

Response to Comments on Proposed Revisions to AP-42
Chapter 7, Section 7.1 – Organic Liquid Storage Tanks
November 20, 2019

Commenter 1: John L. Henkes, New York State Department of Environmental Conservation

Comment: “Are there any conclusions as to the magnitude (+ or -) these changes will have on emission estimation?”

Response: EPA notes the variability of the magnitude (+ or -) of the changes to Chapter 7 Section 7.1 is dependent upon each Tank scenario.

Comment: “Is there any guidance on past TANK 4 estimations? Is there an urgency in recalculating emission estimations from the current 7.1 or TANKS program?”

Response: EPA acknowledges and appreciates the comment. However, comments on issuing guidance on TANKs 4.09d are outside the scope this proposal. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory entities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.

Commenter 2: Renu M. Chakrabarty, West Virginia Department of Environmental Protection, Division of Air Quality

Comment: “EPA has not provided sufficient characterization what the proposed changes are, and their expected impact, to allow for informed comment and feedback. A summary of which pollutants are changing, under which scenarios, and how (increasing or decreasing) would have provided the regulated community, regulators and the public with sufficient information to determine whether additional review or comment would be warranted. The absence of any characterization of the changes and their expected impact leaves only those with specialized knowledge of the algorithms and operating scenarios, and the resources to run them, with any way to know what the changes may be, in order to then comment on them with credibility.”

Response: EPA disagrees with the commenter that EPA has not provided sufficient documentation on the proposed changes. The “proposed revisions summary” posted to the EPA website along with the proposed Chapter 7.1 itself contains detailed descriptions of the proposed changes and includes tables illustrating the differences resulting from the revised equations for numerous scenarios

[https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42 Chapter 7 section 7-1 revisions summary.pdf](https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42_Chapter_7_section_7-1_revisions_summary.pdf).

Also, the redline markup that was also posted to the EPA website shows the differences in estimated emissions for the example cases worked within Chapter 7.1. However, at this time it’s not feasible to work out quantitative comparisons for every imaginable scenario.

[https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42 Chapter 7 section 7-1 revisions redline.pdf](https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42_Chapter_7_section_7-1_revisions_redline.pdf)

Commenter 3: Dale Wells, Colorado Department of Public Health and Environment, Air Pollution Control Division

Comment (in reference to section 7.1.3.5): “Flashing Loss is a new section on estimating flashing emissions. The section refers to pressurized liquid sampling, but does not describe it, nor how to analyze a pressurized liquid sample. Pressurized liquid sampling is used to determine the rate of flash emissions and to design controls, but is fraught with problems. Noble Energy entered into a consent decree with EPA, DOJ and the State of Colorado that in part resulted in a study "Pressurized Hydrocarbon Liquids Sampling and Analysis Study Data Assessment and Analysis Report" that can be found here: https://jointagreement.noblecolorado.com/wp-content/uploads/2018/05/SPL_PHLASStudy_Final-Report_020718.pdf. This document lists the difficulties in pressurized liquid sampling and analysis and makes recommendations about how to perform and use the results of such sampling. This work should be integrated into AP42.”

Response: EPA acknowledges not all State agencies agree on a specific method for pressurized liquid sampling. The EPA does not preclude the use of a specific methodology a State or Local agency might want to use. EPA believes that methods for taking and analyzing a pressurized liquid sample are beyond the scope of AP-42. The EPA will provide clarity by removing the methodology discussion for estimating flashing losses and provide a statement that guidance for estimating flashing losses is beyond the scope of this section.

Commenter 4: Khal Rabadi

Comment: “[For the] fixed roof tanks equation 1-37 for calculating N (number of turnovers), can you please include a comment when using horizontal storage tanks? Currently, you have equation 1-37 as follows:

If ΣH_{QI} is unknown, it can be estimated from pump utilization records. Over the course of a year, the sum of increases in liquid level, ΣH_{QI} , and the sum of decreases in liquid level, ΣH_{QD} , will be approximately the same. Alternatively, ΣH_{QI} may be approximated as follows:

$$\Sigma H_{QI} = (5.614 Q) / ((\pi/4) D^2)$$

In the case of the horizontal storage tank, is it accurate to use D_E for D ? [Where] D_E is calculated [via] equation 1-4:

$$D_E = \sqrt{\frac{LD}{\pi}} .”$$

Response: EPA agrees with the commenter that D_E should be used in equation 1-37 for horizontal tanks. We will incorporate language for D_E below equation 1-37.

Comment: “In the comments on calculating HLX and HLN (for calculating N using annual sum of liquid increases), you provided a comment when the tank is horizontal storage tank, but you described the diameter for the horizontal tank as D_H , shouldn’t this be D_E ? There is no reference to D_H in the document other than in this place.”

[from [AP-42 Chapter 7, Section 7.1 proposed revisions: Organic Liquid Storage Tanks](#).]

N = number of turnovers per year, dimensionless

$$N = \Sigma H_{QI} / (H_{LX} - H_{LN}) \text{ (equation 1-36)}$$

ΣH_{QI} = the annual sum of the increases in liquid level, ft/yr

If ΣH_{QI} is unknown, it can be estimated from pump utilization records. Over the course of a year, the sum of increases in liquid level, ΣH_{QI} , and the sum of decreases in liquid level, ΣH_{QD} , will be approximately the same. Alternatively, ΣH_{QI} may be approximated as follows:

$$\Sigma H_{QI} = (5.614 Q) / ((\pi/4) D^2) \text{ (equation 1-37)}$$

5.614 = the conversion of barrels to cubic feet, ft³/bbl

Q = annual net throughput, bbl/yr

H_{LX} = maximum liquid height, ft

If the maximum liquid height is unknown, for vertical tanks use one foot less than the shell height and for horizontal tanks use $(\pi/4) D_H$ where D_H is the diameter of the horizontal tank

H_{LN} = minimum liquid height, ft If the minimum liquid height is unknown, for vertical tanks use 1 and for horizontal tanks use

Response: The EPA agrees with the commenter and will remove the subscript H to read "...D where D is the diameter of a vertical cross-section of the horizontal tank.

Comment: "[For the] net working loss throughout equation 1-38, can you please provide a description/comment when using this equation for horizontal storage tanks? Is it accurate to use D_E for D when calculating VQ [via equation 1-38]:

$$VQ = (\Sigma H_{QI})(\pi/4) D^2 \text{ ?}"$$

Response: Yes, D_E should be used in equation 1-38 for the net working loss throughput. This will be addressed below equation 1-38.

Comment: "[For Section 7.1.3.8.1 Time Periods Shorter than One Year], what is the best way to handle material change in the middle of the month when doing monthly calculations. Should we calculate for the full month twice (first time with Material A and second time for material B) or split the calculation into two?

Response: For periods shorter than a month, each material must have a separate monthly calculation. However, the tank results should be prorated based upon the number of days during the month the tank is in service.

Comment: "[For Section 7.1.3.8.1 Time Periods Shorter than One Year], reference to K_N equation should be added in this section, so if we are calculating monthly emissions, N will become number of turnovers per month. Since this section reference other situations when doing monthly calculations, we believe this one (K_N calculation) should be included as well."

Response: The EPA agrees with the commenter and will provide the following statement in 7.1.3.8: "The turnover factor in the working loss equation for fixed roof tanks would need to be extrapolated to an annual rate when estimating emissions for a time period other than one year. This would be done by dividing the number of turnovers during the given time period by the number of days in the time period and then multiplying by 365."

Comment: "Should equation 3-5 be applicable to Domed External Floating as well? If yes, please add."

Response: The EPA agrees with the commenter and will edit the text to include domed external floating roof tanks as well.

Commenter 5: Janet L. Greenberg, GREEN Environmental Consulting, Inc.

Comment: “There are mentions of using Distillate Flooding in the text, accompanied by a statement that the vapor space will equilibrate with the new liquid heel within 24 hours. Is this time frame based upon a certain tank size? That is, if we are using distillate flooding with a relatively small tank, is there a rule-of-thumb for a lesser time frame in which we could begin cleaning and presume that the vapor space has equilibrated?”

Response: **Test results from comparing the time frame for the vapor space to reach equilibrium after a diesel flush in a small vs. a larger tank were determined to be similar.**

Comment: “[The following] statement is being removed, regarding Constant Level Tanks: *‘Alternatively, a default turnover rate of four could be used based on data from these type tanks.’* Has it been found to be unacceptable? Was there originally a basis for the assumption of 4 turnovers, based upon calculation assumptions? We have used this for many years for constant level wastewater surge tanks and feel that the more extensive calculation procedure may be inappropriate for such tanks. We typically choose a likely floating organic that could accumulate on top of the wastewater, then assume the vapor space is 100% saturated with that organic, at 4 turnovers per year.”

Response: **The EPA is concerned the default of four turnovers per year is subjective when there is a significant amount of variability in a “constant level tank” and the effective number of turnovers per year. Therefore, the EPA has deemed this default factor as inappropriate and it has been removed.**

Commenter 6: Madison Miller, Oklahoma Department of Environmental Quality, Office of General Counsel

Comment: “ODEQ recommends the meteorological data (TAX, TAN, V, I, PA) for selected U.S. locations in Table 7.1-7 be updated. The current reference for the meteorological data in Table 7.1-7 is the 30-year averages for the years 1961 through 1990. This data has been updated and is available. The Comparative Climatic Data publication is available at: <http://www.ncdc.noaa.gov/data-access/quick-links#ccd> and contains data for the 30-year official Climate Normals period (1981-2010).”

Response: EPA agrees with the commenter and has updated Table 7.1-7 and the examples supporting the table. It should also be noted a State agency can specify their own meteorological data to be used within their jurisdiction.

Comment: “There is an error in the references for Table 7.1-7. The reference for the new Table 7.1-7:

References 22. Data for this table are 30-year averages for the years 1961 through 1990, prepared by the National Renewable Energy Laboratory and distributed by the National Climatic Data Center. Similar historical averages of meteorological data from nearby National Weather Service sites or site-specific data may also be used.

However, Reference 22 is as follows:

Evaporative Loss Reference Information and Speciation Methodology, Manual of Petroleum Measurement Standards, Chapter 19.4, Third Edition, Addendum 2, American Petroleum Institute, Washington, D.C., June 2017.

The reference should have remained the same - References 13 and 14:

13. Comparative Climatic Data Through 1990, National Oceanic and Atmospheric Administration, Asheville, NC, 1990.

14. National Solar Radiation Data Base, 1961-1990, prepared by National Renewable Energy Laboratory, Golden, CO, distributed by National Climatic Data Center, Asheville, NC, September 1992.”

Response: Table 1.1-7 and the associated reference has been updated to reflect newer data.

Comment: “In the Laboratory GOR section of Section 7.1.3.5 it states that 379.48 is the SCF per pound-mole at standard conditions. However, this is not the value for EPA standard conditions it is the value for API standard conditions. This should be noted in the calculations since the GOR is typically determined at the API standard conditions.”

Response: EPA will remove the discussion of methodologies in Section 7.1.3.5 for estimating flashing losses and will add a statement “that specific guidance estimating flashing losses is beyond the scope of this section”.

Comment (in reference to K_N – turnover factor, dimensionless): “It should be noted that when a tank is vapor balanced that the saturation factor predicted using the equation K_N should remain set equal to one (1) no matter what the specific throughput is. Also, for crude oil/condensate storage tanks where flashing does occur shouldn’t the turnover saturation factor be set equal to one (1) because the tank is already filled with hydrocarbon vapors?”

Response: The EPA agrees with the commenter and has added the following statement: , “for tanks that are vapor balanced and tanks in which flashing occurs, $K_N = 1$ regardless of the number of turnovers”.

Comment (in reference to K_P – working loss product “saturation” factor, dimensionless): “It should be noted that the value for K_P for lower MW crude oils or higher API gravity “light” crude oils should not be assigned the same value as the value for “heavy” crude oils with RVP 5 of 0.75. Condensate and “light” crude oils should be assigned a value of one (1). Also, for crude oil/condensate storage tanks where flashing does occur shouldn’t the product saturation factor be set equal to one (1) because the tank is already filled with hydrocarbon vapors?”

Response: The EPA disagrees with the commenter. No underlying data/references were provided by the commenter to justify these changes.

Comment: “There should be additional crude oil specifications noted within Section 7.1 because the crude oil speciation for crude oil RVP 5 is not representative of all crude oils. As identified in 40 CFR Part 98, Subpart W, there should be at least two designations for crude oil “heavy” (API gravity < 20) and “light” (API gravity ≥ 20). There should also be at least one specification for condensate (crude oil with API gravity > 40/50).”

Response: The EPA acknowledges the comment provided. However, AP-42 Chapter 7.1 only addresses a limited amount of default properties for certain stocks. We do not plan on updating the properties of every stock that could be stored in storage tanks.

Comment: “Emissions from produced water (oily water) storage tanks should be addressed.
a. Working and breathing emissions should be calculated based on the upper or lighter layer of separated liquids (crude oil/condensate).
b. Saturation based on amount of time needed for separation to occur.

Response: The EPA will add the following sentence: “Tanks containing aqueous mixtures in which phase separation has occurred, resulting in a free layer of oil or other volatile materials floating on top of the water, should have emissions estimated on the basis of the properties of the free top layer.” Saturation based on the amount of time needed for separation to occur involves short-term phenomena that are not addressed in this guidance.

Comment: “The [following comments are regarding] EOS process simulation programs:
a. The section on computer simulation modeling should address in some fashion the

different equations of state (EOS) (i.e. Peng-Robinson (P-R), API modified P-R, company modified P-R, etc) and which is more appropriate for use in calculating emissions. 40 CFR Part 98 relies on the P-R EOS.

b. Address issue of EOS in overestimating the lower MW (C₁-C₃) component carryover in the liquids rather than estimated as being emitted.

c. Address limitations of the computer simulation models such as being valid only under equilibrium conditions and the inability of simulation to take into account undersized equipment or physical limitations leading to non-equilibrium conditions.

d. Use of site-specific data or from the latest available analysis that is representative of crude oil or condensate from the sub-basin category for production or from the county for gathering and boosting.”

Response: EPA will remove the discussion of methodologies in Section 7.1.3.5 for estimating flashing losses and will add a statement “that specific guidance estimating flashing losses is beyond the scope of this section”.

Commenter 7: Patrick Ryan

Comment: “The formula for KE using equations 1-5, 1-12 and 1-13 are consistent for diesel but the value from eq 1-5 is about 10 times more than from 1-12 and 1-13 for gasoline. I request eqs. 1-12 and 1-13 be deleted as they do not have universal applicability.”

Response: The EPA disagrees with the commenter. Section 7.1 clearly states that Equations 1-12 and 1-13 may be used if the liquid stored in the fixed roof tank has a true vapor pressure less than 0.1 psia. One should not apply Equations 1-12 or 1-13 to gasoline. The guidance in Section 7.1 specifies the vapor pressure of gasoline is significantly above the stated limit of 0.1 psia for use with these equations. However, just because the equations do not have a universal applicability does not mean that the equations should not be included in Section 7.1. These equations are still useful and appropriate under the conditions stated in Section 7.1.

Comment: “I built a second scenario [using Microsoft Excel] involving a tank with a fixed length and width. The value of K_s is 2x as high for a horizontal as compared to a vertical fixed roof tank with the same vapor space volume inside. This is not a physically intuitive result. Nor, do I believe it is physically correct. I think some effort in fixing this spurious outcome needs to be made.”

Response: EPA disagrees with the commenter. K_s is a function of the height of the vapor space, due to stratification of vapors. There is an inverse relationship between K_s and the height of the vapor space. A cylinder having a length greater than its diameter will have less height when positioned horizontally as compared to being positioned vertically. Because the vapor space is typically assumed to be about half the height of the tank, when the tank is positioned horizontally, the tank will also have less vapor space than when the tank is positioned vertically. As a result, those cylinders positioned horizontally would be expected to have an increased value for K_s .

Commenter 8: Allen Hatfield, Mitchell Scientific, Inc.

Comment: “The vapor space volume, V_v , and vapor space height, H_{v0} , are two variables that are calculated when determining the breathing emissions from a fixed roof storage tank. When the storage tank is a vertical cone top or dome top vessel then the calculation of V_v and H_{v0} take into account the liquid level that exist in the storage tank. On the other hand, when V_v and H_{v0} are calculated for a horizontal storage tank, then the liquid level in the storage tank are not taken into consideration. Instead, only the dimensions of the horizontal storage tank are taken into account and not the actual liquid volume that is being stored. For this reason, the breathing losses for the horizontal storage tank will be calculated to be the same whether the vessel is almost empty or almost full. An improved approach for calculating the vapor space volume, V_v , and vapor space height, H_{v0} , in a horizontal storage tank is being submitted for your review and consideration. The existing approach that is contained in Chapter 7.1 (and earlier Chapter 7.0) for the horizontal storage tank calculations takes into account only the tank dimensions and ignores the actual liquid level height when calculating V_v and H_{v0} which can result in significant calculation errors. The methodology proposed provides a much more accurate approach for calculating V_v and H_{v0} for a horizontal fixed roof tank than the approach described in the proposed rule.”

Response: The EPA disagrees with the commenter. We understand a given tank may have a liquid level above or below the half/full level at a given point in time. However, the equations are not intended for calculating short-term emission rates. The equations were developed for estimating annual emissions. Over an extended time period, a tank will on average be half full. In AP-42 Section 7.1.3.8.1, EPA discusses multiple reasons why the methodology currently in AP-42 Chapter 7.1 is not appropriate for estimating short-term emission rates. The issue of the liquid level is addressed in paragraphs (k) and (l) of Section 7.1.3.8.1. In addition, Chapter 7.1 indicates the liquid height for vertical fixed-roof tanks is typically assumed to be at the half-full level. For a horizontal tank, the text indicates an assumption that the vapor space height is half the effective height of the tank, thereby similarly imposing an assumption of a half full tank as the typical condition.

Commenter 9: Cary Secret, EPA Office of Enforcement and Compliance Assurance, Air Enforcement Division

Comment: “Regarding references to ASTM D 2879 (for measuring the true vapor pressure of low pressure liquids), Note 2 on page 7.1-24 has the following correct statement: *‘Vapor pressure is sensitive to the lightest components in a mixture, and the de-gassing step in ASTM D 2879 can remove lighter fractions from mixtures such as No. 6 fuel oil if it is not done with care (i.e. at an appropriately low pressure and temperature). In addition, any dewatering of a sample prior to measuring its vapor pressure must be done using a technique that has been demonstrated to not remove the lightest organic compounds in the mixture. Alternatives to the method may be developed after publication of this chapter.’* However, D 2879 is referenced much later, on page 7.1-87, without the above cautionary note. I suggest that the note be included there, as well.”

Response: EPA agrees with the commenter and will add a sentence to Figure 7.1-14a noting the cautionary message as well.

Comment: “At the end of Note 2 it would be useful to include a statement to inform that ASTM has balloted method D 2879 for removal, with no replacement, because an industry study showed that the analytical precision is not acceptable. Note 2 could be amended as follows: *‘Vapor pressure is sensitive to the lightest components in a mixture, and the de-gassing step in ASTM D 2879 can remove lighter fractions from mixtures such as No. 6 fuel oil if it is not done with care (i.e. at an appropriately low pressure and temperature). In addition, any dewatering of a sample prior to measuring its vapor pressure must be done using a technique that has been demonstrated to not remove the lightest organic compounds in the mixture. In addition, in July 2017 ASTM balloted to remove the method due to inadequate analytical precision with no plans to replace it at the time.’*”

Response: The EPA appreciates the comment by the user. However, the balloting process for removing ASTM D2879 did not pass and, therefore, the standard is still active. In addition, the EPA will provide a cautionary statement to Note 2 stating: “Caution should be exercised when considering ASTM D 2879 for determining the true vapor pressure of certain types of mixtures.”

Commenter 10: Richard A. Anderson, Plains All American Pipeline, LP

Comment: “Is there any possibility that a new version of the TANKS program will ever be developed and offered by EPA? Since the early days of AP-42, this methodology has grown increasingly complicated (as evidenced by the fact that the draft version is approximately 196 pages, the 11/06 version is 123 pages, and the 9/85 version was only 35 pages). If regulated entities are forced to write their own spreadsheets or other applications to perform these calculations, it will raise the possibility of agencies questioning the correctness of our implementation and require us to expend additional effort to demonstrate correctness. This has rarely, if ever, been an issue when using the TANKS program.”

Response: **The EPA appreciates the users comment. However, this proposal does not address the TANKS 4.09d model and is beyond the scope of this project.**

Comment: “The recommendation of one or more methods for estimating emissions of hydrogen sulfide (H₂S) from crude oil, when the concentration is known in the liquid phase, would be extremely helpful. While H₂S probably doesn’t obey Raoult’s Law generally, it appears that Raoult’s Law probably gives reasonable estimates when H₂S is present in crude oil at the ppm level. An undated paper coauthored by staff of the Texas Air Control Board (TACB) and Waid & Associates recommended a Kvalue approach, but the only K-value referenced was for one specific grade of crude, so the usefulness of this approach may be limited. (TACB ceased to exist in September 1993, so this document is at least 25 years old.) The use of process simulation software is not convenient for most people and may not be available at all to facilities that do not involve chemical processes, such as storage facilities and terminals.”

Response: **The EPA thanks the user for the comment. However, the EPA is unaware of this methodology for estimating H₂S emissions from crude oil. We would be open to reviewing documentation that supports the methodology if it’s provided to the EPA and to take it into consideration.**

Comment: “The footnote to Table 7.1-7, Meteorological Data, indicates that the values presented represent 30-year average values from 1961 to 1990. This is the same time period indicated for the meteorological data in the current version of Section 7.1 (dated 11/06), as well as the dataset in the TANKS program, yet the monthly and annual average temperature data do not match. Is this the correct time period for the data set, or is a newer dataset presented in the draft document?”

Response: **The meteorological data in Table 7.1-7 have been updated to reflect a newer dataset from the National Solar Radiation Database.**

Commenter 11: Eugene Kang, South Coast Air Quality Management District

Comment: “The EPA website states that the TANKS model was developed using a software that is now outdated and that the EPA can no longer provide assistance to end-users. If the EPA is not planning to update TANKS 4.09, will other tools or resources that incorporate the proposed changes be made available to government agencies and the public? Is EPA aware of any other free, publicly available tools?”

Response: **This proposal does not address the TANKS 4.09d model and is beyond the scope of this project. It's possible a third party has developed a program that can compute those results, but as a Federal Agency, we're unable to endorse any products developed by an outside entity.**

Comment: “Various SCAQMD [South Coast Air Quality Management District] programs, including permitting of storage tanks and checking calculations for emissions reporting and inventory, rely on the current version of AP-42 Chapter 7, Section 7.1 and U.S. EPA TANKS 4.09 software. There are also federal and state programs for GHG emissions that reference 40 CFR Chapter 1, Section 98.253(m)(1) which call for the use of the subject AP-42 section or TANKS when calculating emissions. Given all of this, has the EPA had discussions with other state and local regulatory agencies regarding how the proposed changes would impact their existing programs (e.g., changes to PTE calculations - NSR, annual emissions reporting, emission inventories for AQMPs and GHG, etc.)? Would programs and associated emission inventories need to be retroactively updated to reflect the proposed changes to emission calculations?”

Response: **The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.**

Comment: “Based on the sample calculations provided in Appendix B, it appears that using revised defaults for average liquid surface temperature and vapor space temperature will result in approximately a 5%-10% difference in emissions when compared to using prior defaults. Can the emission impacts for each proposed change or addition be explained quantitatively? If so, can EPA share the range of percent changes in emissions for other revised and new defaults/equations (e.g., flashing losses, liquid surface temperatures for various steel tanks, insulated tanks, net and pump throughputs, etc.)?”

Response: **The EPA believes we've already addressed the commenters concerns. The “proposed revisions summary” posted to the EPA website along with the proposed Chapter 7.1 itself contains detailed descriptions of the proposed changes and includes tables illustrating the differences resulting from the revised equations for numerous scenarios. https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42_Chapter_7_section_7-1_revisions_summary.pdf**

Also, the redline markup that was posted to the EPA website shows the differences in estimated emissions for the example cases worked within Chapter 7.1.

[https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42 Chapter 7 section 7-1 revisions redline.pdf](https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42_Chapter_7_section_7-1_revisions_redline.pdf)

Additional scenarios would have to be addressed on each individual case.

Comment: “As noted in the background section for revised temperature equations, new and revised equations more accurately reflect theoretical derivations due to no longer using approximations because of the accessibility of computers. A variety of instrumentation types are available to measure actual pollutant concentrations and may shed light on emissions coming from tanks. Have the theoretical derivations for existing, revised, and newly proposed equations been compared against actual measurements using modern monitoring technology?”

Response: The EPA appreciates the comment provided. However, we are not currently aware of modern monitoring technology of annual emissions from storage tanks that could be compared with the current AP-42 methodology.

Comment: “In the 2006 version of Section 7.1, no distinction was made between inner and outer tanks diameters in emission calculation equations. Similar to the default value of 0.5 used for Tank Height-to-Diameter ratio (H/D), this assumption seems to be due to the tendency to simplify the calculations which is unnecessary now with the present proliferation of computers. The proposed changes, such as requiring H/D to be calculated for vapor space temperature calculations and liquid levels increases and decreases to be used for working loss emission calculations as opposed to tanks throughputs, can be another reason for the need for this distinction in the calculation. The diameter used to calculate the H/D, which is used to account for tank’s surface solar absorption, appears to refer to the outer diameter and should consider the inner diameter when calculating a tank’s vapor space, turnovers, and liquid level increases and decreases. This does not appear to be discussed or incorporated in the proposed equations of Section 7.1. Is there guidance that EPA can point to for this?”

Response: In most scenarios, the difference between the use of the inner tank diameter and the outer tank diameter is insignificant. The table on page 16 of the “Proposed Revisions Summary” ([https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42 Chapter 7 section 7-1 revisions summary.pdf](https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42_Chapter_7_section_7-1_revisions_summary.pdf)) shows that the estimated emissions are not sensitive to minor differences in the H/D ratio.

Comment: “On page 7.1-32, it is assumed that all external floating roof tanks only have welded decks. What is the source of this assumption?”

Response: The assumption that all external floating roof tanks only have welded decks is based on discussions with tank owners and tank/floating roof manufactures.

Comment: “It is not always clear when to use the actual diameter or the effective diameter (D_e) for horizontal tanks (i.e., not clear that the text always notifies the reader when D_e should be

substituted for D). For example, in Equation 1-37 (page 7.1-26), should the actual diameter be used or the effective diameter? Also, see Example 2 (page 7.1-158), where D_e is estimated and used in estimating V_v , but not used to estimate H_{vo} .”

Response: The DE should be used in Equation 1-37 and Equation 1-38 for horizontal tanks. A clarifying note will be added below each of the equations. Furthermore, an additional clarifying statement will be added below Equation 1-15 stating:

“where:

D = diameter of a vertical cross-section of the horizontal tank, ft”.

Comment: “The variable S appears to be used for both the “saturation factor” and the “filling saturation factor”. In Equation 3-18 (page 7.1-41), the “filling saturation factor” is defined as the variable S. However, in the discussion of Equation 4-2, the text on page 7.1-48, the “saturation factor” is defined as the variable S. In Table 7.1-17 (page 7.1-142 of the June 2018 version), the “saturation factor” is defined as S for the Ks condition in the second row, and the “filling saturation factor is defined” as S in the last row of the table. In Table 7.1-20 (page 7.1-145), the “saturation factor” is defined as S and the “filling saturation” is only represented by a constant. The variable S should be used consistently. It may be helpful to rename to the filling saturation factor the filling saturation constant in addition to using a different variable to prevent confusion.”

Response: The EPA will reduce confusion by adding “filling saturation factor” at each reference to the S variable.

Comment: “Page 7-1-41 includes the statement *‘This equation [3-18] accounts for the arrival losses and the generated losses.’* This statement is confusing, because it could be interpreted that the emissions estimated using this equation includes both arrival and generation losses. The text should state that the equation should be used to estimate arrival losses, then used again to estimate generation losses.”

Response: The EPA will reduce confusion by updating the sentence to read: “This equation should be used to estimate arrival losses, then used again to estimate generation losses.”

Comment: “The internal floating roof tank with liquid heel and external floating roof tank with liquid heel subsections of Section 7.1.3.3.2 (pages 7.1-41 and 7.1-42) do not adequately detail that both arrival and generation losses should be estimated. There is no mention of arrival and generational losses in the internal floating roof tank with liquid heel subsection. The external floating roof tank with liquid heel subsection only mentions arrival losses. References to Tables 7.1-17 and 7.1-18 in the text should be added to the subsections for further clarification.”

Response: The EPA will reference Table 7.1-17 and Table 7.1-18 in section 7.1.3.3 to reduce confusion.

Comment: “On page 7.1-37, it states that Ks should be *‘assumed to be less than or equal to the saturation factor during filling (labeled S).’* It is assumed that the saturation factor during

filling is the “filling saturation factor” not the “saturation factor” function (i.e., $C_{sf} \times$ “filling saturation factor”). This is also not clear in Table 7.1-17. However, if the limit for K_s is the saturation factor function ($C_{sf} \times$ “filling saturation factor”) not the “filling saturation factor” by itself, then there would be an issue of circular references. The saturation factor function is $0.6 \times C_{sf}$ or $0.5 \times C_{sf}$ depending on the liquid heel, and C_{sf} as defined by Equation 3-21 is estimated using K_s and S , where K_s is equal or greater than the saturation factor (i.e., equivalent to the saturation factor), which would result in circular references.”

Response: The EPA will address this comment by changing the text from ‘saturation factor during filling’ to ‘filling saturation factor’.

Comment: “The text on page 7.1-38 states that ‘*assuming that the stock properties included in the vapor pressure function (P^*) will adequately account for differences in liquid product type, K_c is assumed to equal 1.*’ How can the user know when the vapor pressure function will adequately account for differences in liquid product type since the vapor pressure function is estimated by Equation 2-4? Is there a range where this is valid? Is the only exception to the case crude oil? The text quoted above provides background for simplifying Equation 3-8 into Equation 3-10. However, Equations 2-3, 2-13, 2-18 also include both the vapor pressure function and K_c , but prescribe using 0.4 as K_c for crude oils and 1.0 as K_c for all other organic liquids. If the only exception is crude oil, then consistent guidance should be given.”

Response: The specified K_c value for crude oil of 0.4 in Equations 2-3, 2-13, and 2-18 was developed for estimating emissions from tanks while the floating roof is floating. However, for Equation 3-8, the floating roof is landed and because it is not known if the K_c factor for the floating condition is appropriate for the landed condition, the conservative value of 1.0 was assigned.

Comment: “Since laboratory testing, computer simulation modeling, or direct measurement is required in Section 7.1.3.5 (page 7.1-51) to estimate flashing losses, guidance should be provided for when flashing losses should be expected.”

Response: The circumstances under which flashing losses could be expected are described in Section 7.1.3.5. The EPA will provide clarity by removing the methodology discussion for estimating flashing losses and provide a statement that guidance for estimating flashing losses is beyond the scope of this section.

Comment: “In Section 7.1.3.8.2 Internal Floating Roof Tanks with Closed Vent Systems (page 7.1-56), is the five percent reduction applied to the total loss (i.e., both breathing and working losses) or only to either the breathing or working loss? If the second case, does it apply to the breathing or working loss?”

Response: The 5% reduction for internal floating roof tanks which have a closed pressure/vacuum vents pertains to the total estimated emissions. EPA will add this note to Section 7.1.3.8.2.

Comment: “In Example 5, on page 7.1-182, the saturation factor function ($C_{sf} \times S$) for arriving vapors is the $C_s \times S$ for the landed roof – the saturation factor for generated vapors (0.15 as defined in Section 7.1.3.3.2 for drain dry tanks with gasoline). The procedure used in Example 5, does not seem to be clear from the text in Chapter 7.1. It is also not clear how the user should estimate the saturation factor for generated vapors for non-gasoline products, since the methodology referred to in AP-42 Chapter 5 (Equation 3 of Chapter 5) only mentions crude oil and gasoline (i.e., does not state if Equation 3 of Chapter 5 can be used for non-crude oil products).”

Response: EPA will modify the text to state “The resulting saturation factor of 0.15 is applied as the filling saturation factor for drain-dry tanks regardless of the stored liquid”.

Comment: “In Example 5, step 10.a. (page 7.1-183), the stock molecular weight used is 66 lb/lb-mole. It should be 68 lb/lb-mole since the tank is refloated with gasoline with an RVP of 7 (see Table 7.1-2).”

Response: This is an alternative value in the absence of measured data. Please note the value of 66 lb/lb-mole is specified in the footnote (e) to Table 7.1-2.

Comment (in reference to Table 7.1-4): “It is not clear what the ‘condition’ column in Table 7.1-4 means. The column appears to present S_b and liquid height equations.”

Response: EPA will remove the heading “Condition” to prevent any confusion.

Comment (in reference to Table 7.1-4): “It is not clear that facility representatives would know the slope of the cone on the bottom of a tank. Is there a default value that can be used like the default slope for coned roofs of 0.0625 ft/ft given for use in Equation 1-8)? In general, the slopes of cones of tanks do not seem to be information that facility representatives typically have or use. It seems that using the shell diameter and height or depth of the cone in equations might make them more understandable to facility representatives.”

Response: EPA appreciates the comment provided. However, we are unaware of a default slope for tank bottoms.

Comment (in reference to Table 7.1-4): “The terminology is also inconsistent with the text of Chapter 7.1. The height of liquid at the tank shell (h_l) seems to be the height of the liquid heel. Is this correct?”

Response: EPA will clarify the terminology by adding Figure 7.1-23 and 7.1-24.

Comment (in reference to Table 7.1-4): “It is not clear that the expressions for height of the vapor space for the partial liquid heel is valid for both cone up and cone down conditions. It seems like both cone up and cone down conditions could result in a partial liquid heel; therefore, equations for both conditions should be presented.”

Response: Thank you for your comment. EPA believes the cone up and cone down conditions are already addressed in Table 7.1-4 under “Slope convention” where it’s positive for cone down and negative for cone up.

Comment (in reference to Table 7.1-4): “It is not clear that the volume of the heel would be known or calculated by the facility representatives for the partial liquid heel. Equations for estimating the volume of the heel should be provided for various conditions (e.g., cone up, cone down, liquid at sump level, liquid above sump level, etc.)”

Response: The EPA will add an equation to Table 7.1-4 for estimating the volume of a partial heel.

Comment (in reference to Table 7.1-4): “A clear definition for ‘slight cone-up’ should be provided. For example, cone composes less than 10 percent of the liquid surface. It is also not clear how facility operators would know this information or be able to estimate this information.”

Response: Thank you for your comment. In a footnote, EPA will provide the following clarification: “a slight cone-up bottom may have an upward slope on the order of 1:120.”

Comment (in reference to Table 7.1-4): “Since floating roof tanks are typically very large in volume, does assuming all tanks are flat bottom with a full liquid heel for roof landing and floating roof tanks result in landing or cleaning emissions that are outside of the range of emission estimate values (i.e., estimated emissions \pm error)? Since the vapor space estimates for landing and cleaning are both based on Table 7.1-4 (which means that the vapor space is the same before and after cleaning), it seem as though the emission calculations might also not warrant adjusting for partial liquid heel vapor space differences (i.e., assuming all tanks are flat bottomed with a full liquid heel).”

Response: The EPA disagrees with the commenter. EPA believes the differences between partial and full liquid heel are too big to disregard, and thus the heel type and bottom must be accounted for to determine the emissions during floating roof landing. The depth of the liquid heel determines the height and volume of the vapor space and has a direct impact on the estimated emissions in floating roof landings. See Equation 3-4 as an example. In a 100-foot diameter tank, a partial heel may have an emissions limit on the order of 600 pounds based on the amount of volatile material remaining in the tank, whereas a full liquid heel with a height of one foot may have a limit on the order of 350,000 pounds.

Commenter 12: Matthew Hite, GPA Midstream Association

Comment: “GPA Midstream suggests EPA evaluate the overall organization of the document. Some examples of such improvement opportunities are as follows: remove ‘Section 7.1.1.1 Scope’ as it is unnecessary and inconsistent with the format of other Chapters of AP-42, align figures with sections of narrative where it makes sense (for example, Section 7.1.2.1 Fixed Roof Tanks on page 8 would be prime territory to place Figure 7.1-1 Typical fixed-roof tank as an illustration of said tank, and present final equations with a simple description of variables in the main body of the document [and] move detailed discussion of how the equations or variables are derived into separate narrative preferably in an appendix to the document.”

Response: The EPA appreciates the commenters concerns on the “overall organization” of the chapter. EPA also understands Section 7.1 is the most complex chapter in AP-42 which will highly unlikely ever be consistent with the formatting of other sections in AP-42. However, EPA does not believe the chapter benefits from the suggested alignments. There are so many large tables and figures that are referenced in multiple locations in the chapter, EPA believes having them at the end, where they can easily be printed out or brought to a separate document, makes it easier to reference while going through the document.

Comment: “GPA Midstream suggests that EPA refrain from using the word “routine” as it pertains to emission losses with organic liquid storage tanks since it can be misleading. E.g., section 7.1.1.1 (*Sections 7.1.3.1 and 7.1.3.2 present emissions estimating methodologies for routine emissions from fixed roof tanks and floating roof tanks.*) Taken out of context, the word “routine” can imply that emissions occur at a regular frequency without regard for the actual operations of a particular process. For fixed and floating roof tanks, for example, working losses are driven by withdrawal of product. If there is no withdrawal of product, then no emissions would occur. Similarly, standing losses are driven by diurnal changes in temperature. If there is no substantial change in temperature, then there would be no emissions. Furthermore, GPA Midstream fails to see the reasoning behind classifying these emissions as routine when there is no assignment of non-routine emissions from storage tanks. In sections 7.1.3.1 and 7.1.3.2, the titles would be more appropriately phrased as working and standing losses for fixed and floating roof tanks.”

Response: The EPA disagrees with the commenter. Routine as it’s specified in this chapter pertains to an action which is part of a regular procedure as opposed to for a “special reason”. We believe the term is appropriate for storage tank emissions for the purposes of this document.

Comment: “GPA Midstream additionally requests that EPA develop a replacement to the TANKS 4.0 software program.”

Response: We appreciate the comment. However, TANKs 4.09d replacement is outside the scope of this project.

Comment: “GPA Midstream requests that EPA establish a defined phase-in period for using these revised emission calculations. GPA Midstream suggests EPA provide at least 180 days

from when the finalized revisions are published to allow stakeholders time to integrate these changes and for software to be revised/developed to accommodate this wholly revised standard.”

Response: The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.

Comment: “The discussion for the calculation of the vapor space expansion factor in equation 1-5, previously identified as 1-7, mentions that this factor, K_E , must be between the values of zero and one if standing losses occur. The maximum value of one for this factor is a new addition in the proposed revisions, and GPA Midstream requests clarification in the equation, or an additional equation, that reflects this upper limit. One possibility would be to provide two equations as shown below:

$$0 < K_E \leq 1$$
$$K_E = \frac{\Delta T_V}{T_{LA}} + \frac{\Delta P_V - \Delta P_B}{P_A - P_{VA}}$$

Response: The EPA has made the suggested change.

Comment: “GPA Midstream requests clarification regarding the changes to the equation previously identified as 1-8, now represented as 1-6. In the proposed revisions, EPA decided to eliminate two constants and substitute them with an equation that includes more variables for the user to define. To elaborate, the equation previously had four variables and now has seven. The new variables include tank shell height, tank diameter, tank roof surface solar absorptance and tank shell surface solar absorptance. The constants used in the original equation come from API MPMS 19.1. GPA Midstream requests confirmation that using the constants in lieu of the newly developed equations is still an acceptable methodology. GPA Midstream believes it should be acceptable to use the constants as long as they continue to reside in the API Standard. The redlined version of the proposed revision should also be reorganized to show the updated version of Equation 1-6 vs. the previous version 1-8 so it more easily displays for the reader how the equation has changed if the user continues to use 1-6 with default values for H/D and solar absorptance.”

Response: The EPA included the more general form of the equation with the additional variables to allow users to estimate emissions with greater accuracy. In addition, the simplified form of the equation requested by the commenter is provided as Equation 1-7.

Comment: “GPA Midstream believes that equation 1-12 on page 7.1-21 of the redlined draft was erroneously redlined. The equation and the associated text is all outlined in red as if it was new, but after reviewing the current version of the document, the same equation and some of the text is included on page 7.1-11. GPA Midstream requests EPA to maintain a public redline version of this chapter when the Agency finalizes these revisions, but only redline the parts of this section that are new to the document in its entirety. For example, the addition of “average” in front of the

temperature variables and the new paragraph discussing average maximum and minimum ambient temperatures. In addition, there are slight changes to the direction on how to handle a situation if the tank location is unknown. Instead of underlining the whole paragraph in red because it is in a new place in the document, only the actual changes from the last version should be redlined. This will allow the user to better understand the actual changes to the calculation methodology.”

Response: The EPA moved equation 1-12. That’s why it’s redlined. While a redlined version of the final version of the Chapter will not be provided, the redlined version of the draft will remain available on the website.

Comment: “GPA Midstream requests EPA clearly indicate the new variable in equation 1-22 on page 7.1-23 is now T_V rather than T_{LA} . Although this is identified through redline in the explanation of variables, GPA Midstream also requests that it be redlined in the actual equation. An explanation as to why this variable has changed in the equation should also be included. Finally, clarification needs to be included on how these numbers will change when the new equations are adopted by a facility, perhaps using an example calculation.”

Response: The “proposed revisions summary” posted on the EPA website along with the proposed Chapter 7.1 contains detailed descriptions of the proposed changes: https://www3.epa.gov/ttn/chief/ap42/ch07/draft/AP42_Chapter_7-1_revisions_summary.pdf This is stated in the summary: “Replaced T_{LA} with T_V . In that WV is the stock vapor density, the temperature in question is that of the vapor space. Earlier versions of the temperature equations had sometimes used liquid surface temperature as a surrogate for the vapor space temperature, but it would be more accurate to use the vapor space temperature.” Furthermore, because changes in the numbers will be site specific, it is not possible to show how the numbers will change with the new equations.

EPA does not intend to revise the redline version currently available. The redline version was intended to assist the public with identifying major changes to Section 7.2 in order to more easily and quickly provide comments on the revisions.

Comment: “Equation 1-24 requires the use of Raoult’s law to calculate the total vapor pressure of the stored liquid. While GPA Midstream supports the use of Raoult’s law as a calculation option, we believe that other options should be allowed for vapor pressure calculations in addition to Raoult’s Law. Thermodynamic equations of state, while much more rigorous, are also more accurate than Raoult’s Law, as they don’t make many of the “ideal solution” assumptions that Raoult’s law uses. Many of the other changes proposed for this document stem from the fact that computer software is now widely available and more rigorous calculations can be performed. There are several software programs commercially available that do rigorous thermodynamic calculations using equations of state like Peng-Robinson and Soave-Redlich-Kwong (SRK) that would more accurately predict vapor pressure from a given sample. However, these software packages are often expensive and can be cost prohibitive. Therefore, we support the use of Raoult’s law since it provides a method of calculation that all companies have access to, and for EPA to include the option to use other software option that utilize equation of state calculations.”

Response: While Raoult's Law is referenced in Note 1, it is not intended to limit the methods of vapor determination. The EPA will address this by adding a statement to Note 1 clarifying that other methods may be used.

Comment: "In note 2 on true vapor pressure there are calculations for true vapor pressure. Similar to comment V above, GPA Midstream would like to propose the option to use software programs to perform true vapor pressure calculations. These calculations could also be performed using rigorous thermodynamic equations of state. ASTM D2879 states 'Vapor pressure, per se, is a thermodynamic property which is dependent only upon composition and temperature for stable systems. The isotenoscope method of ASTM 2879 is designed to minimize composition changes which may occur during the course of measurement.' A thermodynamic equation of state is also able to calculate the thermodynamic property of True Vapor Pressure given a liquid composition and temperature, without the issue of composition changes during measurement. However, these software packages are often expensive and can be cost prohibitive. Therefore, we support the use of more simplistic calculations methods that all companies would have access to."

Response: The EPA will address this by adding the following statement to Note 2: "More thermodynamic equations of state are available in process simulation software packages and may be used in determining the true vapor pressure of mixtures that are not adequately characterized by Raoult's Law."

Comment: "On page 7.1-30, EPA added a statement to equation 1-39 stating that the '*use of gross throughput to approximate the sum of increases in liquid level will significantly over estimate emissions...*'. GPA Midstream requests that EPA acknowledge that continued use of gross throughput is still allowed, since it is clearly a conservative estimate of emissions. Many company throughput tracking systems are based on gross throughput to truck loadout and has been used to establish throughput limits and specific permit conditions, therefore the option to continue with this process should be made to available to companies. Additionally, tracking liquid throughput at specific tanks would require additional liquid meters for each tank. This is not common practice and would require costly modifications to thousands of existing facilities. GPA Midstream requests that EPA also add this clarification to Note 1 on page 7.1-33. The option to continue using gross throughput should be made to available to companies."

Response: The EPA believes Equation 1-39 already provides for the determination of working loss throughput from gross throughput in lieu of determining working loss throughput from changes in liquid level.

Comment: "On p. 7.1-29, the definition of T_B says to see note 5 for Eqn. 1-22, but then other equations for T_B are given in Eqn. 2-9 and Eqn. 2-12. GPA Midstream recommends that EPA just refer to Eqn. 2-9 and 2-12 directly instead of Note 5. This will add clarity and eliminate confusion."

Response: The EPA appreciates the comment and will address this by deleting the reference to Note 5 for Equation 1-22 from the definition of T_B at Equation 2-5.

Comment: "The draft revisions present significant changes to T_{LA} . The method for calculating T_{LA} has gone from one equation (previously 1-26) to four equations: one for fixed roof, one for

internal floating roof and two for external floating roof tanks as outlined starting on page 7.1-30. The use of a single equation aligned with API MPMS Chapter 19.4 which indicates ‘for an IFRT with a steel pan floating roof, the liquid surface temperature would be calculated as for a fixed roof with no floating roof.’ Therefore, that was the standard practice for calculating T_{LA} for all tank types. None of the new equations to calculate T_{LA} match the previous, single equation. By developing all new equations for T_{LA} based on tank type, a significant effort will have to be put forth to update calculation software and spreadsheets that relied on the well-established, single equation. As such, if these changes are retained, all tank emission calculations would need to be updated to reflect this new methodology for T_{LA} . In light of these concerns, GPA Midstream requests that EPA defer these revisions to this methodology for calculating T_{LA} until the Agency further explains the proposed changes to this calculation methodology in order to allow stakeholders to comment fully on that explanation, as these proposed changes would produce a significant amount of work for the end user without any apparent benefit in the form of improved results. Indeed, the record does not indicate that EPA has considered fully how this update creates a significant change in the calculation process, the substantial burdens on stakeholders that those changes would impose, and what the repercussions would be if emissions must be recalculated using these new equations.”

Response: The EPA disagrees with the commenter. Detailed descriptions of the proposed changes are available via the “Proposed Changes Summary” and the proposed Chapter 7.1 both located on the EPA website. Appendix B contains background information on the temperature equation revisions and why they are appropriate.

Comment: “Despite providing reference to the Texas Commission on Environmental Quality’s (TCEQ) 2016 Emissions Inventory Instructions, Section 7.1.3.5 Flashing Loss appears to borrow logic from state guidance documents on the subject. GPA Midstream believes that including such discussion in a technical reference document such as AP-42 may be misguided and result in unintended consequences. For example, language on page 62 of the draft document suggests that direct measurement should be the primary method of estimating flashing emissions; however, this method is not widely practiced by industry as it is expensive and logistically challenging. In addition, while the draft text briefly touches on certain limitations associated with the listed methodologies, it does not lay out the detailed considerations needed to be made when selecting a method to characterize emissions in order to achieve a satisfactory balance of cost and benefits. GPA Midstream suggests that EPA remove guidance language on estimating flashing emissions from AP-42 Chapter 7 and evaluate addressing the matter in a separate and more appropriately suited document format. At a minimum, EPA needs to include the appropriate language to indicate the origin of this text and ensure facility owner/operators have the necessary flexibility, consistent with existing state requirements.”

Response: The EPA will address this comment by removing the discussion of methodologies for estimating flashing loss and adding a statement indicating that specific guidance for estimating flashing losses is beyond the scope of this section.

Comment: “GPA Midstream requests EPA remove the language in Section 7.1.3.5 which states direct tank measurement is the preferred option to determine flash emissions at storage tanks. EPA adds the following caveat for direct vent measurement, *‘if a reliable means of measurement for*

both the flash vapors and the amount of liquid produced during the testing period were employed.’ However, listing the method as preferred may still lead state and local permitting authorities to rely on it as the best option above others listed for flash emission calculations. In the experience of GPA Midstream members, direct tank vent measurement produces an unreasonable result since emissions at tanks are determined by field conditions that are variable over short time periods. For gathering compressor stations specifically, the amount and quality of hydrocarbon liquid is dependent on the upstream producer’s method of operating and there can be multiple upstream producers on each gathering system. For example, during the time of direct tank vent measurement, an upstream producer may have a failure on its production separation equipment and send the gathering station more liquid than the average daily amount. The inverse could be true as well, where a producer may shut in oil and gas for a variety of reasons without the knowledge of the gathering company. In either case, the direct measurement result should not be used to determine an hourly or annual emission rate for permitting purposes. GPA Midstream is concerned state and local permitting authorities may require industry to use this ‘preferred’ method for flash emission calculations, even though it may produce short-term results that are not representative of typical hourly or annual emissions for the facility. Furthermore, there are safety issues that would limit the use of direct measurement on tank vents. Oil and gas operators try to limit the time employees spend on top of tank batteries to prevent exposure to either explosive environments or specific chemicals present in the gas stream, such as H₂S. Operators have installed wave guided radar systems or other tank level gauge methodology that limit the number of times employees must be on top of the tanks to hand gauge for liquid measurement. Direct measurement of the tank vents would introduce increased risk operators prefer to avoid or may be prohibited in a high H₂S area. GPA Midstream requests EPA keep direct measurement as an option for flash emissions but remove the “preferred” language as shown below:

*‘Direct measurement. Direct measurement of emissions at the tank vent **can be utilized** ~~would be a preferred approach~~, if a reliable means of measurement for both the flash vapors and the amount of liquid produced during the testing period were employed. Efforts at direct measurement should account for uncertainty in the field measurements of vapor concentration and flow rate through the vent and in the field measurements of volume of liquid produced during the test period, as well as variation in emission rates over time. Uncertainty may be mitigated by use of EPA Method 25A over an extended period of time.’*”

Response: The EPA will address this comment by removing the discussion of methodologies for estimating flashing loss and adding a statement indicating that specific guidance for estimating flashing losses is beyond the scope of this section.

Comment: “GPA Midstream supports the addition of language in [Section 7.1.3.8.1 paragraphs a through l] but believes the statement that these parameter ‘*render the equations for routine emissions inappropriate for time period short than one month*’ is not correct. EPA should provide guidance on preferred methodologies for maximum hourly calculations, either quantitative or qualitative. If EPA cannot provide guidance for preferred methodologies for hourly emission calculations than EPA should, at a minimum, remove language indicating that AP-42 methodologies are “inappropriate” for time periods less than one month. In this way, the AP-42 document will not invalidate maximum hourly emission calculation guidance from State or Local agencies that derive hourly calculations from the AP-42 methodology.”

Response: The EPA is not aware of a preferred methodology for estimating hourly emissions from storage tanks. While the methods developed by some State and local agencies mentioned by the commenter are used for estimating emissions for a reasonable worst case scenario, the EPA believes for the reasons specified in 7.1.3.8.1, those methods are not adequate for estimating actual hourly emission rates.

Comment: “GPA Midstream identified multiple changes within Table 7.1-7 that are not clearly identified. For example, in Birmingham, AL, TAN in January was previously 33.0°F, while in the draft version of the document it’s 31.3°F. GPA Midstream requests that any changes made within Table 7.1-7 also be identified with redline. The redline version will allow for the user to easily determine which values in the table have changed; therefore, need to be updated in related calculations. For new cities that have been added, that data should be redlined as well.”

Response: The EPA appreciates the comment. However, because the entire meteorological data table was revised, redline markups of the individual values changed would have made the table unreadable.

Comment: “GPA Midstream requests that EPA define ‘flexible enclosure system’ as referenced in [Table 7.1-12, page 7.1-138] footnote ‘i’ to match the definition that is finalized in API MPMS 19.2.”

Response: The EPA will address this comment by adding the following description of a flexible enclosure given in API MPMS 19.2 to footnote ‘i’ to Table 7.1-12: “A flexible enclosure surrounds the guidepole from the gasketed cover at the deck opening up to an elevation on the guidepole above all slots or holes through the guidepole.”

Commenter 13: Donna Huff, Texas Commission on Environmental Quality

Comment: “The TCEQ recommends clarifying that the definition of “routine emissions” as standing and working losses applies only for the purposes of this document, and not for any other air quality purposes, including New Source Review (NSR) permitting. TCEQ recommends that the EPA add a disclaimer that specifically states the definition of “routine emissions” is limited only to the context of this document and does not apply for other air quality purposes, such as air permitting or air emissions inventory reporting.”

Response: The EPA will address this comment by adding the following statement: “Use of the terminology “routine emissions” to refer to standing and working losses applies only for the purposes of this document, and not for any other air quality purposes such as New Source Review (NSR) permitting.”

Comment: “For fixed-roof storage tanks, the document should note that the saturation (turnover) factor and the product factor used in the working loss equations may need to be modified based upon site-specific circumstances. The AP-42 working loss equations do not instruct the user to modify the saturation and/or product factor to account for the increased turbulence and saturation

that occurs when product is splash-loaded from the top of the tank. The document should be modified to instruct the user to select more appropriate (i.e., higher) saturation and product factors to account for increased emissions from splash-loading operations.”

Response: The EPA will address this comment by adding the following statement for the determination of the turnover (saturation) factor: “further adjustment of K_N may be appropriate in the case of splash loading into a tank”. An additional statement will be added for the determination of the product factor: “adjustment of K_P may be appropriate in the case of splash loading into a tank”.

Comment: “The TCEQ recommends changing the second paragraph under Subsection 7.1.3.3, “Floating Roof Landing Losses” for calculating standing idle losses for partial days. One of the sources of standing idle emissions is breathing losses due to daily changes in ambient temperature. Because these breathing losses would occur as the vapor space expands during heating, they would generally only occur during daylight hours. Therefore, the TCEQ recommends that the daily standing idle losses for a partial day be calculated by multiplying the estimated daily loss by the number of daylight hours that the roof was landed and dividing by 12.”

Response: The EPA appreciates TCEQ’s comment. The recommended approach is meant as a way to simplify the calculation of the tank landing emissions. Due to the fact that tank landings happen both during the day and at night, we believe that this approach provides a reasonable estimate of the average result over time. Additionally, while we agree that a major cause of emissions from tank landings are due to vapor expansion during ambient temperature changes, it is not the only method by which emission may occur. For example, the wind could be a big factor in releasing vapors beneath the floating roof; these emissions would occur from an external floating roof tank that landed no matter what time of day or night.

Comment: “The TCEQ recommends minor updates to specific measurement methods discussed in the ‘Flashing Loss’ subsection. The portion of the section discussing direct measurement of flashing losses recommends the use of EPA Method 25A to determine emissions rates. The text should note that this method determines total VOC emissions rates only and does not speciate emissions, particularly hazardous air pollutant (HAP) emissions. The text should further state that another measurement method that performs an extended gas analysis to identify HAP emissions would be necessary to accurately assess and quantify these emissions. The TCEQ recommends adding the underlined text to the following sentence: *‘It is imperative that the sample be collected in a pressurized instrument, so as to prevent loss of light ends in the handling of the sample, and that the laboratory conducting the analysis perform appropriate quality assurance checks to verify that sample integrity has been maintained.’*”

Response: The EPA will address this comment by removing the discussion of methodologies for estimating flashing loss and adding a statement indicating that specific guidance for estimating flashing losses is beyond the scope of this section.

Commenter 14: Tony Shoberg, Barr Engineering

Comment: “EPA has added additional rim-seal loss factors to Table 7.1-8 Rim-Seal Loss Factors for Floating Roof Tanks for “tight-fitting seals” with this footnote describing them:

“Tight-fitting” means that the rim seal is maintained with no gaps greater than 1/8 in. wide between the rim seal and the tank shell. It is not appropriate to use the values for tight-fitting seals unless the seal is known to be maintained with gaps no greater than 1/8 in. through the full range of liquid level in the tank.’ Please provide clarification on situations when the “tight-fitting” factors can be used. For example: (1) Can the factors for “tight-fitting seals” be used on external floating roof tanks for which the primary and secondary seal gap inspections required by 40 CFR Part 60 Subpart Ka, Part 60 Subpart Kb, Part 63 Subpart G, Part 63 Subpart WW, or other storage tank regulations do not identify any gaps greater than 1/8 inch? (2) Can the factors for “tight-fitting seals” be used for external floating roof storage tanks which have gaps greater than 1/8 inch but are in compliance with one of the cited regulations’ maximum allowable gap and maximum allowable accumulated area of gaps? For example, Subpart Kb permits a secondary seal to have a maximum gap of 1.27 cm (0.5 inch) and a maximum allowable accumulated area of gaps of 21.2 cm²/m of tank diameter (1 in²/ft of tank diameter). (3) Can the factors for “tight-fitting seals” be applied to an internal floating roof tank for which seal gap measurements are not required to be conducted? (4) Can the factors for “tight-fitting seals” be used for an internal floating roof tank that has an approved Alternative Monitoring Procedure which requires inspections in accordance with 40 CFR 63 Subpart WW, for which we understand that US EPA is currently interpreting that the 1/8 inch gap criteria is applied to the rim-seals? Additionally, no guidance was provided regarding whether seal gaps need to be measured at different heights, and if so, how many different heights. No guidance is provided regarding how frequently these measurements should be taken. Would an owner/operator prove that there are no gaps greater than 1/8 inch through the “full range of liquid level in the tank”? Would seal gaps need to be measured at various heights? If so, how many different heights? How frequently should these measurements be taken?”

Response: The “tight-fitting” rim seal factors should be used only when the rim seals of a floating-roof tank are maintained such that no gaps are greater than one-eighth of an inch. Methods to determine whether the rim seals are maintained with gaps no greater than 1/8 in. are beyond the scope of this guidance. This may be a matter of enforcement discretion for the agency having jurisdiction.

Comment: “EPA has added deck-fitting loss factors to Table 7.1-12 Deck-Fitting Loss Factors for “Ladder-guidepole combination well”. Additional revisions elsewhere in the AP-42 chapter suggest that these new factors are intended to be used on ladder-guidepole combinations for which one or both legs of the ladder is a slotted pipe. EPA also shows in Figure 7.1-21 a ladder-guidepole combination with ladder sleeve where the guidepole is slotted. However, the loss factor for a “ladder-guidepole combination well” with a “sliding cover, ungasketed” appears to be the same as the factor for a “ladder well” with a “sliding cover, ungasketed” where one would expect emissions to be higher if one of the ladder’s legs was slotted. Please provide clarification that the loss factors provided in table 7.1-12 for ladder wells and ladder-guidepole combination wells are correct.”

Response: The factors in Table 7.1-12 are correct.

Comment: “We would also suggest clarifying the name of the “ladder-guidepole combination well” in table 7.1-12 to “ladder-slotted guidepole combination well” to clarify that these loss factors are for the slotted guidepole arrangement.”

Response: The EPA will address this comment by making the suggested edit in the text.

Comment: “The proposed addition of Section 7.1.3.4 Tank Cleaning Emissions only includes the “vapor concentration method” which is based on the lower explosive (LEL) as measured during cleaning and degassing operations for the continued forced ventilation emissions during sludge removal (equation 4-10). The original tank cleaning and degassing document, API TR 2568 (Nov. 2007) included, in addition to the vapor concentration method, two alternative methods in Appendix A for sludge removal emissions. They are referred to as the “sludge volume method” and “air driven loss method”. The air driven loss alternative calculation method provides both increased simplicity and conservatism in emission calculations by correlating vapor pressure of the previously stored product to be representative of the vapor pressure of hydrocarbon material present in the tank at the time of cleaning despite any weathering of the product that may already have occurred. We believe the air driven loss method should be included in the revised version of AP-42. Our concerns with the proposed vapor-concentration method are as follows: (1) Regarding LEL measurement, neither API TR 2568 nor the proposed updates to Section 7.1 provide details of how to accurately measure LEL. The only specification given can be found in Appendix C of API TR 2568, to which the example forms indicate that you should measure the LEL concentration in the headspace or vent stream. Additionally, during the sludge removal phase, personal LEL monitors may be reading 0% until a pocket of vapor would be disturbed, then a momentary high spike of LEL may occur, which is otherwise not representative of the general vapor space composition during the sludge removal process depending on how or where LEL measurements are taken and recorded. (2) While the proposed updates state that the LEL used for emission calculations is the “average of the % LEL readings during a given stage of continued forced ventilation”, it is not clear what type of average is required (i.e. how many samples per day or stage of cleaning and degassing are required?), or if continuous data logging must occur. Additionally, it is not clear if samples of the vapor space be taken at one single point, or multiple points throughout the tank when determining the average LEL reading. (3) Finally, based on the description of the “average vapor concentration by volume during continued forced ventilation”, C_V (Equation 4-10) it is implied that LEL must seemingly be measured for each stage of the cleaning and degassing process for each event. If this is the case, this approach does not appear consistent with the general emission factor methodology provided elsewhere in AP-42. General emission calculation methodologies throughout AP-42 rely on either specified emission factors or calculations based on reliable, known information (i.e. product vapor pressures and molecular weights). The vapor concentration method does not conform to this. Additionally, the sludge volume method from API TR 2568 should not be included due to variability in evaporation rates and due to the concerns noted above for the proposed vapor-concentration method. API TR 2568 notes a possible evaporation rate of 20%, based on one event.”

Response: The EPA appreciates the comment. The air driven loss method is based on air (wind) driven loss past a floating roof rim seal, and thus would not be applicable to a fixed-roof tank. This approach is presented in API TR 2568, without a theoretical basis or field

validation. The EPA believes the vapor concentration method is the only method put forward to date that can reasonably model the wide variability in tank cleaning methods and scenarios in use. API is republishing the tank cleaning loss methodology as API MPMS 19.6.2 with the additional statement:

The Vapor Concentration Method is the only method that lends itself to field measurement of the key unknowns involved in the calculation. It accounts for the volatility of the stock and for the period of time required to clean the tank. Of the methods considered, this was the method chosen.

Commenter 15: Cathe Kalisz, American Petroleum Institute

Comment: “Facilities may have used the tank emissions estimating methodologies in AP-42 to assess the need for an air permit or to establish tank emission permit limits. EPA should clarify that, for purposes of determining permit compliance, the emissions estimating methodologies that were current at the time of a permit application should continue to be used, or the permit limits should be adjusted in proportion to the changes resulting from the updated methodology. A change to an emissions equation or methodology does not, by itself, constitute a basis for being out of compliance with an existing permit or create a situation where a source that was previously determined to not require a permit is now considered to be out of compliance with State or Federal permitting requirements. EPA should also address how updated AP-42 guidance should be used when renewing New Source Review (NSR) construction permits and/or Title V permits, when the best available information at that time is considered.”

Response: The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.

Comment: “The tank emissions estimating procedures are complex, and most of the equations for standing and operating losses have been unchanged since 1997. Facilities will need time to update and quality-assure in-house tank emissions programs and systems that are based on Section 7.1, as will vendors who offer commercial products. A minimum one-year transition period is needed to allow time for programs to be updated. A transition period will also preclude any questions regarding the need to update a pending or under-review permit application that uses the current Section 7.1 provisions. A transition period is consistent with previous agency practice, such as the one-year implementation period that EPA provided when it updated its regulatory dispersion model, AERMOD.”

Response: The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.

Comment: “Once EPA finalizes its revisions to Chapter 7, EPA should also provide an updated software program or other electronic tool for estimation of tank emissions. This would be helpful to both regulators and regulated sources.”

Response: TANKs 4.09d replacement is outside the scope of this project.

Comment: “[For the] 7.1.1.1 Scope, add a sentence at the end of the first paragraph to point the user to AP-42 Section 5.2 for estimating emissions from underground gasoline storage tanks at service stations. Suggested wording for this note is as follows: ‘To estimate losses that occur from underground gasoline storage tanks at service stations, please see AP-42 Chapter 5.2, *Transportation and Marketing of Petroleum Liquids.*’”

Response: The EPA will address this comment by adding the recommended sentence to 7.1.1.1: ‘To estimate losses that occur from underground gasoline storage tanks at service stations, please see AP-42 Section 5.2, *Transportation and Marketing of Petroleum Liquids.*’

Comment: “[For] Equation 1-17, put parentheses around the (1/3) to clarify that the Hr term is not in the denominator.”

Response: The EPA will address this comment by making the suggested edits to Equation 1-17.

Comment: “[For] Equation 2-3, insert a second sentence that reads, ‘Ambient wind speed should be measured at an elevation of at least 10 meters above grade.’”.1

Response: The EPA will address this comment by adding the recommend sentence: “Ambient wind speed should be measured at an elevation of at least 10 meters above grade.” to Note 1, below Equation 2-3.

Comment: “[For] Equation 40-3, in the definition of terms below the equation, xi should be x_i . That is, the ‘i’ should be a subscript.”

Response: The EPA will address this comment by making the recommended edit by subscripting the “i” in xi.

Comment: “[For] Figures 7.1-13a, 13b, 14a, & 14b, these figures each use the term ‘stock temperature.’ This term should be edited to read “liquid surface temperature.” If the nomographs cannot be edited, this clarification could be stated in a note below the figure. In the body of the document, Note 2 under Equation 1-22 (old Equation 1-21) already indicates that the stored liquid surface temperature should be used in these figures, but the term “stock temperature” in the figures themselves sometimes misleads users into using the liquid bulk temperature.”

Response: The EPA will address this comment by clarifying in the figures that the stock temperature should be taken as the liquid surface temperature.

Comment: “[For] Figure 7.1-14a, add the following additional sentence below the table: ‘However, see the cautions in Note 2 to Equation 1-22 with respect to ASTM D 2879.’”

Response: The EPA will address this comment by adding the suggested sentence to the notes below Figure 7.1-14a.

Comment: “[For] Table 7.1-3, put a superscript “d” on Liquid Density in the headings, and add a footnote “d” that reads: “^d The superscript denotes the temperature in °F; if no superscript is given the density is for 68°F.””

Response: The EPA will address this comment by making the suggested edit to Table 7.1-3.

Comment: “[For] Table 7.1-12, add a footnote indicating, ‘Deck fittings with only a K_{Fa} factor and no K_{Fb} or m factor should not be applied to external floating roof tanks because the emission factor for such deck fittings does not account for wind effects.’”

Response: The EPA will address this comment by adding the suggested footnote to Table 7.1-12.

Comment: “[For] Table 7.1-12, add a footnote referencing Equation 2-17 for determining loss factors for deck fitting configurations not listed in the table.”

Response: The EPA will address this comment by adding the following footnote to Table 7.1-12: “Emission factors for IFR deck fittings that are not listed in this table may be calculated using equation 2-17.”

Comment: “[For] Table 7.1-12, edit the Fitting Type ‘Ladder-guidepole combination well’ to read ‘Ladder/slotted-guidepole combination well’.”

Response: The EPA will address this comment by making the suggested edit to Table 7.1-12.

Comment: “[For] Sample Calculations – Example 1, 4.a, for clarity, put parentheses around ($\pi/4$).

Response: The EPA will address this comment by making the suggested edit to Example 1, 4.a.

Comment: “[For] Sample Calculations – Example 6, last numbered step, the last step should be (9) rather than (6).”

Response: The EPA will address this comment by making the suggested edit to Sample Calculations – Example 6.

Comment: “Edit Reference 24 to show a date of March 2014 rather than December 2013.”

Response: The EPA will address this comment by making the suggested edit to Reference 24.

Commenter 16: Peter Lidiak, International Liquid Terminals Association

Comment: “Facilities may have used the tank emissions estimating methodologies in AP-42 to assess the need for an air permit or to establish tank emission permit limits. EPA should issue guidance to its regional offices, and state and local air agencies that, for purposes of determining permit compliance and monthly, annual and Toxic Release Inventory (TRI) reporting, the emissions estimating methodologies that were current at the time of a permit application should continue to be usable, or optionally, the permit limits may be adjusted in proportion to the changes resulting from the updated methodology.”

Response: **The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.**

Comment: “EPA should also address how updated AP-42 guidance should be used when renewing New Source Review (NSR) construction permits, Title V permits and/or state operating permits including synthetic minor and Federally Enforceable State Operating Permits, when the best available information at that time is considered.”

Response: **The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.**

Comment: “The tank emissions estimating procedures are complex, and most of the equations for standing and operating losses have been unchanged since 1997. Facility operators will need time to update and quality-assure in-house tank emissions programs and systems that are based on Chapter 7.1, as will vendors who offer commercial products for estimating tank emissions. A transition period of two years is needed to allow for programs to be updated. A transition period will also allow pending or under review permit applications that use the current Chapter 7.1 provisions to be completed without requiring significant rework or rereview. A transition period is consistent with previous agency practice, such as the one-year implementation period that EPA provided when it updated its regulatory dispersion model, AERMOD.”

Response: **The EPA understands the concerns specified by the commenter. The EPA has delegated the authority to Local, State, Federal, or Tribal regulatory authorities to provide guidance on permitting/enforcement related inquiries with regards to emissions factors.**

Comment: “ILTA requests that EPA update and continue to support the TANKS emission model. It provides value to the industry as a comparison tool for the many versions of emission calculating tools available.”

TANKs 4.09d replacement is outside the scope of this project.

Commenter 17: Todd Tamura, Tamura Environmental, Inc.

Comment (on section 7.1.3): “EPA is proposing to have the following language in this section: *‘The software program entitled "TANKS" is available through the U. S. Environmental Protection Agency website. While this software does not address all of the scenarios described in this chapter, is known to have errors, and is no longer supported, it is still made available for historical purposes. There are also commercially available storage tank emissions estimation software programs. Users of these programs are advised to understand the extent of agreement with AP-42 Chapter 7 calculation methodology and assume responsibility of the accuracy of the output as they have not been reviewed or approved by the EPA.’* This paragraph neglects (a) the fact that for most tanks, the “errors” in the TANKS model have been shown to be quite trivial, and (b) because the AP-42 Chapter 7 calculation methodology is by far the most complex methodology in all of AP-42, commercially available software is expensive and complex, and telling all persons who calculate emissions from storage tanks—of which there are many in the United States—that they have to “understand the extent of agreement with AP-42 Chapter 7 calculation methodology and assume responsibility of the accuracy of the output” is a significant request that is likely to be very burdensome in terms of labor hours associated with evaluating the software and the assumption of risk for the various software packages (for agencies and businesses that do not have the capacity to evaluate the software). The following would seem to be more appropriate language than the language shown above: ‘The software program entitled "TANKS" is available for free from the U.S. Environmental Protection Agency website. This software does not address all of the scenarios described in this chapter, is known to have minor errors, and may not run on future operating systems, but generally has been found to produce results that are quite close to those that follow the methodology identified here for storage tanks. There are also commercially available storage tank emissions estimation software programs, although users of these programs are advised to understand the extent of agreement with AP-42 Chapter 7 calculation methodology and assume responsibility of the accuracy of the output as they have not been reviewed or approved by the EPA.’”

Response: TANKs 4.09d replacement is outside the scope of this project.

Comment (on section 7.1.3.1.1): “EPA is proposing various options to calculate ΔT_V , all of which differ from the existing equation (1-8). While there are theoretical underpinnings of the new equations, there does not appear to be any new experimental data supporting them, and it is not at all clear that they improve the accuracy of the result or make a substantive enough difference to warrant the removal of the current generally accepted practice. Given that this is the case—and that EPA is proposing to still allow the use of existing equation (1-5) for K_E (under certain circumstances) and instead even the bald assumption that $K_E = 0$, both of which are likely to result in considerably larger differences from the newly proposed equations than the currently generally accepted practice—EPA should continue to allow ΔT_V to be calculated using the existing equation (1-8) that is incorporated into the TANKS model.”

Response: The EPA appreciates the comment. However, the derivation of ΔT_V is entirely theoretical and the EPA believes the proposed changes represent an improvement in the application of the theoretical basis for this determination. The revised equations accommodate accounting for the actual height-to-diameter ratio of the tank, as well as

accounting for tank insulation. Furthermore, there's no point in preserving the old equation for ΔTV after the other temperature equations have been revised.

Comment (on section 7.1.3.1.1): “For tank solar absorptance α , EPA is proposing to rename the existing values in Table 7.1-6 for “good” and “poor” paint condition as being for “new” and “aged” paint condition, and to add a new “average” value which is simply the mean of the “good” and “poor” values. Given that there does not appear to be any data to support this change nor any objective quantitative information with which to gauge what constitutes “good”, “average”, or “poor” condition, this change is not helpful, and may simply result in more controversy regarding how the condition should be classified rather than resulting in a more accurate estimate.”

Response: The EPA disagrees with the commenter. We believe the revised categories are more objective than the previous subjective determinations of good and poor, and as such, a better representation of the paint conditions for which the absorptance factors are applicable. Note 1 to Table 7.1-6 clearly defines the categories of new, average, and aged.

Additionally, the EPA determined it was appropriate to add a new category (aged). For most of the life of the tank coating, the condition is not as reflective as it would be for a recently painted tank or if the tank is in need of repainting. As a result, a middle value is needed in many cases.

Comment (on section 7.1.3.1.1):: “[For underground tanks], EPA is not proposing any substantive changes, but is proposing to leave in existing language stating that ‘*For underground horizontal tanks, assume that no breathing or standing losses occur ($L_S = 0$) because the insulating nature of the earth limits the diurnal temperature change.*’ While the statement about temperature change is accurate, it has been previously shown that there are standing losses associated with underground tanks containing relatively volatile liquids like gasoline, as a result of dilution of the headspace and relatively fast subsequent vapor growth. Therefore, it seems more appropriate to modify the language as follows: ‘Standing losses from underground gasoline tanks, which can experience relatively fast vapor growth after the ingestion of air and dilution of the headspace, are addressed in Section 5.2 of AP-42.’”

Response: The EPA will address this comment by adding the requested statement to Chapter 5, Section 5.2 of AP-42.

Comment (on section 7.1.3.1.1): “[For stock vapor density], EPA is proposing to change the equation from $W_V = M_V P_{VA} / RT_{LA}$ (which is what is incorporated in the TANKS model) to $W_V = M_V P_{VA} / RT_V$ to reflect the fact that it should be a function of the vapor temperature T_V rather than the liquid surface temperature T_{LA} . However, given that these two temperatures are on an absolute temperature basis (i.e., degrees Rankine), differ relatively little (and to the extent that they differ, there is some question as to whether it is more appropriate to define P_{VA} as being based on $T = T_V$ instead of $T = T_{LA}$), and are both based on a number of assumptions, it does not seem necessary to completely disavow the original equation. If EPA would like to retain the proposed equation, language should be added which identifies that ‘The equation for W_V that has been used previously

and is incorporated into the TANKS model, which is based on T_{LA} instead of T_V , is also acceptable and will typically yield a very similar result.”

Response: EPA believes the vapor space temperature is the more accurate approach. In the equation for W_v , the temperature specified is for vapor space not the liquid surface temperature.

Comment (on section 7.1.3.1.1): “EPA is proposing to identify the ASTM D 6377 method for the determination of the true vapor pressure of crude oils with TVP > 3.6 psia and the ASTM D 5191 method for the determination of the Reid vapor pressure of volatile crude oil and volatile nonviscous petroleum liquids. To execute the AP-42 equations, there will be a need to have an appropriate equation for pressure as a function of temperature, not just the vapor pressure at a single temperature, and therefore running ASTM D 6377 or ASTM D 5191 at a single temperature will not be sufficient.”

Response: The EPA will address this comment by adding the following statement to Note 2 below Equation 1-22: “ASTM D 6377 may be used to directly measure true vapor pressure at a given temperature. In order to utilize ASTM D 6377 to predict true vapor pressure values over a range of temperatures, the method should be applied at multiple temperatures. A regression of the log-transformed temperature versus vapor pressure data obtained may be performed to obtain A and B constants for use in Equation 1-25.”

Comment (on section 7.1.3.1.1): “For mixtures, vapor pressures can depend on the vapor-to-liquid (V/L) ratio. ASTM D 5191 specifies a V/L ratio of 4:1 (consistent with the V/L ratio identified in ASTM D 323 for Reid vapor pressure), but ASTM D 6377 leaves the choice of V/L up to the method user, and results are reported as VPCR X where X is the V/L ratio. For consistency (and to avoid ambiguity), where EPA specifies ASTM D 6377, may want to also specify that the method should be run at V/L = 4:1 (i.e., VPCR4 results)—as opposed to, for example, a V/L of “effectively zero” (the minimum V/L identified in ASTM D 6377 is 0.02) as identified in the International Safety Guide for Oil Tankers & Terminals (ISGOTT).”

Response: The EPA will address this comment by adding the following statement to Note 2 below Equation 1-22: “In order to determine true vapor pressure for purposes of estimating emissions of volatile organic compounds, ASTM D 6377 should be performed using a vapor-to-liquid ratio of 4:1, which is expressed in the method as VPCR4.”

Comment (on section 7.1.3.1.1): “At a recent ASTM training course on the topic of crude oil sampling and analysis, it was pointed out that ASTM D 5191 was not scoped for crude oil and the instructor stated verbally that the method should not be used to determine the RVP of crude oils. EPA should therefore also not recommend ASTM D 5191 for crude oils. At a minimum, EPA should acknowledge that D 5191 results include the partial pressure of any dissolved air.”

Response: The EPA will address this comment by editing the ASTM D 5191 reference to indicate that it is an alternative method for petroleum products and it should not be used for crude oils.

Comment (on section 7.1.3.1.1): “EPA is also proposing to add the language “the equations in Figure 7.1-16 are known to have an upward bias” – please provide a citation for that statement and any available quantitative information.”

Response: The EPA will address this comment by adding the appropriate citation for the statement: California Air Resources Board in the document, “Technical Guidance Document for the Emission Inventory Criteria and Guidelines Regulation for AB 2588,” August 1989.

Comment (on section 7.1.3.1.1): “EPA is proposing two new equations to calculate T_{LA} , including $T_{LA} = 0.4T_{AA} + 0.6T_B + 0.005 \alpha I$ for uninsulated tanks, and removing the existing equation $T_{LA} = 0.44T_{AA} + 0.56T_B + 0.0079 \alpha I$ for uninsulated tanks. While there are theoretical underpinnings of the new equations, there does not appear to be any new experimental data supporting them, and there does not appear to be any evidence that they improve the accuracy of the result (given that T_{AA} and I are monthly average values—typically from the nearest airport rather than on-site, and T_B is also a monthly average value, typically calculated from a series of assumptions) or make a substantive enough difference to warrant the removal of the current generally accepted practice. Given that this is the case—and that EPA is proposing to still allow the use of existing equation (1-5) for K_E (under certain circumstances) and instead even the bald assumption that $K_E = 0$, both of which are likely to result in considerably larger differences from the newly proposed equations than the currently generally accepted practice—EPA should continue to allow T_{LA} to be calculated using the existing equation that is incorporated into the TANKS model (at least for uninsulated tanks): i.e., $T_{LA} = 0.44T_{AA} + 0.56T_B + 0.0079 \alpha I$.”

Response: The EPA appreciates the comment. The EPA believes the two new equations provide an improvement in the application of the basis for this decision in lieu of using the existing theoretical (unproven) equation.

Comment (on section 7.1.3.1.1): “In the absence of T_B measurements, EPA is proposing to change the formula for T_B from $T_B = T_{AA} + 6\alpha - 1$ (which is incorporated into the TANKS model) to $T_B = T_{AA} + 0.003\alpha SI$. Since no supporting data are provided for the change and neither equation accounts for the important variable of the temperature of the liquids that are delivered to the tank, it is unclear whether this change improves the accuracy by any significant extent; instead, it appears to simply be a “refinement” to a theoretical construct which is already based on several assumptions. If EPA would still like to retain the proposed equation, it would be helpful to at least add language noting that ‘While the theoretical basis for this equation is considered to be better than the historical equation for T_B that is incorporated into the TANKS model ($T_B = T_{AA} + 6\alpha - 1$), both rely on several assumptions that are likely to not be entirely correct and ignore the temperature of the liquids that are delivered to the tank, and no analysis of empirical data has been conducted to show the superiority of one formula over the another.’”

Response: The EPA disagrees with the comment. The historical equation does not reflect the solar radiant heat input. Even so, the results provided the same difference between ambient and bulk liquid temperatures for a tank (color/paint condition) in Juneau, Alaska as for the same tank in Tucson, Arizona. Temperature rise should account for solar radiant heat input.

Comment (on section 7.1.3.1.1): “EPA is proposing to base certain calculations on estimates of T_V rather than T_{LA} as was done previously. As has been commented on numerous other items, these calculations seem substantially similar to the original equations and no data are identified for supporting this change.”

Response: EPA believes the vapor space temperature is the more accurate approach. The temperature in question is for vapor space not the liquid surface temperature.

Comment (on section 7.1.3.1.2): “EPA is proposing to make a change to the preferred Equation [for L_w]; relative to the current equation that is incorporated into the TANKS model, the proposed refinements for L_w appear to consist of primarily (a) using the calculated vapor density (W_V) instead of the current factor $0.0010 M_V P_{VA}$, which will have a very minor effect for unheated tanks—and (b) multiplying by a vent correction factor K_B (which is also very close to 1 when (a) tanks with PV valve pressure settings that are much lower than the difference between atmospheric pressure and the vapor pressure of the stored liquid, and (b) $K_N \approx 1$, which is nearly always the case). Rather than simply indicating that the old equation is “no longer recommended” (as EPA is proposing), it would be much more technically accurate to state that the old equation will give essentially the same answer as the new equation unless (a) the absolute temperature of the emitted vapors that is used to correct the volume emitted is substantially different from $523 \text{ }^\circ\text{R} = 63 \text{ }^\circ\text{F}$ (this is the temperature that the which is the basis for the 0.0010 factor in the old equation), (b) the PV valve pressure setting is significant relative to $P_A - P_{VA}$ and/or K_N is substantially less than 1.”

Response: The EPA disagrees with the commenter. The EPA believes it would be extremely confusing to recommend an alternative for L_w (the old equation) only if multiple conditions are met. As the user states, the old equation can not be used if the conditions are “substantially different”. The EPA believes that it is more straightforward for users and more accurate to update the equations.

Comment (on section 7.1.3.1.2): “While the proposed definition of N makes theoretical sense, it is different from what has often been assumed in the past: i.e., having the denominator correspond to *total* tank capacity rather than the difference between the high and low levels. Given the extremely approximate basis of the K_N equation, the current procedure should still be allowed, even if it is not ‘preferred’.”

Response: The EPA disagrees with the commenter. We believe it was never appropriate to use total tank capacity to determine the number of turnovers. We have provided this clarity in the revisions to Section 7.1 so that assumptions do not have to be made in this regard. The turnovers should be based on the net working capacity.

Comment (on section 7.1.3.2): “EPA is proposing equations for TLA that differ somewhat from equations used in the past, but again there does not appear to be any empirical data to support this, nor is there any recognition of the fact that these are all still very approximate. Use of the current equations should still be allowed.”

Response: EPA has addressed multiple questions of the same comment by the same commenter above.

Comment (on section 7.1.4): “In general, Raoult’s Law is identified as being most applicable for mixtures of similar molecules (e.g., benzene and toluene) and the actual data for a given component of the mixture are closest to those predicted by Raoult’s Law when the mole fraction of that component approaches 1. For EPA’s proposed statement that ‘An assumption of ideal behavior has been found to be reasonable for most hydrocarbon mixtures’, please provide a citation.”

Response: The EPA has recommended the use of Raoult’s Law to characterize hydrocarbon mixture in previous versions of AP-42 Chapter 7.1 and it is common practice in industry. Numerous references indicate the assumption of ideal behavior, and thus the applicability of Raoult’s Law, is reasonable for hydrocarbon mixtures (e.g., Chemistry & Chemical Reactivity, Kotz and Treichel, Saunders College Publishing, Fourth Edition, 1999, page 658.).

Comment: “Separately, with regard to the statement that the speciation of withdrawal losses for floating roof tanks should assume ‘that the entire film of liquid evaporates, and thus relative fractions of individual components in the vapors would be the same as for the liquid’ should be amended to recognize that substances that are non-subliming solids at the storage temperature (such as most polycyclic aromatic hydrocarbons, for most tanks storing liquids at ambient temperatures) are not going to evaporate. This is important because in some cases health risk assessments are being impacted by the (erroneous) assumption that all of the PAHs in the clinging liquid are evaporating.”

Response: The EPA will address this comment by adding the following statement: “It would be appropriate, however, to adjust this assumption to recognize that substances which are non-subliming solids at the storage temperature (such as most polycyclic aromatic hydrocarbons at ambient temperatures) are not going to evaporate.”

Comment (on section 7.1.4): “Henry’s Law constants are strong functions of the solute, solvent, and temperature. Therefore, EPA’s statement that ‘Section 4.3 of AP-42 presents Henry’s Law constants for selected organic liquids’ should be revised to say ‘Section 4.3 of AP-42 presents Henry’s Law constants for selected organic liquids in water at 25 °C’.

Response: The EPA will address this comment by revising the suggested statement.