TCEQ

Texas Commission on Environmental Quality

Annual Emissions Inventory Workshop

Presented to 2014 Emissions Inventory Workshop

January 23, 2014

Agenda

- Emissions Inventory Rule Applicability
- Representing a Site in the Emissions Inventory: Basic and Advanced
- Emissions Determination Methods and Reporting
- Heated Storage Tanks
- Combustion Emissions Sources Reporting Challenges
- Emissions Inventory Challenges: Volatile Organic Compounds Emissions Sources
- Electronic Reporting

TCEQ

Emissions Inventory Rule Applicability

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Presented to the 2014 Emissions Inventory Workshop
January 23, 2014

Overview

- 30 Texas Administrative Code (TAC) Section (§) 101.10
- Applicability: Do you need to submit an Emissions Inventory (EI)?
- EI types
- Revisions policy
- Publications
- Contact information

30 TAC §101.10

EI rule organization

(a) Applicability

(b) Types of inventories

(c) Calculations

(d) Certifying statements

(e) Reporting requirements

(f) Enforcement

Applicability Requirements: Do You Need to Submit an EI?

- Major stationary source defined under 30 TAC §116.12, Nonattainment and Prevention of Significant Deterioration Definitions
  - Rule defines potential to emit (PTE) thresholds
  - Major source definition can change based on attainment status of county
- Need to know:
  - PTE and actual emissions thresholds for regulated pollutants
  - PTE and actual emissions thresholds for hazardous air pollutants (HAPs)
  - Site location and attainment status of county

Reporting Thresholds for Ozone Nonattainment Areas

Summary of Reporting Requirements in tons per year (tpy) for 30 TAC §101.10

Note: For ozone nonattainment areas, the more stringent or severe classification (where applicable) between the 1997 and 2008 ozone standards is used to determine reporting requirements for ozone precursor potential emissions.

County	Volatile Organic Compounds (VOC)		Nitrogen Oxides (NO_X)		Other		Individual HAPs		Aggregate HAPs	
	Actual	PTE	Actual	PTE	Actual	PTE	Actual	PTE	Actual	PTE
Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller SEVERE/OZONE	10	25	25	25	100	100	10	10	25	25
Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, SERIOUS/OZONE	10	50	25	50	100	100	10	10	25	25
Wise MODERATE/OZONE	10	100	25	100	100	100	10	10	25	25
All Other Counties	100	100	100	100	100	100	10	10	25	25

Recent Nonattainment Designation

- Effective July 20, 2012, Wise County was designated moderate ozone nonattainment.
- Updated reporting requirements for actual emissions of VOC and NO_x
  - 10 tpy actual VOC
  - 25 tpy actual NO_x
- Reporting requirements for PTE, HAPs, and other regulated pollutants remain the same
  - 100 tpy PTE VOC or NO_x
  - 100 tpy PTE or actual regulated pollutants
  - 10 tpy PTE or actual individual HAP
  - 25 tpy PTE or actual aggregate HAPs

Applicability Summary: What Does This Mean to You?

- What is the attainment status of the county where the site is located?
- What are the site's actual emissions for regulated pollutants and HAPs (single and aggregate)?
- What are the site's PTE limits for regulated pollutants and HAPs (single and aggregate)?

Greenhouse Gas (GHG) Update

- Implement House Bill 788 of the 83rd Legislative Session
- Incorporate GHG as a pollutant under prevention of significant deterioration and New Source Review (NSR)
- Stationary sources would submit to the EI if they are major for NSR
- Stationary sources would be subject to emissions fees if they are major for Title V

GHG Update (cont.)

- Proposed EI reporting changes under 30 TAC §101.10
  - Sources that become major due to GHG would report:
    - Criteria pollutants
    - HAPs
    - Regulated pollutants
  - GHG reporting is not required
- Proposed emissions fees change under 30 TAC §101.27
  - No fee on GHG

    GHG excluded as a "regulated pollutant" for emissions fee assessment purposes only
  - New Title V sources (because of GHG) would pay on all other regulated pollutants

GHG Update (cont.)

- November 8, 2013: rule proposal published in the Texas Register
- December 5, 2013: Public hearing
- December 9, 2013: Comment period ends
- April 2014: Tentative adoption

EI Types

- Initial
- Annual update
- Special

Initial EI

- Applies to a site that has never submitted an inventory
- Data collected using standardized forms or through the Web-based system
- *2013 Emissions Inventory Guidelines* (RG-360/13)
  - Chapter 2: Creating an Initial Emissions Inventory
  - Chapter 5: Example Initial Emissions Inventory
- Due to the Texas Commission on Environmental Quality (TCEQ) by March 31st

Annual EI Update

- Annual update is required every year reporting criteria are met.

  Paper or Web

- Update is due March 31st unless otherwise notified in writing.
- Guidance for annual update
  - Updating an Emissions Inventory Questionnaire: *2013 Emissions Inventory Guidelines,* Chapter 6
  - Emissions Inventory Checklist: *2013 Emissions Inventory Guidelines*
  - Sample calculation templates

New for 2013

Special EI

- Regulated entities that receive a written request from the TCEQ

  Respond to letter even if site does not meet reporting thresholds.

- What are the current special emissions inventories?
  - Lead
    - Any regulated entity that emits ≥ 0.5 tpy of lead emissions during normal operations
    - Any regulated entity that has the PTE 5 tpy or more of lead emissions

Special EI (cont.)

– Ozone Precursors

Regulated entities that had at least 10 tpy of VOC or 25 tpy of NO_X emissions during normal operations and that are located in one of the counties specified below:

Bastrop	**Gregg**	**Henderson**	**Orange**	**Upshur**
Bexar	**Guadalupe**	**Hood**	**Rusk**	**Victoria**
Caldwell	**Hardin**	**Jefferson**	**San Patricio**	**Williamson**
Comal	**Harrison**	**McLennan**	**Smith**	**Wilson**
El Paso	**Hays**	**Nueces**	**Travis**	

Inapplicability Notification Letter

- If you receive a notification letter from the TCEQ but the site does not meet any of the reporting thresholds in 30 TAC §101.10 or special inventory requirements:

  A certifying letter instead of a full EI update is acceptable

- The sample letter provided in the *2013 Emissions Inventory Guidelines*, Appendix B is recommended.
  - No option currently to submit through the Web
  - Similarly worded letter can be provided
- Letter provides two options:
  - Remain on the mailing list; or
  - Removal from the mailing list.

Inapplicability Notification Letter (cont.)

To be removed from the mailing list, the following are required:

- Last emissions in the State of Texas Air Reporting System (STARS) database cannot exceed the applicability requirements.

  Must submit a current updated emissions inventory questionnaire (EIQ) and sample calculations before the site can be removed

- May have to void the site's Title V permit to demonstrate that the PTE levels are below reporting requirements

  If EI reporting requirements are met at any time during the calendar year, an updated EIQ must be submitted.

  One Example: Title V permit was voided in June 2013; therefore, a 2013 EIQ must be submitted.

Insignificant Change Notification Letter

Can be submitted if changes in emissions for each pollutant do not exceed 5% or 5 tpy, whichever is greater

- Changes can be either increases or decreases.
- 2013 emissions compared to last reported emissions in the STARS database.
- If an insignificant change letter is submitted several years in a row, the EI may need to be updated if the OVERALL change exceeds 5% or 5 tpy from last submitted EI.
- Emissions from the previous reporting year are copied to current year.
- Sample letter provided in *2013 Emissions Inventory*, Appendix B

Insignificant Change Notification Letter (Cont.)

In addition to the Insignificant Change Notification Letter the following must be provided:

- Account Information and EI Contact Information on page 2 of the EIQ; and
- Criteria Emissions Totals and Site Quantifiable Event Totals on page 3 of the EIQ;
- Signed Legally Responsible Party on page 4 of the EIQ; and

Insignificant Change Notification Letter (Cont.)

- Updates to emission events and/or scheduled maintenance, startup, and shutdown activities (EE/SMSS);
  - If site experienced no EE, then the EE certification statement on page 4 of the EIQ must be signed
  - If site experienced EE, then provide EE updates on the applicable paths emissions pages of the EIQ.

Who's Responsible for Submitting the EI?

- The owner or operator of the site at the time the inventory is due is responsible for submitting the EI.
- Due date for sites that submitted an EI the previous year is March 31, 2014 unless otherwise directed in writing by the TCEQ.
- Due date for sites that did not submit an EI the previous year but are applicable to reporting requirements is March 31, 2014.

Revising EI Data

- What should be included with the emissions revisions request?
  - Signed cover letter describing the nature and reason for the revisions
  - Revised applicable EIQ pages
  - Updated criteria emissions totals for the site (found on page 3 of the EIQ)
  - Detailed sample calculations and supporting documentation for the revised emissions
- All company initiated revisions requests are subject to the Emissions Assessment Section (EAS) review and approval
- Revisions are processed as time permits

  Typically after all EIs for the current reporting year are reviewed

Revising EI Data (cont.)

EAS revisions policy is year dependent

- Current reporting year (2013) + one previous reporting year (2012)

  Revisions may be updated in STARS.

- Up to three more reporting years (2011, 2010, and/or 2009)
  - Revisions may be updated in STARS or filed in the corresponding year's EI folder.
  - Case-by-case basis
- Five or more years from the current reporting year (2008 and prior)

  Receipt of revisions will be noted in the STARS tracking system and filed in the corresponding year's EI folder.

All revisions are subject to EAS review and approval

Revising EI Data (cont.)

Company Initiated Revisions Submitted during the 2013 Inventory year	
Inventory Year Revision Requested	Can the revisions be entered in STARS?*
2013	Yes
2012	Yes
2011	Case-by-case
2010	Case-by-case
2009	Case-by-case
2008 and prior	No. Filed only and noted in the STARS tracking system.

*Subject to EAS review and approval

EI Publications

- EI guidelines book (RG-360/13) provides:
  - Step-by-step instructions for completing an EI
  - Yearly updates with current reporting requirements
  - Technical supplements for common emissions sources
- EI forms and instructions
  - Blank forms in enterable PDF format
  - Files include instructions and example forms
- Web-based EI Reporting Instructions
- All documents available at: www.tceq.texas.gov/goto/ieas

Call TCEQ publications for your one free hard copy of the *2013 EI Guidelines*: (512) 239-0028

Using EI Data

- Annual submission to the national emissions inventory
- Auditing for air emissions fee
  - Fees group compares EI to fee basis form
- Data requests: Open Records and Internal
- State implementation plan development
- Photochemical and dispersion modeling
- Emissions trends
- Section 185 baseline determinations
- Emissions reduction credits

Contact Information

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TCEQ

Representing Your Site in the Emissions Inventory

Basic and Advanced

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Presented to 2014 Emissions Inventory Workshop
January 23, 2014

Overview

Basic: Establishing Emissions Inventory (EI) Structure

- Resources
- EI terms
- Identifying emissions sources
- How to create EI structure
- What sources must be included in the EI?
- What are the rules for including small emissions sources as group or collective sources?
- What forms are required?

Overview (cont.)

Advanced: Modifying EI Structure

- Adding new paths
- Deactivating paths versus shutting down a facility
- Adding an abatement device to an existing path
- Relabeling facilities or emission points

EI Structure Terms

See Chapter 2, *2013 Emissions Inventory Guidelines*

- **Structure:** The relationship of emissions sources (facilities), emission points, abatement devices, and related emissions data
- **Facility:** Stationary source capable of generating emissions
- **FIN:** Facility Identification Number – An alphanumeric character identification or label for the facility, 10 characters maximum.

EI Structure Terms (cont.)

See Chapter 2, *2013 Emissions Inventory Guidelines*

- **Emission Point:** The physical location where the emissions enter the atmosphere. In the EI, there are three types of emission points:
  - **Stack:** Boilers, engines, building vents, etc.
  - **Fugitive:** Leaking component fugitives, paint curing/drying areas, etc.
  - **Flare:** Only related to flares
- **EPN**: Emission Point Number- An alphanumeric character identification or label for the emission point, 10 characters maximum.

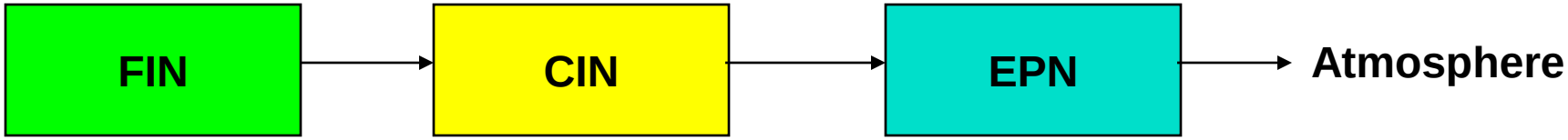
EI Structure Terms (cont.)

See Chapter 2, *2013 Emissions Inventory Guidelines*

- **Emissions Path:** The route a pollutant takes from its origin, through its abatement device (if applicable), to its entrance into the atmosphere. The path is the association of one facility, abatement device (if applicable), and one emissions point.
- **Abatement Device**: A device used to control emissions
- **CIN**: Control Identification Number - An alphanumeric character identification or label for the abatement device.

Emissions Path

Simple Path



Identifying Sources

See Chapter 3, *2013 Emissions Inventory Guidelines*

- Each stationary source/process capable of generating air emissions at the site must be identified to develop an accurate EI.
- **Available tools include:**
  - Plot plans
  - Site maps
  - Comprehensive process flow diagrams
  - Knowledge of the processes at the site
  - Maximum allowable emissions rate table (MAERT) from air permit

Example Site

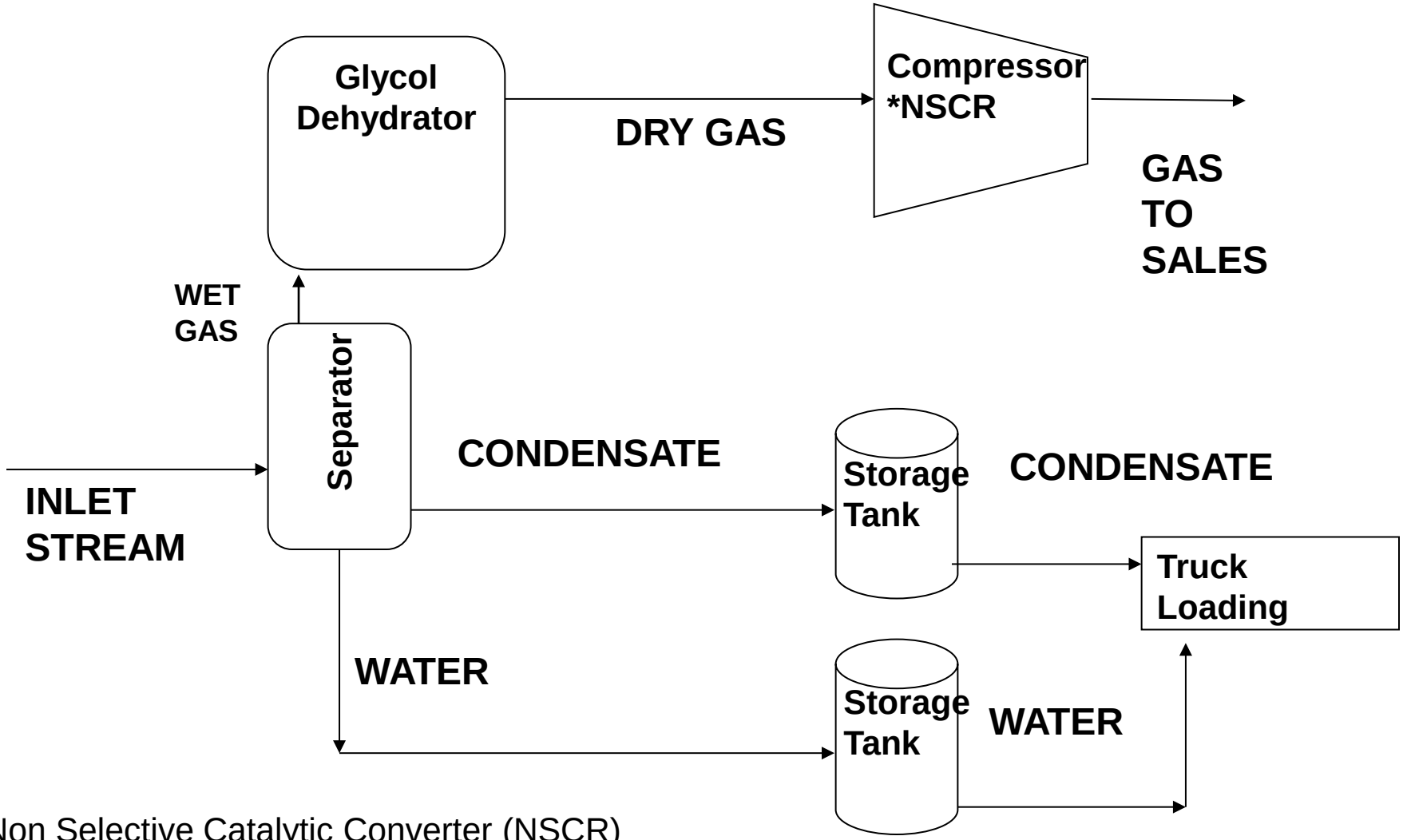
Identifying Sources for Example Site

Process Description

- We have a natural gas gathering station.
  - Process: The inlet stream is separated into gas, condensate, and water. The gas is dehydrated in a glycol unit and compressed. The liquids are sent to storage tanks and then loaded into tank trucks.
  - Controls: The emissions from the glycol unit are routed to a flare; the emissions from one of the compressor engines are controlled by a catalytic converter.
- Use this information in conjunction with a process flow diagram.

Identifying Sources for Example Site (cont.)

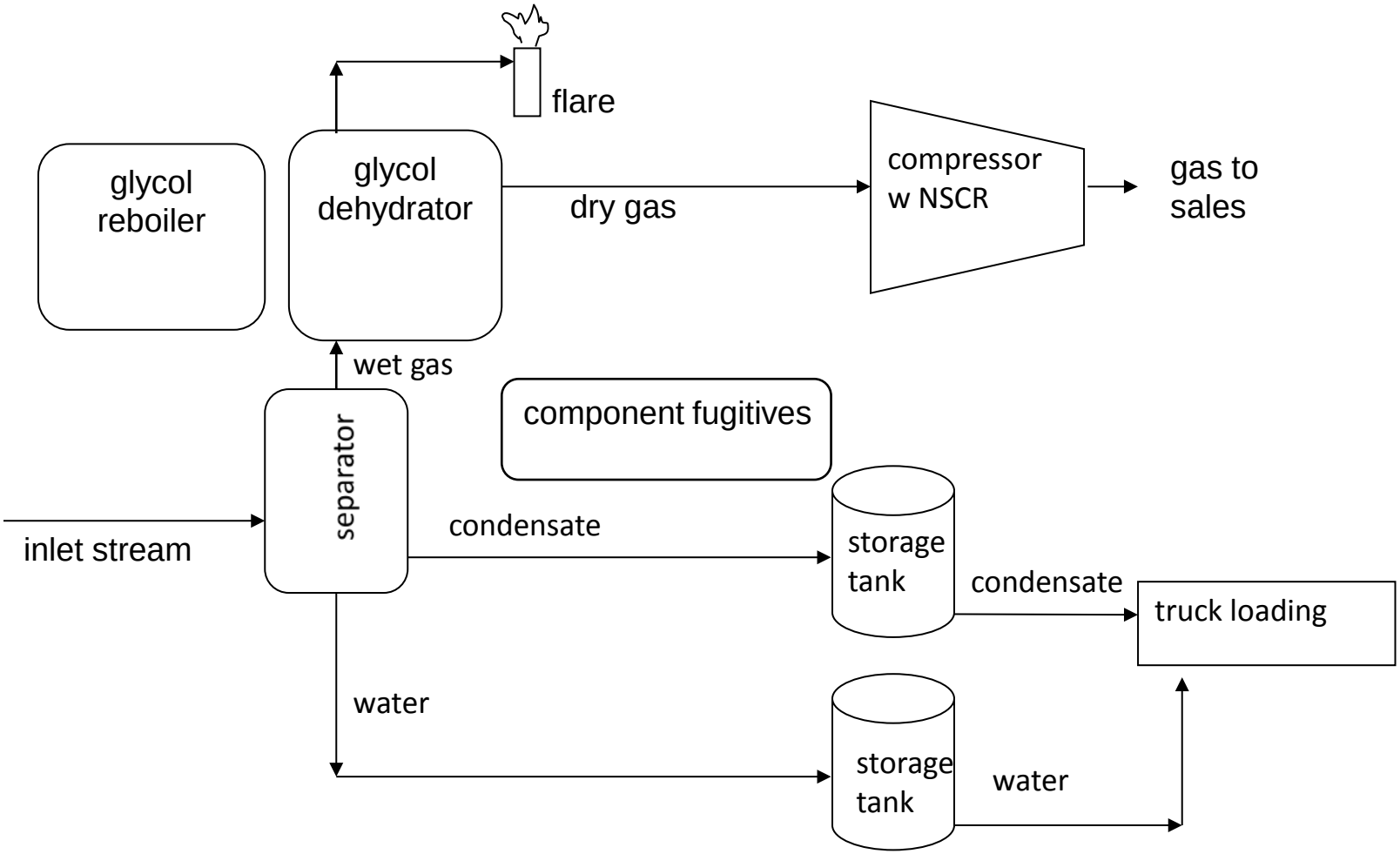
Basic process flow diagram



*Non Selective Catalytic Converter (NSCR)

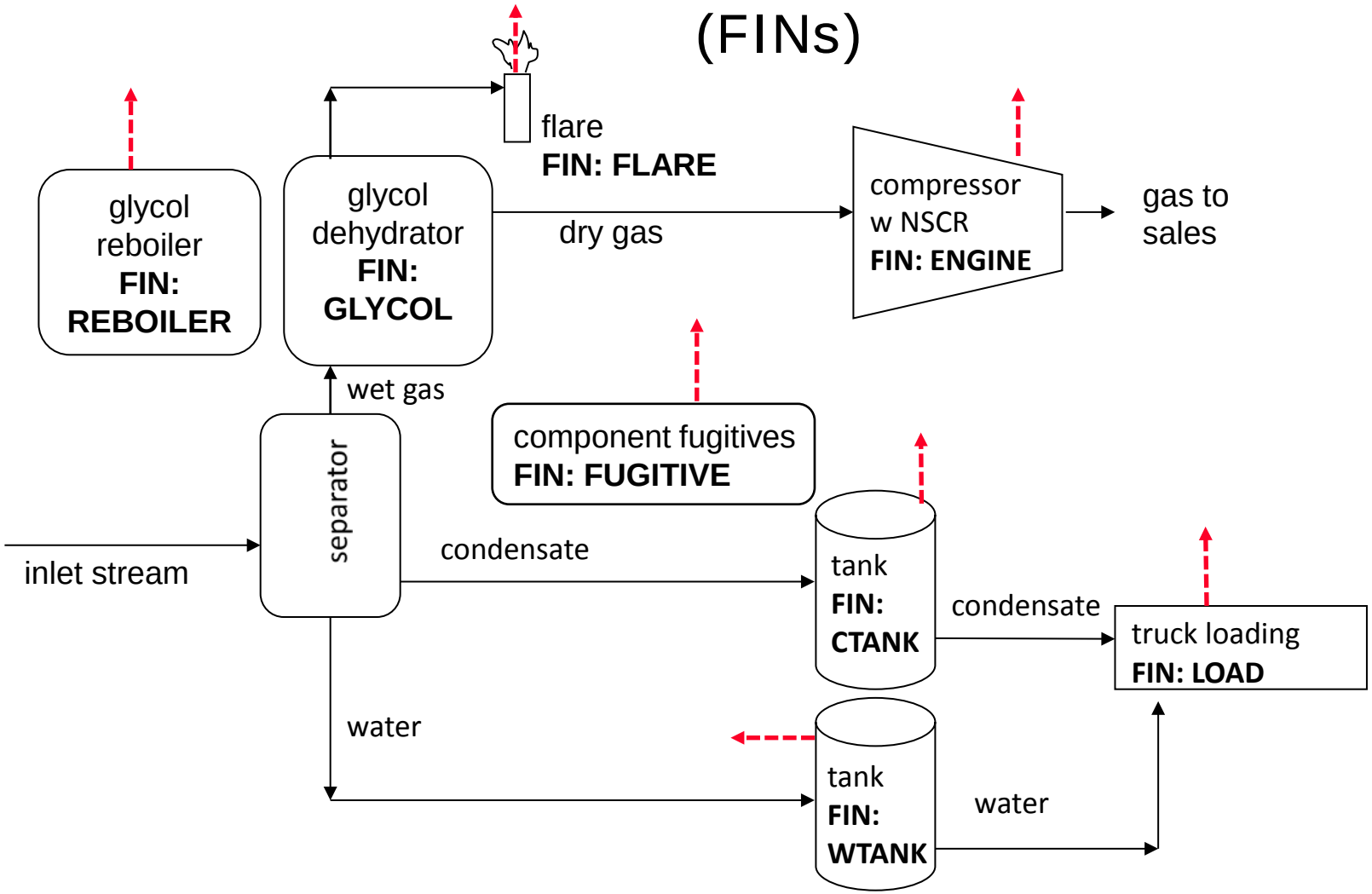
Identifying Sources for Example Site (cont.)

Include related processes



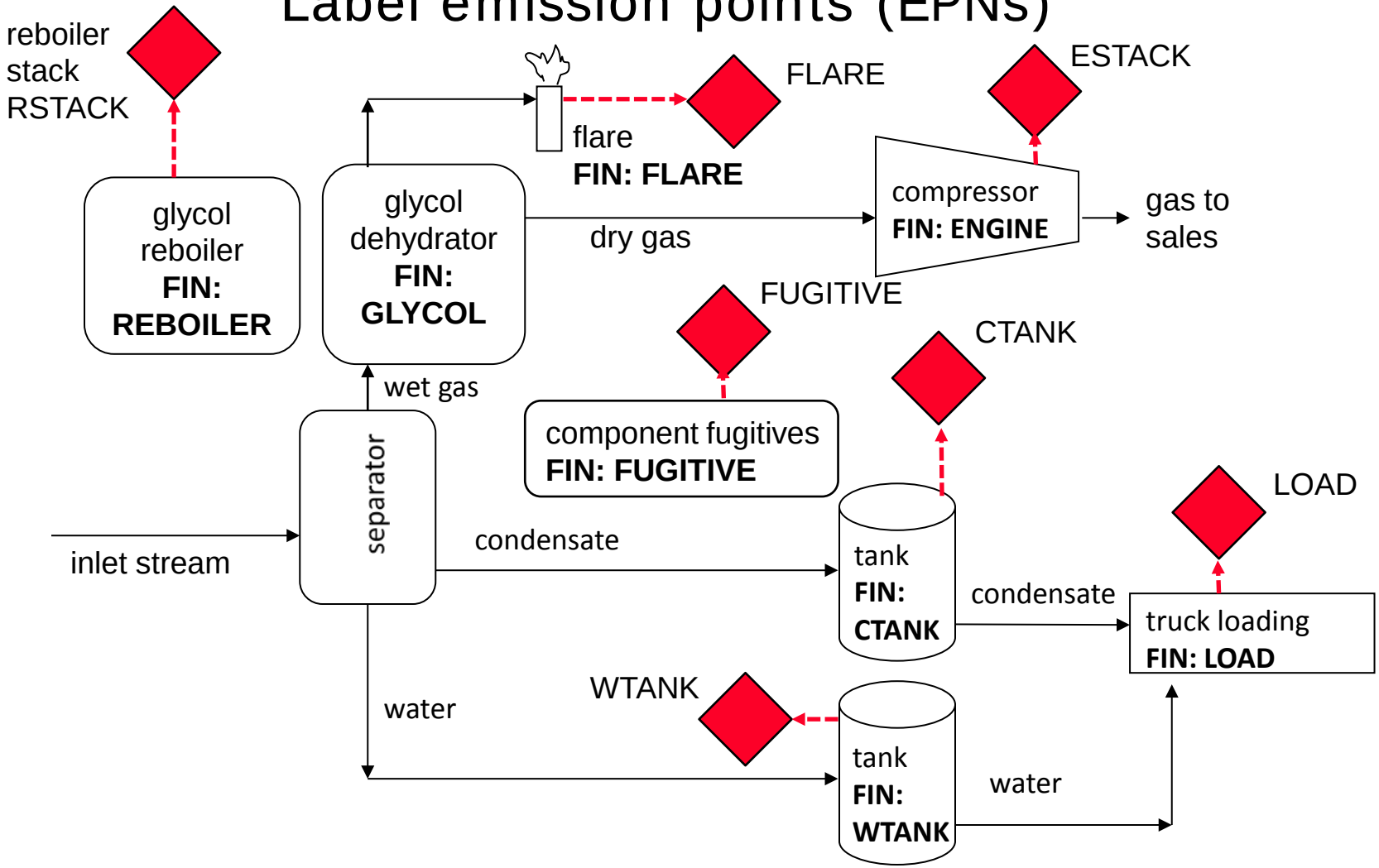
Identifying Sources for Example Site (cont.)

Label sources capable of generating emissions (FINs)

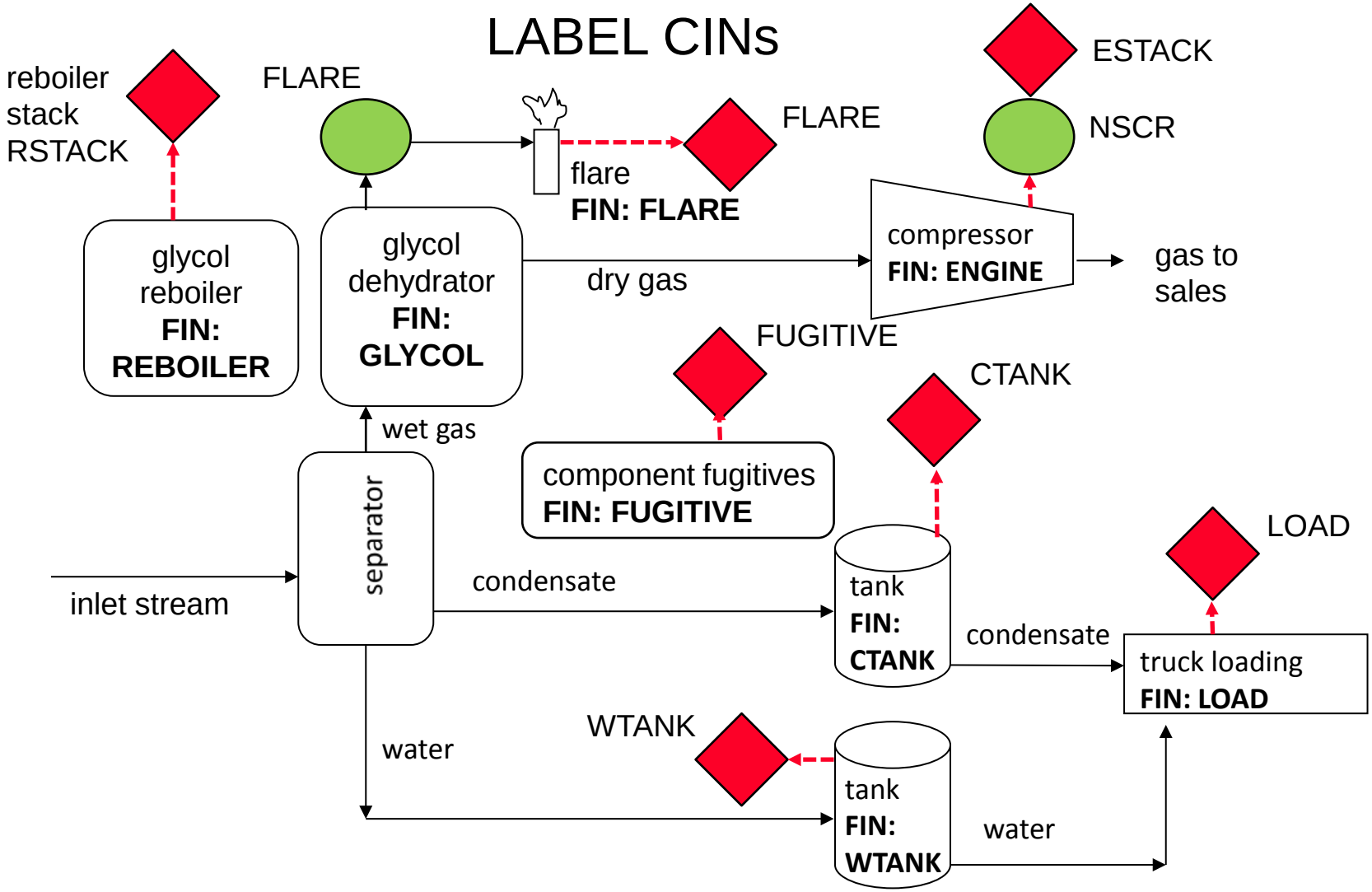


Identifying Sources for Example Site (cont.)

Label emission points (EPNs)



Identifying Sources (Cont.)



Sources that Must be Reported

See Chapter 3, *2013 Emissions Inventory Guidelines*

Each emissions source must be added with associated emissions if it meets *any* of the following criteria.

- It emits **1 ton per year (tpy)** or more of any **regulated pollutant**.
- It emits **0.1 tpy** or more of any **toxic chemical or hazardous air pollutant (HAP).**
- It emits **0.001 tpy** or more of **mercury** or **lead**, or any individual HAP or aggregate HAP listed in any Texas Commission on Environmental Quality (TCEQ)-enforceable document such as a permit, regulation, or commission order.
- It is listed in any TCEQ-enforceable document such as a permit, regulation, or commission order.

Note: "TCEQ-enforceable document" includes permits by rule that have federally enforceable emission limits. Including permit by rule

Sources that Must be Reported (cont.)

- If the individual sources do not meet the requirements outlined on the previous slide, these sources are not required to be reported in the EI provided that the sum of the emissions from the unreported sources are:
  - Less than 5 tpy of any regulated pollutant; and
  - Less than 1 tpy of aggregate HAPs.
- If the sum of the emissions from all the unreported sources exceed the totals above, then these sources must either be:
  - Individually added to the EI; or
  - Grouped according to the collective sources guidelines.

Collective Sources

See Chapter 3, *2013 Emissions Inventory Guidelines*

Small emission sources can be grouped as a collective source if they meet all of the following criteria:

- Have similar source classification codes.
- Each emitted **< 1 tpy** of each **regulated pollutant.**
- Each emitted **< 0.1 tpy** or more of any **toxic chemical or HAP.**
- Each emitted **< 0.001 tpy** or more of **mercury** or **lead**.

Note: The collective source must be reported if the sum of the emissions meets or exceeds 5 tpy for regulated pollutants or 1 tpy of aggregate HAPs.

Emissions to Report: Any Regulated Air Contaminant

- Criteria pollutants
- HAPs identified in Federal Clean Air Act, §112(b)
- Other regulated air contaminants subject to rules, regulations, permits, commission orders, or court orders

  Example: hydrogen sulfide
- Once a site meets applicability for any contaminant, all regulated contaminants must be reported.

Forms Required

- Use the structural overview form as a guide to determine what forms need to be completed.
- Choose the correct facility information form.

  There are 12 different types of facility information forms for representing the common types of sources reported in the EI.
- Choose the correct type of EPN form.

  Stack, flare, or fugitive
- Complete a Path Emissions Form to create a path and report emissions.
- Complete an Abatement Device Information Form to establish a CIN and associate it with an emissions path.

Structural Overview Form

Structural Overview TCEQ Emissions Inventory Year _____	TCEQ Air Emissions Inventory	Page _____ of _____ Structural Overview pages

Company Name:	Site Name:	TCEQ Air Account Number:

NEW OR MODIFIED PATHS LIST			
Facility Identification Number (FIN) *10-character maximum*	Emission Point Number (EPN) *10-character maximum*	Control Identification Number (CIN) *10-character maximum*	Primary Indicator

Completed Structural Overview

NEW OR MODIFIED PATHS LIST		
Facility Identification Number (FIN) *10-character maximum*	Emission Point Number (EPN) *10-character maximum*	Control Identification Number (CIN) *10-character maximum*	Primary Indicator
ENGINE	ESTACK	NSCR	
GLYCOL	FLARE	FLARE	
FLARE	FLARE		
REBOILER	RSTACK		
CTANK	CTANK		
WTANK	WTANK		
FUGITIVE	FUGITIVE		
LOAD	LOAD		

Facility Information Form
VOC Process

Facility Information TCEQ Emissions Inventory Year _____	TCEQ Air Emissions Inventory	**VOC Process**

Company Name: One of These Days Inc.	**Site Name:** We'll Strike it Rich	**TCEQ Air Account Number:** HGXXXXX	**Plant ID:**

FACILITY IDENTIFICATION

FIN: GLYCOL	**Facility Name: GLYCOL SUPER H2O REMOVER**	**SCC:**	3	1	0	0	0	2	2	7

OPERATING SCHEDULE

Facility Status (Circle *only* ONE):	**Facility Status Effective Date:**	**Operating Schedule**
(Active) Idle Permitted but not built	1/01/2012	Start Time: _____ **NOTE:** Start Time REQUIRED Hours/Day: _24___ Days/Week: _7__ Weeks/Year: _52_____

Seasonal Operating Percentages	Spring: __25__% Summer: _25___% Fall: __25__% Winter: __25__% (**NOTE**: Spring % + Summer % + Fall % + Winter % **must equal** 100%)	**Annual Operating Hours:** __8760_____ **Percent Max Capacity:** _100_____%

PROCESS PROFILE

Unit Type (Profile) (Mark only *one* box below)

☐ Analyzer	☐ Polypropylene unit	☐ Polyethylene unit	☐ Mixing vessel	☐ Reactor
☐ Glycol still	☐ Blowdown operations	☐ Flexicoker unit	☐ Delayed coker unit	☐ Other:_____

FACILITY COMMENTS

_____

_____

_____

TCEQ-20036h (11-16-2012) Page 1 of 1

EPN Flare Form

Emission Point Information TCEQ Emissions Inventory Year ____	Flare

Company Name:	Site Name:	TCEQ Air Account Number:	RN:
One of These Days Inc.	We'll Strike it Rich	HGXXXXX	RN123456789

EMISSION POINT IDENTIFICATION	
EPN: FLARE	**Point Name:** Destroy Almost Everything Flare

GEOGRAPHICAL COORDINATES *Fill in one section below.*

Latitude and Longitude *in NAD of 1983*		OR	**UTM Coordinates** *in NAD of 1983*		
Latitude	Longitude		Zone	North Meters	East Meters
_____ deg _____ min _____ sec	_____ deg _____ min _____ sec		☐ 13 ☐ 14 ■ 15	1756493	347693

FLARE INFORMATION

Number of Pilots: 1	Average Flow Rate: 0.4 Mscf / minute

Composition Determination:[11] ☐ Continuous Measurement ☐ Engineering Estimate ☐ One-time performance test ■ Periodic Testing

Flow Determination: ■ Continuous Measurement (by a flow meter at the flare header) ☐ Engineering Estimate ☐ One-time performance test

Height: 80 feet	Inside Tip Diameter: 0.67 feet

Low Heating Value: 900 Btu/scf	Molecular Weight: 22 lb/lb-mole	Temperature: 600 °F

TCEQ-20038b (11-10-11)

Adding a CIN

Abatement Device Information Form

Abatement Device Information

TCEQ Emissions Inventory Year

Company Name:	Site Name:	TCEQ Air Account Number:	RN:
One of These Days Inc.	We'll Strike it Rich	HGXXXXX	RNXXXXXXXXX

ABATEMENT DEVICE INFORMATION

CIN: FLARE	Control Device Name: S-Series Flare	CIN Effective Date: 1/1/2013
Primary Abatement Device: ■ Yes ☐ No	Abatement Code: 511	Number of Units: 1

Annual Operation	Percent Time Offline	Inspection and Maintenance Schedule (Select one)
8760 hours	31 %	☐ Annually ☐ Biannually ☐ Continuously ☐ Daily ☐ Hourly ■ Monthly ☐ Q

CONTROL EFFICIENCY[14] (Please check all contaminants controlled by this abatement device and enter the control efficiency in the space provided)

■ Volatile Organic Compounds: 98 %	☐ Nitrogen Oxides: ____%	☐ Carbon Monoxide: ____%	☐ Sulfur Dioxide: _____%
☐ Inorganic Compounds: _____%	☐ Particulate Matter (PM): _____%	☐ PM_{10}: _____%	■ C_1 & C_3 compounds: 99 %
■ C_{4+} Compounds: 98 %	■ Hydrogen Sulfide (H_2S): 97 %	☐ Ammonia (NH_3): _____%	

PATH(S) ABATED BY THIS DEVICE[15]

FIN	EPN	FIN	EPN
GLYCOL	FLARE		

Reporting Emissions

- Complete the Path Emissions Form.
  - Include FIN, EPN, and CIN for each source.
  - Make sure the effective date is provided.
- Remember that an emissions path is the route the emissions take.
- Make sure combustion emissions (pilot and waste gas combustion) are reported on a combustion path.
- Uncombusted waste gas is reported at the source's emissions path (TANK:FLARE).

Path Emissions Form

Path Emissions
TCEQ Emissions Inventory Year __

Already exists in the STARS database[1]
☐ FIN ☐ EPN ☐ CIN

Company Name:	**Site Name:**	**TCEQ Air Account Number:**	**RN:**
One of These Days Inc.	We'll Strike it Rich	HFXXXXX	RN123456789

CREATE A PATH

FIN: GLYCOL	**EPN:** FLARE	**CIN(s):** FLARE

Path Comment(s):

Total Annual Aggregate Heat Input (Combustion Units Only): _____ MMBtu | **Path Effective Date:** 1/1/2013

LIST NO_x EMISSIONS FACTOR AND SOURCE FOR THIS PATH (if applicable)

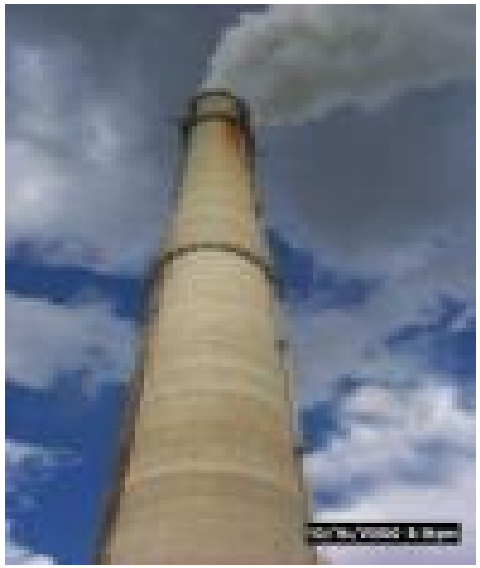
NO_x Emissions Factor	Emissions Factor Units	Factor Reference/Source
_____	_____	_____

REPORT EMISSIONS FROM THIS PATH

Contaminant Code	**Contaminant Name**	**Annual Emissions** *(tons/year)*	**Ozone Season Emissions** *(pounds/day)*	**Determination Methodology**	**SMSS** *(tons/year)*	**Emissions Events (EE)** *tons/year)*
50001	VOC-Unspecified	0.3021	1.6981	B	0	0
52420	Benzene	0.4321	2.4288	B	0	0
52490	Toluene	0.3210	1.8043	B	0	0
52450	Ethyl benzene	0.2100	1.1804	B	0	0
52510	Xylene	0.1000	3.0400	B	0	0

TCEQ-20039 (11-10-11)

Advanced:
Modifying EI Structure



Advance: Modifying EI Structure

- Adding new paths
- Deactivating paths versus shutting down a FIN
- Adding a CIN to an existing path
- Renaming facilities versus emission path changes

Adding New Emission Paths

- Complete a Structural Overview Form to indicate a new path.
- Complete forms for the FIN, EPN, and/or CIN that is/are not in the inventory.
- Complete the Path Emissions Form to create the emissions path and report related emissions (if any).

Shutting Down a FIN Versus Deactivating Path

- If the equipment exists but is no longer operating and will never operate again, change the FIN status to shutdown (S) with effective date.
- If the FIN is still operating but the emissions will no longer emit through the current emission point, write on the EI "Deactivate path, effective (date)".
- In both cases:
  - Zero emissions if the FIN was shut down or the path did not operate for the entire year.
  - Report emissions if the FIN or path was active during any part of the reporting year.

Shutting Down FINs

```
                                                                                                                                  Page:     5
RN:RN999999999      Account:HGA9999
Company:EXAMPLE SITE                                                                                                     EIQ Year:2006

FIN:BOILER-GLY  EPN:BOILER-GLY
Comment:
-------------------------------------------------------------------------------------------------------------------------------------
FACILITY INFORMATION
-------------------------------------------------------------------------------------------------------------------------------------
 FIN:BOILER-GLY         Facility Name:BOILER-GLY                                                    Plant ID:TEST PLANT
     ______________                  ____________________________________________________                  __________

Comment:
          ____________________________________________________________________________________________________
 SCC:31000228  __________  Description:GLYCOL DEHYDRATORREBOILER BURNER
 Status:A_S__ Status Date:   4/15/2006__ Operating Schedule:24  ___hrs/day,7   ___days/wk,52  ___wks/yr
 Annual Operating Hours:8322_________   Percentage Max Capacity:95  __________    Start Time:0   __________

 Seasonal Operating Percentages (NOTE: Spring % + Summer % + Fall % + Winter % must be equal to 100%)
     Spring: 25%_____          Summer: 25%_____          Fall: 25%_____         Winter: 25%_____

 Group Type:COMBUSTN

 Profile:BOILER
 Characteristic        Value       Unit              Characteristic        Value       Unit
 ----------------------------------------------      ----------------------------------------------
 DESIGN CAPACITY       40          MMBTU/HR          FIRING TYPE           OT          ----
-------------------------------------------------------------------------------------------------------------------------------------
EMISSION POINT INFORMATION
-------------------------------------------------------------------------------------------------------------------------------------
 EPN:BOILER-GLY            Point Name:BOILER-GLY
     ___________________              ____________________________________________________________________________

 UTM Zone:15  __________                              Latitude:294955.0000   ______________
 UTM North Meters:3302058.000  ______________         Longitude:950646.0000  ______________
 UTM East Meters:295859.000    ______________

 Profile:STACK

 Characteristic        Value       Unit
 ---------------------------------------------
 DIAMETER              1           FEET
 HEIGHT                20          FEET
 HORDSCHG              N           ----
```

Deactivating Paths

```
                                                                                                                Page:     8
RN:RN999999999      Account:HGA9999
Company:EXAMPLE SITE                                                                                        EIQ Year:2006

FIN:CHEM-PROC   EPN:FLARE-1
Comment:
-----------------------------------------------------------------------------------------------------------------------
FACILITY INFORMATION
-----------------------------------------------------------------------------------------------------------------------
 FIN:CHEM-PROC          Facility Name:CHEMICAL PROCESS                                    Plant ID:TEST PLANT
     ________________                  ____________________________________________________          __________

Comment:
          ____________________________________________________________________________________________
 SCC:30184001  ___________  Description:ORGANIC CHEMICALSGENERAL PROCESSESDISTILLATION UNTS
 Status:A____ Status Date:          _________ Operating Schedule:24  ___hrs/day,7   ___days/wk,52  ___wks/yr
 Annual Operating Hours:7884__________   Percentage Max Capacity:90  __________    Start Time:0   __________

 Seasonal Operating Percentages (NOTE: Spring % + Summer % + Fall % + Winter % must be equal to 100%)
     Spring: 25%_____          Summer: 25%_____          Fall: 25%_____         Winter: 25%_____

 Group Type:VOCPROCESS

 Profile:REACTOR
 Characteristic        Value       Unit              Characteristic        Value       Unit
 ----------------------------------------------      ----------------------------------------------
 -NO CHARACTERISTICS-  -----       ----              -NO CHARACTERISTICS-  -----       ----
-----------------------------------------------------------------------------------------------------------------------
CONTROL DEVICE INFORMATION
-----------------------------------------------------------------------------------------------------------------------
*CIN:FLARE-1           Name:FLARE 1
     __________             ____________________________________________________________________________________

 Abatement Code: 512_____  Desc: FLARES-WASTE GAS,ELEVATED-(>30FT.)SMOKELESS
 No. Of Units:   1_____    Annual Operating Hrs:8760_____     % Time Off Line:  0_____   IM Schedule:D_____

 Control Efficiencies:
    VOC: 98.00%_____        NOX:  0.00%_____         CO:  0.00%_____        IOC:  0.00%_____
    TSP:  0.00%_____       PM10:  0.00%_____        SO2:  0.00%_____      C1-C3:  0.00%_____
    C4+:  0.00%_____        H2S:  0.00%_____        NH3:  0.00%_____
```

Deactivate path FIN: CHEM-PROC / EPN: FLARE-1 effective 4/15/2006

Adding or Linking a CIN

- To add or link a CIN to an existing path:
  - If the CIN is new, complete an Abatement Device Information Form.
  - If CIN already exists in EI, write “Link CIN: XXXX” on the EI.
- Add a CIN to an existing path only if the emissions are still routed to the original emission point.
- When the emissions emit from a different emission point:
  - Deactivate the path (history is preserved)
  - Complete a new Structural Overview Form and Path Emissions Form

Adding a CIN

Abatement Device Information Form

Abatement Device Information

TCEQ Emissions Inventory Year 2012

Company Name:	Site Name:	TCEQ Air Account Number:	RN:
One of These Days Inc.	We'll Strike it Rich	HGXXXXX	RNXXXXXXXXX

ABATEMENT DEVICE INFORMATION

CIN: FLARE1	Control Device Name: S-Series Flare	CIN Effective Date: 1/1/12
Primary Abatement Device: ■ Yes ☐ No	Abatement Code: 511	Number of Units: 1

Annual Operation	Percent Time Offline	Inspection and Maintenance Schedule (Select one)
8760 hours	31 %	☐ Annually ☐ Biannually ☐ Continuously ☐ Daily ☐ Hourly ■ Monthly ☐ Q

CONTROL EFFICIENCY[14] (Please check all contaminants controlled by this abatement device and enter the control efficiency in the space provided)

■ Volatile Organic Compounds: 98 %	☐ Nitrogen Oxides: ____%	☐ Carbon Monoxide: ____%	☐ Sulfur Dioxide: _____%
☐ Inorganic Compounds: _____%	☐ Particulate Matter (PM): _____%	☐ PM_{10}: _____%	■ C_1 to C_3 compounds: 99 %
■ C_{4+} Compounds: 98 %	■ Hydrogen Sulfide (H_2S): 97 %	☐ Ammonia (NH_3): _____%	

PATH(S) ABATED BY THIS DEVICE[15]

FIN	EPN	FIN	EPN
TANK1	FLARE1		
TANK2	FLARE1		
TANK3	FLARE1		
AMINE	FLARE1		

Linking a CIN

```
                                                                                                                Page:    16
RN:RN999999999      Account:HGA9999
Company:EXAMPLE SITE                                                                                        EIQ Year:2006

FIN:ENG-1       EPN:ENG-1
Comment:
-------------------------------------------------------------------------------------------------------------------------
FACILITY INFORMATION
-------------------------------------------------------------------------------------------------------------------------
 FIN:ENG-1              Facility Name:ENGINE 1                                                    Plant ID:TEST PLANT
    ______________                  ____________________________________________________          __________

Comment:
          ____________________________________________________________________________________________________
 SCC:20200254  __________  Description:INDUSTRIAL       NATURAL GAS      4-CYCLE LEAN BURN
 Status:A____ Status Date:          _________ Operating Schedule:24  ___hrs/day,7   ___days/wk,52  ___wks/yr
 Annual Operating Hours:7709__________   Percentage Max Capacity:88  __________    Start Time:700 __________

 Seasonal Operating Percentages (NOTE: Spring % + Summer % + Fall % + Winter % must be equal to 100%)
     Spring: 25%_____          Summer: 25%_____          Fall: 25%_____         Winter: 25%_____

 Group Type:COMBUSTN

 Profile:I.C. ENGINE
 Characteristic        Value       Unit              Characteristic        Value       Unit
 ----------------------------------------------      ----------------------------------------------
 BURN TYPE             LEAN        ----              CYCLE                 4           CYCLE
 DESIGN CAPACITY       325         MMBTU/HR          ENGINE RATING         850         HP
 FIRING TYPE           IN          ----                                                ----
-------------------------------------------------------------------------------------------------------------------------
EMISSION POINT INFORMATION
-------------------------------------------------------------------------------------------------------------------------
 EPN:ENG-1                  Point Name:ENGINE 1
    ___________________                  ____________________________________________________

 UTM Zone:15  __________                          Latitude:294946.0000   ______________
 UTM North Meters:3301791.000  ______________     Longitude:950700.0000  ______________
 UTM East Meters:295478.000    ______________

 Profile:STACK

 Characteristic        Value       Unit
 ----------------------------------------------
 DIAMETER              1           FEET
```

Link CIN: CATOX

Note: This is if the CIN already exists in the EI.

Changing FIN and EPN Designations

See Chapter 6, *2013 Emissions Inventory Guidelines*

- FIN or EPN designations are not normally allowed to be changed due to the historical nature of emissions data.
- Exceptions to this policy will be made to correct errors or to align EI nomenclature with permit nomenclature.
- Complete a Revisions Request Form and provide a reason for the request.
- Include supporting documentation such as the MAERT.

Changing FIN and EPN Designations (cont.)

Revision Request
TCEQ Emissions Inventory Year ___

Page _1_ of __1_ Revision Request pages

Company Name:	Site Name:	TCEQ Air Account Number:	RN:
One Day Inc.	We'll Strike it Rich	HGXXXXX	RNXXXXXXXXX

REVISION REQUEST LIST

Facility Identification Number (FIN)		Emission Point Number (EPN)		Control Identification Number (CIN)	
Existing FIN	Requested FIN	Existing EPN	Requested EPN	Existing CIN	Requested CIN
01001	ENGINE 1	01001	STACK1	CC1	CATCONV1
01002	ENGINE2	01002	STACK2	CC2	CATCONV2

REASON(S) FOR REVISION REQUEST(S)

__To bring FINs and EPNs in line with the Title V permit._

TCEQ-20041f (10-01-0811-16-2012)
Page 1 of 1

Emissions Inventory Help

Help Line: (512) 239-1773

Monday - Friday, 8am - 5pm

E-mail: psinvent@tceq.texas.gov

Emissions Assessment Section Web site:
http://www.tceq.texas.gov/airquality/point-source-ei/psei.html

Contact

Steve O'Neal

(512) 239-2390

Steve.ONeal@tceq.texas.gov

TCEQ

Emissions Determination Methods and Reporting

Julia Segura
Emissions Inventory Specialist
Air Quality Division

Presented to the 2014 Emissions Inventory Workshop
January 23, 2014

Overview

- Emissions determination requirements
- Hierarchy of emissions determination methods for emissions inventory (EI) reporting
- Speciation of volatile organic compounds (VOC)
- Hazardous air pollutants (HAPs) and toxic speciation
- Particulate matter (PM) reporting
- Ozone season emissions

Emissions Determination Requirements

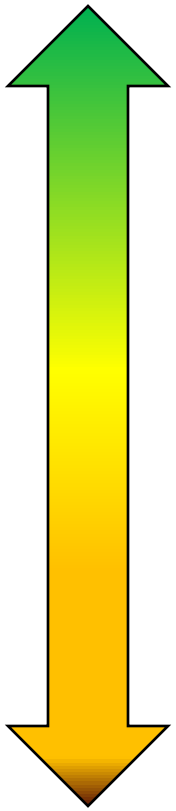
- Use the best emissions determination methods available:
  - Most current emission factors;
  - Most current testing data; and
  - Latest guidance.
- Provide detailed sample calculations for largest sources of criteria and HAP emissions.
- Use correct contaminant and emissions determination codes.

Emissions Determination Requirements (cont.)

- Speciate based on *Chapter 4* of the *2013 Emissions Inventory Guidelines*
  - Particulate matter
  - VOCs, especially benzene, toluene, ethyl benzene, xylene, and formaldehyde
  - Highly reactive volatile organic compounds (HRVOC)
  - Mercury, lead, metals, acid gases
  - Other HAPs and toxics
- Provide explanations for significant changes in emissions in the supporting documentation.

Hierarchy of Emissions Determination Methods

Most Preferred



Least Preferred

General order of preference for EI emissions determination methods

- **D:** Continuous Emissions Monitoring System (CEMS)
- **H:** HRVOC monitoring system
- **F:** Predictive emissions monitoring system (PEMS)
- **M:** Measured or stack test data
- **Q:** Portable analyzer test data
- **V:** Vendor-supplied emissions factors
- **A:** AP-42 and other US Environmental Protection Agency (EPA)-approved factors
- **B:** Material balance
- **S:** Scientifically calculated
- **E:** Estimated
- **O:** Other

CEMS: Code "D"

- CEMS generate real-time emissions data 24 hours per day.
- CEMS is typically the most preferred method for determining annual and ozone season emissions.
- 30 Texas Administrative Code (TAC) §101.10(c) requires that monitoring data be used to determine and report emissions, if available.
- CEMS must be certified according to EPA or Texas Commission on Environmental Quality (TCEQ) standards.
- CEMS must be properly calibrated, operated, and maintained.

CEMS: Code "D" (cont.)

- A representative set of summary sheets from the most recent relative accuracy test audits (RATA) should be provided.
- Nitrogen Oxides (NO_x) emissions calculations must be based on the molecular weight of Nitrogen Dioxide (NO_2) (46.01 lb/lb-mol).
- CEMS not properly calibrated
  - CEMS data can only be used from a properly calibrated and operated unit.
  - Inform the Emissions Assessment Section (EAS) that a CEMS exists but was not used due to improper operation or malfunction.

CEMS: Code "D" (cont.)

If the CEMS is inoperative for any part of the year, use other data to determine emissions for the period of time the CEMS did not operate.

- Ensure data substitution adheres to state and federal regulations.
- Document the data substitution method as part of the supporting documentation.
- Contact the EAS to determine if "D" is appropriate to use.

CEMS: Code "D" (cont.)

CEMS that are not required by a specific rule or permit

- If the CEMS is properly calibrated and operated, it must be used to determine and report emissions per 30 TAC §101.10(c) regardless of the reason it was installed.
- Applies to CEMS installed for plant process knowledge purposes.

HRVOC Monitoring: Code "H"

- Requires continuous monitoring system (CMS) that measures gas composition contained in a process stream not emissions.
- Required by 30 TAC §115.725 and §115.726.
- Currently only applies to the Houston-Galveston-Brazoria nonattainment area.
- HRVOC emissions should be coded as "H".
- Other monitored non-HRVOC emissions should be coded as "B" for material balance.

Predictive Emissions Monitoring (PEMS): Code "F"

- PEMS predicts real time emissions based on monitoring of other process parameters.

- PEMS can be used to determine emissions if:
  - PEMS is properly calibrated and certified according to EPA or TCEQ standards; and
  - PEMS is properly operated and maintained.

Predictive Emissions Monitoring (PEMS) : Code "F" (cont.)

- A representative set of summary sheets from the most recent RATA should be provided.
- NO_x emissions calculations must be based on the molecular weight of NO_2 (46.01 lb/lb-mol).
- If the PEMS is inoperative for any part of the year, use other data to determine emissions from the downtime.
  - Document the alternate emissions methods as part of the supporting documentation.
  - Contact the EAS to determine if "F" is appropriate to use.

Stack Test: Code "M"

- Stack testing is a formal, structured event coordinated with the appropriate TCEQ regional office.
- Test methods must be approved by the EPA or the TCEQ.
- Stack testing should reflect the actual routine operations.
  - If a unit is modified, or its operating conditions or associated process parameters change significantly, stack test results may no longer be representative.
  - Do not use test data that is not representative of current conditions.
  - Select a different method to calculate emissions, such as vendor or AP-42 factors.

Stack Test: Code "M" (cont.)

- Summary sheets from the most recent stack test should be provided as supporting documentation.
- To determine emissions, use test results in conjunction with process rate data.

  Example: divide the pounds per hour (lb/hour) emissions rate by the million British thermal units per hour (MMBtu/hr) fuel usage rate during testing to obtain a factor with units of lb/MMBtu.

Stack Test: Code “M” (cont.)

Identical units with similar emissions located at the same site:

- EAS may approve stack-test data for identical units at the same site, if test data is only available for one unit.
- The emissions from the tested unit should be coded as “M” for measured.
- The emissions from the untested identical unit must be coded as “E” for estimated.

Stack Test: Code “M” (cont.)

Identical units located at different sites:

- Use stack-test data for identical units at different sites, if test data is only available for one unit at one site.
- EAS may approve on a case-by-case basis.
- The emissions from the tested unit should be coded as “M” for measured.
- The emissions from the untested identical unit must be coded as “E” for estimated.

Stack Test: Code "M" (cont.)

- If a single unit is tested multiple times within a calendar year, you may average the most recent calendar year's results.
- Due to process and fuel variations, stack test data from multiple calendar years must not be averaged. This includes:
  - Stack test data for similar/identical units at a site for one or multiple years; and
  - Stack test data for similar/identical units at different sites for one or multiple years.

Stack Test: Code “M” (cont.)

- Testing conducted using a Draeger tube, fuel gas analysis, or fuel flow measurement does not qualify as stack testing.
  - Use “E” for engineering estimate
- Contact the EAS if you have questions.

Portable Analyzer: Code "Q"

Test methods must be approved by the EPA or the TCEQ.

- Measurements must be taken during conditions that reflect the actual routine operation and processes of the unit, including control equipment.
- Use portable analyzer data that represents how the unit currently operates to determine and report emissions.
- Determine emissions using test results in conjunction with process rate data.

Portable Analyzer: Code "Q" (cont.)

- If a source is tested more than once a year, account for this when calculating emissions.

  For example, if a source is tested quarterly, apply the emissions factors appropriately to determine emissions for each quarter.

- *Technical Supplement 1* of the *2013 Emissions Inventory Guidelines* has additional guidance for emissions from internal and external combustion sources.

Vendor Data: Code "V"

- Emissions information may be supplied by equipment manufacturers.
- Information is typically based on testing for a particular type and/or size of equipment.
- Use vendor data only if:
  - Emission factors are specific for that piece of equipment;
  - There have been no significant modifications to the unit; or
  - There have been no significant changes in fuel characteristics.
- Provide a copy of the manufacturer's data in the supporting documentation.

AP-42 and Other EPA or TCEQ Approved Factors: Code "A"

- *Compilation of Air Pollutant Emission Factors,* Volume I: Stationary Point and Area Sources (AP-42).

- Emissions factors have generally been determined by testing a representative population varying in size and age.

- EPA TANKS software, WATER9 software, and TCEQ Technical Guidance are also coded as "A".

AP-42 and Other EPA or TCEQ approved Factors: Code "A" (cont.)

- When AP-42 factors are updated, use the most current factors.
- Use the most recent factor as of the end of the reporting year (2013 for 2013 reporting year).
- If factor is updated in March 2014 do not use the updated AP-42 factor to determine emissions for the 2013 EI.

  The updated AP-42 factor can be used for the 2014 EI.

Material Balance: Code "B"

Used for specific types of processes or methods that incorporate certain analytical methods:

- Surface coating;
- Parts cleaning;
- TCEQ-approved program for monitoring cooling towers;
- An extended inlet gas analysis used in Gas Research Institute GlyCalc software; and
- CMS to determine flow rate and composition of gas routed to a flare.

Material Balance: Code "B" (cont.)

Provide sufficient supporting documentation, including:

- Process rates (quantity of materials used);
- Weight percentages of the materials (especially VOC, HAPs, toxics, and PM) or mass flow rates and composition of gas;
- Material safety data sheets;
- Capture, transfer, and control efficiencies applied; and
- Extended inlet gas analysis.

Scientific Calculation: Code “S”

Use of first-order engineering principles constitutes a scientific calculation methodology.

- Thermodynamic equations
- Ideal gas law

Estimation: Code “E”

- Do not estimate emissions if a more preferred method exists.
- Provide sufficient supporting documentation.

Other: Code "O"

- Code "O" is reserved for use of emissions factors developed by an industry group or other organizations.
  - National Council for Air and Stream Improvement
  - Simulation Programs such as E&P TANK
  - Electric Power Research Institute
- Provide sufficient supporting documentation.

Do Not List a Permit as a Factor's Source

- If the same factor is used for the EI as was used in the permit application, provide the origin of the factor (stack test, vendor data, AP-42, etc.).
- If any of the following applies, DO NOT use the emission factor from a permit application to determine emissions in the EI:
  - AP-42 factor has been revised or updated;
  - A CEMS was installed or stack testing was conducted after the permit was issued; or
  - Operating conditions have change since the permit was issued.

VOC Speciation

- Use the specific contaminant code for each individual VOC species.
- When possible, speciate at least 90% of the VOC emissions from each source that is:
  - East of the 100 degree longitude and the VOC emission rate is ≥ 5 tons per year (tpy).
  - West of the 100 degree longitude and the VOC emission rate is ≥ 25 tpy.
- Detailed information: *2013 Emissions Inventory Guidelines*, Chapter 4

HAPs and Toxics

- Section 112(b)(1) of the Federal Clean Air Act identifies HAPs.
- Toxic Release Inventory (TRI) chemicals are identified in 40 Code of the Federal Regulations Section 372.65.
- Report a source in the emissions inventory questionnaire (EIQ) if the source emitted more than 0.1 tpy of a HAP or toxic.
- Report mercury and lead emissions in the EIQ if the source emitted ≥ 0.001 tpy.
- TCEQ staff will ask for explanations and possible EI updates regarding discrepancies between the TRI and the EIQ.

PM Definition

30 TAC §101.10 (76) defines PM emissions as, "All finely-divided solid or liquid material, other than uncombined water, emitted to the ambient air as measured by EPA Reference Method 5, as specified at 40 Code of Federal Regulations (CFR) Part 60, Appendix A, <u>modified to include particulate caught by an impinger train</u>; by an equivalent or alternative method, as specified at 40 CFR Part 51; or by a test method specified in an approved state implementation plan."

PM: Filterable and Condensable

- What does the definition mean for EI reporting?
  - Means both the filterable (front-half) and condensable (back-half) emissions must be summed and reported as PM, PM_{10}, and $PM_{2.5}$ emissions.
  - If condensable emissions were not tested, then an alterative method must be used to determine condensable PM emissions.
- Specific PM, PM_{10}, and $PM_{2.5}$ reporting guidance in *2013 Emissions Inventory Guidelines:*
  - Chapter 4
  - Technical Supplement 1

PM_{10} and $PM_{2.5}$ Emissions

- PM_{10} – portion of PM that has an aerodynamic diameter less than or equal to 10 microns
  - PM_{10} is a subset of PM
  - Most PM is composed of a percentage of PM_{10}
- $PM_{2.5}$ – portion of PM that has an aerodynamic diameter less than or equal to 2.5 microns
  - $PM_{2.5}$ is subset of PM and PM_{10}

Ozone Season Emissions

- Reported from sites in El Paso County and counties east of 100º longitude
- Average daily emissions during the ozone season: May 1 through September 30
- Report as pounds per day in the EI
- Do not include emissions events (EE) or <u>unpermitted</u> scheduled maintenance, start-up, and shutdown (SMSS) emissions when calculating ozone season emissions.
- Report EE and unpermitted SMSS emissions under the appropriate columns in the EIQ.

Resources

- EAS Web Page:

www.tceq.texas.gov/goto/ieas

  - *2013 Emissions Inventory Guidelines*
  - Sample Calculation Templates

- EPA Web Page:

http://www.epa.gov/ttn/chief/efpac/esttools.html

  - AP-42
  - EPA TANKS software
  - WATER9 software

Resources (cont.)

- EI Help Line: (512) 239-1773

  Mon-Fri, 8am - 5pm

- E-mail: psinvent@tceq.texas.gov

Contact

Julia Segura

(512) 239-2936

julia.segura@tceq.texas.gov

TCEQ

Heated Tanks: Guidance and Updates for the 2013 TCEQ Emissions Inventory

Russ Nettles
Technical Specialist
Air Quality Division

Presented to the 2014 Emissions Inventory Workshop
January 23, 2014

Overview

- Heated tank concerns
- Environmental Protection Agency (EPA)TANKS 4.09 (TANKS) software concerns
- Cutter stock
- Potential breathing losses
- #6 fuel oil vapor pressure
- Potential emissions from tank mixing operations

Tank Emissions Concerns

Quantitative evidence

- 2011 City of Houston DIAL project measured elevated emissions from crude oil tanks and intermediate refinery process tanks.
- These studies indicate that crude oil and heated tank volatile organic compounds (VOC) emissions are potentially under-reported in the annual EI.

Heated Tank Emissions Concerns

- Qualitative evidence

  Emissions from heated tanks are routinely visualized with Forward Looking Infrared (FLIR) infrared (IR) camera technology.

- Concerns identified by the EPA
  - Formal information collection request (ICR) initiated in March 2011
  - Issued “Emission Estimation Protocol for Petroleum Refineries” guidance document that identified significant emission estimation problems with the EPA TANKS software program

Specific Tank Type Concerns

- Heated tanks

  Refineries, terminals, and end users

- Intermediate process tanks that receive "warm products" which are higher than ambient temperature, but not directly heated.

FLIR Infrared Video of Heated Tanks

Heated Tanks and Hot Product Storage Tanks

- The TANKS software does not apply AP-42, Chapter 7 equations accurately when determining emissions from these types of storage tanks.
- For EI purposes, emission estimates from the TANKS software is no longer accepted for heated tanks or hot product storage tanks.

  For heated tanks, TANKS contains several default routines that prevent the AP-42 equations from being properly applied. Examples include:

  - **TANKS cannot determine emissions for some high molecular weight petroleum distillates if storage temperature is above 100°F**.
  - TANKS does not compute the vapor space and liquid temperature ranges for heated tanks.

Heated Tanks and Hot Product Storage Tanks (cont.)

- TANKS will underestimate emissions from intermediate process tanks with floating roofs that store material at warmer-than-ambient temperature.
- **Use AP-42, Chapter 7 equations.**
  - **Use vapor pressure at the actual storage temperature of the liquid.**
  - **Do not use AP-42 defaults or permitted values** for vapor pressure, liquid composition, and other relevant parameters unless representative of the stored liquid.
  - American Society for Testing and Materials method D 2879 is suitable for determining vapor pressure for heavy liquids at the actual storage temperature.

Reminder

Cutter Stock

Reminder

- If a stored product is “cut” with another material, the “cutter stock” must be accounted for in emissions determinations.
  - Cutter stock will impact the liquid’s:
    - composition and
    - vapor pressure at the stored temperature.
  - Process records should indicate the amount and type of cutter stock added.
- Cutter stock emissions must be reported in the annual EI.
  - Process records should provide detail about the cutter stock composition.
  - Hazardous air pollutants must be speciated.

#6 Fuel Oil Vapor Pressure Concerns

- Limited data on #6 fuel oil vapor pressures shows the potential for extremely large range of vapor pressures.
- Elevated vapor pressures from #6 fuel oil tanks were identified during a recent EPA investigation.
  - Vapor pressure of 0.32 pounds per square inch (psi) @130 °F
  - Vapor pressure of 0.21 psi @116 °F
- AP-42 Chapter 7 default vapor pressure @100 °F is 0.00019 psi.

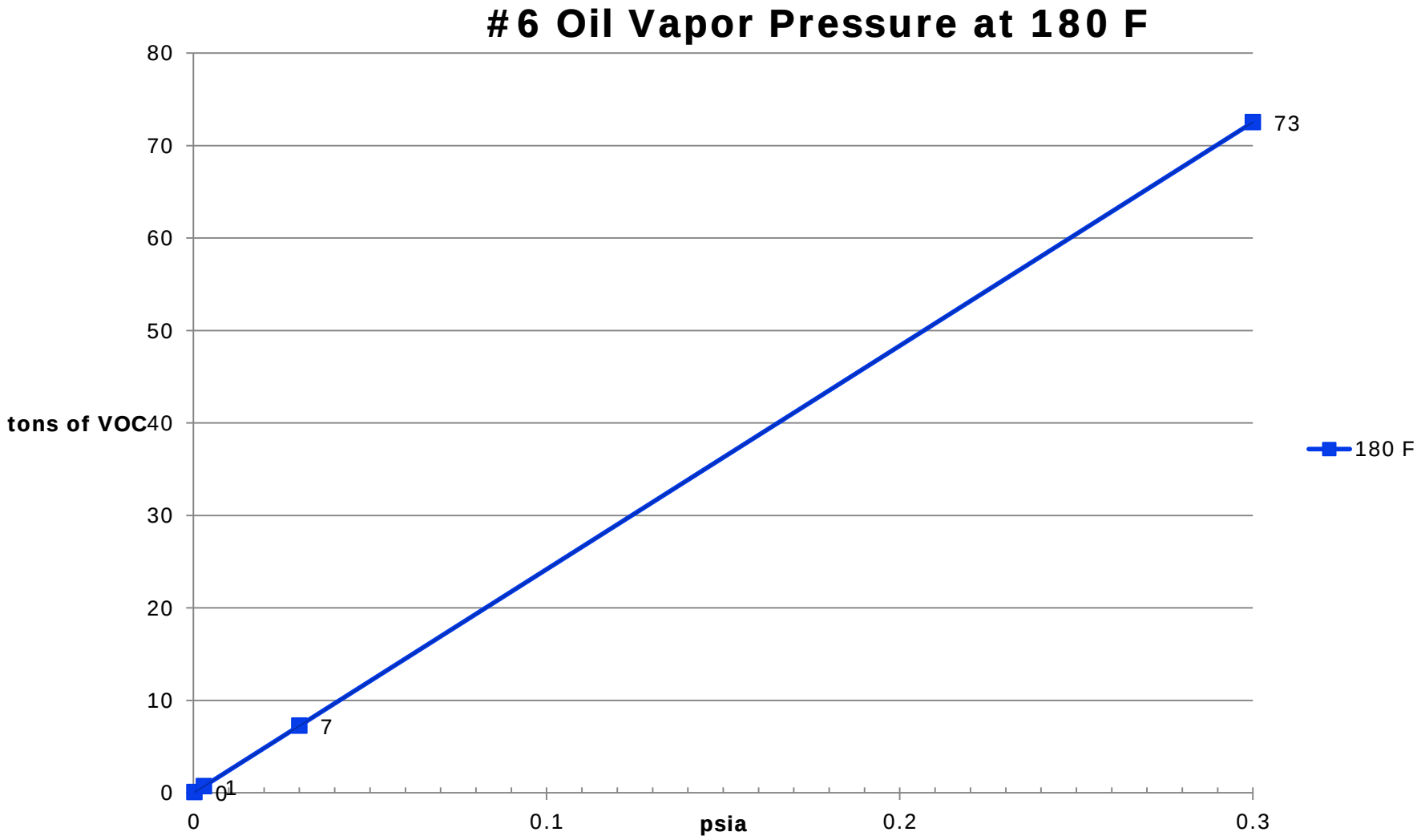
#6 Fuel Oil Working Emissions vs. Vapor Pressure

Vapor Pressure pounds per square inch atmosphere (psia)	*Emissions of VOC at 180 F°
0.0003	0.0725 tons per year (tpy)
0.003	0.7252 tpy
0.03	7.2522 tpy
0.3	72.5221 tpy

*Some parameters were assumed. Emissions were estimated using TankESP software.

Note – tank working emissions are directly proportional to the magnitude increase in vapor pressure

#6 Fuel Oil Working Emissions vs. Vapor Pressure (cont.)



Potential Breathing Losses From Insulated Shell Tanks

- Historically, only working losses were considered from insulated tanks.
- Tanks with insulated shells and **uninsulated roofs** may have potential for breathing losses.
- Significant heat exchange may occur between the vapor space and ambient air through the uninsulated roof resulting in breathing losses.
- A conservative approach to estimate emissions would be to model as an uninsulated tank.

Potential Breathing Losses From Fully Insulated Tanks

- Tanks with an insulated shell and insulated roof may have potential for breathing losses due to tank heating cycles.
- The amount of breathing losses depends on the heating cycles:
  - temperature range,
  - frequency, and
  - duration.

Potential Breathing Losses From Fully Insulated Tanks (cont.)

A conservative approach to estimate emissions would be to modify the breathing equations in AP-42 Chapter 7.

- Replace 365 days with number of annual heating cycles.
- Replace daily delta temperature with temperature range of the tank liquid.

Potential Emissions From Tank Mixing Operations

- AP-42 Chapter 7 equations do not account for emissions generated by mixing (stirring or blending) tank contents.
- If tank contents are mixed, emissions need to be estimated from:
  - mechanical mixing,
  - air injection or air sparging, and
  - other means of mixing.
- Estimate emissions using engineering calculations that account for air flow and volatility of the stored liquid, including cutter stock.

Accurate Data and Parameter Inputs

- Accurate data is critical for estimating tank emissions.
- Use accurate and representative data inputs when using AP-42 Chapter 7 equations or tank estimation software that properly applies Chapter 7 equations.
- Accurate vapor pressure at the storage temperature is critical to determine an accurate emission rate.

Permitted or default vapor pressure values can only be used if it is representative of the stored liquid.

EI Calculations and Permit Allowable Emissions

If emissions determined using the procedures in the EI guidelines exceed the allowable emission rates in a site's relevant New Source Review permit:

- Regulated entity should apply for a permit amendment to authorize the corrected emission rates.
- Application should include a retrospective review to establish whether the higher level of emissions would have triggered nonattainment or prevention of significant deterioration permit review when emissions were authorized.

Summary

- **EPA TANKS 4.09d (or any earlier version) is no longer accepted as a tool for determining emissions for emissions inventory purposes for:**
  - tanks storing warm products and
  - heated tanks.
- Use accurate input data when estimating emissions from heated and hot product tanks. Do not use permit or AP-42 default parameters.
- Account for potential breathing or mixing losses.

Contact Information

- Russell Nettles
  - (512) 239-1493
  - russell.nettles@tceq.texas.gov

- EI Help Line
  - (512) 239-1773
  - Monday-Friday from 8AM-5PM

TCEQ

Combustion Sources Reporting Challenges

Steve O'Neal
Emissions Inventory Specialist
Air Quality Division

Presented to the 2014 Emissions Inventory Workshop
January 23, 2014

Overview

- General Challenges
- Combustion Reporting Challenges
- Flares

Terms (Acronyms)

- Carbon Monoxide (CO)
- Continuous Emissions Monitoring Systems (CEMS)
- Control Identification Number (CIN)
- Emissions Inventory Questionnaire (EIQ)
- Emissions Point Number (EPN)
- Facility Identification Number (FIN)
- Hazardous Air Pollutants (HAP)
- Pound (lb)
- Million British Thermal Units (MMBtu)
- Nitrogen Oxides (NO_x)

Terms (Acronyms) (cont.)

- Particulate Matter (PM)
- Particulate Matter with an aerodynamic diameter ≤ 2.5 microns ($PM_{2.5}$)
- Particulate Matter with an aerodynamic diameter ≤ 10 microns (PM_{10})
- Sulfur Dioxide (SO_2)
- Tons per year (tpy)
- Total Hydrocarbons (THC)
- Total Organic Compounds (TOC)
- Volatile organic compound (VOC)
- Year (yr)

General Challenges

- Are the facility operating parameters updated for the reporting year?

  Status code, hours, seasonal percentages, etc…

- Do the facility operating parameters match the supporting documentation?
- Are all sources that meet reporting requirements included in the EIQ?
- Are the facility characteristics included in the EIQ and accurate?

  Design capacity, engine rating, horsepower, etc…

General Challenges (cont.)

- Are EPN parameters included in the EIQ?
  - Stack height, velocity, etc…
  - Coordinates (North American Datum 1983)
- Were supporting documents and sample calculations provided?
  - Stack test summaries
  - Vendor data sheets
- Do the sample calculations allow for verification of the emissions?
- Does the supporting documentation clearly identify the source by FIN or EPN?

Combustion Reporting Challenges

- Was the Annual Aggregate Heat Input in (MMBtu/yr) recorded in the EIQ?
- Was the NO_x emissions factor and reference source recorded in the EIQ?

  Reference sources: stack test, vendor, AP-42, etc…
- Are abatement devices to control combustion related emissions represented in the EIQ?
  - Catalytic converters
  - Scrubbers
  - Cyclones/baghouses

Combustion Reporting Challenges (cont.)

- Are the emissions determined using best available methodology?
- Combustion sources methodologies order of preference:
  - Continuous Emissions Monitoring Systems - “D”
  - Predictive Emissions Monitoring System - “F”
  - Measured-Stack test data - “M”
  - Portable Analyzer Data - “Q”
  - Vendor supplied data - “V”
  - AP-42 Factors or Texas Commission on Environmental Quality (TCEQ) factors - “A”
  - Scientifically Calculated - “S”
  - Estimated - “E”

Combustion Reporting Challenges (cont.)

Were products of combustion reported in the EIQ?

Contaminant	Notes
NOx	Is the annual aggregate heat input in MMBtu/yr and emission factor included in the EIQ?
CO	
VOC	
HAPs	Reporting threshold ≥ 0.1 tpy (especially formaldehyde)
SO_2	
PM, PM_{10}, $PM_{2.5}$	PM, PM_{10}, and $PM_{2.5}$ rates are all equal (natural gas combustion)

Combustion Reporting Challenges: NO_x and CO

Contaminant	Reminders from the Emissions and Reporting Presentation
NO_x and CO	• **General –** Are sample calculations provided in a manner to allow reproduction of results? • **Stack test** - Summary sheets clearly identify the FIN or EPN - If similar unit is used, methodology coded as "E" - Is the stack test representative of actual operation (such as controls, load and excess air)? - Future year stack tests cannot be applied retroactively – that is, a 2014 stack test cannot be used to determine 2013 emission rates - Use process-based emission factors **Example: lb/MMBtu not lb/hr**

Combustion Reporting Challenges: NO_x and CO (cont.)

Contaminant	Reminders from the Emissions and Reporting Presentation
NO_x and CO	**Stack test (cont.)** - Can average test results if tested multiple times within one calendar year - Do not average stack test results from multiple calendar years

Combustion Reporting Challenges: NO_x and CO (cont.)

Contaminant	Reminders from the Emissions and Reporting Presentation
NO_x and CO	• **Portable analyzer data** - Reflects actual routine operations - Quarterly reports were provided and identify combustion source by FIN or EPN - If combustion source is tested quarterly, apply quarterly results to determine emissions for each quarter Averaging may or may not be appropriate, depending on the source operation • **Vendor data** Vendor data sheets were provided and identify combustion source by FIN or EPN • **AP-42** Use the most current factor

Combustion Reporting Challenges: VOC

- Stack test data or vendor data that provides THC instead of VOC
  - Determine VOC emissions by multiplying the THC emission factor by the following ratio:
    - AP-42 VOC emission factor/ AP-42 TOC emission factor
    - Code as “S” for scientifically calculated
  - Do not apply the inlet gas VOC percentage to the THC factor to obtain a VOC factor
- AP-42 combustion emission factors
  - Must use the VOC emission factor
  - Do not use the TOC emission factors

Combustion Reporting Challenges: VOC Speciation

Stack test or vendor data exists for VOC but not for speciated contaminants

- Use AP-42 “trace organic compounds” emission factors rated “C” or better
- Divide each trace organic factor by AP-42’s VOC emission factor to obtain the contaminant's speciation ratio
- Multiply the source’s VOC-total emission by each ratio to obtain that compounds emission rate
- Code the speciated contaminant as “S” for scientifically calculated
- Code VOC-u as either “M” for stack test or “V” for vendor

Combustion Reporting Challenges: VOC Speciation (cont.)

- **Example:** 4-cycle lean burn (4CLB) engine with vendor data VOC results of 11.2 tpy
  - No vendor or stack test results for speciated contaminants, so AP-42 Chapter 3.2 emission factors must be used
  - Formaldehyde is rated "A" for 4CLB
  - Determine the AP-42 formaldehyde ratio:

$$0.0528\frac{lb}{MMBtu} \div 0.118\frac{lb}{mmbtu} = 0.44746$$

  - Multiply the ratio by the total VOC vendor data results

$$11.2\ tons\ of\ VOC\ \times 0.44746 =$$
$$5.0115\ tons\ of\ formaldehyde$$ (coded as "S")

Watch Out

- Does the vendor data **<u>exclude</u>** or **<u>include</u>** formaldehyde?

Combustion Reporting Challenges: SO_2 and PM

Contaminant	Methodology / Sample Calculation Tips
SO_2	• If higher order methods such as CEMS are not available, emissions can be determined using material balance from the sulfur content of the fuel.
PM	• The AP-42 emissions factor to use is the sum of the condensable and filterable emission factors. • Reminder: PM total is PM filterable (front-half) + PM condensable (back-half)

Combustion Reporting Challenges: PM, PM_{10} and $PM_{2.5}$ Methodology

- Example: Determine PM emissions from a 4-cycle rich burn (4CRB) engine using the following AP-42 Chapter 3.2 emission factors:
  - PM_{10} (filterable) = 0.0095 lb/MMBtu
  - $PM_{2.5}$ (filterable) = 0.0095 lb/MMBtu
  - PM (condensable) = 0.00991 lb/MMBtu
- Add PM_{10} filterable to the PM condensable to achieve a cumulative PM emission factor
  - 0.0095 + 0.00991 = 0.01941 lb/MMBtu
  - 0.01941 lb/MMBtu will be the PM emission factor used to determine PM, PM_{10}, and $PM_{2.5}$ from the 4CRB engine

Flares/Thermal Oxidizers Reporting Challenges

- Structure of combustion abatement devices
  - Devices generate emissions while burning contaminants
  - Must be represented in the EI structure as an emission source and an abatement device
  - Proper structure allows reporting of emissions on the paths that created the emissions
  - Important for data retrieval and analysis
- Flare structure
  - (FIN) FLARE / (EPN) FLARE: flare/flare path

    Report products of combustion
  - (FINs) various? / (EPN) FLARE / (CIN) FLARE: process/flare path

    Report uncombusted VOC and hydrogen sulfide emissions

Flares/Thermal Oxidizers Reporting Challenges (cont.)

Expected contaminants from the flare/flare path:

Contaminant	Notes
NO_x	The sum of pilot gas and flared waste gas emissions
CO	The sum of the pilot gas and flared waste gas emissions
SO_2	Based on the sulfur content of the flared waste gas
VOC	Pilot gas natural gas combustion

Flares/Thermal Oxidizers Reporting Challenges (cont.)

- Flare emissions are dependent upon the **flare gas flow rate** and **composition**
- Preferred gas flow rate and composition determinations (preference order):
  - CEMS
  - Continuous monitoring with instruments that may not meet all quality assurance tests
  - Periodic testing with instruments and lab method
  - Engineering determinations based on process evaluation
  - One-time performance test conducted during the inventory year

Flares/Thermal Oxidizers Reporting Challenges: NO_x and CO

- Must know the **net heating value** of the waste gas
- Use **TCEQ emission factors** listed in Technical Supplement 4 of the *2013 Emissions Inventory Guidelines*
  - Choose factor based on the assist type and the waste gas stream net heating value
  - Code as "A" for TCEQ emission factors

Flares/Thermal Oxidizers Reporting Challenges: SO_2

- Use material balance and destruction efficiency of the flare to determine emissions
- Code as “B” for material balance
- Report SO_2 emissions at the flare/flare path only

Flares/Thermal Oxidizers Reporting Challenges

Flares subject to highly reactive volatile organic compound (HRVOC) regulations in 30 TAC Chapter 115, Subchapter H, must use the net heating value data required by §115.725 and §115.726 for any portions of the reporting year in which HRVOC monitors were installed and operational.

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TCEQ

Emissions Inventory Challenges: Volatile Organic Compounds Emissions Sources

Danielle Nesvacil
Team Leader
Air Quality Division

Presented to the 2014 Emissions Inventory Workshop
January 23, 2014

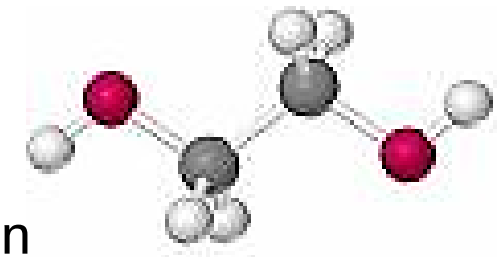
Overview: Emissions Determination Challenges

- Review challenges associated with common volatile organic compounds (VOC) sources
- Focus on:
  - Glycol dehydrators
  - Amine units
- Briefly review:
  - Piping component fugitives
  - Cooling towers
  - Storage tanks (non-heated)

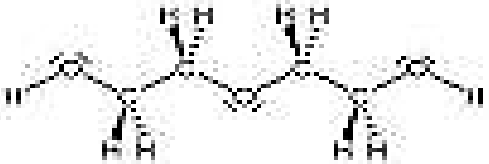
Glycol Dehydrators

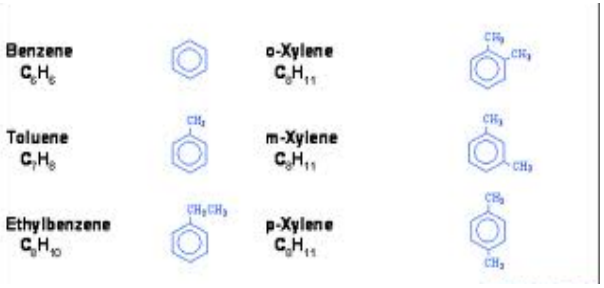
Glycol Dehydrators (cont.)

- Remove water from natural gas streams using an ethylene glycol compound (typically)
  - Prevents hydrate formation and corrosion in the pipeline
- Glycol contacts the wet gas to remove water, but also absorbs VOC and hazardous air pollutants (HAPs)
  - Including benzene, toluene, ethylbenzene, xylenes (BTEX), and n-hexane
- Once saturated, the glycol is regenerated through heating to evaporate water and recirculated.

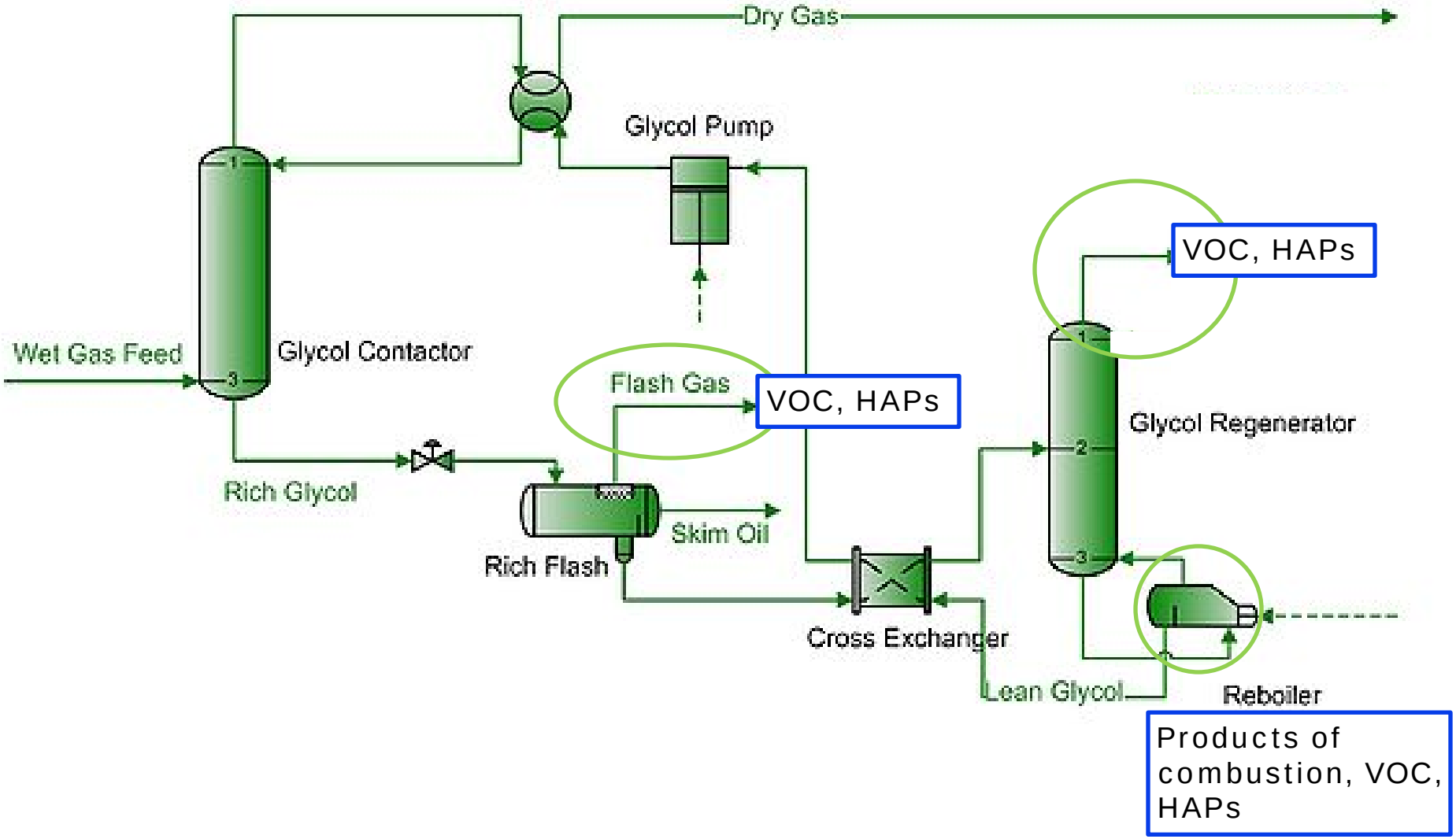


Ethylene glycol

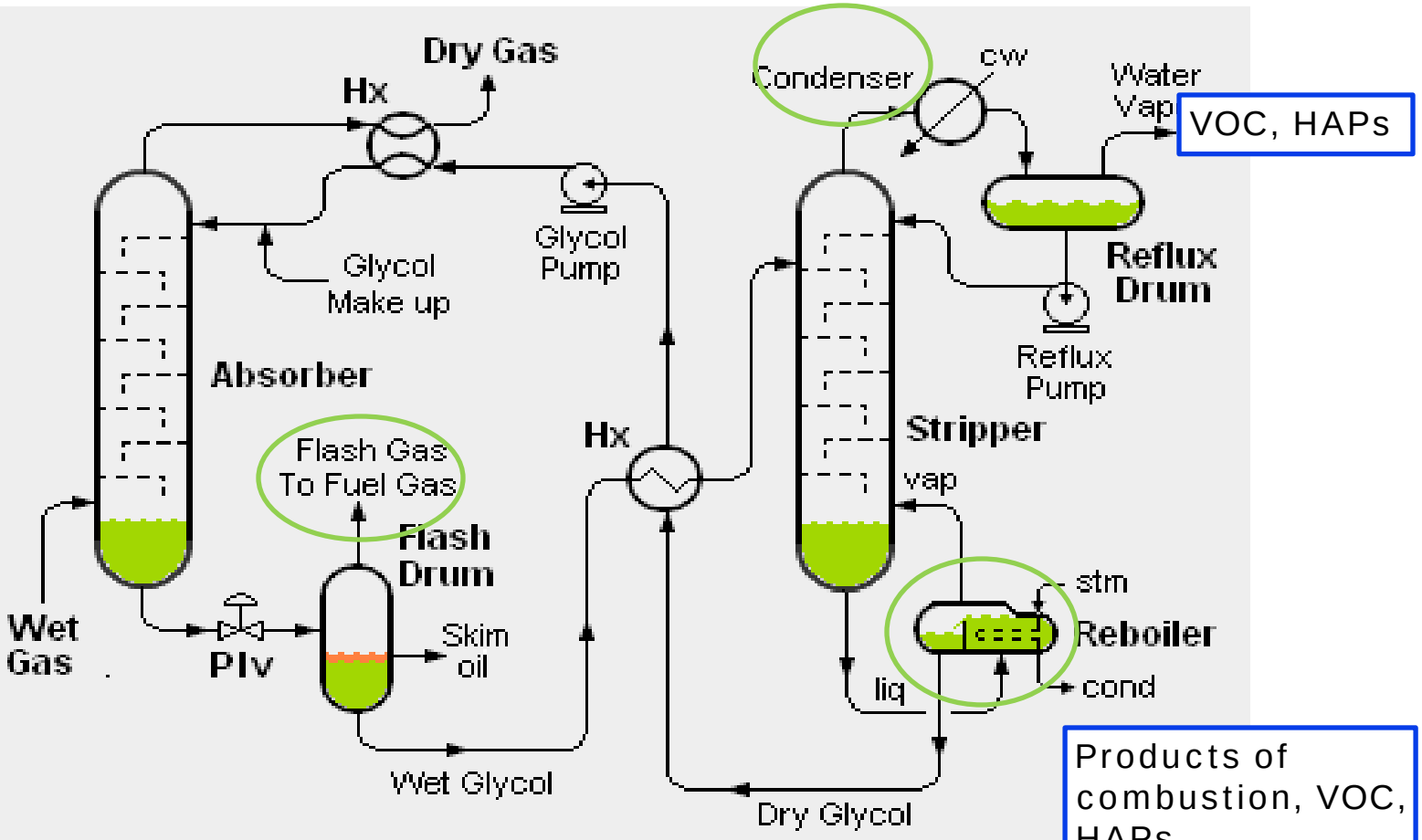




Uncontrolled Glycol Dehydration Unit



Controlled Glycol Dehydration Unit



cond = condensate	Hx = heat exchanger
stm = steam	Plv = pressure letdown valve
vap = glycol vapor	cw = cooling water
liq = glycol liquid	

Glycol Dehydrator Emissions

- If glycol dehydrator emissions are controlled, determine emissions using the order of preference found in most recent version of RG-360, *Emissions Inventory Guidelines*, Chapter 4
  - If monitoring or test data exists, use that data to determine emissions
  - If monitoring or test data is unavailable, may be able to input control device data into emissions model.

- Methods to determine combustion emissions from reboiler heater:

  Use order of preference in RG-360, Technical Supplement 1

Glycol Dehydrator Emissions (cont.)

Methods to determine glycol still VOC and HAP emissions in order of preference:

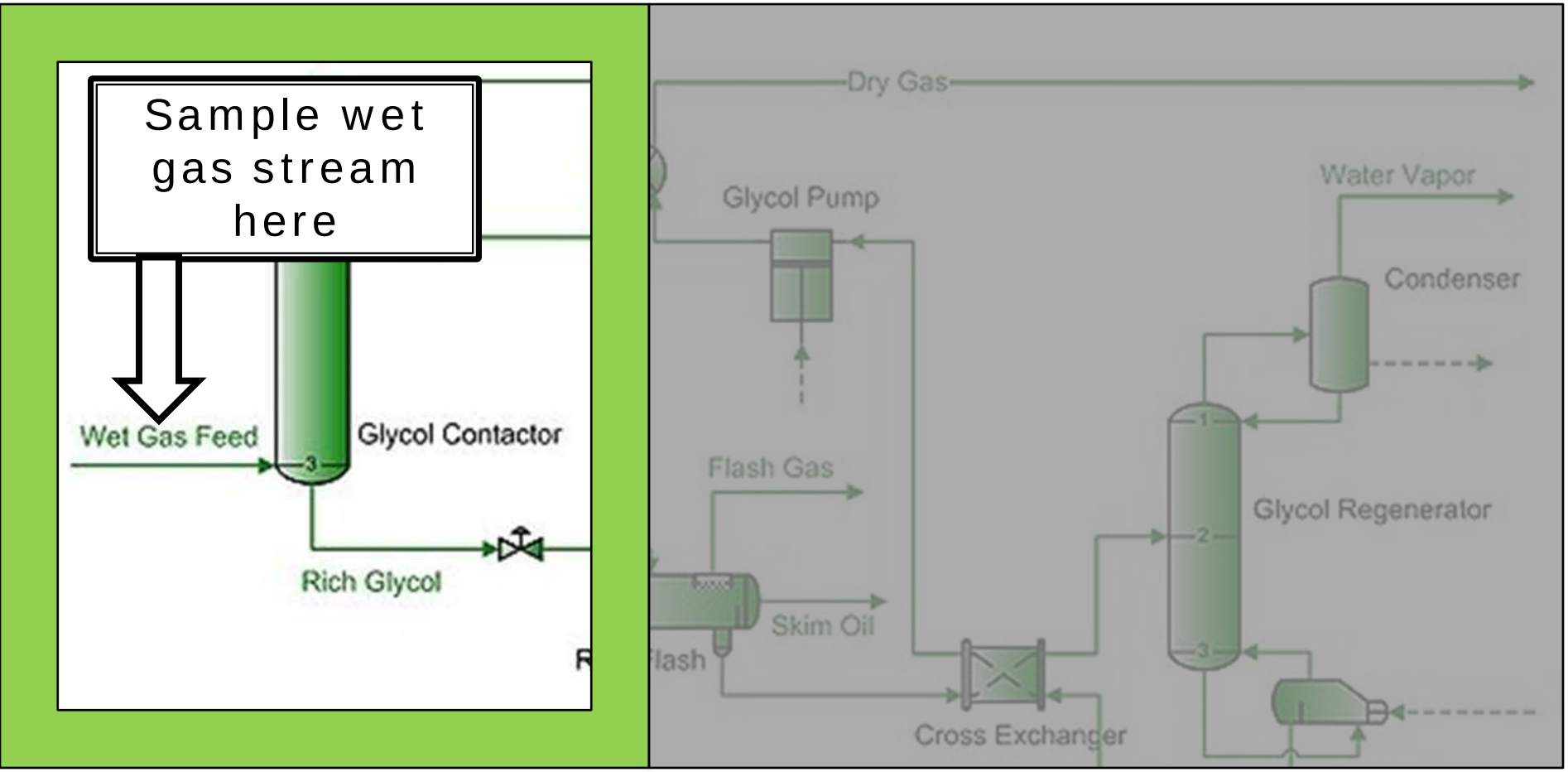
- Direct measurement (when performed properly)
  - Stack sampling
  - Total capture condensation method
  - Need to account for emissions from:
    - Still column
    - Flash tank
- Gas Research Institute (GRI) GLYCalc version 4.0
  - Comparable to direct measurements
  - Easier to use, less cost prohibitive
- Process simulator
- Rich/lean glycol analysis

  Does not account for condenser efficiency or flash tank emissions

Determining Glycol Dehydrator Emissions: GRI-GLYCalc Ver. 4.0

Inputs for software include:

Gas composition sampled upstream of contactor



Determining Glycol Dehydrator Emissions: GRI-GLYCalc Version 4.0 (cont.)

Inputs for software include:

- Gas composition sampled upstream of contactor
  - Extended gas analysis required to speciate HAPs (BTEX, n-hexane, 2,2,4-trimethylpentane, etc.)
- Annual gas flow rate in million standard cubic feet (MMSCF) per year; convert to MMSCF per day for input
- Annual hours of operation
- Contactor pressure and temperature
- Glycol circulation rate in gallons per minute (gpm)
- Volume of stripping gas, if used
- If present, condenser temperature and pressure

Determining Glycol Dehydrator Emissions: GRI-GLYCalc Version 4.0 (cont.)

Inputs for software include:

- Type of glycol pump: gas, electric, pneumatic
  - Gas-injection pumps: need pump volume ratio
  - Pump volume ratio: volume of gas that is injected into the glycol to the volume of liquid glycol that is pumped.
  - Can be obtained from manufacturer
- Water content of wet and dry gas in pounds (lbs) per MMSCF
  - Wet gas is likely saturated.
  - Provide lab analysis if wet gas is sub-saturated.
  - Dry gas water content must be below 7 lbs/MMSCF.
- Flash separator pressure, temperature, and gas destination

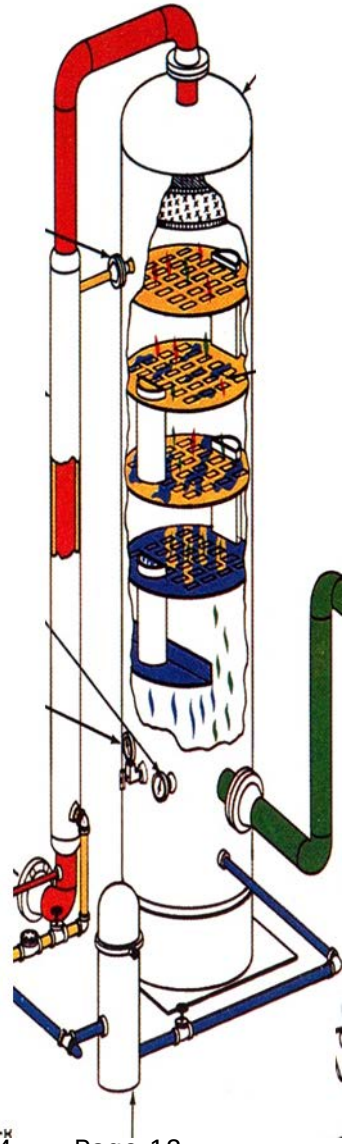
Determining Glycol Dehydrator Emissions: GRI-GLYCalc Version 4.0 (cont.)

- Accurate inputs are critical for accurate emissions determinations
- Do NOT use sales gas analysis
  - Does not contain HAP speciation
- Obtain accurate operational data
  - Accurate glycol circulation rates imperative
    - Vendor may have published circulation rate data, but need to verify.
    - Field personnel can obtain this data.

Determining Glycol Dehydrator Emissions: GRI-GLYCalc Version 4.0 (cont.)

- Why is the glycol circulation rate so important?
- Aromatic compounds are very soluble in glycol and significant absorption can occur.

  Based on equilibrium constants, approximately 5-35% of the BTEX in the gas can be absorbed.
- Aromatic absorption is directly proportional to the glycol circulation rate: the higher the rate, the higher the aromatic compound absorption.
- Higher contactor pressure and/or lower contactor temperature will also lead to increased absorption.



Control Devices: GRI-GLYCalc Version 4.0

- If flash separator is present, input the destination of flash gas correctly.
  - Routed to fuel gas or heater, or used as stripping gas
- If stripping gas is used, input accurate flow rate.
  - Stripping gas reduces condenser efficiency.
- If condenser is used, input accurate temperature.

Example of Low Efficiency Condenser

Control Devices: All Glycol Dehydrator Emissions Determination Methods

- If flash gas or still column is routed to the glycol heater, input/use accurate control efficiency.

  Not necessarily 98 percent destruction and removal efficiency (DRE)

- Heater DRE is limited for the following reasons:
  - Firebox temperature is approximately 375-400 degrees Fahrenheit
  - Burner system must be properly designed to promote complete combustion of BTEX
  - Burner does not fire constantly
  - DRE should be 80 percent or less

Determining Glycol Dehydrator Emissions: Direct Measurement

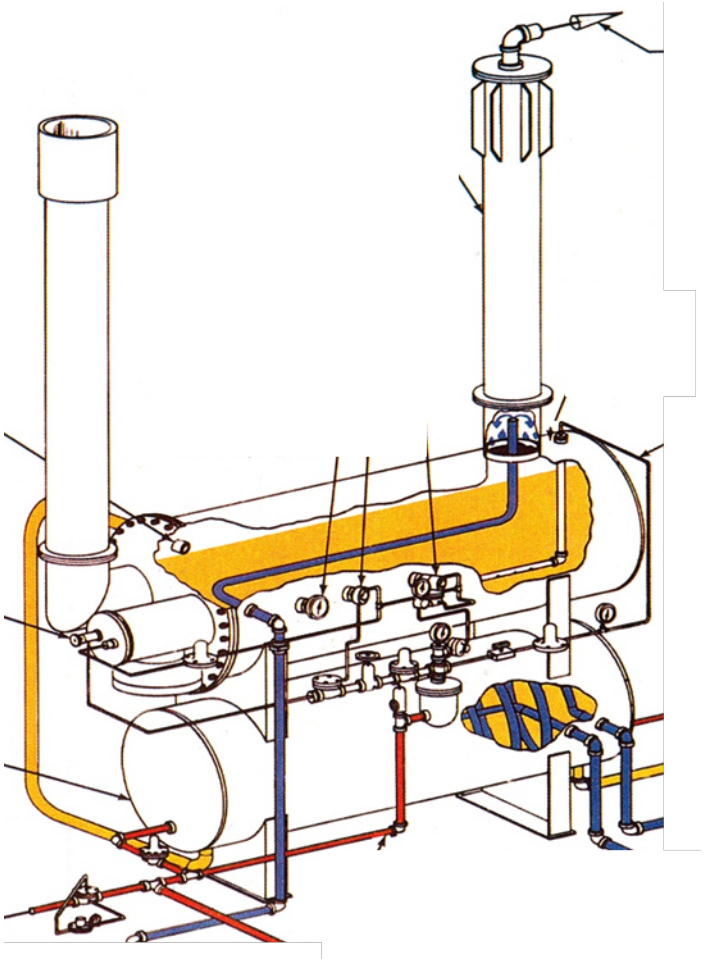
Conventional stack measurements using reference methods in 40 Code of Federal Regulations Part 60, Appendix A

- United States Environmental Protection Agency (EPA) reference methods 18 and 25
- Measurements can be difficult due to:
  - High moisture content
  - Low, cyclical, or variable vent exhaust flow rate
  - In smaller units, small stack diameter and vent line wall effects
- Ensure test plan is approved by Texas Commission on Environmental Quality (TCEQ)

Determining Glycol Dehydrator Emissions: Direct Measurement (cont.)

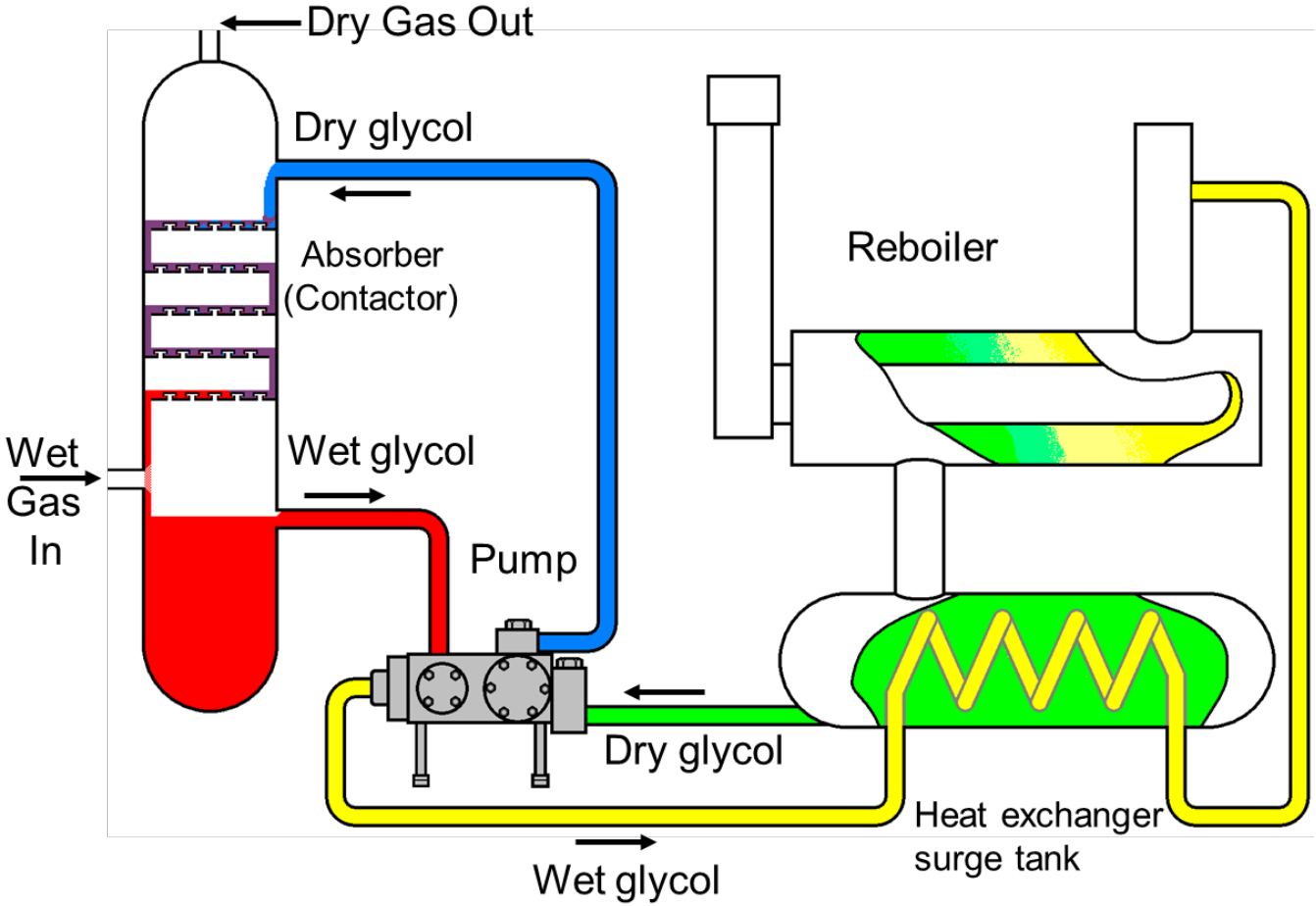
Total capture condensation

- Still vent exhaust is collected, condensed, separated, and measured
  - Water, liquid hydrocarbons, and non-condensable hydrocarbon gases
- Expensive, but considered more accurate than stack test
- Total capture: only suited for smaller dehydrators
- Partial capture: should not be used; concerns about representativeness, flow rate accuracy exist



Determining Glycol Dehydrator Emissions: Atmospheric Rich-Lean Analysis

Material balance method: determines emissions based on VOC and HAP concentrations in rich (wet) and lean (dry) glycol streams



Determining Glycol Dehydrator Emissions: Atmospheric Rich-Lean Analysis (cont.)

- Only applicable to units **with** flash separators and **without** stripping gas

  These processes entrain gas in the rich glycol, producing measurement errors.

- Sample rich glycol before the regenerator, lean glycol prior to contactor

Determining Glycol Dehydrator Emissions: Atmospheric Rich-Lean Analysis (cont.)

- Extended gas analysis for methane through decanes-plus hydrocarbons required
  - Gas Processors Association (GPA) 2286 or similar method
  - Needs to speciate BTEX, n-hexane, and other HAPs
- Difference in concentrations coupled with glycol circulation rate and operating hours produces emissions rates.
- $E_x = (C_i - Co) * Q$, where:
  - E_x = Emissions of pollutant x
  - C_i = Rich sample pollutant x concentration
  - C_o = Lean sample pollutant x concentration
  - Q = Glycol circulation rate
- Example on next slide, with conversions

Determining Glycol Dehydrator Emissions: Atmospheric Rich-Lean Analysis (cont.)

- Sample analyses indicate:
  - a rich glycol benzene concentration prior to the reboiler of 800 milligrams per liter (mg/L) and
  - a lean glycol benzene concentration prior to the contact tower of 100 mg/L.
  - the dehydrator operates 8,760 hours per year
  - the pump circulates glycol at 5 gpm
- To determine emissions, use the equation on the previous page and convert units appropriately:

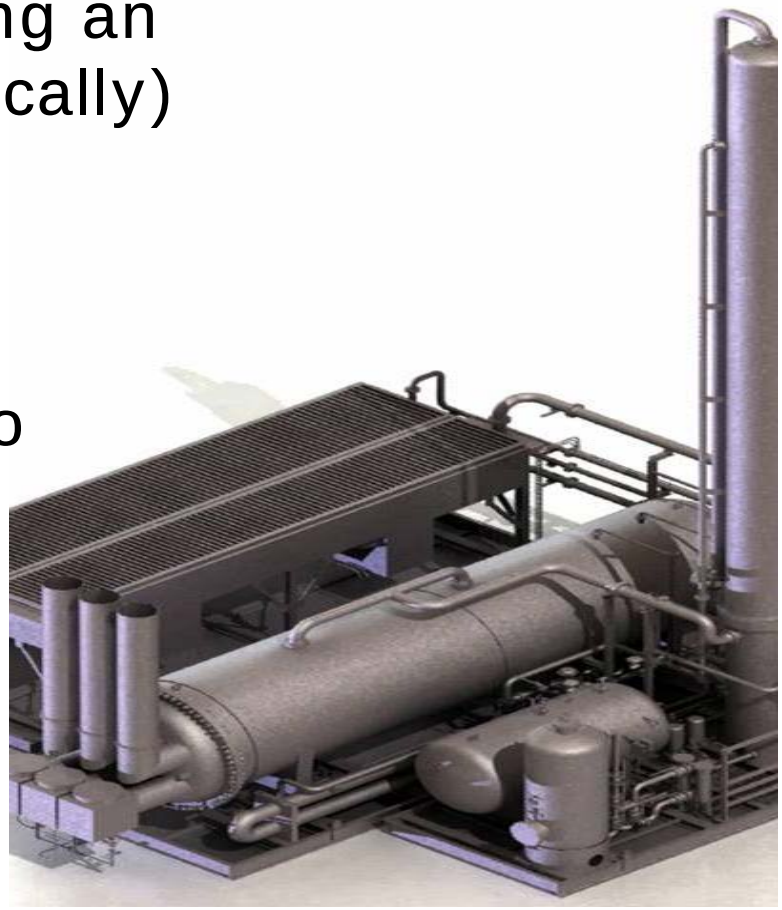
$$\frac{(800-100)mg}{L}\times\frac{1\,\mathrm{g}}{1000mg}\times\frac{1\,\mathrm{lb}}{453.59g}\times\frac{1\,\mathrm{ton}}{2000lbs}\times\frac{3.78\,\mathrm{L}}{gal}\times\frac{5\,\mathrm{gal}}{\mathrm{min}}\times\frac{60\,\mathrm{min}}{hour}\times\frac{8{,}760\,\mathrm{hours}}{year}=\frac{7.67\,tons_benzene}{\mathrm{year}}$$

Amine Treatment Units

Amine Units

- Remove acid gases, carbon dioxide (CO_2) and hydrogen sulfide (H_2S), from natural gas streams using an alkanolamine compound (typically)
  - Meet pipeline specifications
  - Prevent corrosion
  - Reduce toxic H_2S emissions
- Amine contacts the wet gas to remove acid gases, but also absorbs VOC and HAPs

  Including BTEX and n-hexane

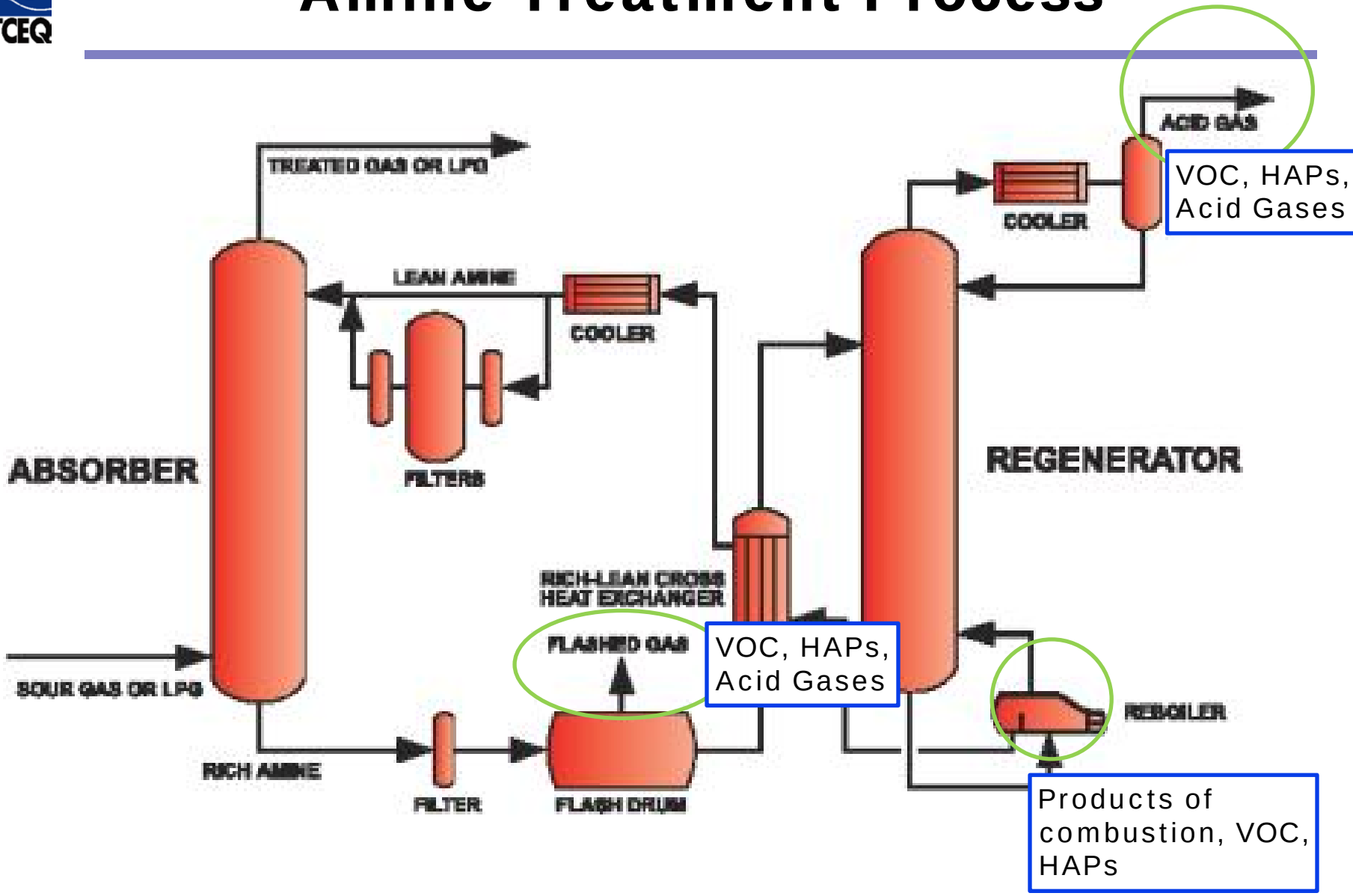


Amine Units (cont.)

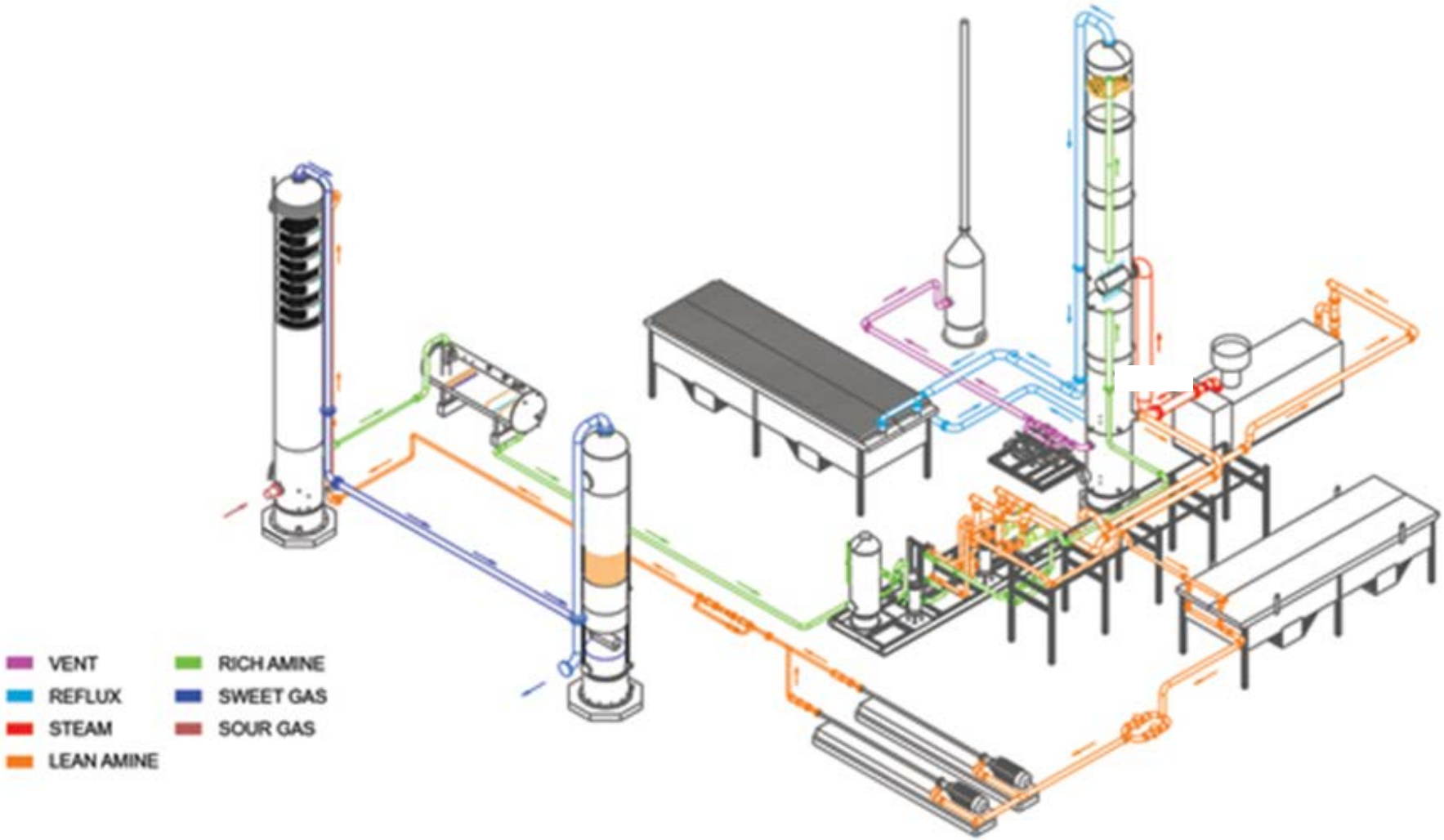
- Once saturated, the amine is regenerated through heating to evaporate acid gases and recirculated.
- Potentially results in VOC, HAP, H_2S, and sulfur dioxide (SO_2) emissions
  - Amine units in CO_2 service have typically been vented to the atmosphere, with no control.
    - High CO_2 concentrations can interfere with combustion controls.
    - Can have significant VOC and HAP emissions.
  - For safety reasons, units in H_2S service are controlled.

    If sulfur recovery is not installed, SO_2 along with small amounts of H_2S, VOC, and HAPs will be emitted.

Amine Treatment Process



Amine Treatment Process (cont.)



Amine Unit Emissions

- Similar to glycol still emissions, amine regenerator emissions are dependent upon multiple factors.
  - Strongly dependent upon:
    - Gas composition
    - Amine recirculation rate
    - Absorber pressure
    - Absorber temperature
  - Aromatic compounds are very soluble in amine solutions and significant absorption can occur.
- Emissions are:
  - directly proportional to gas composition and amine circulation rate, as well as increasing pressure; and
  - inversely proportional to temperature.

Amine Unit Emissions (cont.)

- If amine regenerator emissions are controlled, determine emissions using the order of preference found in RG-360, Chapter 4
  - If monitoring or test data exists, use that data to determine emissions
  - If monitoring or test data is unavailable:
    - For H_2S units, determine emissions using a material balance approach with measured sour and sweet gas H_2S concentrations.
    - For CO_2 units, may be able to input control device data into process simulator

- Methods to determine combustion emissions from reboiler heater:

  Use order of preference in RG-360, Technical Supplement 1

Determining Amine Unit SO_2 and H_2S Emissions: Material Balance

- H_2S reported in grains per 100 standard cubic foot (scf) of natural gas:

$$\text{ton/yr } H_2S = \frac{\text{scf}}{\text{day}} \cdot \frac{\text{gr } H_2S}{100 \text{ scf}} \cdot \frac{\text{lb}}{7000 \text{ gr}} \cdot \frac{365 \text{ day}}{\text{year}} \cdot \frac{\text{ton}}{2000 \text{ lb}}$$

$$\text{ton/yr } SO_2 = \frac{\text{scf}}{\text{day}} \cdot \frac{\text{gr } H_2S}{100 \text{ scf}} \cdot \frac{\text{lb}}{7000 \text{ gr}} \cdot \frac{64 \text{ lb } SO_2}{\text{lb-mole}} \cdot \frac{\text{lb-mole}}{34 \text{ lb } H_2S} \cdot \frac{365 \text{ day}}{\text{year}} \cdot \frac{\text{ton}}{2000 \text{ lb}}$$

- H_2S reported in mole percent:

$$\text{ton/yr } H_2S = \frac{\text{scf}}{\text{day}} \cdot \frac{\text{mol\% } H_2S}{100} \cdot \frac{34 \text{ lb } H_2S}{\text{lb-mole}} \cdot \frac{\text{lb-mole}}{379.5 \text{ scf}} \cdot \frac{365 \text{ day}}{\text{year}} \cdot \frac{\text{ton}}{2000 \text{ lb}}$$

$$\text{ton/yr } SO_2 = \frac{\text{scf}}{\text{day}} \cdot \frac{\text{mol\% } H_2S}{100} \cdot \frac{64 \text{ lb } SO_2}{\text{lb-mole}} \cdot \frac{\text{lb-mole}}{379.5 \text{ scf}} \cdot \frac{365 \text{ day}}{\text{year}} \cdot \frac{\text{ton}}{2000 \text{ lb}}$$

Determining Amine Regenerator VOC and HAP Emissions

Methods to determine amine unit VOC and HAP emissions in order of preference:

- Direct measurement (when performed properly)
  - Stack sampling
  - Need to account for emissions from:
    - Regenerator column (if vented)
    - Flash tank
- Process simulator
  - However, certain software may under-estimate emissions
  - See details later in presentation

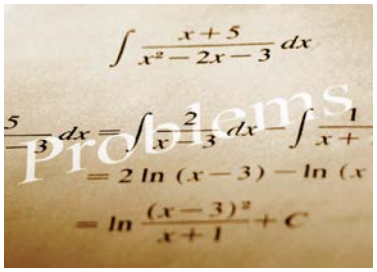
Determining Amine Regenerator VOC and HAP Emissions: Direct Measurement

Conventional stack measurements using reference methods in 40 Code of Federal Regulations Part 60, Appendix A

- EPA reference methods 18 and 25
- Measurements can be difficult due to:
  - High moisture content
  - Cyclical or variable vent exhaust flow rate
- Ensure test plan is approved by TCEQ

Determining Amine Regenerator VOC and HAP Emissions: Other Methods

- Process simulators
  - Software for engineering design and analysis that can also predict emissions rates
  - Mathematically describe operations based upon inputs and required/desired specifications
  - Variables include:
    - Inlet and outlet stream data
    - Sizing and performance requirements
    - Internal variables for specific process units
  - Algorithms solve equations per user-entered constraints
  - If gas composition is used for input, an extended gas analysis must be performed to characterize HAPs (GPA 2286 or similar)
- Variety of manufacturers for process simulators
- Expensive, often requiring initial and yearly licensing fees



Determining Amine Regenerator VOC and HAP Emissions: Other Methods (cont.)

- A recent University of Oklahoma study indicates software used to model amine regenerator emissions may not accurately predict emissions rates.
  - Specifically, AmineCalc did not predict BTEX absorption by the amine solution accurately.
  - ProII modeled CO_2 removal systems more accurately than H_2S removal systems.
  - Software thermodynamics (specifically mixing rules) do not reproduce real system interactions.
  - These specific software programs: least preferred options for determining emissions
  - Other software may model emissions more accurately
- Any model is only as accurate as its inputted data

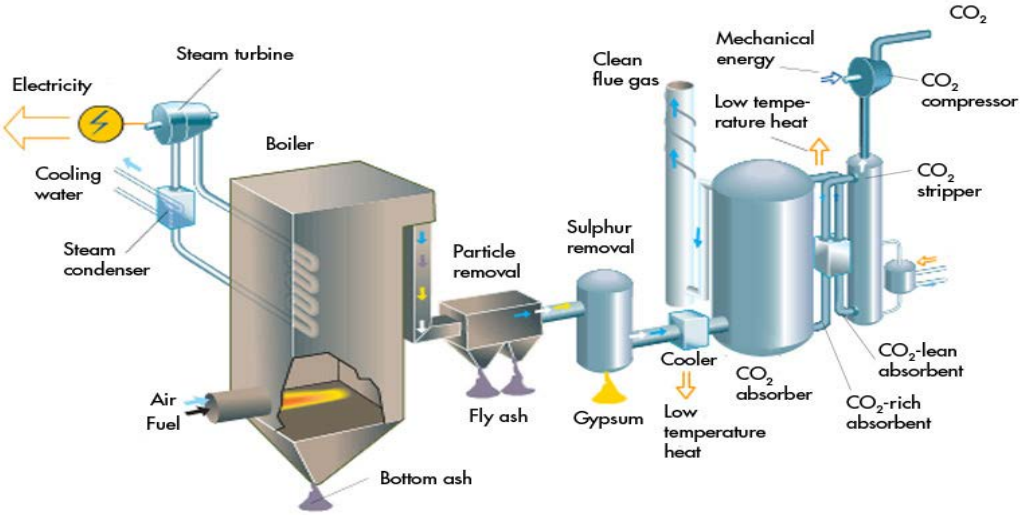
Amine Unit in CO_2 Service: Reported VOC and HAP Emissions

EMISSIONS INVENTORY REPORTED ANNUAL ROUTINE EMISSIONS, TONS PER YEAR			
CONTAMINANT	2009	2011	2012
VOC-UNCLASSIFIED	3.42		
BENZENE		66.29	30.2
ETHYL BENZENE			1.24
TOLUENE		36.31	17.27
PARA-XYLENE			2.49
CYCLOHEXANE		5.1	2.63
ISOHEXANE (AKA: 2-METHYLPENTANE)		10.44	3.7
HEPTANE			2.74
HEXANE		2.61	2.36
ISOBUTANE	1.15	3.52	
ISOHEPTANE		9.11	6.65
OCTANE			1.78
ISO OCTANE		3.46	9.37
DECANE			0.56
UNDECANE		8.63	1.67
ISO PENTANE		4.37	
NONANE			3.01
N BUTANE	3.45	22.9	20.43
PENTANE	2.86		2.86
N-PENTANE		6.56	
PROPANE	6.99	110.95	115.39
VOC-TOTAL	17.87	290.25	224.35

- 2009: Used model to determine emissions
- 2010-2011: Used direct measurement results to determine emissions

Determining Amine Regenerator VOC and HAP Emissions: Other Methods

- Rich-lean amine analysis
  - Very little available data on accuracy for:
    - Varying amine sweetening unit configurations
    - Units in CO_2 versus H_2S service
  - Follow guidelines for glycol dehydrator sampling and analysis.
  - Considered material balance
- Prefer measurement or other process simulator to be used
- More preferred than AmineCalc, ProII



Leaking Component Fugitives

- Use monitoring data

  EPA average factors can only be non-monitored components

- Include leaks from unconventional and difficult-to-monitor components in emissions

- Fugitive data sheet
  - VOC percentage question

    Refers to percent of VOC in each gas and liquid stream, not the percent of the components in gas and liquid service.
  - Group components by process area and service type

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Cooling Towers

Primary sources of VOC emissions are heat exchanger leaks

- Hydrocarbon-containing process fluids leak into the cooling water
- Once the hydrocarbon-contaminated cooling water reaches the tower, the VOC either flash out of the water or are stripped out by the tower's air flow, resulting in VOC emissions.
- VOC emissions determinations
  - Monitored data most preferred
  - For emissions inventory purposes, monitoring data must be sufficient to derive an emissions rate
  - If not able to quantify VOC emissions from the monitoring data, use the unmonitored factor

Does not constitute certification of monitoring status

Cooling Towers (cont.)

- When using monitoring data, emissions are determined by program requirements, frequency of monitoring, and inputs.
- Required inputs for:
  - Appendix P, El Paso method monitoring
    - Flow rate of water
    - Flow rate of stripping gas
    - Concentration of VOC in the stripping gas
  - Inlet-outlet monitoring
    - Concentrations
    - Detection limits

- Determine emissions for each monitoring period, sum to obtain annual emissions rate.

Cooling Towers (cont.)

- Determine total suspended and fine particulate emissions
  - Vendor data preferred
  - AP-42 can be used if better method not available
- Remember to determine particulate matter less than 10 microns and less than 2.5 microns in diameter (PM_{10} and $PM_{2.5}$)
  - Limited data
  - Conservative assumption $PM_{2.5}$ emissions = PM_{10} emissions

Non-heated Storage Tanks

- Storage tanks emissions modes
  - Working, breathing, flashing
  - Cleaning, degassing, landing
  - Blending, air or nitrogen sparging, highly unstable liquid losses
- Flash emissions
  - Ensure site-specific data are used to determine emissions
  - If site-specific data are not available, representative data can be used if TCEQ's representative analysis criteria are met.
  - If E&P TANK errors are encountered with high gravity oil, indicates potential highly unstable liquid
    - Verify data inputs; errors in the temperature, pressure or composition can have a significant impact.
    - If errors persist, may have to use another method to determine emissions.

Non-heated Storage Tanks (cont.)

- Ozone season emissions:
  - Use AP-42, Chapter 7 equations to determine emissions.
  - E&P TANK can be used to determine ozone season emissions <u>for upstream oil and gas storage tanks.</u>

- If blending or mixing product to specifications occurs on-site, use material balance equations to determine emissions.
- If sparging of material occurs on-site, use engineering equations and process knowledge to determine emissions

  Example: Merox unit at refinery

Finally, Trust, but Verify (and Adjust Emissions as Necessary)

Finally, Trust, but Verify (and Adjust Emissions as Necessary) (cont.)

References and Contact Information

- Questions?
  - Danielle.Nesvacil@tceq.texas.gov
  - (512) 239-2102
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