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	7
Title:	Written communication from William F. O'Keefe, API to Susan Wyatt, US EPA regarding EPA docket No. A-80-14 NESHAP for benzene storage emissions from storage tanks Janury 25, 1983

American Petroleum Institute
2101 L Street, Northwest
Washington, D.C. 20037
202-457-7320

A-80-14
IV-H-4

William F. O'Keefe
Vice President

January 25, 1983

Ms. Susan Wyatt
Standards Development Branch
Emission Standards & Engineering Div.
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

Re: EPA Docket No. A-80-14

Dear Ms. Wyatt:

The American Petroleum Institute (API) hereby submits this letter and the accompanying materials into the docket on the proposed national emission standard for benzene emissions from benzene storage tanks, pursuant to the Agency's notice of November 24, 1982. 47 Fed. Reg. 53059. As the notice suggests, the enclosed technical note and attachments address the implications of the API testing program on "the magnitude of the emissions calculated for the regulatory alternatives considered in the proposal and the relative performance of the control technologies." Id.

API's August, 1981 comments in this docket*/ demonstrated, among other things, that the data base EPA had assembled at that time was not an adequate basis for the proposed NESHAPS for benzene storage tanks. Specifically, it was incomplete, such that it did not allow for an independent evaluation of all reasonably available control alternatives; and, its accuracy was questionable, due to problems in the test program. See API's August 10, 1981 Comments, pp. 15-34 & App. B.

As elaborated in the enclosed technical note and attachments, API's position continues to be that EPA's data base is an inadequate basis to determine total benzene emissions from storage tanks or to assess the effectiveness of alternative control techniques. API's recent test program provides comprehensive information on emissions from internal floating-roof tanks storing volatile organic compounds (VOC). Qualitative conclusions have been drawn from the results of this test program with regard to an assessment of control alternatives from benzene storage tanks. These conclusions indicate that a number of the Agency's proposed requirements are either unnecessary or should be re-evaluated to assess accurately their cost-effectiveness as compared to other control equipment. Specifically, the API tests indicate that:

*/ Post-Hearing Comments of the American Petroleum Institute on the Proposed National Emission Standard for Benzene Emissions from Benzene Storage Vessels (August 10, 1981).

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- The requirement of both a fixed roof and an internal floating deck is unnecessary. API's data show that external floating decks, with proper ancillary equipment, may be equally effective in reducing emissions. Technical Note p. 4.

- The requirement of a "contact" floating deck is unnecessary. API's data show that deck emissions are due to seam and fitting losses that are independent of deck-type. Accordingly, "non-contact" floating decks may be just as effective as "contact" decks in reducing emissions. Technical Note pp. 5-6.

- The requirement of a liquid-mounted primary seal and a secondary seal should be reconsidered. EPA's incomplete analysis of seal system components does not provide an adequate basis to evaluate the control effectiveness of liquid-mounted primary seals as compared to vapor-mounted primary seals, or of the use of secondary seals with either primary seal type. Technical Note, pp. 6-7.

In short, API's data show that differing combinations of control equipment may be as effective in reducing benzene emissions as the specific equipment configuration of the proposed NESHAP. Consequently, the proposal appears to mandate expensive retrofitting of many existing storage tanks with contact floating decks, fixed-roofs and a specific rim-seal system, even though the current data base -- including especially API's tests -- fails to show that these detailed specifications are sufficiently more effective than other approaches as to justify their significant additional cost.

As discussed in the Technical Note (pp.8-10), there remains an unresolved question about whether benzene behaves significantly differently from other VOCs with respect to permeation through sealing materials used in floating-roof tanks. At present there is no data from which to determine whether or not this effect is significant. Therefore, the use of currently available API data to calculate total benzene emissions rests on assuming that benzene permeation does not contribute significantly to total emissions. If this assumption is not made, additional experimental data is then needed to quantify benzene emissions from storage tanks and to quantitatively evaluate the cost-effectiveness of control alternatives. In any event, the issue of permeation does not affect the three qualitative conclusions above.

API continues to believe that ambient benzene concentrations, due to storage tanks or other emission sources, have not been shown to pose a significant public health risk calling for standards under section 112 of the Clean Air Act. See

API August 10, 1981 Comments at 4-14. If EPA determines that a NESHAP for benzene storage tanks is nonetheless called for, however, API's tests should result, as the Agency's Federal Register notice anticipates, in "significant changes" in the proposed standard. These changes should permit the use of more cost-effective control equipment, as evaluated in API's tests and discussed in the attached materials.

If we can offer further assistance, we would be happy to provide it. Inquiries should be forwarded to Mr. James Walters (202) 457-7055 or Ms. Valerie Ughetta (202) 857-5676.

Sincerely,

cc: Kathleen M. Bennett
Jack Farmer
Central Docket Section (A-130)

A TECHNICAL NOTE

INTRODUCTION

From 1977 to 1982, API conducted theoretical and experimental work and literature surveys on the subject of emissions from volatile organic compounds (VOC)[1], including petroleum liquids[2] and volatile organic liquids (VOL)[3], stored in floating roof tanks. API's findings and conclusions based on its studies are explained and expressed in the emission-estimating equations found in API Publication 2517, "Evaporation Loss from External Floating-Roof Tanks" (Attachment I), and the final draft of API Publication 2519, "Use of Internal Floating Covers and Covered Floating Roofs to Reduce Evaporation Loss" (Attachment II).

The purpose of this Technical Note and its Attachments is to describe those API findings and conclusions which pertain to the information in EPA's Background Information Document[4] (hereafter called BID), as reflected in EPA's proposed National Emission Standard for Hazardous Air Pollutants (NESHAPS), "Benzene Emissions from Benzene Storage Tanks"[5]. This note emphasizes the findings and conclusions drawn from API's recently completed work on internal floating roof tanks.

API's work focused generally on emissions from VOCs, not benzene in particular. As a result, some of API's specific quantitative findings [in Parts 1 and II] may not be applicable to benzene, although API's conclusions (also in Parts I and II) are applicable to benzene as dealt with in the BID and

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1-Volatile organic compounds means compounds which under favorable conditions may participate in photochemical reactions to form oxidants. EPA, "Control of Volatile Organic Emissions from Petroleum Liquid Storage in External Floating Roof Tanks," EPA 450/2-78-047, Dec. 1, 1978, p.X.

2-Petroleum Liquids means crude oil, condensate and any finished or intermediate products manufactured or extracted in a petroleum refinery. Ibid. p.X.

3-Volatile organic liquids are liquids in a chemical industry composed of pure chemicals or mixtures of chemicals with similar true vapor pressure. EPA AP-42, "Compilation of Air Pollution Factors," Part A, Section 4.3, p.4.3-1(1981).

4-EPA, "Benzene Emissions from Benzene Storage Vessels," Background Information for Proposed Standards (EPA 450/3-80-034a) (Hereafter called BID).

5-45 Federal Register 83952 Col. 1, (Dec. 19, 1980).

the proposed NESHAPS. The reason why some of API's quantitative findings may not apply to benzene is because of unanswered questions as to whether or not benzene permeates significantly more than other VOCs, the sealing materials used in floating-roof tanks and whether or not the amount of permeation which does occur contributes significantly to total emissions. The issue of permeation is discussed in Part III.

This note supplements the written comments that API filed in August 1981,[1] with EPA on the proposed NESHAPS and is forwarded for filing in Docket Number A-80-14, pursuant to EPA's November 24, 1982 "Notice of Additional Emissions Test Data," 47 Federal Register 53059.

The Technical Note is organized in four (4) parts as follows:

PART I - This part addresses two areas relative to total VOC emissions in general: (A) VOC emissions from floating roof storage tanks; and, (B) the comparison of emissions from VOCs stored in internal floating-roof tanks (IFRTs) with emissions from VOCs stored in external floating- roof tanks (EFRTs).

PART II - This part addresses the individual sources of VOC emissions from IFRTs and related factors: (A) floating decks (deck fitting and deck seams); (B) rim seal systems; and (C) product factor.

In PARTS I and II, where appropriate, API's findings and conclusions are compared to EPA's positions as found in the BID or proposed NESHAPS, both of which predated the completion of API's IFRT test program.

PART III - This part addresses the implications of permeation on quantifying benzene emissions from IFRTs.

PART IV - This part presents API's conclusions on the adequacy of all available information (including literature information and API's and EPA's data bases) for the regulation of emissions from benzene storage tanks.

PART I - TOTAL VOC STORAGE TANK EMISSIONS

A. VOC Emissions From Floating Roof Storage Tanks

API's calculations of total VOC emissions from IFRTs and EFRTs are based on the results of comprehensive API programs. API's work allows for the calculation

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1-API Post-hearing comments of the American Petroleum Institute on the Proposed National Emissions Standards for Benzene Storage Vessels, EPA Doc. DA-80-14.

of total VOC emissions from EFRTs by the use of API Publication 2517 and from IFRTs by applying the equations in Chapter 1 of the recently-revised API draft Publication 2519.

EPA's calculations of total benzene emissions from IFRTs and EFRTs are based solely on the results of its benzene test program.[1] API has identified reasons to question the results of EPA's benzene test program. These reasons were discussed in detail in API's August 1981 filing with the Agency, and included such issues as condensation under the rim seals, large air/product temperature differentials, and the use of data points taken under non-equilibrium conditions.

API's conclusion, in contrast to EPA's, continues to be that the EPA program does not provide an adequate data base from which to calculate total benzene emissions (or general VOL emissions) from IFRTs and EFRTs.

B. Comparative IFRT and EFRT Total Emissions

A comparison of the emissions from IFRTs, as calculated in the revised API Publication 2519, with those from EFRTs, as calculated from API draft Publication 2517, shows that emissions from EFRTs, with either mechanical shoe or liquid-mounted resilient filled primary seals and secondary seals, are approximately equivalent to or less than emissions from IFRTs.

EPA's assessment[2] of EFRT and IFRT emissions does not show an equivalency between the emissions from EFRTs with secondary seals and IFRT emissions. This assessment is based only on the results of EPA's benzene test program, which, as API has previously commented, may have been flawed by unaccounted-for technical difficulties. Further, EPA's assessment does not take into account either API's findings on emissions from EFRTs, as accepted by EPA in AP-42,[3] or the results of API's IFRT program.

API's conclusion is that, based on this inadequate assessment, the proposed NESHAP incorrectly requires the use of only IFRTs, such that existing EFRTs

1-Chicago Bridge & Iron Co. (CBI) "Measurement of Benzene Emissions from a Floating Roof Test Tank," EPA No. 68-02-2608 (May 1979). Hereafter called CBI/EPA Report.

2-BID p. 4-16.

3-AP-42, P. 4.3-13 (1981).

must be retrofitted with a fixed roof. However, based on API's data, EFRTs with secondary seals are equally effective in controlling benzene emissions.

PART II - INDIVIDUAL SOURCES OF AND FACTORS RELATED TO VOC EMISSIONS FROM IFRTS

API's new equations for IFRTs (in API draft Publication 2519) show total standing storage emissions to be the sum of the emissions from floating decks, including deck fittings and deck seams, and rim seals. The equations are based on API's analysis of the data developed in API's IFRT test program (Attachment III).

A. Floating Decks (Deck Fittings and Deck Seams)

API's test program provided the data necessary to determine the independent effects of deck fittings, deck seam types, and deck types. API developed specific emission factors for VOCs for a wide range of typical deck fittings (Attachment IV), together with estimates of the number of each type of fitting most commonly used in IFRTs. Specific emission factors for VOCs were also developed for deck seams (Attachment V), which are a function of seam type, i.e., bolted (applicable to any mechanically-joined seams) or welded. Neither the deck fitting nor deck seam emissions factors are a function of deck type, i.e., contact or non-contact.

EPA's test program did not allow for the determination of the independent effects of deck fittings, deck seam types, and deck types. As a result, EPA did not develop specific emission factors for deck fittings in the BID[1]; fitting losses were only considered as a part of total deck losses and, therefore, the contribution of fitting emissions to total emissions could not be independently calculated. EPA developed emission factors for total deck emissions which were a function of only deck type, i.e., contact or non-contact. These factors cannot be supported by EPA's data which is too limited to allow for the assessment of the effects of seam type versus deck type on deck emissions.

API, in contrast to EPA, found that the primary variable in deck emissions is deck seam type, not deck type. As a result, API concludes that the

1-Appendix C.

proposed NESHAPS incorrectly does not allow for the use of non-contact roofs for benzene storage.[1]

B. Rim Seal Systems (Attachment VI)

API's testing determined that rim seal emissions for a rim seal system with a liquid-mounted primary seal are approximately 50% lower than for a rim seal system with a continuous vapor-mounted primary seal. Also, emissions from rim seal systems which include a secondary seal are approximately 50% lower than from a system with a primary seal only.

EPA's assessment of the emission reductions associated with different primary seal types and with the use of secondary seals is based on data which do not allow for a complete comparison among all types of seal systems. Specifically, EPA's testing of only shingled seals (continuous vapor-mounted seals were not tested) results in EPA's ascribing to vapor-mounted seals in general higher emissions than would have been determined had EPA tested continuous seals. This results in an invalid comparison of emissions from liquid and vapor-mounted seals. Further, since EPA did not test a vapor-mounted primary seal without a secondary seal, EPA's data are not adequate to determine the effectiveness of the use of secondary seals with vapor-mounted primary seals.

API concludes that, based on its findings and the incompleteness of EPA's data base, the cost-effectiveness of different seal systems in the BID is incorrect.[2] Therefore, the requirements for liquid-mounted seals with secondary seals in the NESHAPS[3] is based on an incorrect cost-effectiveness calculation.

C. Product Factor (Attachment VII)

A product factor is included in API's emission-estimating equations for IFRTs to relate emissions measured from one type of stock to emissions from other stock types. A discussion of this factor is not directly related to EPA's proposed NESHAPS, since EPA does not include a product factor in the benzene emission equations developed from EPA's benzene test program as documented in its BID. However, it is raised here since it relates to a

1-§61.122(a)(i).

2-Section 4.3.

3-§61.122(a)(i).

primary finding of API's test program and it is relevant to one of API's General Conclusions, #3, PART IV.

Although EPA did not develop a product factor for benzene, it did develop a product factor of 10 for VOCs based on its benzene test program, the problems of which have been discussed earlier. This factor is found in AP-42.[1]

API's test program clearly demonstrated that a product factor of 1, rather than 10, is appropriate for VOCs in general.

PART III - THE IMPLICATIONS OF PERMEATION ON QUANTIFYING BENZENE EMISSIONS FROM IFRTS

The purpose of this part is to discuss the implications of benzene permeation on the quantification of total emissions from benzene storage tanks.

API's emission-estimating equations (in API draft Publication 2519) include emission factors for rim seals and deck fittings. These factors include the effects of permeation through seal materials by VOCs in general, although they do not contain a quantification of the independent contribution of permeation. Therefore, while the API equations adequately account for permeation from VOCs in general, they do not allow one to judge whether or not permeation from VOCs is a significant part of total emissions.

The question is, then, can these equations, which are applicable to VOCs in general, be applied to benzene? The reasons why the equations may not be applicable to benzene include the following:

(1) Limited API tests[2] and a review of the literature suggest that benzene may permeate materials used in rim seal systems and deck fittings at a significantly higher rate than other VOCs.

(2) There is no basic laboratory-type permeation rate data for benzene or other VOCs through the various seal materials used in IFRTs.

1-Section 4.3.2.3, p. 4.3-16.

2-CBI, "Testing Program to Measure Hydrocarbon Emissions from A Controlled Internal Floating Roof Tank," for the American Petroleum Institute, contract #05000, (March 1982) p. 107.

(3) Even if such data were available, one cannot directly relate laboratory-type permeation rate data through a single layer of material to the permeation rate through an entire rim seal system or deck fitting without specifically testing permeation through such systems.

(4) Even if relative permeation rates through rim seal systems or deck fittings were known, one could not directly apply such information, since the absolute value of the contribution of permeation to total emissions has not been quantified for benzene or any other VOC through any given rim seal system or deck fitting.

Based on the above points, although there is information to suggest that benzene permeation in IFRTs is higher than for other VOCs, there is no basis to conclude that permeation from benzene or VOCs in general, is, in fact, a significant part of total IFRT emissions; nor is there sufficient data to quantify total benzene emissions.

PART IV - GENERAL CONCLUSIONS

1. As API stated previously, the EPA data base is an inadequate basis to determine total benzene emissions from floating roof storage tanks or to assess the cost-effectiveness of alternative control techniques to reduce emissions.

2. The API data base provides comprehensive information on IFRT emissions from VOCs in general, such that qualitative conclusions can be drawn with regard to an assessment of emission control alternative for benzene storage tanks. However, it does not provide the supplemental information on permeation necessary to quantify the contribution of permeation to total benzene emissions from IFRTs.

3. Taking into consideration both EPA's and API's data bases, total benzene emissions from storage tanks or the cost-effectiveness of control alternatives cannot be calculated unless (1) it is assumed that benzene permeation does not significantly contribute to total emissions, or (2) additional experimental data is developed to quantify the contribution of permeation through IFRT rim seal systems.

(1) If the benzene permeation rate is assumed to be insignificant, then API Publications 2519 (draft) and 2517 can be directly applied to determine total benzene emissions from storage tanks and to evaluate the cost-effectiveness of control alternatives. In applying the API publications, a product factor of 1 should be used, as discussed in PART II-C.

(2) If additional data on permeation is developed, then that data should be used in conjunction with API Publications 2517 and 2519 (draft) to determine total benzene emissions from storage tanks and to evaluate the cost-effectiveness of control alternatives.