the best sampling site, sample port entry number, and sampling point number. (The plant will weld on threaded 3 in. diameter, 6 in. long steel pipe nipples at sample ports.)

Sketch out all work with dimensions.



6. Using an Orsat apparatus, a source test team found that a bituminous coal-fired power plant had $\%O_2 = 8.0$ and $\%CO_2 = 9.1\%$. Do you think the test was good or bad? Why?

7. Molecular Weight of a Stack Gas

An integrated bag sample of the stack gas in a coal-fired power plant duct was analyzed by Orsat. The Orsat indicated readings of 14.2 for CO_2 , 21.4 for O_2 , and 21.4 for CO . The moisture content of the stack gas was 7% H_2O vapor. What is the:

- a. dry molecular weights of the gas
- b. wet molecular weights of the gas

Stack Gas Constituents

$CO_2 = 14.2\%$ by volume

$O_2 = 21.4 - 14.2 = 7.2\%$ by volume

$CO = 21.4 - 21.4 = 0\%$

$N_2 = 100 - 21.4 = 78.6\%$ by volume

$H_2O = 7\%$

8. A dry gas meter indicated that 32 ft³ of gas passed through the meter during a source test. What would the volume of gas have been at stack conditions if the moisture content of the stack gas was 12% and its temperature was 198° F? (Estimate any other parameters that you might need in the solution of this problem.)