



## **Oil & Natural Gas Industry Survey**

# **General Instructions**

Mailing Address:

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Attention: SSD / Oil & Gas Survey

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# Overview

The Oil & Natural Gas Industry Survey has been designed to improve our estimates of greenhouse gas emissions in California. We are collecting data for the 2007 calendar year in order to accurately quantify equipment and operation processes. This survey is intended to be a one-time collection of information needed to develop a statewide inventory baseline. This survey is not being used as a compliance tool nor is it part of other mandatory reporting programs. This survey pertains to all upstream oil and natural gas facilities regardless of the size of the operation.

The following instructions have been provided to answer general questions pertaining to the individual survey tables. Since this survey covers a wide range of processes and operations, some companies may not need to complete every table.

***Who should fill out this survey?*** Any owner or operator of the following facilities:

Oil or Natural Gas Extraction Facilities: includes any facility that extracts crude oil, natural gas, or both crude oil and natural gas.

Processing Facilities: includes any facility that processes crude oil or natural gas for use or distribution. This survey does not include refineries.

Crude Oil Transmission Facilities: includes crude oil pipelines or crude oil bulk loading operations. This includes ship, truck, or rail car loading facilities.

Storage Facilities: includes any facility that stores crude oil or natural gas, including underground natural gas storage facilities. This survey excludes crude oil tank farms that are located on refinery premises.

***Submission Format.*** Paper forms, Microsoft Excel/Access files, or a combination of both paper and electronic files are acceptable. It is preferable to have all data submitted electronically. We have staff available to provide assistance or answer questions via e-mail or telephone.

***Permitted and Non-Permitted Equipment.*** This survey covers both air district permitted and non-permitted equipment and includes equipment that is registered under the Portable Equipment Registration Program (PERP). Therefore, this survey includes equipment that is moved more than once annually and includes non-air district permitted equipment that is below 50-horsepower in rating.

***Questions?*** Please contact any of the following ARB staff for questions or assistance:

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# General Instructions

## ***Table 1: Facility Description***

This survey and the Facility Description Table are to be completed one time per geographically distinct facility (i.e., property boundary) by the entity that has operational control of the equipment. Even though a single operator may oversee operations at multiple facilities, please complete one survey per geographically distinct facility in order for us to determine the locations of equipment and processes.

PERP Equipment Owners: In the case where a company owns and operates equipment that is portable (e.g., PERP registered equipment such as drill rigs, portable gas compressors) please use the company headquarters contact information as the facility description.

Inside a facility there may be different Facility ID numbers provided by the local air district (e.g., multiple gas plants). Please provide the facility ID number where indicated. In some cases, a Facility ID number may not be available and a generic number must be created. One way to create a unique ID number is by using the first two letters of the local air district where the facility is located and a number. For example, a facility located in San Joaquin Valley APCD could use “SJ1, SJ2, etc.”

## ***Table 2: Facility Production***

The Facility Production Table is designed to list active wells, production, and workover information for the 2007 calendar year. Enter information in the corresponding categories.

Indicate the number of new wells drilled, completions, and workovers for the facility. For well workovers, enter the number that required tubing removal only. The number that did not require tubing removal is not required. Well cleanups (also referred to as well unloading) include fluids removal or well fracturing, where in either case fluids are removed from the well.

There is a separate column listed for underground natural gas storage facilities. Some of these facilities may intermittently produce crude oil with the natural gas. For simplification, please enter the volume of oil intermittently produced from the gas wells in Box 1 under the Natural Gas Storage Column, and enter the total volume of natural gas extracted in Box 2. For all companies, please enter the average natural gas composition and volume in Box 2.

For crude oil transmission facilities, a section has been included for length of pipeline and barrels of crude oil transported. These facilities are located after a production facility’s LACT unit. A production facility does not enter information in Box 3.

### **Table 3: Facility Electrification**

The Facility Electrification Table is designed to determine the level of electrification at crude oil and natural gas facilities. This information is important to understand the level of electrification within the sector. In some instances, a facility may generate or export its own electricity using Generators, Microturbines, Turbines, or Combined Heat and Power units. This includes electricity generated from standby or backup, on-site generators used in the event of power outages. Please indicate the amount of electricity generated, exported, and purchased. Estimated values are acceptable.

### **Table 4: Vapor Recovery and Flaring**

Vapor recovery units consist of flares, thermal oxidizers, incinerators, and carbon adsorption units. These units control the release of hydrocarbons and may be designed for continuous or emergency operation. Table 4 is to be completed one time for each piece of equipment. In most cases, it may be easier to use one of the electronic templates.

Enter the throughput volume and rated size of the unit. For flares, enter the size in terms of btu/hour. For carbon adsorption units, enter the size in terms of the volume of the unit (height x diameter, etc.). In some cases the units are source tested for combustion or capture efficiency. If test data are available, please enter the efficiency where indicated.

For flares, thermal oxidizers, or incinerators, the average composition of the raw natural gas stream is required to enter the average gas composition and calculate the Carbon Mole Ratio. In many cases, a Gas Chromatograph (GC) analysis will have all of the values but the Carbon Mole Ratio must be calculated. If you are unsure on how to calculate these parameters, please call or submit a copy of a GC analysis and we will provide assistance. For convenience, the formula and a simplified example are shown below.

$$\text{Carbon Mole Ratio} = \sum \left[ \frac{\text{mole \% hydrocarbon}}{100} \right] * \text{Number carbons in hydrocarbon}$$

The carbon mole ratio is calculated by adding up each of the mole percentages multiplied by the number of carbons in each species. The following is a simplified example:

Species	Mole %
Methane (CH <sub>4</sub> )	80
Ethane (C <sub>2</sub> H <sub>6</sub> )	15
Propane (C <sub>3</sub> H <sub>8</sub> )	5

In this example, the carbon mole ratio would be calculated as follows:

$$\text{Carbon Mole Ratio} = (80/100)*(1) + (15/100)*(2) + (5/100)*(3) = \underline{1.25}$$

## **Table 5: Combustion Equipment**

Table 5 is to be completed one time for each piece of combustion equipment. In most cases, it may be easier to use one of the electronic templates. This table is designed to accommodate a wide variety of external and internal combustion equipment. List both air district and non-air district permitted equipment. The table also includes a box to indicate if the equipment is included in the Portable Equipment Registration Program (PERP).

The purpose of this survey is to perform an accurate statewide inventory baseline. Therefore, this survey includes equipment that is moved more than once annually and includes non-air district permitted equipment that is below 50-horsepower in rating.

We have provided examples from which to choose and the option to specify equipment not included as an example. For engines powering compressors, enter a unique ID number that will be used with the natural gas compressor table (Table 12). This number will link the primary driver engine with the natural gas compressor.

Enter the manufacturer name where indicated. For some external combustion units (e.g., steam generators) it is acceptable to enter the name of the burner manufacturer if no other information is available. Enter the inspection frequency and indicate the frequency that involves testing with instruments, visual inspections, and the use of a third-party tester. Estimated inspection frequencies are acceptable.

### **Fuel Type and Fuel Properties**

Under fuel type, list the primary and, if necessary, the secondary fuel type and volume as metered or calculated. The average Higher Heating Value and Liquid Fuel Density may be entered as standard values. If available, it is preferred to have actual values. A Gas Chromatograph (GC) analysis will provide the values for you.

In many cases, a GC analysis will list values or allow figures to be computed. If you are unsure on how to calculate these parameters, please call or submit a copy of a GC analysis and we will provide assistance. For convenience, the formula for Gaseous Fuel Molecular Weight is provided below.

$$\text{Gaseous Fuel MW} = \frac{1}{100} * \sum [(Mole \%_{Compound}) * (MW_{Compound})]$$

Where:

$Mole\%_{Compound}$  = indicated on GC analysis

$$MW_{Compound} = \sum Weight_{Element} * Coefficient_{Element}$$

An example calculation for  $MW_{Compound}$  :  $CH_4 = (12*1) + (1*4) = \underline{16}$

## **Table 6: Component Counts**

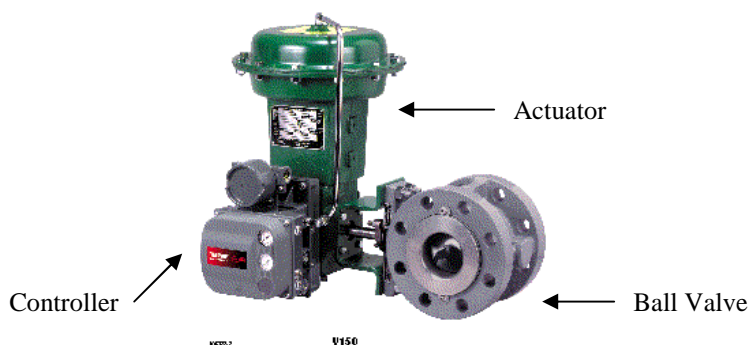
Table 6 provides a means of organizing components by natural gas, heavy crude, and light crude oil. If the actual number of components is unknown for a facility, it is acceptable to estimate the number using an average number of components per unit and then multiply by the total number of similar units. Table 6 has been designed similarly to local air district inspection and maintenance (I&M) programs and should be completed in conjunction with Table 8.

## **Table 7: Automated Control Devices**

Automated Control Devices (i.e., pneumatic devices) control the flow of fluids or gases. The devices may be connected to a central vapor recovery system or plumbed back into a natural gas system (gas recovery). Table 7 has been designed similarly to local air district inspection and maintenance (I&M) programs and should be completed in conjunction with Table 8.

Typically, a single unit consists of one or more components. For example, a controller is used to control an actuator and the actuator is used to operate a block or turbine valve. Intermittent bleed devices are the actuators that only emit when actuated. Low bleed devices are the controllers that continuously emit less than 6 scfh. Figure 1 shows the common components. For additional information, please refer to the manufacturer catalogue or look at the EPA Natural Gas Star web site for topics on pneumatic devices, such as [http://www.epa.gov/gasstar/documents/11\\_pneumatics.pdf](http://www.epa.gov/gasstar/documents/11_pneumatics.pdf)

Due to design characteristics of the various units, indicate how many controllers and actuators are located at the facility and whether the devices are instrument air, gas, or electronically actuated. If the actual number of components is unknown for a facility, an estimated number of components are acceptable.



**Figure 1.** Typical Vee-Ball® Valves with Type 1052 Actuators and DVC6020 Digital Valve Controllers.

### ***Table 8: Inspection and Maintenance Program***

An inspection and maintenance (I&M) program requires a facility operator to routinely screen for and repair leaks from equipment at their facility. Many facilities are required to comply with local air district I&M programs. Table 8 is designed to list how companies comply with the various requirements. Check the box or boxes that indicate the stratum range that the facility tests to. Indicate a different leak threshold should the facility test to a different level within the indicated stratum range.

In many cases oil and gas facilities store I&M data electronically. This data may be provided by a third-party tester, etc. If you have I&M data available in electronic format, submittal of the information would help prevent overestimating emissions or relying on national averages. Please submit electronic I&M program data in any Microsoft Excel or Access format. Submittal of hard copy data is not required.

### ***Table 9: Natural Gas Dehydration***

Natural Gas Dehydration units are used to remove moisture from a natural gas stream. The most common types are glycol and desiccant units. Please complete one table for each unit. In some cases, it may be simpler to use one of the electronic templates.

Enter the average input and output gas composition and enter the estimated volume of liquids removed for the 2007 calendar year. Indicate if the unit is connected to a vapor recovery system and if available, enter the control efficiency of the vapor recovery system.

For glycol units, there are fields provided for average circulation rate, pump type, and stripping gas. Check each box and fill in the appropriate fields that apply. Similarly, a separate box is included for desiccant units. For desiccant units, indicate the volume of the unit (height x diameter, etc.) and indicate the average remaining volume that exists after the unit is packed with desiccant (a typical value is 45 percent). If you can estimate a more precise percent packed volume value, please provide where indicated.

### ***Table 10: Natural Gas Sweetening or Acid Gas Removal***

Natural gas sweetening and acid gas removal units are used to condition gas for combustion or resale. Table 10 is designed to accommodate a large variety of units. In some cases all fields may not need to be completed. Please complete one table for each particular unit. It may be convenient to use one of the electronic templates.

Enter the average input and output gas composition. Enter the Higher Heating Value of the input and output gas streams (average values are acceptable).

In some units CO<sub>2</sub> is mixed with waste gas and sent to an incinerator or vented. Indicate the method of CO<sub>2</sub> disposal. For units that require regular solid material replacement, indicate

the average remaining volume that exists after the unit is packed with material (a typical value is 45 percent). If you can estimate a more precise percent packed volume value, please enter the value where indicated.

### ***Table 11: Other Natural Gas Processing***

Table 11 is for listing other processing units used for removing natural gas liquids other than CO<sub>2</sub>, H<sub>2</sub>S, and water. Please complete one table for each particular unit. It may be convenient to use one of the electronic templates.

Enter the average input and output gas composition and average volume of liquids removed. Indicate if the unit is connected to a vapor recovery system and list the estimated control efficiency of the vapor recovery system where indicated. In some cases it may be necessary to estimate total throughput.

### ***Table 12: Natural Gas Compressors***

Table 12 is designed to cover a variety of natural gas compressors. Please complete one table for each individual unit. This table should be completed using the unique compressor ID number from Table 5. This will link the compressor with the primary driver engine.

The primary types of compressors are reciprocating, centrifugal, rotary, and integral. In an integral unit, the primary driver engine and compressor are combined into a single unit. In other cases, the primary driver engine (internal combustion or turbine engine) are separated by a drive shaft.

For centrifugal units, indicate the type and number of wet or dry seals under the corresponding seal type. Wet seals, also known as lubricated seals, use oil as a means to retain internal compressor pressure. Wet seal units may be identified as having a separate “seal oil” pump used to maintain seal pressure. Dry seal compressors may be identified as having a separate “seal gas” outlet for gas to escape the compressor. Both wet and dry seal compressors will have a lube oil pump.

Indicate the primary driver and starter type. Enter the average discharge and idle pressure in units of pounds per square inch and the discharge temperature in degrees F. The discharge pressure is the average pressure inside the unit during operation. The idle pressure is the average pressure when the unit is idle.

Indicate the hours of usage, number of start-ups and blowdowns, and the inspection frequency. The maintenance frequency is the number of times the unit had to be disassembled to replace valves, seals, or packing. If actual numbers are not available, estimated values are acceptable.



### ***Table 13: Pipelines***

Table 13 pertains to natural gas gathering systems found within an extraction or underground natural gas storage facility (prior to a gas meter). Enter, or estimate, the length of the natural gas pipeline gathering system where indicated. Enter estimated volumes depicting how gas is handled for system maintenance or modification activities.

Table 13 also pertains to crude oil transmission and natural gas pipeline pigging operations conducted at the facility. Enter, or estimate how many times a pig was sent or received for the 2007 calendar year. Please indicate whether the operations were for crude oil or natural gas pipeline.

### ***Table 14: Crude Oil or Natural Gas Separation Units***

Table 14 is designed to accommodate a variety of crude oil and natural gas separation units. There are a variety of units in this category. We have included a list of some examples and an option to specify units at the facility that may go by a different name. Please complete one table per individual unit. In some cases, it may be more convenient to use one of the electronic templates provided.

Enter the Working, Breathing, and Flashing Losses as calculated with *TANKS* (US Environmental Protection Agency) or similar software or calculation, or enter the values as listed on the district permit. If the calculations have not been performed and are not required by the local air district, please leave these fields blank.

In order to prevent double counting of components, indicate if the separation unit components were included in Table 6 and indicate if the unit is controlled by a vapor recovery system.

### ***Table 15: Crude Oil Separation Units Sumps or Pits***

Crude oil separation sumps or pits are used to separate water from crude oil and may be used for permanent or emergency purposes. Indicate whether the sump is primary, secondary, or tertiary and list the average crude oil API number and number of days the sump or pit was in use. In some cases, a sump may be used in conjunction with a cover or a vapor collection system. Please indicate if either type of system is used.

### ***Table 16: Crude Oil Storage Tanks***

Table 16 is designed to accommodate fixed roof and floating roof crude oil storage tanks. Please complete one table per storage tank. In some cases, it may be convenient to use one of the electronic templates.

Enter the tank type, size, and average crude oil API number. Enter the number of degassing events that required the tank to be completely emptied of liquid and vapor. For fixed roof and floating roof tanks, enter the Working, Breathing, and Flashing Losses as reported to the local air district. If available, enter the average methane and carbon dioxide values as depicted in a Gas Chromatograph analysis. If information is not available for methane or carbon dioxide concentration, please leave those fields blank.

In order to prevent double counting, indicate if the tank components were included in Table 6. For floating roof tanks, enter the tank's deck leg height and diameter. Indicate the primary and secondary seal type. If the seal is not included in one the examples, please enter the type in the "other" category.