Short-term Evaporative Loss Estimation from Atmospheric Storage Tanks

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Introduction

This Technical Report provides guidance on how to determine reasonable worst-case short-term hourly emissions from individual tanks and from a battery of tanks.

Currently available estimation methodologies are based on factors that rely on averaging throughputs and meteorological conditions on a yearly or monthly frequency and may deviate significantly when compared to a reasonable worst-case short-term duration of hours to days. This guidance document presents a standardized approach for estimating reasonable worst-case short-term emissions, but it does not address estimation of actual short-term emissions (see Annex A for limitations on applying this methodology to actual scenarios). This short-term approach combined with the dispersion model will provide the user the ability to assess potential higher mass scenarios relative to yearly averages and can be used for process safety assessments, structure siting, area classifications, determining the need for additional controls, assessing risk of potentially elevated hazardous air pollutants (HAPs) from a confluence of conditions, and other possible concerns associated with short-term scenarios such as approach to lower explosive limit (LEL) or odor potential.

Hourly and annual emissions are used in air dispersion models that evaluate a facility's risk against the National Ambient Air Quality Standards for the purpose of issuing construction and operating air permits. Hourly emission rates are also used to evaluate whether or not there has been an emission increase to determine if a tank has been “modified” and has become subject to a New Source Performance Standard (NSPS) or a New Source Review (NSR). EPA's 2011 Refinery MACT Information Collection Request (ICR) Protocol required reporting “maximum hourly average emission rates” based on “the reasonable worst-case (high emission rate) situation,” but did not provide a methodology.

Short-term Evaporative Loss Estimation from Atmospheric Storage Tanks

1 Scope

This Technical Report provides methodology on how to estimate short-term individual tank and facility-wide emissions. The methodology is intended to generate reasonable worst-case short-term emission estimates, and not necessarily an estimate of actual short-term emissions (see Annex A for limitations on applying this methodology to actual scenarios). The methodology is applicable to routine tank operations and not applicable to emissions associated with maintenance activities or tank roof landings. The methodology is applicable for estimating short-term emissions from tanks with fittings and seals in good condition and not applicable for tanks with damaged seals or roof fittings. Also, this methodology is not intended for situations where a tank has a malfunction, the emission controls are not working as intended, or there is other structural damage.

The calculated mass emissions using this methodology can be used as input for short-term air dispersion modeling. The Technical Report does not provide guidance on applicability of any particular air dispersion models or modeling protocol.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API *Manual of Petroleum Measurement Standards* (*MPMS*) Chapter 19.1, *Evaporative Loss from Fixed-Roof Tanks*, 4th Edition, 2012.

API *MPMS* Chapter 19.2, *Evaporative Loss from Floating-Roof Tanks*, 3rd Edition, 2012.

API *MPMS* Chapter 19.4, *Evaporative Loss Reference Information and Speciation Methodology*, 3rd Edition, 2012.

3 Estimating Reasonable Worst-case Short-term Emissions from an Individual Storage Tank

NOTE While units from these calculations are typically in pounds/year from the referenced API *MPMS* Ch. 19.1 and 19.2 standards, the short-term emissions durations are usually calculated on the order of hours to days. See Annex A for a more complete explanation of limitations.

3.1 Liquid Storage Temperature

Liquid surface temperature is correlated to tank short-term emissions. If the tank is not fully insulated, then the average daily liquid surface temperature for a given time period is determined as a weighted average of the ambient and liquid bulk temperatures.

$$T_{LA} = 0.4T_{AA} + 0.6T_B + 0.005\alpha I \quad [1]$$

This expression for average daily liquid surface temperature may be converted to a reasonable worst-case maximum liquid surface temperature by using the average daily maximum ambient temperature, T_{MAX}, for the month in

[1] API *MPMS* Ch. 19.1, 4th Edition, 2012, Equation 8, and API *MPMS* Ch. 19.2, 3rd Edition, 2012, Equation 14; average daily liquid surface temperature (TLA).