Kentucky's Approach to the Implementation of the New Source Performance Standards (NSPS) 40 CFR 60 Subpart OOOO for Storage Tanks

APPLICABILITY AND COMPLIANCE

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General Applicability

Affected Facilities Applicable to NSPS Subpart OOOO				
Affected Facilities	**Production Facility (Well Site)**	**Gathering Facility**	**Onshore Gas Processing Facility**	**Transmission Facility**
Natural Gas Well (hydraulically fractured or refractured)	X			
Centrifugal Compressor (using wet seal)		X	X	
Reciprocating Compressor		X	X	
Natural Gas Driven Pneumatic Controller (continuous bleed)	X	X	X	
Storage Vessels	**X**	**X**	**X**	**X**
Equipment (pump, valve, flange, etc. in VOC/wet service) within a process unit			X	
Sweetening units located at onshore natural gas processing plants			X	

Applicable Tanks in the Program

Storage Vessel is a tank containing

- Crude Oil,
- Condensate,
- Intermediate hydrocarbon liquids, or
- Produced Water

And

- Has the PTE > or = 6 TPY of VOCs

What is does **VOC** and **PTE** Mean?

- VOC = Volatile organic compound (VOC)
  - Defined by EPA as generally any carbon compound that participates in atmospheric photochemical reactions, but excludes compounds such as CO, CO2, methane, ethane, methylene chloride, trichloroethane and acetone to name a few.
- PTE = Potential to emit
  - Maximum or worse-case potential air emissions from a source based on maximum daily throughput (a.k.a. barrels/day or gal/day of production) given its physical and operational design.

Tanks **Not** In The Program

Storage Vessels do not include:

- Skid-mounted or permanently attached to something that is mobile and on-site for < 180 consecutive days
- Process vessels (surge control vessels, bottom receivers or knockout vessels)
- Pressure vessels (operate in excess of 204.9 kilopascals with no atmospheric emissions)

Storage Vessel Affected Facility

- Affected Storage Vessels Threshold
  - PTE of VOC emissions > than or = **6 TPY**
    - PTE calculated using a generally accepted model or calculation methodology
    - Based on the maximum average daily throughput for a 30-day period of production prior to the applicable emission determination deadline
    - Remains an affected facility even if PTE decreases to < 6 TPY VOC
    - PTE based on VOC emissions after any vapor recovery unit (VRU)
- Group 1 Storage Vessels
  - Constructed/Modified/Reconstructed after **Aug 23, 2011 and before April 12, 2013**
- Group 2 Storage Vessels
  - Constructed/Modified/Reconstructed **after April 12, 2013**

PTE Calculations

- PTE for each tank requires evaluation to determine if = or > 6 tons/year
- The total VOC PTE for each tank needs to be evaluated that will generally include three components:
  - flash emissions,
  - working losses and
  - breathing losses.

PTE Summary from EPA

- Condensate Storage Vessels

Regulatory Option	Throughput Cutoff (bbl/day)	Equivalent Emissions Cutoff (tons/year) [a]	Emission Reduction (tons/year) [b]	
1	0.5	3.0	2.89	
2	1	6.1	5.77	
3	2	12.2	11.55	
4	5	30.4	28.87	

a. Table 7-10 from EPA's Oil and Natural Gas Section: Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution (EPA-453/R-11-02 dated July 2011) and emissions based on the VOC Emissions From Oil and Condensate Storage Tanks, Texas Environmental Research Consortium revised 4/2/2009.

b. Calculated using 95 percent reduction.

PTE Summary from EPA

- Crude Oil Storage Vessels

Regulatory Option	Throughput Cutoff (bbl/day)	Equivalent Emissions Cutoff (tons/year) [a]	Emission Reduction (tons/year) [b]	
1	1	0.3	0.28	
2	5	1.5	1.4	
3	20	5.8	5.55	
4	50	14.6	13.87	

a. Table 7-11 from EPA's Oil and Natural Gas Section: Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution (EPA-453/R-11-02 dated July 2011) and emissions based on the VOC Emissions From Oil and Condensate Storage Tanks, Texas Environmental Research Consortium revised 4/2/2009.
b. Calculated using 95 percent reduction.

- >=20 BOPD generally accepted threshold for 6 tpy VOC.
- Please note that the threshold could be < 20 BOPD.

PTE Calculations

- Some Methods used to determine PTE:
  - Direct Measurement (working, breathing, flash)
  - Process Simulator Software (HYSIM, HYSYS, VMGSim, WinSIM Designed II) (flash losses only)
  - ProMax (working, breathing, flash)
  - E&P Tanks Software designed by American Petroleum Institute (API) (working, breathing, flash)
    - Use option that requires site-specific sampling
    - Use geographical database option
  - Vasquez-Beggs Equation (VBE) (flash losses only)
  - EPA Tanks Program Version 4.0.9d developed by API (working and breathing losses) from AP-42.

PTE Calculations

- To save time and perform an initial estimate of PTE we recommend using the following methods:
  - Vasquez-Beggs Equation (VBE) for **flash losses**
  - EPA Tanks Program Version 4.0.9d for **working and breathing losses** (Not reliable on Windows VISTA & 7 OS)
- Kentucky DAQ reported that most of the submissions they have seen (Registrations and Permits) and approved have performed PTE calculations using VBE and EPA Tanks although more complex operations have used ProMax.

PTE Calculations

- Vasquez-Beggs Equation (VBE) Required Input Data for Flashing Losses:
  - Stock Tank API Gravity (Default 78)
  - **Separator Pressure (psig), if any, or inlet pressure**
  - Separator Temperature (°F) (Default 60°F)
  - Separator Gas Gravity at Initial Condition (Default 0.90)
  - **Stock Tank Barrels of Oil per day (BOPD)**
  - Stock Tank Gas Molecular Weight (Default 49)
  - Fraction VOC (C3+) of Stock Tank Gas (Default 0.8)
  - Atmospheric Pressure (psia) (Default 14.7)

PTE Calculations

- EPA Tanks Program Version 4.0.9d Required Input Data for Working and Breathing Losses (annual):
  - Tank Location (City and State)
  - Type of Tank (vertical/horizontal, fixed roof/floating roof, etc.)
  - Tank Dimensions
    - Shell Height
    - Diameter
    - Liquid Height
    - Average Liquid Height
    - Net Annual Throughput
    - Is tank heated?
  - Paint Characteristics:
    - Shell Color/Shade and Shell Condition
    - Roof Color/Shade and Roof Condition
  - Roof Characteristics (if vertical tank):
    - Type (Cone or Dome)
    - Height
    - Slope (cone roof)
  - Breather Vent Settings
    - Vacuum Settings (psig)
    - Pressure Settings (psig)
  - Tanks Contents (Organic Liquids, Petroleum Distillates, Crude Oil) including speciation and any available information on vapor pressure, liquid molecular weight, vapor molecular weight

Example PTE Calculations – Flashing Losses

- Vasquez-Beggs Equation (VBE) Required Input Data:
  - Stock Tank API Gravity: 29.99°API
  - **Separator Pressure (psig): 285.3 psig**
  - Separator Temperature (°F): 200°F
  - Separator Gas Gravity at Initial Condition: 0.75
  - **Stock Tank Barrels of Oil per day (BOPD): 20 BOPD**
  - Stock Tank Gas Molecular Weight: 50 lb/lb-mole
  - Fraction VOC (C3+) of Stock Tank Gas: 0.9
  - Atmospheric Pressure (psia): Default 14.7 psia
- Results: PTE (Flash Emissions) = **21.9 tpy VOC**

Example PTE Calculations – Working/Breathing Losses

- EPA Tanks Program Version 4.0.9d Required Input Data:
  - Tank Location (City and State): **Louisville, KY**
  - Type of Tank (vertical/horizontal, fixed roof/floating roof, etc.): **Oil and Gas – Vertical Fixed Roof Storage Tank**
  - Tank Dimensions
    - Shell Height: **20 feet**
    - Diameter: **15.00 feet**
    - Liquid Height: **19 feet**
    - Average Liquid Height: **15 feet**
    - Net Annual Throughput: **306,600.00 gal/year (= 20 BOPD)**
    - Is tank heated? **No**
  - Paint Characteristics:
    - Shell Color/Shade: **Gray/Light** and Shell Condition: **Good**
    - Roof Color/Shade: **Gray/Light** and Roof Condition: **Good**
  - Roof Characteristics (if vertical tank):
    - Type (Cone or Dome): **Cone**
    - Height: **3 feet**
    - Slope (cone roof): **0.4 ft/ft**
  - Breather Vent Settings:
    - Vacuum Settings (psig): **-0.03 psig**
    - Pressure Settings (psig): **0.03 psig**
  - Contents: **Crude oil (RVP 5),** multiple component liquid using vapor molecular weight of 50 lbs/lb-mole
- Results:
  - Working Losses: 832.91 lbs/year or 0.416 tons/year
  - Breathing Losses: 791.34 lbs/year or 0.395 tons/year
  - Total VOC PTE: **1,624.25 lbs/year or 0.81 tons/year**

Example PTE Calculations

- Flash emissions = 21.9 tpy VOC
- Working/Breathing Loss Emissions = 0.81 tpy VOC
- Total PTE = 22.7 tpy VOC
- Therefore, if this was a condensate/oil tank that was equipped with a three phase separator upstream then the tank is applicable to NSPS Subpart OOOO.
- If this was only an atmospheric storage tank with no pressurized separator or other equipment upstream then you would only consider the Working and Breathing loss emissions and the tank would **not** be applicable to **NSPS Subpart OOOO** since you are < 6 tpy VOC.

Group 1 Storage Vessel Initial Compliance

- **Determine VOC PTE** by **October 15, 2013**
- **Initial Notification** identifying location of each Group 1 vessel along with Initial report was required by **January 13, 2014**
- **Comply** (install capture and controls) by **April 15, 2015**

Group 2 Storage Vessel Initial Compliance

- **Determine VOC PTE** by the later of April 15, 2014 or **30 days after start-up**
- **Reduce VOC emissions by 95%** the later of by April 15, 2014 or within **60 days after start up**
- **Comply** (install capture and controls) by the later of April 15, 2014 or **60 days after start-up**

Group 1 Storage Vessel Continuous Compliance

- Reduce VOC emissions by 95% by **April 15, 2015** through the use of control device or floating roof

Or meet alternative emission limit:

- May remove control device* and maintain uncontrolled VOC to < 4 TPY after demonstrating that uncontrolled VOC emissions have been < 4 TPY for 12 consecutive months
  - Uncontrolled VOC emissions determined on a monthly basis thereafter using average throughput for the month

Group 2 Storage Vessel Continuous Compliance

- Reduce VOC emissions by 95% by April 15, 2014 or **within 60 days of startup** through the use of control device or floating roof

Or meet alternative emission limit:

- May remove control device* and maintain uncontrolled VOC to < 4 TPY after demonstrating that uncontrolled VOC emissions have been < 4 TPY for 12 consecutive months
  - Uncontrolled VOC emissions determined on a monthly basis thereafter using average throughput for the month

Continuous Compliance (Group 1 & 2)

- *Control device must be reinstalled if :
  - Well feeding the storage vessel undergoes fracturing or re-fracturing:
    - Must reduce VOC emissions by 95% as soon as liquids from the well are routed to the storage vessel
  - If monthly VOC emissions increase to > 4 TPY without fracturing or re-fracturing
    - Must reduce VOC emissions by 95% within 30 days of the monthly calculation

Continuous Compliance (Group 1 & 2)

- If storage vessels have controls, they must
  - Reduce emissions by 95%
  - Equip storage vessel with a cover and all openings on the cover to form a continuous impermeable barrier
  - Equipped with a closed vent system to route all gases to a control device or a process
  - Meet prescriptive performance testing requirements
  - Meet prescriptive continuous monitoring and maintenance requirements

Options for VOC Recovery

- Carbon Adsorption System
- Combustion Devices (e.g. thermal vapor incinerator, catalytic vapor incinerator, boiler or process heater)
- Vapor Recovery Unit

Control Options: Activated Carbon

PROS	CONS
Costs	Viable for less than 1,000 ppm vapor streams.
Safety	Creates a waste product that must be disposed of.
Better public perception	

- Contact at Calgon Carbon Corporation:

James P. Gray
Phone: (412) 787-6841 (office) or (412) 956-7885 (cell)
Email: jgray@calgoncarbon-us.com
www.calgoncarbon.com

Control Options: Combustion

PROS	CONS
Available for large producers	Safety
Relatively easy operation	Permit may be required
Can handle fluctuations in concentration, flowrate, heating value, etc.	May cause loss of product
Efficient (approx. 95% efficient)	Public perception – environmental issues
Less expensive than VRU	Creates secondary pollutants

Control Options: Vapor Recovery

PROS	CONS
Environmental perception	May cause fluctuations in vapor loading
Effective (approx. 95% reduction in VOC emissions)	Expensive
Salable gas product	May still need to flare or vent
	Operator must provide evidence of compliance
	Must have sufficient electrical service
	Safety concerns
	Must have storage tank and/or gathering line available

Recordkeeping

- Identification of each storage vessel including:
  - Location(lat. and long. coord. in decimal degrees to five decimals – NAD 1983)
  - Date of startup and the reporting period
- VOC emission rate determination for each storage vessel with calculation methodology and/or calculation model used
- Deviations from requirements during the reporting period
- Mobile vessel consecutive days on site
  - If removed and returned or replaced within 30 days, entire period will count as consecutive days
- Closed vent system inspections and results
- Control devices:
  - Minimum and maximum operating parameter values
  - Continuous parameter monitoring data
  - Results of all compliance calculations and any performance tests
  - Results of all inspections
- Annual Reports

Reporting Schedule (Initial and Annual)

- Initial annual report due January 13, 2014 (Group 1)
- If the storage vessel affected facility's compliance period began upon start-up, then the annual report is due no later than 90 days after the end of the compliance period (one year after startup)
- Future annual reports are due on the same date each year
- Annual report may coincide with Title V report if all elements of annual report are included
- A common schedule for reports may be submitted provided the schedule does not extend the reporting period

Reporting

- Report must contain information such as
  - Company name and address of affected facility
  - Beginning and ending dates of the reporting period
  - Identification and location of each storage vessel affected facility constructed, modified, or reconstructed during the period
  - Documentation of VOC emission rate determination
  - Records of deviations that occurred during the reporting period
  - Identification of each Group 1 and Group 2 storage vessel with location coordinates in decimal degrees to 5 decimal places.
  - Compliance statement regarding initial compliance requirements
  - Storage vessel affected facilities removed from service*
  - Storage vessel affected facilities returned to service*
  - Results of any required Performance Tests if using control devices
  - Certification by a responsible official of truth, accuracy and completeness and shall state that based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate and complete.

Reporting Information(Initial and Annual)

- Storage vessels removed from service
  - Submit notification in annual report identifying all affected vessels that are removed from service during the period
- Storage vessels returning to service
  - If returning to service and associated with fracturing
    - Comply with control requirement options immediately
    - Submit notification in annual report
  - If returning to service and not associated with fracturing
    - Determine VOC emissions within 30 days
    - If uncontrolled VOC emissions > 4 TPY must comply with control requirements within 60 days of return to service
    - Submit notification in annual report

Guideline for Initial Compliance

- Develop an inventory of storage tanks installed, modified, or reconstructed after August 23, 2011.
- Determine potential VOC emission rate
  - **Group 1** October 15, 2013
  - **Group 2** April 15, 2014 or **within 30 days after startup**
- Reduce VOC emissions as required (95%)
  - **Group 1** by **April 15, 2015**
  - **Group 2** by April 15, 2014 or **within 60 days after start-up**
- Meet control requirements
  - **Group 1 April 15, 2015**
  - **Group 2** April 15, 2014 or **within 60 days after start-up**
- Submit Group 1 notifications by January 13, 2014
- Maintain required records

Guideline for Continuous Compliance

- Reduce VOC emissions by 95%
- If storage vessels have controls, they must
  - Reduce emissions by 95%
  - Be covered, and have closed vent system
  - Meet prescriptive performance testing requirements
  - Meet prescriptive continuous monitoring requirements
- Or maintain uncontrolled VOC to < 4 TPY with monthly determinations
- Submit annual reports as required by the dates established.
- Maintain all records either onsite or at the nearest local field office for at least 5 years.

Guides and Helpful Links

- Kentucky Division of Compliance Assistance – Compliance Guide to NSPS Subpart OOOO (7/8/2014)
  - http://dca.ky.gov/DCA%20Resource%20Document%20Library/NSPS4OGuidance7.8.14final.pdf
- EPA Oil and Natural Gas Air Pollution Standards
  - http://www.epa.gov/airquality/oilandgas/
- EPA Storage Tank Emission – TANKS Ver. 4.09D
  - http://www.epa.gov/ttnchie1/software/tanks/
- Electronic Code of Federal Regulations – Title 40
  - http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40tab_02.tpl

Questions

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