

Air Quality Impacts of Oil & Gas Drilling in the Green River Valley

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Summary

Drilling operations such as those in the Green River Valley emit harmful chemicals into the air. These dangerous chemicals can cause respiratory problems, other irritations, cancer and even death. They contribute to degraded visual air quality in the immediate vicinity of the operations and at nearby national parks and wilderness areas. Sensitive mountain lakes can become acidic to point that ecosystems are damaged. These impacts become more significant as more drilling sites are created. Assessments of environmental impacts of proposed drilling need to consider cumulative impacts of existing and planned drilling in light of other developments that affect the Green River Valley.

The Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) are assessing air quality impacts of proposed drilling in the Green River Valley and have reported that harmful chemicals are emitted into the air throughout the life of a drilling site.

During construction

- Exhaust from equipment causes health problems and damages ecosystems
- Exhaust and dust creates local plumes and degrades visibility at nearby wilderness areas

Throughout the production phase

- Hazardous cancer-causing pollutants are emitted during capture of the natural gas.
- Blowouts can occur, releasing harmful and even lethal levels of hydrogen sulfide.
- Exhaust from machinery affects human and ecosystem health and degrades visibility.
- Maintenance results in health problems from cleaning products and paint emissions.

After abandonment of wells

- Leakage of toxic chemicals and natural gas can occur.

As outlined in the BLM studies for the Pinedale Anticline Project and USFS studies of proposed drilling in the Bridger-Teton National Forest, referenced below, emissions have an impact on human health, particularly within several hundred feet of the proposed operations. For example, the BLM report notes that the cancer risk has been estimated to be significant (i.e., one additional person in one million developing cancer as a result of exposure to benzene) within 350 feet from an operation. The BLM estimates indicate that visibility in the Bridger Wilderness Area might be noticeably degraded around 10 days a year and lake acidity for sensitive lakes in the wilderness will increase as a result of the Anticline operations alone. When the cumulative effects of emissions from other proposed drilling operations and other developments throughout southwestern Wyoming and adjacent states are taken into account, impacts on the wilderness areas in the Green River Valley will be much more significant. Given these and other environmental considerations, the USFS is suggesting in its draft Bridger-Teton National Forest document that no lands be made available for oil and gas leasing in the Bridger-Teton management areas between the Teton, Bridger and Gros Ventre Wildernesses. More extensive assessments that better quantify the significance of these potential impacts of cumulative drilling operations on human health, visibility and sensitive ecosystems need to be conducted as part of new evaluations, such as the BLM's current reassessment of the Pinedale Field Office management plan.

Gas Drilling Operation Details

Drilling operations include well development, production, maintenance and abandonment with more overall emissions being associated with the longer-term production phase. Well development requires use of engines and turbines usually powered by diesel, which when combusted produces a variety of emissions. These emissions are mainly particles (i.e., aerosols, which are liquid, and/or solid, materials suspended in the air) and gases including nitrogen oxides, carbon monoxide, carbon dioxide and various volatile organic compounds. When the desired well depth is reached, an outer casing is installed. During this process a fluid is put into the well to prevent premature flow of the gas and/or oil from the well. Occasionally, a premature flow or "blowout" does occur, releasing methane (i.e., the main chemical in natural gas) and other impurities such as hydrogen sulfide and various volatile organic compounds into the

atmosphere. Wells are also probed to check the reservoir potential. Gas vented during this testing process is either flared or vented directly into the atmosphere. Construction processes also give rise to wind blown dust.

Production includes bringing the fluid to the surface, separating the liquid and gas components, and removing impurities. Getting the fluid to the surface requires use of powered equipment that typically produces combustion emissions. When the fluid is brought to the surface, it contains natural gas and various impurities. The gases and liquids are separated and then the natural gas mixture undergoes a process of removing impurities such as hydrogen sulfide and carbon dioxide. During these processes leaky tubing, valves, tanks, or other equipment will release harmful volatile organic compounds into the air. When natural gas produced from the well is not sold or used on-site, it is usually flared, releasing carbon monoxide, nitrogen oxides and hydrogen sulfide. Blowouts also can occur during this phase. Depending on the fuel used to power the different equipment, varying amounts of sulfur and nitrogen oxides, volatile organic compounds, carbon monoxide, carbon dioxide and particulate matter are released into the air.

Production wells periodically require significant maintenance including repairing leaks, replacing motors or other equipment, and painting and cleaning the equipment. Emissions result from powering the equipment during this stage and from paint fumes and solvents, which are generally volatile organic compounds. Blowouts, resulting in air emissions, also can occur during maintenance. Similarly, oil spills also can occur and when the cleaning process involves burning the spill, additional combustion emissions result. When production ceases at a well, the main concern is properly plugging the well to prevent emissions from the well since leakage of natural gas and other chemicals like hydrogen sulfide can occur if the wells are not properly sealed.

More on Adverse Impacts

Respiratory problems are mainly associated with the emitted sulfur and nitrogen oxides, volatile organic compounds and fine particles. In addition many of the emitted organic

compounds (e.g., benzene, carbonyl sulfide, formaldehyde, toluene) are considered to be particularly toxic (e.g., implicated in cancer and spontaneous abortions). The health effects associated with these chemicals are most pronounced within a few miles of the operations. Further downwind, ozone, acids and other fine particles formed through chemical reactions in the air from the directly emitted chemicals also can cause health impacts. In addition, the acids can harm sensitive lake and forest ecosystems and the fine particles can obscure beautiful vistas in areas such as the Bridger Wilderness area, many miles from the operations. Hydrogen sulfide, or sour gas, which is sometimes associated with natural gas, has harmful effects on humans and at high concentration levels, such as would be associated with a massive blowout, can cause death. Since hydrogen sulfide chemically reacts in the air to form sulfur dioxide, which in turn produces sulfuric acid and fine particles, it indirectly contributes to the other health, ecosystem and visibility impacts as well.

Methane and carbon dioxide are not removed from the air by chemical reactions near the ground. As a result, they are transported up to the stratosphere, miles above the earth's surface, where they alter the amount of incoming sunlight, which leads to changes in temperature and rainfall at the earth's surface.

Acute health impacts can be noticed quickly and are associated with particularly high concentrations of chemicals occurring over short periods of time such as might occur with a blowout or other large leakage of toxic chemicals. Chronic effects on human health and decay of sensitive aquatic and terrestrial ecosystems are associated with long term exposure to lower concentrations of chemicals. Degraded visibility is associated with short time periods and is most noticeable during daylight hours when the concentrations are high enough to have an impact.

BLM and USFS Findings

Initial assessments of possible impacts that could occur from proposed operations in the Green River Valley and nearby areas have been conducted by the BLM and the USFS. These studies use observations of air quality to determine current conditions and past trends. Models which relate changes in emissions to changes in air concentrations and impacts are used to help

project how air quality and impacts might change in the future if the proposed drilling occurs. Models are helpful because changes in emissions cannot be assumed to be directly and simply related to changes in impacts.

The BLM and USFS analyses indicate that drilling operations can have an impact on human health, particularly within several hundred feet of the operations. They also indicate that operations can affect scenic vistas and sensitive lakes in areas such as the Bridger, Popo Agie and Fitzpatrick Wildernesses and the Wind River Indian Reservation and Roadless area, which are miles away. For example, the cancer risk has been estimated to be significant (i.e., 1 additional person in one million developing cancer as a result of exposure) within 350 feet from an operation as a result of benzene emissions. Formaldehyde also is a potential hazard. The most dramatic health impacts are associated with accidental blowouts that could release lethal levels of hydrogen sulfide. Workers at the operations would be most in danger from these releases.

The air in the Green River Valley is some of the cleanest in the country. As a result, even small changes in concentrations of visibility-reducing chemical can have a noticeable impact on the visibility. The BLM estimates indicate that visibility in the Bridger and Fitzpatrick Wilderness Areas would be noticeably degraded (e.g., ability to see beautiful vistas decreases) around 10 and 2 days a year, respectively, as a result of the proposed operations in the Pinedale Anticline area alone.

Lakes in the Green River Valley are particularly sensitive to increases in acidity since they are set in solid granite with thin soil around them and, as a result, have little ability to buffer acidity. Even current estimates of the impacts of the Pinedale anticline project alone on particularly sensitive lakes in the Bridger Wilderness (i.e., Hobbs, Black Joe, Deep Lake and Lower Saddlebag) and Ross Lake in the Fitzpatrick Wilderness Area indicate somewhat higher acidity would result from these operations. The trout and other ecosystems could be harmed as a result of higher acidity.

Forests and other vegetation also are sensitive to long term increases in acidity, and particularly to increases in nitrogen deposition, that changes the chemistry of the soils. The

BLM and USFS studies do not yet quantify how the potential increases in nitrogen pollution resulting from drilling operations might harm forests. However, ongoing research suggests that increases in nitrogen deposition could adversely affect forests around the US, including forests of the Green River Valley. Due to these changes, animals that rely on vegetation for food also could be adversely affected.

The significance of these impacts depends on the number of drilling sites in the Green River Valley. As the number of drilling sites increases, the level of emissions increases, and the overall contribution of the drilling operations to the full suite of adverse impacts increases. In addition, operations outside of the Green River Valley, particularly areas that are downwind (i.e. to the south and west), can alter the air quality in the Green River Valley. Air quality in the area also is influenced by other non-drilling related emissions from other sources such as wildfires and prescribed burning, power plants, industries and other developments in Wyoming, Idaho, Utah, and Colorado. In light of these other changes in emissions in the future, even small increases in emissions due to drilling operations, when added to the other increases, could result in significant deterioration of air quality throughout the Green River Valley. As noted by the BLM and the USFS, these cumulative impacts associated with multiple emission sources need to be adequately taken into account when assessing the long-term impacts of drilling operations.

Given these and other environmental considerations, the USFS is suggesting that no lands be made available for oil and gas leasing in the Bridger-Teton management areas between the Teton, Bridger and Gros Ventre Wilderness areas. The BLM is currently reviewing the management plan for the Pinedale Field Office, which is part of the region considered in the USFS draft document addressing future drilling in the Bridger-Teton National Forest. It will be important for the BLM to consider the findings and suggestions of the USFS. These next stages of assessments need to take into account all of the cumulative impacts of current and proposed drilling operations in the Green River Valley in light of other air quality related activities and likely developments in the area. The assessments also need to explore and recommend continued careful monitoring of air quality and, in some cases expand monitoring of impacts, such as changes in chemistry of sensitive lakes, throughout the Green River Valley in order to help track potential degradation of air quality and important related environmental values in the area.

Recap

Drilling operations emit harmful chemicals into the air during all stages of operation. As outlined in the BLM studies for the Pinedale Anticline Project and USFS studies of proposed drilling in the Bridger-Teton National Forest, emissions have an impact on human health, particularly within several hundred feet of the proposed operations. For example, the BLM report notes that the cancer risk has been estimated to be significant (i.e., one additional person in one million developing cancer as a result of exposure to benzene) within 350 feet from an operation. The BLM estimates indicate that visibility in the Bridger Wilderness Area might be noticeably degraded around 10 days a year and lake acidity for sensitive lakes in the wilderness will increase as a result of the Anticline operations alone.

When the cumulative effects of emissions from other proposed drilling operations and other developments throughout southwestern Wyoming and adjacent states are taken into account, impacts of drilling operations on the wilderness areas in the Green River Valley will be much more significant. Given these and other environmental considerations, the USFS is suggesting in its draft Bridger-Teton National Forest document that no lands be made available for oil and gas leasing in the Bridger-Teton management areas between the Teton, Bridger and Gros Ventre Wildernesses.

More extensive assessments that better quantify the significance of these potential impacts of cumulative drilling operations throughout the Green River Valley on human health, visibility and sensitive ecosystems need to be conducted as part of any further evaluations, such as the BLM's current reassessment of the Pinedale Field Office management plan. . It will be important for the BLM to consider the findings and suggestions of the USFS. These next stages of assessments need to take into account all of the cumulative impacts of current and proposed drilling operations in the Green River Valley in light of other air quality related activities and likely developments in the area. The assessments also need to explore and recommend continued careful monitoring of air quality and, in some case expanded monitoring of impacts,

such as changes in chemistry of sensitive lakes, throughout the Green River Valley in order to help track potential degradation of air quality and important related environmental values in the area.

Key BLM and USFS Reports

Oil and Gas Leasing Draft Environmental Impact Statement for Management Areas: Hoback Basin, Moccasin Basin, Union Pass, and Upper Green River. (September 2000) US Department of Agriculture, Forest Service, Intermountain Region, Bridger-Teton National Forest <http://www.fs.fed.us/btnf/oil&gas/execsumm.pdf>

Draft Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project Sublette County, Wyoming. (November 1999). U.S. Department of the Interior. Bureau of Land Management. Wyoming State Office, Pinedale Field Office. BLM/WY/PL-00/003+1310.

More Sources of Information

Profile of the Oil and Gas Extraction Industry, EPA/310-R-99-006. <http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/oil.html>

Oil and Gas Development Pollution Prevention and Abatement Handbook World Bank Group (1998). [http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/\\$File/70_oil.pdf](http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/70_oil.pdf)

EPA Fact Sheets on Air Toxics. <http://www.epa.gov/ttn/atw/hapindex.html>

EPA Emission Reports. <http://www.epa.gov/air/data/repst.html?st~WY~Wyoming>

Acid Rain Assessments. http://www.nnic.noaa.gov/CENR/NAPAP/NAPAP_96.htm

