



Project Summary

Oil and Gas Field Emissions Survey

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This report presents available information that may be used for defining emission estimate methodologies for oil and gas production emission sources. From this information, EPA will define additional studies to fill in data gaps and develop emission estimation methodologies.

The production segment of the oil and gas industry has been identified as a source category that requires the development of more reliable emissions inventory methodologies. The overall purpose of this project was to determine available activity and emission factor data that may be used to develop methodologies for states to use in estimating emissions inventories for oil and gas field operations at the county level.

There were four objectives of this project: (1) To gather and compile available activity factors on oil and gas field operations; (2) To gather and compile available emission data for total and speciated volatile organic compounds (VOCs) from all emission sources associated with oil and gas field production activities; (3) To identify ongoing studies for the development of emissions data; and (4) To identify activity and emission data gaps and to recommend future studies to develop necessary data and estimate methodologies.

Activity and emission factors for oil and gas production facilities, natural gas processing plants, and ports and marine terminals are presented, data limitations are identified, and recommendations for future studies are made.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Background

The EPA is engaged in developing improved methodologies for calculating emission estimates for various emission source categories. The production segment of the oil and gas industry has been identified as a source category that requires the development of more reliable emissions inventory methodologies. The current version of the EPA report "Compilation of Air Pollutant Emission Factors, Volume I, AP-42" does not identify procedures for estimating VOC emissions from oil and gas field operations. Examples of emission sources from these operations are wellheads, gathering tanks, and field separation and gas processing equipment. Because some of these emission sources are often uncontrolled and are not identified by the current AP-42 procedures, they may represent a significant missing source in emissions inventories.

This report presents available information on data for oil and gas production emissions and activities that may be used for defining specific emission estimate methodologies for oil and gas production emission sources. From this information, EPA will define additional studies to fill in data gaps and develop emission estimation methodologies.



Project Description

The overall purpose of this project was to determine available activity and emission factor data that may be used to develop methodologies for states to use in estimating emissions inventories for oil and gas field operations at the county level. Activity factor data include any data that characterizes a particular operation of emission source. Typical activity data for oil and gas field production include the number of drilling and producing wells, the amount of oil and gas produced, and typical types and numbers of oil field equipment. Emissions data include emission factors and total emissions released from specific emission sources. An emission factor is an average value relating the quantity of a pollutant released to the atmosphere with the activity associated with the pollutant release.

There were four objectives in this project. The first was to gather and compile all available activity factors on oil and gas field operations, including data for domestic U.S. ports and transshipment facilities. The second objective was to gather and compile all available emission data for total and speciated VOCs from all emission sources associated with oil and gas field production activities, including data for marine terminals at U.S. ports. Emissions data for oxides of nitrogen (NO_x) from combustion sources were also gathered. The third objective was to identify ongoing studies for the development of emissions data. The fourth objective was to identify activity and emissions data gaps and to recommend future studies to develop activity and emissions data and emission estimates methodologies.

The study focused on developing an industry characterization for the field production operations using activity factors and an emissions characterization using emissions data. The technical approach for industry characterization was to gather information on all possible sources of activity factor data at the county level. This information gathering process included reviews of published literature and existing and planned databases. The primary focus of this review was to identify viable sources of data. Information was obtained from 23 different sources, including state and federal agencies, trade associations, private oil and gas consulting firms, and oil and gas equipment manufacturers.

In searching for activity factor data, information on petroleum production operations was divided into eight major areas: (1) oil and gas drilling activity, (2) oil and gas well count data, (3) oil and gas production data, (4) oil assay information, (5) typical oil and gas field equipment, (6)

gathering systems (storage tanks), (7) gas processing plants, and (8) ports and marine terminals. When relevant activity factor databases were identified, their content, format, resolution, and limitations were noted.

The five top oil- and gas-producing states (Texas, California, Louisiana, Oklahoma, and Pennsylvania) were contacted by phone to obtain activity factor data as well as emissions data.

The technical approach for the emissions characterization was to gather all available emissions data from previous studies on oil and gas production emission sources. Particular efforts were made to gather emissions data from state regulatory agencies. Trade associations, oil and gas consulting firms, and state agencies were contacted to obtain information about relevant ongoing studies.

Finally, the gathered information was analyzed to determine data gaps and recommendations were made for future studies.

Discussion of Results

Oil and Gas Production Facilities

Activity Factors. Activity factor data are available at the county level primarily for well drilling and development and for oil and gas production wells. Count and production data for oil and gas wells are generally tracked by states with large oil or gas production. In some cases, the data are not organized on a county level; so, in order to obtain county level totals, additional time may be needed to sort the data. Only the larger producer states were contacted in this study. States not contacted in this study should be surveyed to support the statement that "most" states track oil and gas production and well count data. If it is found that most states *do not* track well count information, a comprehensive (national) production and well count database is available from a private consulting firm.

Reid vapor pressure data are available for crude types that are exported from the U.S. Domestic Reid vapor pressure data are available for some of the domestic crude types — generally, those that are exported from the U.S. An expanded data gathering process would be necessary to compile all domestic Reid vapor pressure values into a single source.

Oil and gas field equipment and gathering tank data are the most meager in terms of available information. Equipment count information for the U.S. is not available. The California Air Resources Board is the only state agency that has an es-

tablished method for estimating and tracking equipment, and this is done at the district level. A definition of typical equipment at field production facilities is needed. In addition, a survey of oil companies, field operators, or equipment manufacturers is also necessary to obtain field equipment count data and information on out-field activities (venting and flaring).

Information on the typical number of storage tanks associated with field production gathering systems is not readily tracked or available.

Emission Factors. Emission factors for the large diesel and natural gas engines used in exploratory and development drilling activities are available from AP-42. The EPA emission factor rating is C (on an A-E scale, with A the best). Little information is available on drilling support equipment type and size that could be used to develop emission factors.

A main source of data for fugitive emission factors from oil and gas field operations, including wellheads, is the 1980 study for American Petroleum Institute (API). Several ongoing studies should eventually provide additional emission factor data for wellheads. While fugitive emission factors for wellheads are available and ongoing studies exist, reliable component counts are not available.

The API fugitive emission factors apply to components associated with field separation equipment. The 1980 study also includes factors for pits, open-top tanks, and sumps. Typical component counts for field separation equipment were not readily available from the literature that was reviewed or from any of the oil- and gas-producing states. Emission factors for gas/liquid separators, glycol regenerators, and heater treaters in field production facilities were not available; however, these emission sources are within the scope of the Air Toxics Multi-Year Study (ATMYS) being conducted by API. Venting and flaring emissions data are very limited. While the combined quantities of vented and flared gas is tracked state by state, states do not have much information about the emission sources or the reason for the release; therefore, it is difficult to assess the amount of gas vented and flared for particular emission sources.

Limited information was available regarding emissions from gathering tanks. The AP-42 equations for storage tanks are generally used to estimate emissions. In some cases, AP-42 equations had been modified by state agencies to estimate their emissions. The AP-42 emission factors for transfer operations are generally used; however, they were not specifically developed for gathering system operations.

No comprehensive field testing programs have been performed for these sources.

Natural Gas Processing Plants

Activity Factors. The population of natural gas processing plants is well documented in the *Oil and Gas Journal's* yearly gas processing survey. Data included are company and plant name, location (county), gas capacity, gas throughput, process method, and annual production.

Emission Factors. While fugitive emission factors for components at gas processing plants had been developed and continue to be studied, component count inventories of equipment at these plants are not available. Little is known about the amount of gas vented and flared for particular emission sources at gas processing plants. Emission factors for heavy-duty natural gas-fired pipeline compressor engines applicable to power compressors used at gas processing plants are reported in AP-42.

Ports and Marine Terminals

Activity Factors. The number of U.S. ports and marine terminals are available

through the Waterborne Commerce of the United States database maintained by the Army Corps of Engineers. The EPA may access these data to track the volume of domestic and imported crude oil throughout the U.S., but the Corps database does not track terminal holding or storage tank data. The number of storage tanks at marine terminals is not readily tracked or available. Additional information gathering, coupled with field equipment surveys, would be needed to obtain this information.

Emission Factors. Using the AP-42 equations for storage tanks is generally accepted for estimating emissions from crude oil storage tanks at marine terminals. The AP-42 emission factors for transfer operations are also generally used for marine terminals.

Recommendations

Several areas with data gaps and that merit further investigation have been identified. However, a more detailed analysis would help prioritize the areas that require future study in the short term. The prioritization of research areas would con-

sider the number of emission sources nationwide and their estimated emissions, as well as the data needs of the individual major producer states. An emissions estimation plan would address: (1) coordination with ongoing projects, (2) implementation of testing programs, (3) data gathering through surveys, and (4) methodology development for estimating emissions using identified reliable activity and emission factors.

Furthermore, more specific information on the ongoing studies would define limitations within their scope and the possibilities of program expansion with EPA support.

A program for providing a Quality Assurance Project Plan (QAPP) protocols review should be established for the different testing programs being conducted by industry and trade associations.

EPA's role could ensure the generation of accurate and reliable emission data. Early involvement and prompt review of QAPPs could be a key factor in the implementing the program. Reviewing and modifying QAPP protocols becomes difficult after a test program is initiated.

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The complete report, entitled "Oil and Gas Field Emissions Survey," (Order No. PB92-184 977/AS; Cost: \$43.00; subject to change) will be available only from:

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