STUDY ON AIR QUALITY MANAGEMENT ISSUES AND POLICY REGULATIONS IN OIL AND GAS INDUSTRY

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ABSTRACT
Natural gas and oil are rapidly increasing across the country due to technological developments that have made extraction of unconventional resources, such as shale gas and tight gas has economically possible. Due to expansion of operations to locations where the industry has never been active, emissions of air pollutants such as sulphur dioxide, Nitrogen dioxide, and volatile organic compounds create potential environmental and public health impacts to the society and to the environment. This study reviews the air pollutant occurs in the oil and gas industry and the effects to the human health and to the environment.

Key words: Pollution, Natural Gas, Emission, Oil and Gas, Unconventional Resources.


1. INTRODUCTION
The oil and natural gas industry includes a wide range of operations and equipment, from wells to natural gas gathering lines and processing facilities, to storage tanks, and transmission and distribution pipelines. Oil and gas industry is the largest industrial source of emissions of volatile organic compounds (VOCs), a group of chemicals that contribute to the formation of ground-level ozone (smog). Exposure to ozone is linked to a wide range of health effects, including aggravated asthma, increased emergency room visits and hospital admissions, and premature death. EPA estimates VOC emission from the oil & natural gas industry at 2.2 million tons a year in 2008 – 2009. The oil and natural gas industry also is a significant source of emissions such as methane, a greenhouse gas that is more than 20 times as potent as carbon dioxide. Emissions of air toxics such as benzene, ethyl benzene, and n-hexane, toluene also comes from this industry.
2. SOURCES OF AIR EMISSION

Sources of Air emissions leaks and venting during the extraction process of natural gas, processing, and transportation of Natural gas result in emissions of GHGs and depending on the local composition of unprocessed gas, other pollutants that contribute to locally- and regionally-elevated air pollution that may threaten public health. There are numerous individual components used in the production of oil and gas systems that are subjected to leaks, including, pumps, flanges, gauges, compressors, valves and pipelines.

Additionally, a number of sources intentionally vent gas. For example, one technology used natural gas systems is pneumatic valves, which operates on pressurized NG during normal operation. This gas is often vented from storage tanks, dehydration unit, depressurization of equipment before maintenance after hydraulic fracturing or when accumulated liquids are removed. Within the oil industry, all methane emissions come from production fields in the form of venting from oil wells, storage tanks, and processing equipment.

2.1. Air pollution concern in oil and gas industry

The vented emissions from Natural gas operations consists predominantly of CH4, a potent GHG, but often also include organic compounds that contribute to the formation of ground-level ozone (smog), as well as hazardous air pollutants like benzene, toluene and xylene (BTX) compounds.

3. METHANE (CH4)

Methane is the principal component of NG with a warming potential 25 times that of carbon dioxide (CO2) over the long term. The U.S. Environmental Protection Agency’s (EPA) estimate of the amount of CH4 released in 2011 because of leaks and venting in the NG network between production wells and the local distribution network is 12.5 million metric tons and this corresponds to just over 2% of gross U.S. NG production. The Environment Protection Agency is proposing a new rule that would reduce methane emissions from oil and natural-gas drilling by 40 to 45 percent of 2013 levels by 2025. The rules would also amend existing regulations and be applicable throughout the oil and natural gas industry, including in production, processing, transmission and storage, the EPA said.

The rules, which would apply only to new and modified gas wells, were first outlined in January by the White House. Both gases contribute to global warming, but methane’s global-warming potential (the amount of heat trapped by a specific amount of mass) is greater than that of CO2, the EPA says. The oil and gas industry was responsible for about 30 percent of methane emissions in the U.S. in 2012 – 2013.

Though the draft regulations advanced by the Environmental Protection Agency chiefly target new oil and gas wells, processing equipment and storage facilities, the four-pronged proposal lays the groundwork for the government to eventually go after methane leaking from existing infrastructure too.

Oil and gas companies already reeling from low commodity prices warn the planned rules will throttle domestic energy development and are unnecessary in light of the industry’s voluntary work to plug leaks of methane, the primary component of natural gas.
4. OZONE POLLUTANT
Natural gas and Oil industry activities also emit Volatile Organic Compounds (VOCs) and oxides of nitrogen (NOx), which are precursors to ground level ozone. In areas of concentrated activity, the emissions can be substantial and used in the exploration and production of NG and oil are the single largest source of VOCs.

5. SULPHUR DIOXIDE
Sulphur dioxide (SO\(_2\)) is a colourless gas. It reacts on the surface of a variety of airborne solid particles, it is soluble in water and can be oxidised within airborne water droplets to form sulphuric acid (H\(_2\)SO\(_4\)), which falls as acid precipitation or "acid rain". SO\(_2\) emissions arise from the oxidation, during combustion, of the sulphur contained within fossil fuels. Fossil fuels, including coal, oil and to a lesser extent gas, contain sulphur in both organic and inorganic form.

5.1. Reducing the sulphur content of the fuel before combustion:
Emissions of SO\(_2\) are proportional to the sulphur content of the fuel, although with regard to coal a proportion, usually less than 10%, is retained in the ash. Therefore, one of the simplest ways to reduce the amount of SO\(_2\) released from the combustion process can be achieved by switching to a fuel that has less sulphur content, i.e. burning low sulphur coal or gas instead of high sulphur coal. The coal sulphur content can vary from below 0.5% to over 10% by weight; for the majority of coals currently in use within the UK this sulphur content is in the range of 1 - 3%.

6. SULPHUR REMOVAL DURING COMBUSTION
A number of technologies to prevent the production and release of SO\(_2\) during combustion have been developed over the past decade, but very few have achieved wide commercial application to date. The most developed are the Fluidised Bed Combustion (FBC) process and the integrated Gasification Combined Cycle (IGCC) system.

6.1. Fluidised Bed Combustion
This process involves the combustion of coal in a bed of inert material such as sand, with air being blown up from beneath the bed at high velocities. As velocity increases individual particles begin to be forced upwards until they reach a point at which they remain suspended in the air stream. The bed in this state behaves like a liquid and can be described as fluidised. Tubes containing water are immersed in the bed to absorb the generated heat (this water is converted to steam which is used to drive the steam turbine and thus produces electricity), the ash, which is removed regularly. The low combustion temperatures allow efficient combustion to take place without causing the ash to soften, thereby allowing easy removal of the ash containing the absorbed SO\(_2\). The FBC can achieve in the region of 80 - 90% SO\(_2\) removal.

There are various methods for reducing the atmospheric SO\(_2\) emissions from power generation. Each method has both advantages and limitations related to cost, removal efficiency, operational experience and waste products produced. Therefore the choice of control technology should be based on the criteria required for each individual combustion plant.

Due to the adverse health effects of high levels of SO\(_2\), government has taken steps to manage and reduce the amount of SO\(_2\) produced. These include:
implementing national fuel quality standards;
• supporting the implementation of tighter vehicle emission standards; and
• Promoting alternative fuels

7. HAZARDOUS AIR POLLUTANTS
Hazardous Air Pollutants Hazardous air pollutants (HAPs) from NG and oil operations include hydrogen sulphide and certain hydrocarbons such as benzene, a known human carcinogen. Formaldehyde is one of the HAP found in the exhaust of compressor engines.

8. AIR QUALITY ISSUES
Impacts of oil and gas development on air quality are a growing issue across the Intermountain West are flaring, venting, and the effects of fugitive emissions on global climate changes in the environment.

8.1. Flaring and Venting
Gas is vented from oil and gas production equipment due to several reasons. Excessive pressure in gas storage tanks and other equipment results in venting through pressure relief valves. When crude oil is extracted and produced, raw natural gas associated with the oil is also produced to the surface, whereas, in areas lacking pipelines and other gas transportation infrastructure, a vast amount of gas is commonly flared as waste.

Vented gas is commonly required by law to be routed to a combustion flare. Flaring greatly reduces the emission of volatile organic chemicals (VOCs) and hazardous air pollutants (HAPs) into the air, although a significant amount of the greenhouse gas has been emitted. Improperly operating flares can still allow VOCs such as methane and sulphur dioxide and HAPs like aromatic hydrocarbons and benzapyrene into the atmosphere.

9. POLICY CONSIDERATIONS
Methane Emissions, although natural gas burns cleaner than coal and petroleum-based fuels, uncombusted methane leaked along the Natural gas supply chain erases some of the carbon advantage that NG has over other fossil fuels at the point of combustion. At some point, NG leakage can be large enough to make NG use worse overall for climate for some period of time.

10. VOC AND HAP EMISSIONS
The European oil and gas industry has expanded since 1970’s. Since in 1960, nearly £240 billion has been invested in the UK oil and gas industry and new projects should attract a further £18 billion by the end of this decade. This has led to an increase in the volume of hazardous materials and chemicals contaminating Europe's ocean. Many of Europe's oil and gas installations may now be up to forty years old and are approaching the end of their useful lives. An estimated 40% of the 500 or so existing offshore North Sea oil and gas installations will be considered for decommissioning or abandonment in the next 20 to 30 years. For decades the only consideration when disposing of these structures was expense, not the long-term impact on our marine environment.
11. REGULATORY ACTIONS
EPA’s rules will reduce air pollution through proven and highly cost-effective air pollution controls, that will standardize many common practices and technologies already implemented in states such as Colorado and Wyoming, and that are already being used by many NG companies throughout the country. The rules will also prevent the needless waste of a valuable domestic energy source by preventing leaks and venting of NG.

Oil and gas development is regulated by all levels of government such Federal, State, and local – and by Indian tribes. Some of the states deals with oil and gas operations directly, while others are more generally concerned with protecting human health, air, land, wildlife, water or other resources and incidentally apply to oil and gas. After laws are passed by state legislature, it is the task of an administrative agency such as the Bureau of Land Management, the Environmental Protection Agency, or a state agency or commission, like the Colorado Oil and Gas Conservation Commission, to issue regulations, further defining, and consistent with, the original law. Beyond their regulations, federal or state government may also issue policy or guidance documents to explain the law. The process of regulating oil and gas varies among Indian tribes with some developing legal codes and others regulating directly through their constitution, management plans or ordinances.

12. CONCLUSION
Reducing and minimizing the lower emissions of air pollutants from oil and gas industry is essential and important in minimizing the health hazards to the society and environment and gaining importance in climatic changes involved in natural gas production route. The EPA rules and policies should be followed in order to reduce the emissions in the oil and gas industry by adopting the standards set by the pollution control board. In addition to this, air quality emission data in each industry is required to evaluate the risk management and their problems in oil and gas industry that will not affect the climate and the environment.

REFERENCES

