

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	

Final Rule Compliance Schedule



NSPS OOOO Affected Facility	Standard	Compliance Date
Hydraulically fractured wildcat and delineation wells	Complete combustion	October 15, 2012
Hydraulically fractured low pressure non-wildcat and non-delineation wells	Complete combustion	October 15, 2012
Other hydraulically fractured wells	Complete combustion	Before 1/1/2015
Other hydraulically fractured wells	REC and complete combustion	After 1/1/2015
Centrifugal compressors with wet seals	95% reduction	October 15, 2012
Reciprocating compressors	Charge rod packing	October 15, 2012
Pneumatic controllers at NG processing plants	Zero bleed rate	October 15, 2012
Pneumatic controllers between wellhead and NG processing plants	6 scfh bleed rate	October 15, 2013
<i>Group 2 and 1 Storage Vessels</i>	<i>95% reduction</i>	<i>April 15, 2014/2015</i>
Equipment Leaks	LDAR program	October 15, 2012
Sweetening Units	Reduce SO ₂ as calculated	October 15, 2012

What is a Storage Vessel:



Storage Vessel is a tank containing

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

What does VOC and PTE Mean?



- VOC = Volatile organic compound
 - Defined by EPA and are generally organic chemical compounds whose composition makes it possible for them to evaporate under normal atmospheric conditions of temperature and pressure.
- 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)

Tanks in the Program



- Each single Storage Vessel with a PTE $>$ or $=$ 6 TPY of VOCs and located in the:
 - Oil and natural gas production segment
 - Oil and natural gas gathering segment
 - Natural gas processing segment
 - Natural gas transmission and storage segment

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
- Pressure vessels

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 daily throughput
 - ✦ Can rely on enforceable limitations 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.

Guidelines for Compliance



- Develop an inventory of storage tanks installed, modified, or reconstructed after August 23, 2011.
- Perform emission calculations for applicable storage tanks
 - Accuracy
 - Parameters/inputs to be collected
 - “Compliance margin” (if any)
 - Evaluate control measures if PTE \geq 6 TPY
 - Group 1 storage tanks in first annual report
 - Install Group 2 storage tank controls by April 15, 2014 and Group 1 storage tank controls by April 15, 2015

PTE Summary from EPA



- Condensate Storage Vessels

Throughput Cutoff (BOPD)	Equivalent Emissions Cutoff (tons/year) ^a	Emission Reduction (tons/year) ^b	
0.5	3.0	2.89	
1	6.1	5.77	
2	12.2	11.55	
5	30.4	28.87	

a. Tables from EPA's Oil and Natural Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution (EPA-453/R-11-002 dated July 2011) and emissions based on the Texas Environmental Research Consortium revised 4/2/2009.

b. Calculated using 95 percent reduction.

PTE Summary from EPA



- Crude Oil Storage Vessels

Throughput Cutoff (BOPD)	Equivalent Emissions Cutoff (tons/year) ^a	Emission Reduction (tons/year) ^b	
1	0.3	0.28	
5	1.5	1.4	
20	5.8	5.55	
50	14.6	13.87	

a. Tables from EPA's Oil and Natural Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution (EPA-453/R-11-002 dated July 2011) and emissions based on the Texas Environmental Research Consortium revised 4/2/2009.

b. Calculated using 95 percent reduction.

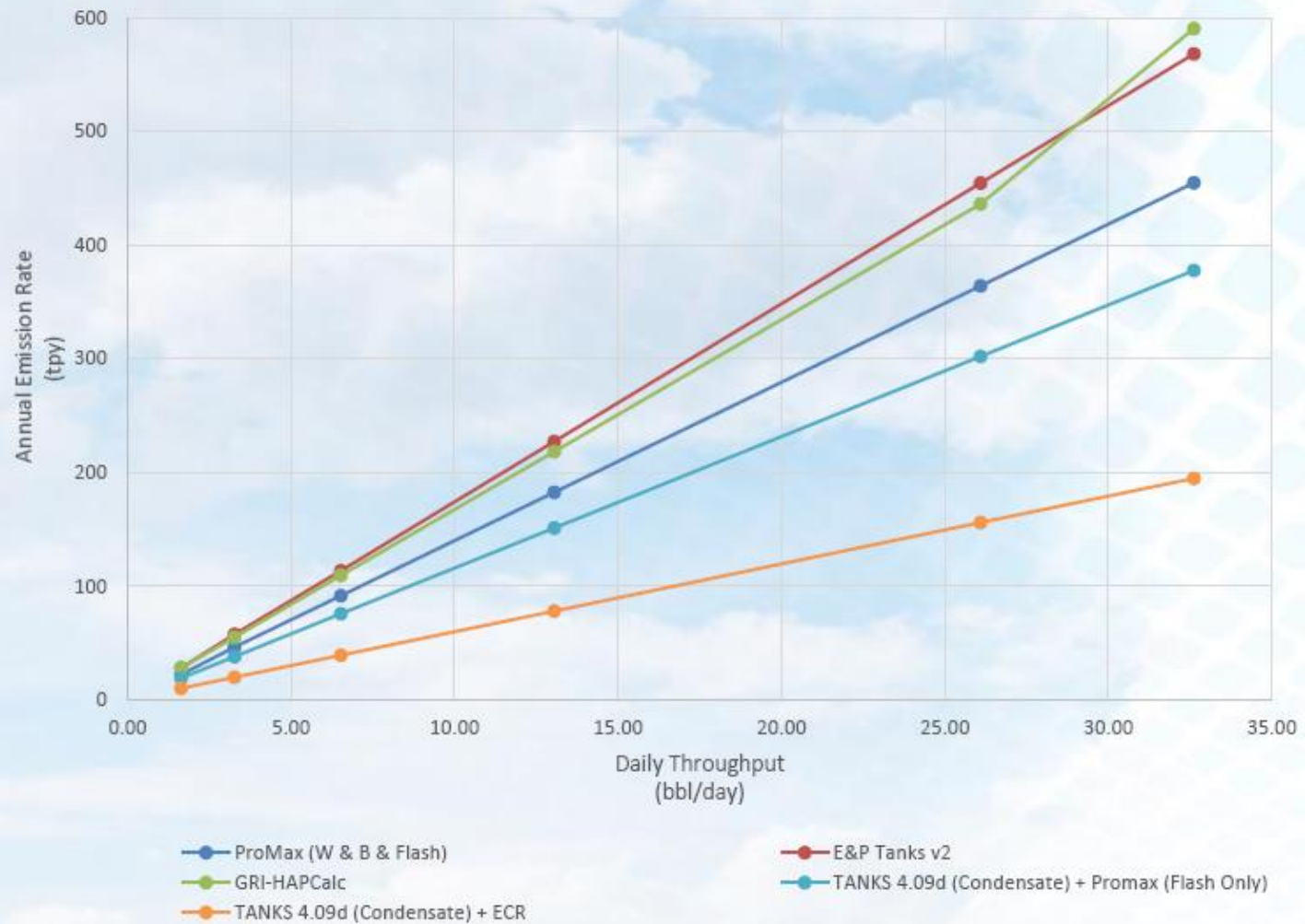
- ≥ 20 BOPD generally accepted threshold for 6 tpy VOC.
- Please note that the threshold could be < 20 BOPD.

PTE Calculations - Methods



- **Some Methods used to determine PTE:**
 - Direct Measurement (working, breathing, flash)
 - Process Simulator Software (HYSIM, HYSIS, VMG, WinSIM Designed II and PROMAX) (flash losses only)
 - E&P Tanks Software designed by American Petroleum Institute (API) (working, breathing, flash)
 - ✦ Use option that requires 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.

Method Comparison



PTE Calculations - Methods



- 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
- Please note that we are still anticipating some guidance from Kentucky DAQ on their approved calculation methods.

PTE Calculations - Methods



- 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 - Methods



- 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.
- Flash emissions do not occur if temperature and pressure differences are 0.

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 by **January 15, 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
- 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



- 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:
 - Reduce VOC emissions by 95% as soon as liquids from the well are routed to the storage vessel
 - If VOC emissions increase to > 4 TPY without fracturing or re-fracturing
 - Reduce VOC emissions by 95% within 30 days of the determination

Continuous Compliance (Group 1 & 2)



- 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

Options for VOC Recovery



- Activated Carbon
- Flaring
- Vapor Recovery Unit

Existing Tank Setup Before VOC System Upgrade





Re-plumb tank
vents

Thief hatch seal

Courtesy: Country Mark

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	

- We are working on developing a “standard” application for pricing purposes.
- 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

Information Needed for Standard Application



STREAM PROPERTIES			
Property	Units	Average	Design
Temperature	<input type="checkbox"/> °F or <input type="checkbox"/> °C	<input type="checkbox"/>	<input type="checkbox"/>
Flowrate	<input type="checkbox"/> Acfm or <input type="checkbox"/> Scfm or <input type="checkbox"/> gpm	<input type="checkbox"/>	<input type="checkbox"/>
Pressure	<input type="checkbox"/> psig or <input type="checkbox"/> inches w.c.	<input type="checkbox"/>	<input type="checkbox"/>
Total Suspended Solids	mg/l	<input type="checkbox"/>	<input type="checkbox"/>
Density	g/cc	<input type="checkbox"/>	<input type="checkbox"/>
pH	-	<input type="checkbox"/>	<input type="checkbox"/>
Relative Humidity (RH)	%	<input type="checkbox"/>	<input type="checkbox"/>
Component	Concentration	Treatment Objective	Units
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> lb/hr <input type="checkbox"/> lb/day <input type="checkbox"/> ppmV <input type="checkbox"/> ppmW <input type="checkbox"/> mg/L
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is there a pH maximum limitation for liquid phase effluent?		<input type="checkbox"/> Yes: pH _{max} = <input type="checkbox"/>	<input type="checkbox"/> No

ACTIVATED CARBON AND EQUIPMENT INFORMATION

Control Options: Flaring/Combustion



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

Performance Testing Combustion Control Devices – Manufacturers' Performance Test NSPS OOOO and MACT HH/HHH



Manufacturer	Model Number	Date of Performance Test Submittal	Control Device Demonstrates Performance Requirements (Y/N) ³	Maximum Inlet Flow Rate ⁴
Abutec	SCUF MTF 0.7	02/12/2013	*	*
	SCUF MTF 2.7	02/13/2013	*	*
COMM Engineering	COMM OOOO Combustor 200	03/06/2013	*	*
Cimmaron	CEI 1-24	05/08/2013	*	*
	CEI 1-30	05/08/2013	*	*
	CEI 1-48	05/08/2013	*	*
	CEI 1-60	05/08/2013	*	*
Leed Fabrication	LDF3096 24"	7/22/2013	*	*
	LDF3096 36"	7/22/2013	*	*
	LDF3096 48"	7/22/2013	*	*

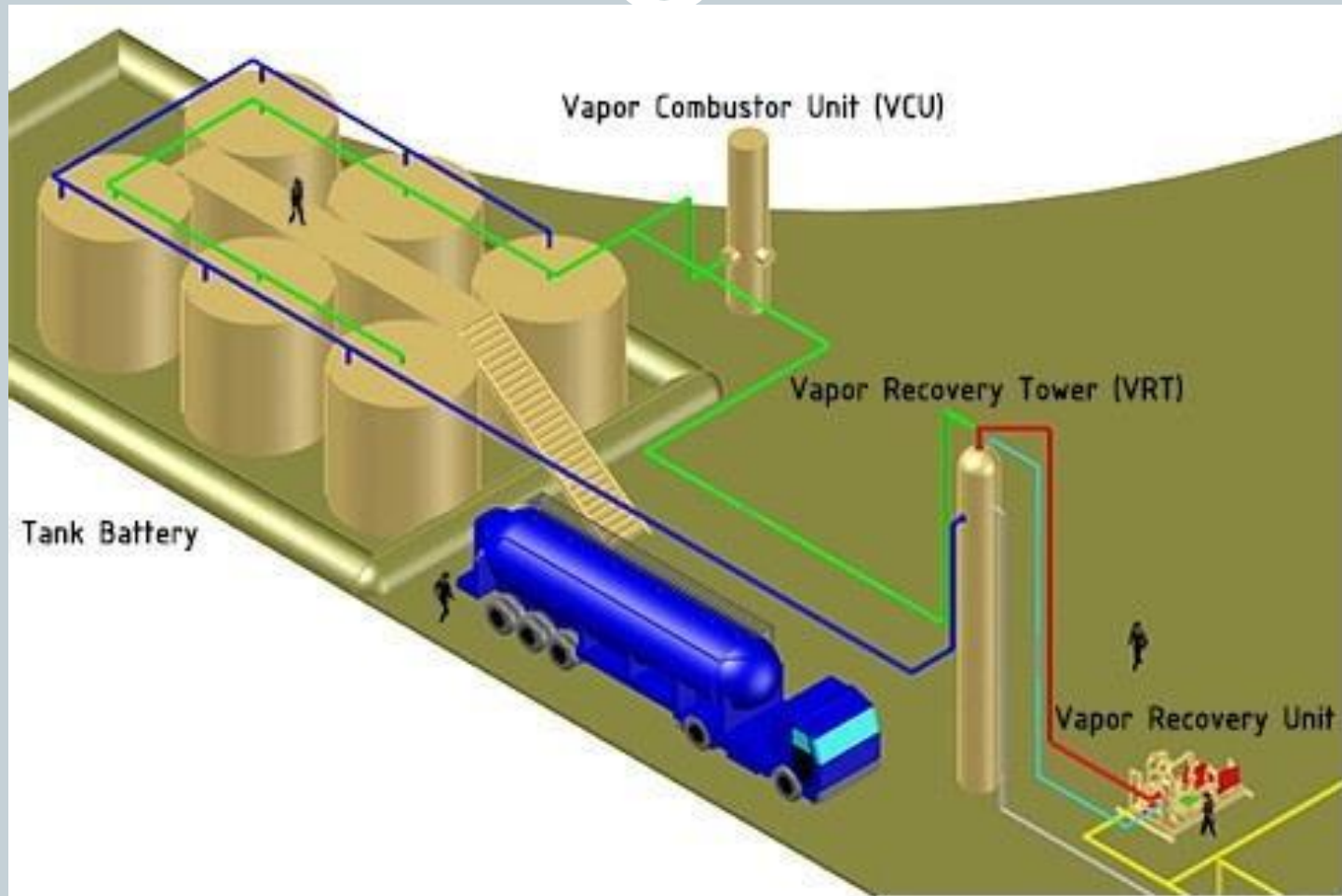
* Blank cells indicate that a decision has yet to be made on the status of the performance test.

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

VRU Installation – Typical Layout



Vapor Recovery Unit



Large Vapor Combustor



Courtesy: Country Mark

Optional
Emergency
Flare



Courtesy: Country Mark

Recordkeeping



- VOC PTE determination for each storage vessel with calculation methodology and/or calculation model used
- Deviations from requirements
- 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
 - Results of all inspections

Reporting



- Initial annual report due January 15, 2014 (Group 1)
- Future annual reports 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 Storage vessel information such as
 - ✦ Identification and location of each storage vessel affected facility constructed, modified, or reconstructed during the period
 - ✦ Documentation of VOC emission rates
 - ✦ Records of deviations that occurred during the reporting period
 - ✦ Identification of each Group 1 storage vessel with location coordinates
 - ✦ Compliance statement regarding initial compliance requirements
 - ✦ Storage vessel affected facilities removed from service*
 - ✦ Storage vessel affected facilities returned to service*
 - ✦ Results of Performance Test if using control devices

Reporting



- **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

Summary: Demonstrate Initial Compliance



- Determine potential VOC emission rate
- Reduce VOC emissions as required
- Meet control requirements
- Submit required notification information
- Maintain required records
- Submit Group 1 notifications

Demonstrate Continuous Compliance



- Reduce VOC emissions by 95%
- Maintain uncontrolled VOC to < 4 TPY
- 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

Best Option to Avoid Subpart OOOO



!! This is important specifically for facilities on the borderline of 6 TPY limit (between 5-8 TPY)

- Prior to calculation determination date (October 15, 2013 for Group 1 and April 15, 2014 for Group 2),
 - ✦ “Permitting out” of NSPS Subpart OOOO for storage tanks by limiting PTE to <6 TPY with federally enforceable limits or
 - ✦ Accept restrictions in state-issued permits to keep VOC < 6 TPY or limit on production or
 - ✦ Install VRUs or control devices and follow monitoring, recordkeeping and reporting requirements in the state issued permits

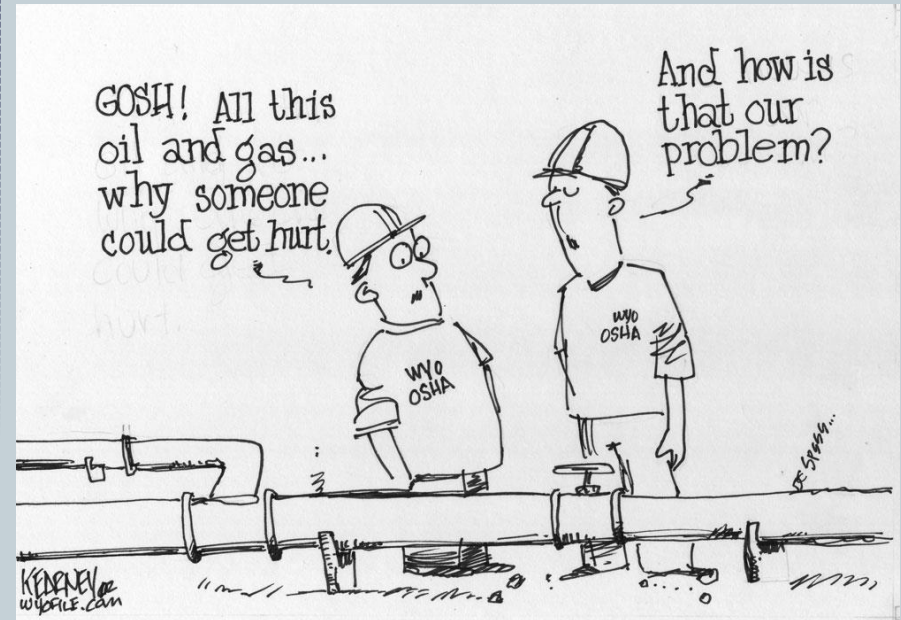
Deadlines to Remember



- October 15, 2013: Group 1 Storage Vessels PTE Determination
- January 15, 2014: First annual report
 - Include Group 1 storage vessels
- April 15, 2014: PTE and compliance for Group 2 storage tanks
- April 15, 2015: Compliance for Group 1 storage tanks

OSHA & The Oil Patch

- U.S. OSHA is paying attention to EPA's rules.
- Kentucky's wells are regulated by KY OSHA.
- KY OSHA gets involved when there are fatalities, increases in accidents and injuries.



What to Do to Avoid OSHA Violations



- Review applicable standards, Health & Safety Plans and employee training.
 - Management of gases from oil and gas operations
 - Flares and other emission management techniques
- Oil & Gas Well drilling and Servicing eTool:
<https://www.osha.gov/SLTC/etools/oilandgas/index.html>

Questions



- SMG has created a checklist for determining applicability

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