

# CHAPTER 5—EXAMPLE INITIAL EMISSIONS INVENTORY

This chapter presents an example initial emissions inventory for a hypothetical site producing and processing natural gas. Carefully consult the materials in Chapters 3 and 4 in conjunction with this example.

## Identifying Emissions Sources

The following processes occur at an upstream gas field site (hypothetical):

- natural gas production
- separation of natural gas and liquids
- natural gas sweetening
- natural gas dehydration
- natural gas compression and delivery to a pipeline
- storage of condensate and natural gas liquids
- loading of condensate on trucks
- blowdown operations

The following equipment is involved in the above processes:

- lift pump and associated electric motor
- gunbarrel separator (initial gas–liquids separation)
- amine unit, associated reboiler, and diethylamine storage tank
- glycol dehydration still, associated reboiler, and ethylene glycol storage tank
- emergency flare to control glycol unit and amine unit emission events, as well as blowdowns
- refrigerated absorption unit and fractionation columns (further natural gas liquids separation)
- compressor engines:
  - one 2000 hp turbine with dual exhaust stacks
  - one 1200 hp lean-burn, 4-stroke engine
  - one 1000 hp rich-burn, 4-stroke engine with a 70 percent–efficient nonselective catalytic reduction (NSCR) system
- two 1500 gal condensate fixed-roof storage tanks
- one condensate truck loading rack (uncontrolled)
- high-pressure storage tanks

Analyzing the two above lists, the following emissions sources can be identified. Characteristic source emissions are listed, as appropriate.

**Table 5-1. Identifying Emissions Sources from Equipment and Processes**

<b>Equipment or Process</b>	<b>Emissions Source</b>
Lift pump and associated electric motor	Piping fugitive components (including pump)
Gunbarrel separator	Gunbarrel separator: flash emissions
	Piping fugitive components
Natural gas sweetening	Amine unit: hydrogen sulfide emissions
	Amine reboiler unit: combustion emissions
	Diethylamine storage tank
	Piping fugitive components
Natural gas dehydration	Glycol still: source of VOC and HAP emissions
	Glycol reboiler unit: combustion emissions
	Ethylene glycol storage tank
	Piping fugitive components
Refrigerated absorption unit and fractionation columns	Piping fugitive components
Compressor engines	Turbine
	Lean-burn four-stroke engine
	Rich-burn four-stroke engine
	Piping fugitive components
Flaring of emissions events	Emergency flare: combustion emissions
	Source that generated emissions events (amine unit, blowdown, etc.)
	Piping fugitive components

**Table 5-1. Identifying Emissions Sources, continued**

<b>Equipment or Process</b>	<b>Emissions Source</b>
Condensate storage	First 1500 gal condensate fixed-roof storage tank
	Second 1500 gal condensate fixed-roof storage tank
	Piping fugitive components
Condensate truck loading	Loading rack: loading emissions
	Piping fugitive components
Natural gas liquids storage	Piping fugitive components, especially relief valves
Gas delivery to pipeline	Piping fugitive components
Blowdown operations	Blowdown process

## Translating Emissions Sources to the Emissions Inventory

**Facilities.** After the emissions sources have been identified, they need to be transferred to emissions inventory forms. Review the material in Chapter 3, “Emissions Inventory Structure,” in conjunction with the guidance in this chapter.

Since a facility is defined as a unique unit, device, structure, or area capable of generating emissions, all of the emissions sources listed in Table 1 are facilities. Now that the facilities have been identified, each one needs to be translated to the EI. To do this, we will first need to assign each facility in the EI with a unique facility identification number (FIN). Remember that EI naming conventions (for facilities as well as emission points) should follow the naming conventions of any associated permits. With that in mind, we can draft a list of FINs (and their corresponding emissions sources) to add to the EI (Table 5-2):

**Table 5-2. Assigning FINs to Emissions Sources**

<b>Emissions source</b>	<b>FIN</b>
All natural gas piping fugitive components	FUGAREA1
All condensate piping fugitive components	CONDFUGS
Gunbarrel separator	GUNBARSEP
Amine unit	AMINEUNIT
Amine reboiler unit	AMREBOILER
Diethylamine storage tank	DEA-TANK
Glycol still	GLYCOLSTIL
Glycol reboiler unit	GLREBOILER
Ethylene glycol storage tank	EG-TANK
Turbine	TURBINE1
Lean-burn four-stroke engine	COMP1
Rich-burn four-stroke engine	COMP2
Emergency flare	UPSETFLARE
First 1500 gal condensate fixed-roof storage tank	CONDTANK1
Second 1500 gal condensate fixed-roof storage tank	CONDTANK2
Loading rack: loading emissions	LOADRACK
Blowdown operations	BLOWDOWN

Note that, in Table 5-2, piping fugitive components are grouped together into two facilities: one equipment leak fugitive facility for the natural gas streams, and one equipment leak fugitive facility for the condensate streams. If an emissions source handles similar process streams, uses the same emissions determination methodology, and is monitored under the same monitoring program, all of the components can be grouped under one facility. See Technical Supplement 3 in Appendix A for more details on creating facilities for piping component fugitive areas.

**Emission points.** Once all of the FINs have been assigned for the emissions sources, their associated emission points need to be identified. From Tables 5-1 and 5-2, you can identify most of the sources' emission points. However, you need to list **all possible** emission points a facility can emit through. Based on this information, identify all of the possible emission points for the sources listed in Table 5-2 as shown in Table 5-3:

**Table 5-3. Identifying Emission Points for FINs**

<b>FIN</b>	<b>Emission Point(s)</b>
FUGAREA1	Fugitive area encompassing piping component fugitives
CONDFUGS	Fugitive area encompassing piping component fugitives
GUNBARSEP	Separator vent
AMINEUNIT	Amine unit vent
	Flare (during emissions events)
AMREBOILER	Reboiler stack
DEA-TANK	Tank vent
GLYCOLSTIL	Glycol still vent
	Flare (during emissions events)
GLREBOILER	Reboiler stack
EG-TANK	Tank vent
TURBINE1	Stack one (dual exhaust stack)
	Stack two (dual exhaust stack)
COMP1	Compressor stack
COMP2	Compressor stack
UPSETFLARE	Flare
CONDTANK1	Tank vent
CONDTANK2	Tank vent
LOADRACK	Area where fugitive loading emissions escape
BLOWDOWN	Emergency flare

In Table 5-3, all facilities that are able to route their emissions from emissions events have the flare as an emission point. Each emission point must be assigned a unique emission point number. The EI naming conventions for EPNs should follow the same naming conventions as their air permit. Table 5-4 lists the FINs and their corresponding EPNs.

**Table 5-4. Assigning EPNs to Emission Points**

<b>FIN</b>	<b>Emission point</b>	<b>EPN</b>
FUGAREA1	Fugitive area encompassing piping component fugitives	FUGAREA1
CONDFUGS	Fugitive area encompassing piping component fugitives	CONDFUGS
GUNBARSEP	Separator vent	SEPVENT
AMINEUNIT	Amine unit vent	AMINEVENT
AMINEUNIT	Flare (during emissions events)	FLARE
AMREBOILER	Reboiler stack	REBOILSTK1
DEA-TANK	Tank vent	DEA-TANK
GLYCOLSTIL	Glycol still vent	GLYCOLVENT
	Flare (during emissions events)	FLARE
GLREBOILER	Reboiler stack	REBOILSTK2
EG-TANK	Tank vent	EG-TANK
TURBINE1	Stack one (dual exhaust stack)	TURBSTK1
	Stack two (dual exhaust stack)	TURBSTK2
COMP1	Compressor stack	COMP1STK
COMP2	Compressor stack	COMP2STK
UPSETFLARE	Flare	FLARE
CONDTANK1	Tank vent	CONDTANK1
CONDTANK2	Tank vent	CONDTANK2
LOADRACK	Fugitive loading emissions area	LOADFUGS
BLOWDOWN	Emergency flare	FLARE

**Control Devices.** Before adding the emissions paths to the EI, the control devices need to be added to the appropriate paths. From the information in Table 5-4, control devices need to be added to the following FIN/EPN paths:

- AMINEUNIT / FLARE
- GLYCOLUNIT / FLARE
- COMP2 / COMP2 (remember, this engine has NSCR controls)
- BLOWDOWN / FLARE

Each control device must be assigned a unique control identification number. Table 5-5 lists the FINs, the EPNs, and their associated CINs.

**Table 5-5. Assigning CINs to Paths**

<b>FIN</b>	<b>EPN</b>	<b>CIN (if applicable)</b>
FUGAREA1	FUGAREA1	
CONDFUGS	CONDFUGS	
GUNBARSEP	SEPVENT	
AMINEUNIT	AMINEVENT	
AMINEUNIT	FLARE	FLARE
AMREBOILER	REBOILSTK1	
DEA-TANK	DEA-TANK	
GLYCOLSTIL	GLYCOLVENT	
GLYCOLSTIL	FLARE	FLARE
GLREBOILER	REBOILSTK2	
EG-TANK	EG-TANK	
TURBINE1	TURBSTK1	
TURBINE1	TURBSTK2	
COMP1	COMP1STK	
COMP2	COMP2STK	NSCR
UPSETFLARE	FLARE	
CONDTANK1	CONDTANK1	
CONDTANK2	CONDTANK2	
LOADRACK	LOADFUGS	
BLOWDOWN	FLARE	FLARE

**EI Forms.** The emission paths can now be transferred to the appropriate Facility Information, Emission Point Information, and Abatement Device Information forms. These forms are available on the EAS Web page or in *2007 Emissions Inventory Forms and Instructions* (publication number RG-360B).

Different types of Facility Information and Emission Point Information forms exist to represent different types of processes or units. A Facility Information form exists for each type of process or unit:

- cleaning
- coating or printing
- cooling tower
- flare (combustion unit—flare profile)
- leaking component fugitives
- loading
- non-flare combustion unit
- storage tank
- VOC process
- wastewater system
- wastewater system component
- other facility

There are three different types of Emission Point Information forms—for stacks, fugitive areas, and flares. There is only one Abatement Device Information form for control devices.

Table 5-6 lists the forms for adding structure to the EI.

**Table 5-6. Appropriate Forms for Adding Structure to the EI**

<b>FIN and Appropriate Facility Form</b>	<b>EPN and Appropriate Emission Point Form</b>	<b>CIN</b>
FUGAREA1: Facility Information form for Leaking Component Fugitives	FUGAREA1: Emission point form for a Fugitive-type EPN	
CONDFUGS: Facility Information form for Leaking Component Fugitives	CONDFUGS: Emission point form for a Fugitive-type EPN	
GUNBARSEP: Facility Information form for a VOC Process (under the “Profile” section of the form, check “other”).	SEPVENT: Emission point form for a Stack-type EPN	
AMINEUNIT : Facility Information form for Other Facility	AMINEVENT: Emission point form for a Stack-type EPN	

**Table 5-6. Appropriate Forms for Adding Structure to the EI, continued**

<b>FIN and Appropriate Facility Form</b>	<b>EPN and Appropriate Emission Point Form</b>	<b>CIN</b>
AMINEUNIT: Facility Information form for Other Facility	FLARE: Emission point form for a Flare-type EPN	FLARE*
AMREBOILER: Facility Information form for a Combustion Unit	REBOILSTK1: Emission point form for a Stack-type EPN	
DEA-TANK: Facility Information form for a Storage Tank	DEA-TANK: Emission point form for a Stack-type EPN	
GLYCOLSTIL: Facility Information form for a VOC Process (under the "Profile" section of the form, check "glycol still")	GLYCOLVENT: Emission point form for a Stack-type EPN	
GLYCOLSTIL: Facility Information form for a VOC Process (under the "Profile" section of the form, check "glycol still")	FLARE: Emission point form for a Flare-type EPN	FLARE*
GLREBOILER: Facility Information form for a Combustion Unit	REBOILSTK2: Emission point form for a Stack-type EPN	
EG-TANK: Facility Information form for a Storage Tank	EG-TANK: Emission point form for a Stack-type EPN	
TURBINE1: Facility Information form for a Combustion Unit (under the "Profile" section of the form, check "turbine")	TURBSTK1: Emission point form for a Stack-type EPN	
TURBINE1: Facility Information form for a Combustion Unit (under the "Profile" section of the form, check "turbine")	TURBSTK2: Emission point form for a Stack-type EPN	
COMP1: Facility Information form for a Combustion Unit (under the "Profile" section of the form, check "IC Engine," and complete the remaining blanks "4-cycle, lean-burn")	COMP1STK: Emission point form for a Stack-type EPN	
COMP2: Facility Information form for a Combustion Unit (under the "Profile" section of the form, check "IC Engine," and complete the remaining blanks "4-cycle, rich-burn")	COMP2STK: Emission point form for a Stack-type EPN	NSCR*

\*Since only one abatement device form exists for control devices, complete the Abatement Device Information form for these two CINs.

**Table 5-6. Appropriate Forms to Add Structure to the EI, continued**

<b>FIN and Appropriate Facility Form</b>	<b>EPN and Appropriate Emission Point Form</b>	<b>CIN</b>
UPSETFLARE: Facility Information form for a Flare (Combustion Unit—Flare Profile)	FLARE: Emission point form for a Flare-type EPN	
CONDTANK1: Facility Information form for a Storage Tank	CONDTANK1: Emission point form for a Stack-type EPN	
CONDTANK2: Facility Information form for a Storage Tank	CONDTANK2: Emission point form for a Stack-type EPN	
LOADRACK: Facility Information form for a Loading facility	LOADFUGS: Emission point form for a Fugitive-type EPN	
BLOWDOWN: Facility Information form for a VOC Process (under the “Profile” section of the form, check “blowdown operations”)	FLARE: Emission point form for a Flare-type EPN	FLARE*

\*Since only one abatement device form exists for control devices, complete the Abatement Device Information form for these two CINs.

For facilities that have multiple paths, only **one** Facility Information form needs to be submitted to add the facility. To link this facility to other emission points simply the facility in the appropriate blank on the Path Emissions form as explained below. These procedures can also be used for emission points and abatement devices that have multiple paths.

**Completing Path Information.** Emissions data need to be completed for each path on the Path Emissions form. Submit Material Throughput forms as necessary to supply process rate data used in emissions determinations.

**Completing Account Information.** An Account Information form must be completed as well as the Contact Information forms.

Use the information in Table 5-6 to complete the Structural Overview form, which documents emission path data.

The sum of all criteria pollutants reported at all emission paths must be entered on the Account Emissions form. The legally responsible party must fill out and sign the section headed “Signature of Legally Responsible Party.” If no emissions from emissions events are being reported within the EI, the legally responsible party must sign the Emissions Events certification.

Detailed instructions on how to complete each EI form are provided in the companion volume, *2007 Emissions Inventory Forms and Instructions* (publication number RG-360B), or on the EAS Web page.