

Note: This material is related to a section in AP42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

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AP42 Section:	7.1
Related	13
Title:	Written communication from William T. Moody, Radian Corp. to Randy McDonald, US EPA; Documentation of Storage Tank Emission Factors April 25, 1984

RADIAN

CORPORATION

R.WTM.84.007
April 25, 1984

Mr. Randy McDonald
Emissions Standards and Engineering Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Mail Drop 13
Research Triangle Park, North Carolina 27711

REFERENCE: VOL AP-42
SUBJECT: Documentation of Storage Tank Emission Factors

Dear Randy:

Attached please find the key documents that led to the previous changes in the last revision of AP-42 and will be utilized in this current revision. These documents are discussed by topic below.

1. Development of Seal Factors for External Floating Roof Tanks

The development of these factors is documented in the March 1981 "Petroleum Liquid Storage Vessels: Revision of AP-42; Background Document". API's development of these factors can be found in the November 11, 1979, letter from Dr. R. Russell to R. K. Burr. The seal gap measurements used to weight individual tests are from a survey performed by the Bay Area Air Quality Division. I believe you have the originals of that survey in your files. However, I have also enclosed a May 4, 1979, letter from Ms. Karen Hanzevack to Dick Burr that develops the weighting factors used by Russell.

2. Development of Vapor Pressure Function: P*

The development of P* can be found in a paper by Royce Laverman "Emission Measurements on a Floating Roof Pilot Test Tank; May 16, 1979". This development has been reviewed by Dr. Robert A. McAllister as part of the 2519 analysis. It should be noted that Laverman makes several simplifying assumptions as part of his development. The key assumption is that the vertical gas flow past the seal is laminar. This allows the pressure differential in equations A6 and A7 to be written as a simple difference rather than the differences of squares. If turbulent flow is assumed (differences of squares) the analytical solutions to the integrals are extremely complex.

The function P* yields results that compare favorably with the available field test data. Additionally, the vapor pressure function analysis performed by Mr. Warren-Hicks on internal floating roofs demonstrates that P* fits the test-tank data. This analysis compares the function $f(P) = \left(\frac{P}{14.7}\right)^{0.7}$ with P*. The technique utilized was to

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normalize a 2519 test result for a given piece of equipment to a test done with identical equipment at another vapor pressure. The variance of the difference between the prediction and the observed results should be zero if all measurements and the vapor pressure function are perfect. The analysis shows that while $f(P)$ fits the data better P^* yields results that are not statistically different from zero.

API has advanced the following additional arguments for excepting P^* for both internal and external floating roof tanks. First, theoretical considerations indicate that the vapor pressure function should become unbounded as the vapor pressure of the liquid approaches atmospheric. As the liquid boils the loss mechanisms that typically dominate would become a small proportion of total losses. Second, API pointed out that the calculation of storage tank losses had become a rather laborious process, and consistency in calculation procedures should be considered. Third, P^* does fit the data. Fourth, and last, differences in predicted emissions using the two functions were generally small. As you are aware, after considering this position, the EPA accepted P^* as the vapor pressure function for both internal and external floating roof tanks.

3. The Power of the Diameter D^N

The previously discussed theoretical development by Laverman indicate that N , the power of the diameter, should be 1. The available field test data indicate that this is in fact the case.

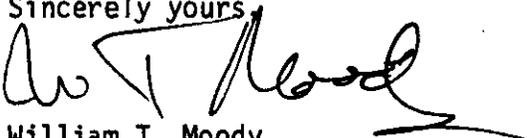
4. Development of Internal Floating Roof Seal, Deck, and Fitting Emission Factors

The enclosed letter from William O'Keefe to Susan R. Wyatt contains API's development of seal, deck, and fitting factors for internal floating roof tanks. Also enclosed are copies of the CBI report to API and Dr. McAllister's internal floating roof technical analysis. API's development of the factors has been carefully reviewed, and we are in agreement that this treatment is appropriate.

I believe that the above four major points cover all of the outstanding issues in both the ongoing and previous revision of AP-42, except the development of clingage factors. Mr. Laverman is sending me the original data on this issue, and the documentation file should be complete at that time.

If you have any questions or comments on this material please contact me.

Sincerely yours,


William T. Moody

Enclosures