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# Drilling Down

## Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production


### Authors

**Principal Author**

Amy Mall
*Natural Resources Defense Council*

**Contributing Authors**

Sharon Buccino
*Natural Resources Defense Council*

Jeremy Nichols
*Rocky Mountain Clean Air Action*


### About NRDC

NRDC (Natural Resources Defense Council) is a national nonprofit environmental organization with more than 1.2 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, and Beijing. Visit us at www.nrdc.org.

### About Rocky Mountain Clean Air Action

Rocky Mountain Clean Air Action is a nonprofit, public interest organization dedicated to protecting clean air for healthy children and healthy communities in Colorado and the surrounding region. With members across the western United States, Rocky Mountain Clean Air Action educates, advocates, and empowers action to safeguard clean air.

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NRDC Director of Communications: Phil Gutis
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NRDC Publications Editor: Anthony Clark
Production: Tanja Bos, tanja@bospoint.com
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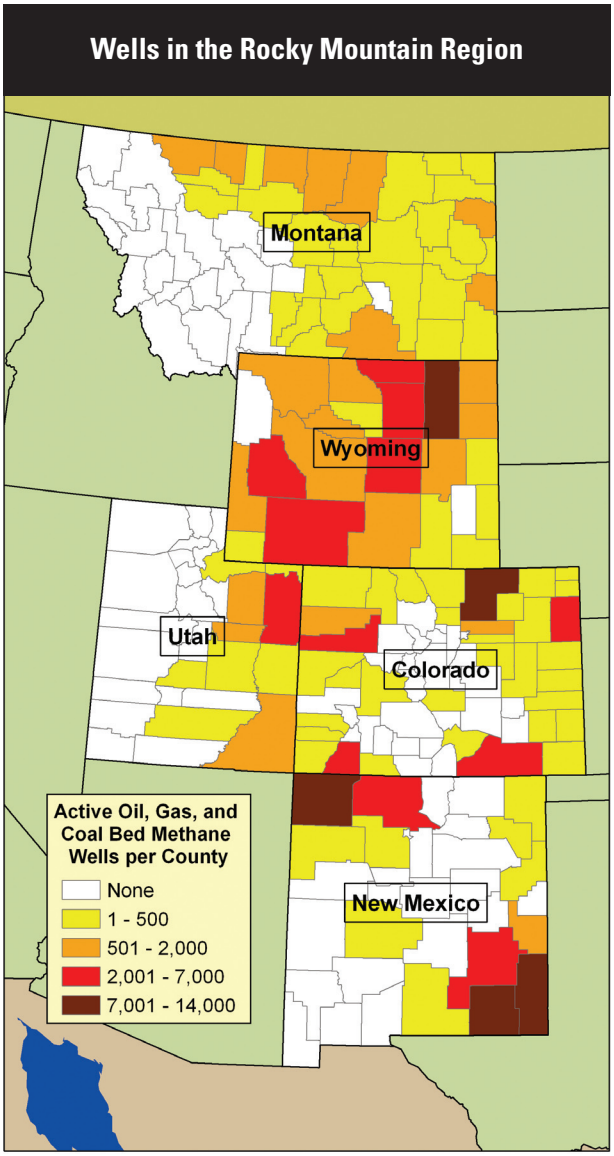
# Executive Summary

The oil and gas industry in the United States has expanded rapidly during the last decade, particularly in the Rocky Mountain region, and predictions call for that trend to continue. Oil and gas production is a dirty process; many of the steps involved can be sources of dangerous pollution that can have serious impacts on the region's air, water, and land—and on people's health. Despite the number of dangerous materials involved in oil and gas production—and the frequent proximity of these operations to residences and other community resources—the oil and gas industry enjoys numerous exemptions from provisions of federal laws intended to protect human health and the environment.

Decades of dealmaking by the industry, Congress, and regulatory offices have resulted in exemptions for the oil and gas industry from protections in the Clean Air Act, the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as the Superfund law), the Resource Conservation and Recovery Act, and the Safe Drinking Water Act. In addition, the oil and gas industry is not covered by public right-to-know provisions under the Emergency Planning and Community Right-to-Know Act, meaning that companies can withhold information needed to make informed decisions about protecting the environment and human health.[1]

> *"The problem of widespread unidentified and unquantified toxic exposure to settled and mobile populations in the drilling fields of the Western Slope is obvious. The complete absence of a systematic approach to the identification of the exposures, and their quantification, and the establishment of a registry of the exposed persons so that exposure-outcome studies can be done, is a disgrace. The opportunity to do the studies is clear. The fact that no level of government nor any industry group has undertaken these critical health studies is inexcusable. When the bells are tolled for those injured, who will be willing to take the blame for these failures in preventive medicine?"*
>
> —Daniel Thau Teitelbaum, MD, medical toxicologist and occupational physician, adjunct professor of environmental sciences, Colorado School of Mines; and associate clinical professor of preventive medicine and biometrics, University of Colorado Health Sciences Center at Denver




## People Who Live Near Oil and Gas Operations Report Serious Health Problems

Many people who live near oil and gas operations experience symptoms resembling those that may be caused by the toxic substances found in oil and gas or the chemical additives used to produce them. The negative health effects associated with these substances range from eye and skin irritation to respiratory illness such as emphysema, thyroid disorders, tumors, and birth defects. NRDC has not determined a direct cause and effect relationship between toxic exposure and the health problems of specific individuals whose stories are told in this report. It is well known, however, that recognizing illness stemming from chemical exposure can be difficult. Chemical poisoning is notorious for resulting in nonspecific signs or symptoms that resemble common diseases, and immediate symptoms can be nonexistent or mild despite the risk of long-term negative health effects.

Among the toxic chemicals that can be released during oil and gas operations are benzene, toluene, ethylbenzene, and xylene (known as the "BTEX" chemicals);[2] radioactive materials;[3] hydrogen sulfide;[4] arsenic;[5] and mercury.[6] The known negative health effects of these and other toxics are described in the chart in this section.

## Recommendations for Protecting Community Health Near Drilling Sites

Why don't we hear even more stories about illnesses related to oil and gas operations? Oil and gas companies may claim there is a lack of data proving that industry pollution is a cause of illness. While more research needs to be conducted, important information is available.

There are now more wells than ever before, and more of them near where people live. Given the difficulty of properly diagnosing chemical poisoning, physicians may not recognize a connection between illness and the oil and gas operations. In addition, some individuals choose not to share their stories, especially in communities with local economies dependent on the oil and gas industry. Others move away, sometimes with their homes purchased by energy companies and with signed agreements that prohibit them from telling their stories. And still others have given up on trying to call attention to this matter. One man recently stated at a public meeting, "If few people are complaining about drilling these days, it's because they've given up after being ignored for so long."[7]

Despite readily available and often economical technological solutions capable of controlling hazardous pollution, such as air emission controls and nontoxic or less toxic chemical alternatives, the industry as a whole has failed to take reasonable steps needed to protect families, communities, and the environment. NRDC therefore recommends that the federal government, in coordination with state and local governments:

- Close the legal loopholes granting oil and gas exemptions from laws designed to protect our air, water, and land;
- Require industry to adopt affordable and available technological solutions for limiting pollution; and
- Evaluate health risks associated with oil and gas production and exploration, including independent testing of air, water, and land; conducting an assessment of the level of toxic exposure of families; identifying chemicals used; and tracking illnesses in workers and communities impacted by oil and gas facilities.

**Toxic Chemicals Released During Oil and Gas Operations**

| Pollutant | Known Negative Health Effects |
|---|---|
| Arsenic | Chronic arsenic exposure can cause damage to blood vessels, a sensation of "pins and needles" in hands and feet, darkening and thickening of the skin, and skin redness. It is a known human carcinogen and can cause cancer of the skin, lung, bladder, liver, kidney, and prostate.[8] |
| Hydrogen Sulfide | Hydrogen sulfide has been linked to irritation of the eyes, nose, and throat; difficulty in breathing; headaches; dizziness; nausea; and vomiting. Low-level exposure might also lead to poor attention span, poor memory, and impaired motor function. Short-term exposure at high concentrations can lead to loss of consciousness and death.[9] |
| Mercury | Mercury can permanently damage the brain, kidneys, and developing fetus and may result in tremors, changes in vision or hearing, and memory problems. Even in low doses, mercury may affect an infant's development, delaying walking and talking, shortening attention "span," and causing learning disabilities.[10] |
| Polycyclic Aromatic Hydrocarbons | Several of the polycyclic aromatic hydrocarbons (PAHs) that can be found in crude oil have caused tumors in laboratory animals and are considered possible or probable human carcinogens. Studies of people have found that individuals exposed for long periods to mixtures that contain PAHs can also develop cancer. In addition, animal tests have found reproductive problems and birth defects.[11] |
| **Volatile Organic Compounds (VOCs)** | |
| Acetone | Acetone can cause nose, throat, lung, and eye irritation; headaches; light-headedness; and confusion. In animals it has been linked to kidney, liver, and nerve damage, and increased birth defects.[12] |
| Benzene | Benzene is a known human carcinogen and causes leukemia.[13] |
| Ethylbenzene | Ethylbenzene can cause dizziness, throat and eye irritation, respiratory problems, fatigue, and headaches. It has been linked to tumors and birth defects in animals, as well as to damage in the nervous system, liver, and kidneys.[14] |
| Toluene | Toluene can cause fatigue, confusion, weakness, memory loss, nausea, hearing loss, central nervous system damage, and may cause kidney damage.[15] It is also known to cause birth defects and reproductive harm.[16] |
| Xylene | Xylene can cause headaches; dizziness; confusion; balance changes; irritation of the skin, eyes, nose, and throat; breathing difficulty; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys.[17] |
| **Radioactive Substances** | |
| Radium | Radium is a known human carcinogen, causing bone, liver, and breast cancer.[18] |
| Radon | Radon can cause an increased incidence of lung diseases such as emphysema, as well as lung cancer.[19] |

# Introduction

The oil and gas industry is booming. In keeping with America's rising national demand for energy, domestic oil and natural gas production has expanded enormously in recent decades—and much of this growth is occurring in the Rocky Mountain region. According to the U.S. Energy Information Administration, between 1990 and 2005 the number of producing gas wells nationwide (spread across 32 states) increased from roughly 270,000 to 425,000.[20] The American Petroleum Institute (API) reported that 2006 was a record year for gas drilling, with more than 29,000 new wells drilled.[21] New Mexico, Colorado, Wyoming, and Montana are among the states with the greatest growth.

In addition to recent industry shifts favoring gas production, the number of producing oil wells also ranks in the hundreds of thousands. The year 2006 saw more oil wells completed—more than 15,000—than in any year since the 1980s.[22] Expectations that this buildup will continue unabated were confirmed by the API's recent report that oil and gas drilling hit a 21-year high in the first half of 2007.[23] Colorado is already home to more than 30,000 active oil and gas wells. At the current rate of development, that number will double in less than six years.[24] State officials in Wyoming have approved more than 50,000 drilling permits since 2000, with more than 9,000 permits approved in 2006 alone.[25] The State of New Mexico approved nearly 20 percent more drilling permits in 2006 than were approved in 2005.[26] In Utah, state officials approved twice as many permits in 2006 as they did in 2004.[27]

## A Well for a Neighbor: Oil and Gas in Communities

Wells can be located near homes and communities, sometimes only hundreds of feet from a home, school, playground, or agricultural operation creating food products. The McCoy Elementary School in Aztec, New Mexico, for example, is located less than 400 feet from two wells—and the playground is less than 150 feet from the wells. Reports of strong fumes both on the playground and in the school come as no surprise. The Piedra Vista High School in Farmington, New Mexico, is located approximately 500 feet from a well pad.

Unfortunately, these are not isolated occurrences. Many wells are in close proximity to places where people farm, work, and live. To illustrate how many people may live close to oil and gas wells, NRDC performed an analysis of the proximity of residential land parcels to active and


A well pad in Farmington, New Mexico, with Piedra Vista High School in the background

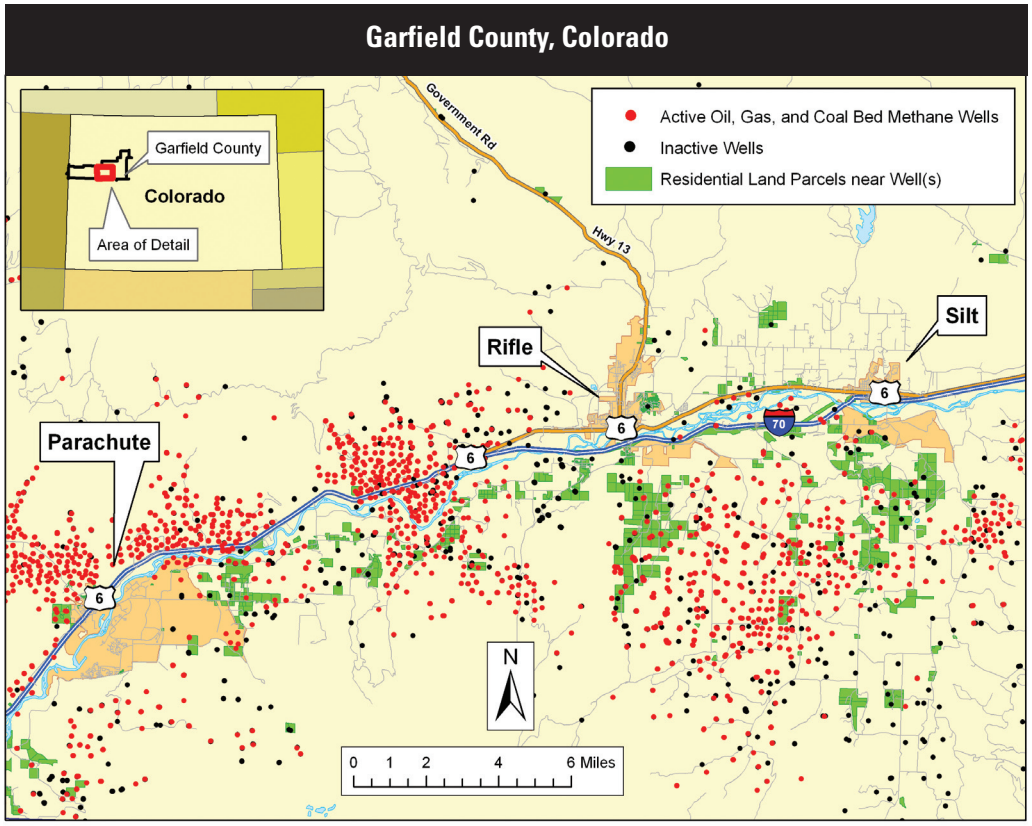
AMY MALL

inactive oil and gas wells in Garfield County, Colorado, and San Juan County, New Mexico; this analysis included active and inactive wells because both are potential sources of pollution.[28] In Garfield County, where there are 7,298 oil and gas wells,[29] NRDC found that 1,179 residential land parcels (8.5 percent of the total) were within 500 meters of at least one well, and 276 residential land parcels were within 500 meters of at least five wells.[30]

In San Juan County, New Mexico, NRDC found even more residential land parcels near oil and gas wells (excluding portions of the Navajo and Ute Mountain nations). There are 28,207 residential land parcels in San Juan County and 18,711 oil and gas wells.[31]

NRDC determined that most residential land parcels in San Juan County lie within 500 meters of at least one well. There are 20,048 residential land parcels near at least one well, 14,540 near at least two wells, and 3,065 are near at least five wells.[32]

Garfield and San Juan counties illustrate the proximity of oil and gas wells to homes in the Rocky Mountain region. Many people do not own all of the rights to oil and gas underlying their land, and therefore cannot stop drilling from happening—even on their own property.[33] The increase in the overall number of wells being drilled could exacerbate the risk of health and environmental problems faced by the thousands of people living in communities with these sources of dangerous pollution. In addition, the impacts on workers and their families, to whom they may bring home toxic materials on their clothing or their shoes, are unknown.


Garfield County, Colorado
Garfield County
Colorado
Area of Detail
Government Rd
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Active Oil, Gas, and Coal Bed Methane Wells
Inactive Wells
Residential Land Parcels near Well(s)
Rifle
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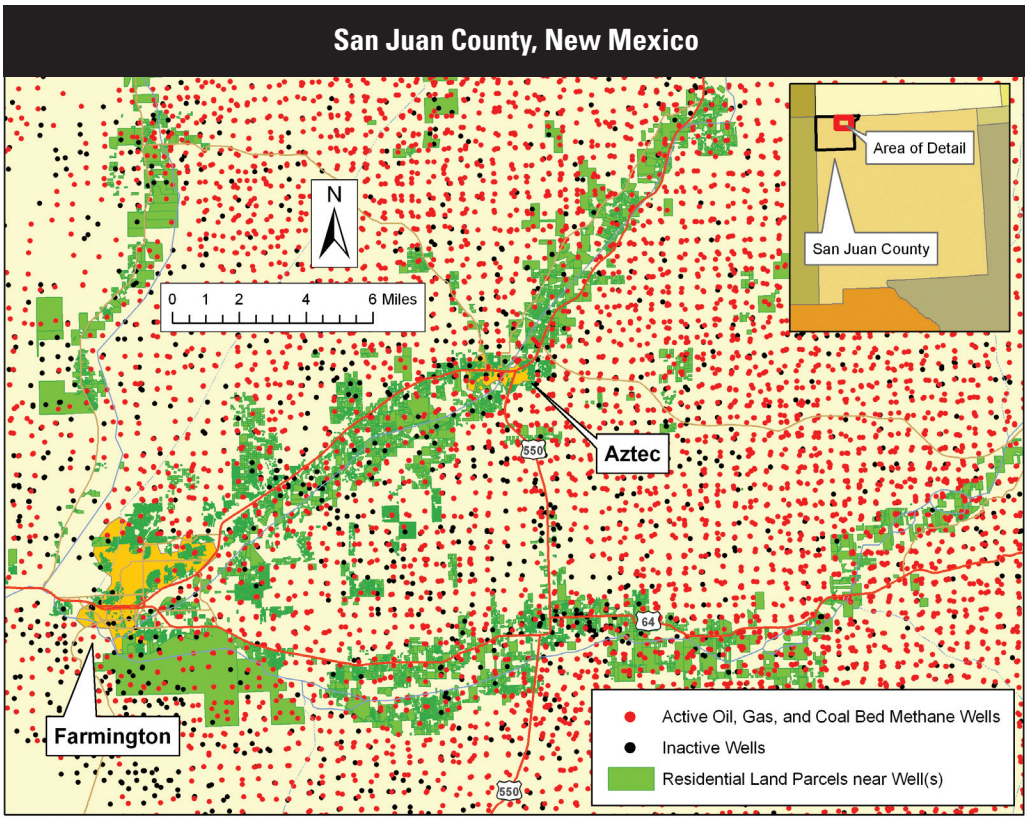
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Active Oil, Gas, and Coal Bed Methane Wells
Inactive Wells
Residential Land Parcels near Well(s)

Example of house located close to well pad in Farmington, New Mexico AMY MALL

## How Are Oil and Gas Produced?

Oil and gas production begins with drilling a well. This process is the first in a string of many actions that may involve toxic chemicals and can result in the contamination of the air, water, and land. The drilling process may involve the use of toxic substances such as pipe dope to reduce friction, drilling fluid,[34] or hydraulic fluids. After initial use, those drilling fluids might be disposed of as waste or placed in a reserve pit in the ground for later use or evaporation. Other chemicals may be used to inhibit corrosion, scale buildup, or bacteria growth in the equipment. After drilling is completed, a well may begin producing oil, gas, or both—along with large amounts of a fluid referred to as produced water, which can contain oil and toxic substances.

Once oil or gas is pumped out of the well, the next stage involves separating the various constituents of the raw product drawn from the well. For example, solids like dirt or sand may have to be separated from oil. Crude oil (petroleum) may need to be separated from natural gas. Natural gas may need to be processed to separate out dirt, sand, water vapor, or other gasses such as carbon dioxide, hydrogen sulfide, propane, and butane. Toxic substances may be used in these separation processes. The substances separated from the natural gas may be stored in a condensate tank. Wastes may be transferred to a disposal pit (regulations for pit location and construction vary from state to state).

The resulting oil and/or gas product is then transported from the well to another location to be further processed or refined. In the case of natural gas, it is often piped to a station where it is compressed, thereby allowing it to travel longer distances in a pipeline leading to further processing and then sale to customers.[35]

CHAPTER 1

# Chemicals Involved in Oil and Gas Production Can Harm Health

Toxic substances can enter the environment and pose a threat to human health at a number of points in the oil and gas production process. To start, oil and gas contain substances that are known to be very hazardous to human health, and exploration and production operations can release hazardous substances found naturally beneath the earth's surface into the environment,[36] such as benzene, toluene, ethylbenzene, and xylene (known as the "BTEX" chemicals);[37] radioactive materials;[38] hydrogen sulfide;[39] arsenic;[40] and mercury.[41] Among the illnesses these substances can cause are cancer, damage to the central nervous system, dizziness, lung diseases and breathing difficulties, headaches, nausea, and eye and nose irritation.

## Many Pathways for Pollution

Without proper safety measures, and compliance with and enforcement of such measures, toxic substances can be released into the environment from active wells, abandoned wells, and other facilities used in the oil and gas production process. Wells can directly vent toxic materials into the air. Oil spills or leaking wells can introduce contaminants into soils or water. Liquid and solid waste products are often dumped in open pits in the ground or even sprayed into the air. Toxic fluids can seep into the groundwater when these pits are not properly lined, and volatile toxic materials in the pits can evaporate into the air. In addition, stormwater can carry these toxic materials to other locations. Produced water—the fluid that is pumped out of the well and separated from oil and gas—is often nothing like water we drink and can contain oil,

> *"The human health effects of oil and gas activities constitute one of the areas in greatest need of additional reliable information."*
>
> —National Academy of Sciences, 2003, "Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope"

chemical additives used in the drilling and production processes, heavy metals, radioactive material, and volatile organic compounds like benzene and toluene. Billions of gallons of produced water are generated each year.[42]

### DRILLING CAN RELEASE HAZARDOUS SUBSTANCES

Naturally occurring radioactive materials, which cause a host of adverse health effects, are among the numerous highly toxic substances that may be released during oil and gas exploration and production. According to the U.S. Environmental Protection Agency (EPA), the oil and gas industry generates an estimated 34 million gallons of radium-contaminated waste each year.[43] The levels of radioactivity can exceed those permitted to be discharged by nuclear power plants.[44]

## Secret Ingredients and the Public's Right to Know

The Emergency Planning and Community Right-to-Know Act was enacted in 1986 to establish a process for informing people of chemical hazards in their communities. Companies are required to report the locations and quantities of certain chemicals stored, released, or transferred.[45] Some of this information is made available to the public in an annual Toxics Release Inventory (TRI). Congress originally specified which industries were required to report to the TRI, but gave the EPA the authority to add or delete industries. The EPA was also given discretion to require reporting from any facility, based on criteria including the toxicity of the chemicals involved, proximity to other facilities that release a toxic chemical or to population centers, and the history of releases at the facility. While petroleum bulk stations, terminals, refining, and related industries are required to report to the TRI, oil and gas exploration and production facilities are not.[46]

> *"Gas industry pollution is causing illness in certain patients who live in close proximity to a gas well. I have patients with symptoms ranging from headaches to breathing problems to multiple chemical sensitivity syndromes.[49] Pollution from the industry has had an impact on people's health, especially those with asthma, lung disease and other respiratory disorders."*
>
> —Dr. Jeremiah Eckhaus, a family physician at Grand River Medical Center, Rifle, Colorado

According to the Oil and Gas Accountability Project, oil and gas companies generally assert that the composition of the chemical products they use is confidential and legally protected information. The industry has claimed that sufficient chemical ingredient information is provided in so-called Tier II reports (required by the Emergency Planning and Community Right-to-Know Act) and Material Safety Data Sheets (MSDS) required by the Occupational Safety and Health Administration. Tier II reports, however, apply only to large volumes of stored chemicals and often list only one chemical (even if a product contains multiple ingredients) or are too general to identify specific chemicals. MSDS reports may state that the mixture of chemicals being stored or used is proprietary or may include an incomplete list of the chemicals in the product.[47]

Oil and gas drilling, production, and processing utilize hundreds of chemical additives, many of them toxic to human and animal health. The independent nonprofit organization TEDX (The Endocrine Disruption Exchange) has analyzed publicly available documents citing the products and individual chemicals used in oil and natural gas development and delivery. TEDX has researched the scientific literature on these substances and has documented the negative health effects associated with them.

The TEDX analysis of products used in oil and gas operations in four western states revealed more than 350 products containing hundreds of chemicals; more than 90 percent of these products contain chemicals with one or more adverse health effects. The health effects vary in type and severity, but the four most common effects experienced on immediate exposure are: skin, eye, and sensory organ toxicity; respiratory problems; neurotoxicity; and gastrointestinal and liver damage. These substances may also cause health effects without immediate symptoms that progress slowly and are more difficult to diagnose in the short term, such as cardiovascular and reproductive disorders, or certain cancers. Because product ingredients are often listed as proprietary or are unspecified, TEDX makes no claim that its data are complete.[48]

According to an article published in *Veterinary and Human Toxicology*, the toxicity of products like drilling fluids and drilling muds "is as varied as the seemingly endless number of potential additives. In most cases drilling fluids, well treatment solvents and chemicals are complex mixtures, where the toxic effects may be additive or synergistic."[50]

In order to monitor for contamination and protect human health, it is essential to know exactly which chemicals are being used in individual oil and gas operations, along with their quantities and how they are combined.[51] Toxic chemicals may be used in many different combinations in various ways throughout the oil and gas production process, e.g., to facilitate drilling, inhibit corrosion, limit mineral scaling, eliminate bacteria, or fracture underground rock formations.

## Limited Research on Oil and Gas Impacts on Human Health

More research is needed on the impacts of oil and gas exploration and production on the health of nearby communities. A recent study reported a higher prevalence of rheumatic diseases, lupus, neurological symptoms, respiratory symptoms, and cardiovascular problems in a New Mexico community built on top of a former oil field with some nearby active wells when compared with a community with no known similar exposures.[52] Other studies have found increased cancer risks associated with living near oil or gas fields.[53] There have been additional studies on the occupational hazards of working in the industry, but it is shocking that an industrial activity present in 32 states—with more than half a million locations that could be emitting toxic materials to which workers and nearby residents may be exposed—has seen no comprehensive scientific monitoring or exposure assessment.

> *"Despite the well-documented adverse human health effects of many of these pollutants, there has been limited scientific research over the years regarding the human health outcomes in communities located near oil and gas exploration, production, and waste disposal sites."*
>
> —Aaron Wernham, MD, MS, Fellow, Columbia University Center on Medicine as a Profession

The individuals whose stories are told in this report often experience symptoms similar or identical to those caused by the toxic substances found in oil and gas or the chemical additives used to produce them. Similar symptoms have been experienced and reported by those who live with or near one another, often with a reduction in severity when the affected individuals travel away from home or move.

## Recognition of Illness Associated with Chemical Exposure

In a 2004 program sponsored by the Centers for Disease Control and Prevention, two medical toxicologists from the National Center for Environmental Health discussed the challenges of recognizing illness stemming from chemical exposure, including the following:

- Chemicals do not always cause acute and obvious health effects. Immediate symptoms of chemical exposures might be nonexistent or mild despite the risk of long-term effects. Because of this lag time, it may be difficult for us to recognize the exposure source leading to the illness.
- Another obstacle that could lead to difficulty in recognition might be exposure to multiple chemical agents.
- Chemical poisoning is notorious for resulting in nonspecific signs or symptoms that resemble other common diseases.
- Physicians might be less familiar with recognition and treatment of illness related to chemical agents simply because illness from most chemicals is just not that common or at least not recognized as often as it occurs.[54]

### SPOTLIGHT ON SOLUTIONS

Limited information is currently available to the public about the substances contained in chemical additives used in specific oil and gas exploration and production. Companies should be required to provide information to the public regarding chemicals used in these activities that may pose a risk to the health of local communities.

CHAPTER 2

# Unchecked Emissions from Oil and Gas Facilities Can Pollute Our Air

According to the State of Colorado, oil and gas production facilities can release more than 50 toxic air pollutants from a variety of sources, including "venting, dehydration, gas processing, compression, leaks from equipment (fugitive emissions), open-pit waste ponds, and land application of volatile wastes."[55] There may be more than 26 individual sources of toxic air pollution associated with the production of oil and gas.[56]

## Oil and Gas Operations Are Among the Largest Sources of VOCs in the Region

Of the dangerous substances emitted into the air from oil and gas production operations, chemicals referred to as volatile organic compounds (VOCs) are the largest group and typically evaporate easily into the air. They are primarily found in oil and gas itself, but are also a byproduct of fuel combustion to operate pumps and engines and are found in chemical additives used in oil and gas production. Benzene, toluene, ethylbenzene, xylene, hexane, acrolein, acetaldehyde, and formaldehyde are common VOCs released during oil and gas production.[57] VOCs pose health threats ranging from short-term illness to cancer or death. Other harmful VOCs that may be released include methanol,[58] triethylene glycol,[59] and a multitude of chemicals used in hydraulic fracturing.[60]

VOCs react with sunlight to form ground-level ozone, or smog, which is known to be extremely hazardous to human health. Ozone can cause problems such as chest pain, coughing, and throat irritation and can worsen bronchitis, emphysema, and asthma. Recent studies have even linked ozone to premature mortality.[61] Several Rocky Mountain counties with oil and gas production are already violating federal standards for ozone or are at risk of doing so.

A 2005 Western Governors' Association report found that oil and gas production operations released more than 430,000 tons of VOCs in Colorado, New Mexico, Utah, Wyoming, and Montana in 2002. It projected that oil and gas operations in these states will more than double their VOCs emissions in 15 years, releasing more than 965,000 tons of VOCs annually by 2018.[62] This would equal the average amount of VOCs released annually from approximately 50,000 gas stations,[63] or the VOC pollution released by more than 25 million passenger cars, each driven 12,500 miles.[64] More recent estimates by the same

## Dee Hoffmeister

DEBRA ANDERSON, *SPLIT ESTATE*, RED ROCK PICTURES

Dee Hoffmeister has lived in Silt, Colorado, for more than 10 years. There is a well pad approximately 800 feet from her house with four wells and two condensate tanks—and her home is ringed by other nearby well pads. Dee reports that she first noticed medical symptoms in 2005, after she returned home from a vacation to discover what appeared to be a cloud of gas outside her house. She passed out within the first 10 minutes of being home. Since then Dee has become disabled with chronic weakness, dizziness, nausea, pain, burning skin, and breathing difficulty. She now walks with a cane. Doctors have not been able to diagnose her condition.

The oil and gas company operating near her home offered to pay for Dee to rent another home or stay in a motel, but in 2005 Dee went to live with her daughter for eight months. She moved back into her home after the major drilling and fracturing was completed on nearby wells and a disposal pit was emptied. Dee experiences relief from her symptoms when she is away from her home, but she has not fully recovered. After a 2007 fire at a nearby well site, she was hospitalized for two days and spent another two months living with her daughter.

Two of Dee's children and their families, with seven grandchildren in all, live on the same property. Four of Dee's grandchildren have asthma. They, too, feel better when they leave the property. Dee's dog has also been diagnosed with asthma. Air testing on the property in 2006 showed elevated levels of benzene, toluene, ethylbenzene, and xylenes.[65]

researchers indicate that the increase in VOC pollution between now and 2018 is likely to be substantially higher.[66]

The high level of VOC emissions makes oil and gas operations among the largest sources of harmful air pollution in the Rocky Mountain region. In Colorado, oil and gas operations are the largest source of the VOCs formaldehyde, benzene, acetaldehyde, acrolein, hexane, toluene, and xylenes among stationary sources in the state.[67] In Garfield County, Colorado, where oil and gas drilling has increased by 132 percent since 2004,[68] sampling and testing conducted by the county near oil and gas operations within its boundaries have detected 15 VOCs at high levels.[69] Oil and gas operations release more VOCs than cars, trucks, and all other sources combined in Garfield County; 77 percent of all human-caused VOC emissions countywide and 95 percent of stationary VOC emissions countywide result from gas industry facilities.[70] In addition to VOCs, other toxic substances may be released into the air during oil and gas production, such as hydrochloric acid and hydrogen sulfide. Although oil and gas wells, condensate tanks, compressor stations, and waste sites have collectively become one of the largest sources of toxic air pollution in the Rocky Mountain region, they are largely unregulated under the Clean Air Act's program to control hazardous air pollutants.

## Air Pollution Loopholes for the Oil and Gas Industry

First passed in 1970, and significantly amended in 1977 and again in 1990, the Clean Air Act limits emissions of nearly 190 toxic air pollutants known to be hazardous to human health by causing cancer, birth defects, reproductive problems, or other serious illnesses. Oil and gas production operations release many of these pollutants, such as benzene, toluene, and xylene. The Clean Air Act established two programs to control these pollutants: one for major sources of the pollutants and a second for smaller sources.

The program to control major sources of hazardous pollutants established limits called the National Emission

Standards for Hazardous Air Pollutants (NESHAPs).[71] To meet these standards, a company must install the maximum level of emission control of hazardous pollutants that is technically achievable by the cleanest facilities in an industry sector. Small sources of toxic air pollution that are under common control and are grouped together in close proximity to perform similar functions are required to be added together and considered as one source of emissions. If the aggregate emissions of these small sources meet the thresholds for major sources, then they must comply with NESHAPs. This "aggregation requirement" is intended to protect the public from smaller sources that might seem individually harmless but cumulatively account for the release of large volumes of toxic substances into the air.

The Clean Air Act completely exempts oil and gas exploration and production activities from this aggregation requirement.[72] Even if wells, compressor stations, condensate tanks, and disposal pits are adjacent to each other and owned by the same company, they do not have to comply with NESHAPs. For example, in Garfield County, Colorado, more than 30 tons of benzene are released into the air from 460 oil and gas wells.[73] This is nearly 20 times more benzene than is released by a giant industrial oil refinery in Denver,[74] yet none of the toxic emissions from these oil and gas wells are subject to NESHAPs.

### RURAL COMMUNITIES LEFT VULNERABLE TO TOXIC AIR POLLUTANTS

The Clean Air Act established a separate NESHAPs program to regulate individual small sources of toxic emissions. This program also has a substantial loophole for the oil and gas industry: Oil and gas wells and their associated equipment are not on the list of small hazardous air pollutant sources and are therefore exempt from this provision.[75] While the EPA can regulate individual small oil and gas facilities like wells and pits if they are within

## Elizabeth Chandler

Elizabeth Chandler, a veterinarian in Rifle, Colorado, has been observing recent health effects on local livestock that live close to gas wells. Keepers of goats, pigs, and cattle have reported reproductive changes in their livestock, dogs, and barn cats. There are meticulous records for one herd of goats going back for more than ten years regarding milk production, pregnancy, fertility, and births, so that all of these parameters can be compared on a yearly basis and on five-year averages. This herd has experienced abnormal incidences of "water on the brain" in newborns, reduced male fertility, false pregnancy, stillbirths, and smaller litters. Testing has been done for a wide range of illnesses and has ruled out other medical explanations. The dogs on this property have had delayed heat cycles and experienced an increased number of false pregnancies. The worst years seem to coincide with the most drilling activity, with the closest well being approximately 850 feet away.

A local hog farmer reports that he used to have a dozen female hogs that all reproduced like clockwork. Reproduction has dramatically decreased since new wells were drilled nearby. The sows produced no litters for more than a year, with one sow having a smaller than normal litter after 18 months. The economic impact on this producer is more than $50,000 in lost sales alone.

This same producer reports that none of his barn cats have had kittens for two years. "What is common for these producers and their animals?" asks Dr. Chandler. "They all share the same air and water and there has been extensive gas production in this area, including the use of misters to get rid of produced water."[76]

AMY MALL

## Shirley McNall


Sign at a well pad near Shirley McNall's house AMY MALL

Shirley McNall has lived on the east side of Aztec, New Mexico, for more than 30 years. Aztec is a town of approximately 7,000 people and more than 100 gas wells. Shirley's home is ringed by wells, and she estimates there are 20 wells and a compressor station within three-quarters of a mile of her home. The closest well pad is 500 feet from her house. Since 2004, Shirley has increasingly observed gas clouds emanating from wells, leaking tanks, and fracturing fluids dumped directly onto the ground. She has also experienced strong odors.

In November 2005, Shirley noticed another strong odor at her house, and was concerned that it was hydrogen sulfide. She called the New Mexico Oil Conservation Division, whose inspectors denied that hydrogen sulfide existed in the area. Yet in December 2005, the federal Bureau of Land Management reported that there were more than 375 reports of wells with hydrogen sulfide in the San Juan basin.[77] During that time, Shirley reports that she experienced sore throat, headaches, dizziness, and muscle weakness. After two and a half months with continued complaints, an engineer from the energy company BP validated that a well located a little more than a half mile from Shirley's house was emitting hydrogen sulfide. The company then took corrective action.

More recently, she noticed that the liner of the disposal pit near her home was being shredded by a maintenance crew and that waste was flowing onto soil of the well pad. This well pad and disposal pit are adjacent to an arroyo that flows into the Animas River. After approaching the pit to take photos, she developed a skin rash, face blisters, sore throat, and burning eyes. She reports similar symptoms when she is close to well pads or oil and gas waste. When her home is permeated by strong fumes, she suffers from headaches, sore throat, and breathing difficulty.

a metropolitan area with a population greater than one million people, the Denver metropolitan area is the only place in the Rocky Mountain region that meets this condition, and the vast majority of small oil and gas operations in the region are outside this area. Oil and gas operations in the Rocky Mountain region, therefore, are virtually exempt from the provisions of the Clean Air Act intended to protect Americans from small sources of hazardous air pollutants.[78]

The effects are especially evident in the case of condensate storage tanks, which are typically associated with many natural gas wells.[79] In Colorado alone, there are more than 5,500 condensate storage tanks, some of which can release in excess of 100 tons of VOCs annually—including benzene and other hazardous air pollutants.[80] No condensate tanks at oil and gas wells in the state of Colorado are currently regulated under the hazardous air pollutant protections of the Clean Air Act.

### POTENTIALLY FATAL, BUT NOT CLASSIFIED AS HAZARDOUS

Hydrogen sulfide released during oil and gas production has been associated with irritation of the eyes, nose, or throat; difficulty in breathing for asthmatics; nausea; vomiting; and headaches. Some studies suggest that even low exposure may be linked to poor attention span, poor memory, and impaired motor function. Hydrogen sulfide can cause loss of consciousness and even death in extreme cases.[81] Estimates indicate that 15 to 25 percent of all natural gas wells in the United States may contain hydrogen sulfide.[82] It can be released by well heads, pumps, piping, separation devices, storage tanks, and flaring. According to the EPA, "the potential for routine $H_2S$ [hydrogen sulfide] emissions [at oil and gas wells] is significant."[83]

## Susan Babb

Susan Babb lived on Battlement Mesa in Parachute, Colorado, for almost 10 years. When she first moved there, some older wells were already in the neighborhood, but new drilling began in 2001. In 2005, Susan began working for a neighbor, irrigating land and planting trees in a nearby field. The neighbor had wells on the edge of his property, and Susan reports that, after beginning work there, she started having medical symptoms such as burning eyes, skin, and sinuses and an elevated heart rate. This lasted several months, but she would always feel better when she left the field and returned to her house. The more time she spent in the field near the wells, the worse her symptoms were and the longer it took for them to subside after leaving the field.

One day Susan got out of her truck and stepped into a cloud of gas. She immediately got a blinding headache and almost passed out, but caught herself. After that she started getting new symptoms, including nausea, intestinal symptoms, and even sores on her face. She needed to wear a respirator every time she went outside her home, even in her car. Inside her home she kept her windows closed, ran high-grade air purifiers constantly, and stopped using her natural gas heater in order to avoid triggering her symptoms. She sometimes felt ill even inside her home if flaring activity was taking place in the area. Susan always felt better when she visited areas without oil and gas activity.

Every one of the six tests of air samples from Susan's property between July 2005 and January 2006 found elevated levels of acetone, toluene, and/or 2-butanone.[84] The latter is associated with irritation of the nose, throat, skin, and eyes, as well as loss of consciousness at high levels.[85] Four tests of air samples taken from Susan's neighbor's property, where the wells were located, between September 2005 and December 2005 show elevated levels of acetone, 2-butanone, toluene, xylenes, 2-hexanone, vinyl acetate, and/or benzene.[86] Susan's doctor diagnosed her with chemical sensitivity and recommended she move away from the area. Since she moved out of state, Susan has not had any symptoms except when she is exposed to natural gas or propane.

AMY MALL

Home next to well pad and condensate tank in San Juan County, New Mexcio

The Clean Air Act entirely exempts hydrogen sulfide from regulation as a hazardous air pollutant. Hydrogen sulfide was on the original list of hazardous air pollutants in the Clean Air Act but was subsequently removed by Congress.[87] In 1997 the *Houston Chronicle* published a series of articles on the harms caused by hydrogen sulfide across the country.[88] One article quoted three former EPA officials explaining the removal of hydrogen sulfide from the list of hazardous air pollutants. One official described it as "a political deal" in which "[c]ompanies in Texas were very successful in removing [hydrogen sulfide] from the list because of its presence in the extraction of oil." Another official "couldn't believe they did that," and thought "it was a poor scientifically based decision, extremely poor," since "[w]e all know it is extremely deadly." "It's clearly known, from industrial exposures, that it's a very toxic gas," said another.[89]

**The oil and gas industry has options for controlling hydrogen sulfide emissions. In May 2007, Kerr-McGee Corporation agreed to install scrubbing systems on its facilities in eastern Utah to remove hydrogen sulfide.**[90]

## SPOTLIGHT ON SOLUTIONS

Not only are pollution control methods widely available, but they can yield a payback for industry, offsetting the capital, operation, and maintenance costs of installing controls—sometimes significantly. As one study reported, "Each volume of gas not vented or leaked to the atmosphere is a volume of gas sold."[91] According to the EPA, payback to industry from some pollution control techniques can come within less than one year.[92] Depending on the technology and the facility, industry's return on investment can be as high as 1,321 percent.[93]

The oil and gas industry has many options available to control its toxic air emissions and actually stands to benefit from readily available, cost-effective technologies. For example, a recent report in the *Journal of Petroleum Technology* discussed 25 cost-effective ways to reduce methane emissions, VOC emissions, and hazardous air pollutants at small to mid-size oil and gas operations.[94] The EPA's Natural Gas STAR Program has identified more than 89 different control options available to industry that involve the recovery of methane and the reduction of air pollution.[95] These options range from basic inspection and preventive maintenance to equipment upgrades, heightened monitoring, and even process changes.

A production engineering manager for Williams Production Company recently stated, "We realized we can make money with this instead of letting the gas escape to the air." Williams has estimated that it has recovered up to 10 dollars for each dollar it invested in new equipment to drill and then separate gas from hydraulic fracturing fluids and sands.[96]

CHAPTER 3

# Activities at Oil and Gas Facilities Can Pollute Our Water

The oil and gas industry has exemptions from two major laws established to protect the nation's water—the Clean Water Act and the Safe Drinking Water Act. The Clean Water Act is our bedrock law that protects American rivers, streams, lakes, wetlands, and other waterways from pollution. These surface waters are often sources of drinking water for people and livestock. The Safe Drinking Water Act was enacted to protect public drinking water supplies as well as their sources.

## How Safe Is Our Drinking Water?

Hydraulic fracturing is a method frequently used to increase a well's production of oil and gas. Hydraulic fracturing fluids, which often contain toxic chemicals, are injected underground into wells at high pressures to crack open an underground formation and allow oil and/or gas to flow more freely. More than 90 percent of oil and gas wells in the United States undergo fracturing, according to the Interstate Oil and Gas Compact Commission,[97] and these wells can be fractured more than once during their lifetime. While a portion of the injected fluids are transferred to aboveground disposal pits, some of them may remain underground.[98]

Hydraulic fracturing is a suspect in impaired or polluted drinking water in Alabama, Colorado, New Mexico, Virginia, West Virginia and Wyoming, where residents have reported changes in water quality or quantity following fracturing operations of gas wells.[99]

Underground injection is a method by which wastes and other fluids are injected into rock formations. The EPA classifies injection wells roughly in accordance with the type of fluid to be put into the ground. Oil and gas production wells are referred to as Class II wells. A 1989 investigation by the General Accounting Office into the effectiveness of safeguards in preventing contamination from injection wells found 23 cases of drinking water contaminated by the underground injection of oil and gas waste.[100]

## Exemptions from the Safe Water Drinking Act Endanger Water Supplies

The Safe Drinking Water Act (SDWA) was enacted to protect public drinking water supplies as well as their sources. SDWA authorizes health-based standards for drinking water to protect against both naturally occurring and man-made contaminants.[101] SDWA's Underground

Injection Control (UIC) program protects current and future underground sources of drinking water by regulating the injection of industrial, municipal, and other fluids into groundwater, including the siting, construction, operation, maintenance, monitoring, testing, and closing of underground injection sites. According to the EPA, there are more than 400,000 underground injection wells across the country used by agribusiness and the chemical and petroleum industries.[102] The oil and gas industry, however, is exempt from crucial provisions of the Safe Drinking Water Act intended to protect drinking water.

In 1997, the U.S. Court of Appeals for the 11th Circuit ordered the EPA to regulate hydraulic fracturing under the SDWA after a hydraulic fracturing operation resulted in the contamination of a residential water well.[103] In 2004, however, the EPA issued a study on hydraulic fracturing; it concluded that fracturing "poses little or no threat" to drinking water. This study was declared "scientifically unsound" by an EPA whistle blower.[104]

## The Amos Family

The home of the Amos family, south of Silt, Colorado, was less than 1,000 feet from approximately 12 wells, and at least another dozen were within 2,000 feet. After drilling started in the late 1990s, Laura and Larry Amos report that they both began experiencing symptoms including headaches, dizziness, nausea, and nosebleeds. During hydraulic fracturing at the wells closest to their home—about 500 feet—in 2001, there was a blowout of their water well. The well cap burst and water blew into the air, according to Laura, "like a geyser at Yellowstone." The Amos family's drinking water turned gray, had a horrible smell, and bubbled "like 7-Up." They stopped drinking the water after that, but they continued to use it for bathing, dishwashing, and other household needs. The Colorado Oil and Gas Conservation Commission (COGCC) tested the Amos water well for methane, which it found in the water, but judged the water to be safe. It did not test for chemicals used in the hydraulic fracturing process.

In 2003, Laura began experiencing more severe symptoms, including difficulty breathing, swelling, elevated heart rate, and high blood pressure. Medication didn't help, and after spending months in medical offices, she was diagnosed with primary hyperaldosteronism, a rare condition involving a tumor in the adrenal gland that affected her thyroid and pituitary glands. The tumor and adrenal gland were removed. None of the doctors had any idea of how this rare disease had developed. In 2004, Laura found out that 2-butoxyethanol, known as 2-BE, had been used in the 2001 fracturing (although energy company EnCana had previously denied this). She also learned that 2-BE (a product also used in cleaners like Formula 409) has been linked to an increased incidence of adrenal gland tumors in laboratory animals.[105] In 2006, EnCana was fined by the COGCC for contaminating the Amos water well.[106] The Amos family has since moved out of the Silt area.

## Elizabeth and Steve Mobaldi

Elizabeth and Steve Mobaldi lived near Rifle, Colorado, for almost 10 years. Drilling started about a year after they moved there, and eventually there were about 20 wells within a mile of their home. Approximately 300 feet from their house was a well with a disposal pit that they observed was never lined and was eventually just filled in with dirt. There were strong odors in the air, and the Mobaldis frequently found dead birds in their yard.

DEBRA ANDERSON, *SPLIT ESTATE*, RED ROCK PICTURES

Elizabeth and Steve report that they both began experiencing symptoms after drilling started. Steve had itchy skin, burning eyes, nosebleeds, toe numbness, and swelling all over. Elizabeth woke one morning with burning pain in her feet and hands. Her symptoms grew more severe over time, and she had body pain, swelling all over, and burning and itching skin. Elizabeth said, "It felt like small wheels made of needles turning on my entire body." When she showered the pain became worse. She started losing her voice for a month at a time and experienced burning of her throat and eyes, painful headaches, heavy nosebleeds, and blisters all over her body.

Of their water, Elizabeth said it "had a residue that would float on top of a glass of water when set out for several hours and looked like very thin oil. Sometimes our water looked like soda water out of the tap and would fizz and with a sewer-like odor." Elizabeth had surgery twice to remove a pituitary tumor that was causing her to lose her eyesight. She has had increasing difficulty speaking in a clear manner.

Doctors prescribed medications that didn't help, and it wasn't until the Mobaldis read about Laura Amos in the news that they considered the possible connections to nearby oil and gas development. The Mobaldis have since moved out of the Rifle area. Steve's symptoms have disappeared, except for the toe numbness. Elizabeth still experiences all of her symptoms, although some have lessened.

Commenting on the EPA study, the Montana Bureau of Mines and Geology stated:

> The study does not consider the fate of fracture-fluid residuals after decommission of the wells. When hydrostatic pressures recover sufficiently, the residuals will become mobilized in the Powder River Basin's fresh-water regimen that we have already demonstrated to be an active flow system. Twenty or 50 years from now these aquifers will be far more important than they are today, and to have left them contaminated with residuals from hydrofracturing would only be seen as a stupid and costly mistake. It can only be concluded that hydrofracturing in the Powder River Basin must be done only with fresh water, or not at all….[107]

An analysis by the Oil and Gas Accountability Project (OGAP) found that critical information had been removed from the study, including a table with estimates for nine chemicals (including benzene, naphthalene, and ethylene glycol) that exceeded water quality standards and the fact that hydraulic fracturing operations may involve the use of radioactive tracers.[108] According to OGAP, the final report admitted that: (1) many chemicals in hydraulic fracturing fluids are linked to human health effects; (2) in some cases, hydraulic fracturing fluids are injected directly into underground sources of drinking water; and (3) it is possible for hydraulic fracturing fluids, even if they are not injected into these sources of drinking water, to move into adjacent formations.

The EPA Inspector General found that mishandling of this study warranted an investigation. This investigation was put on hold, however, after Congress created a new loophole for industry in the Energy Policy Act of 2005 by exempting hydraulic fracturing by the oil and gas industry from the UIC program.[109]

## THE NEED TO PROTECT RURAL FAMILIES' DRINKING WATER SOURCES

In addition to the exemption for hydraulic fracturing, there is another aspect of the Safe Drinking Water Act that puts families with private water wells at risk. The SDWA protects drinking water by regulating water systems that serve 25 or more individuals or have at least 15 service connections. People who obtain their domestic water from private wells that supply fewer than 25 individuals are not protected by the law's provisions that require monitoring of drinking water quality or treatment of discovered contaminants.[110] While this exclusion of wells that serve fewer than 25 individuals is not limited to the oil and gas industry, that industry is positioned to greatly affect many private water wells and benefit from this provision. Rural Americans need protection from the risk of contamination of their water supply caused by industrial underground injection of materials that could release toxic substances.

In 1990, the last year the national census asked families about their water source, 30 percent of households in Montana, 20 percent of households in Wyoming, 15 percent of households in New Mexico, and 8 percent of households in Colorado reported obtaining drinking water from private wells.[111]

In August 2006, there was a gas well blowout in Clark, Wyoming, when a drill hit a high-pressure zone underground. Not only were drilling fluids, petroleum condensates, and natural gas blown out of the top of the well into the air, they were also blown into underground fractures. The substances underground began to surface through approximately 20 blowholes up to 150 feet from the drill rig. They have also been traveling underground. Approximately 20 private water wells are within 1.5 miles of the blowout, and testing has shown that benzene has been found in one of these wells.[112] Testing at more than 20 monitor wells and at six springs flowing into Line Creek has found that all but one of the springs and most of the well test sites have been contaminated. Surface soils and groundwater in the vicinity show concentrations of petroleum hydrocarbons and volatile organic compounds including benzene, toluene, and xylenes[113] in concentrations exceeding regulatory standards.

### Other SDWA Exemptions for Oil and Gas

The Safe Drinking Water Act allows fines of up to $10,000 per day for certain violations of the law—unless the violation involves underground injection of fluids related to oil or gas production, in which case the maximum fine is only $5,000 per day.[114]

The Underground Injection Control program classifies different types of wells. Class I wells are for injection of waste, including hazardous waste as defined in RCRA, and the materials must be injected deep into the ground beneath the lowest underground source of drinking water. Class I wells are strictly regulated and even banned in some places. Because many toxic materials associated with oil and gas operations are exempt from the hazardous materials section of RCRA, they do not have to be injected only into Class I wells. Instead, they can be injected into Class II wells, which have different standards than Class I wells.[115]

The EPA may not prescribe requirements which interfere with or impede underground injection related to certain oil or gas operations – "unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection." This establishes a higher hurdle for regulating the oil and gas industry that does not apply to other industries.[116]

**SPOTLIGHT ON SOLUTIONS**

According to the Oil and Gas Accountability Project, studies show that alternatives to toxic hydraulic fracturing fluids exist, and that they are effective, economical, and less hazardous. Industry has developed non-toxic fluids for offshore oil and gas operations, such as Schlumberger's GreenSlurry, which the company claims is "earth-friendly."[117] In addition, water can be an alternative. At a 2001 EPA expert panel meeting, it was stated that hydraulic fracturing can be performed using water without additives.[118] Two studies conducted in the field by Amoco Production Company found that gas wells fractured with water produced more gas and cost considerably less to fracture than wells fractured with a gel comprised of chemicals. Another study, by the Gas Research Institute, Phillips Petroleum Company, Amax Oil and Gas, and Resource Enterprise, also found that hydraulic fracturing using water was more effective than fracturing with a gel.[119]

## The Dangers of Stormwater Pollution

Stormwater pollution from oil and gas operations causes real problems. Nevertheless, oil and gas companies have been excused from taking simple steps to prevent harm. The Clean Water Act (CWA) is our bedrock law that protects American rivers, streams, lakes, wetlands, and other waterways from pollution. These waters are often the source of drinking water for people and livestock. The oil and gas industry, however, is exempt from several crucial provisions of the Clean Water Act and is thereby allowed to pollute our waters. Compliance with the law is not onerous and is required for almost every other American industry.

## Oil and Gas Are Given Broad Exemption from Clean Water Protections

One oil and gas industry exemption is for stormwater runoff. During a rainstorm or snowstorm, flowing water causes excessive soil erosion and picks up pollutants along the way—including toxic materials and sediment. Congress amended the Clean Water Act in 1987 to require a stormwater permit for large-scale ground disturbing and other activities that can increase runoff and the risk of water pollution. To obtain a permit, a company or municipality must have a Storm Water Pollution Prevention Plan outlining precautions the company will take to reduce the discharge of pollutants and impacts to receiving waters, and to eliminate illegal discharges.[120]

Unfortunately, the oil and gas industry now enjoys significant exemptions from the Clean Water Act's stormwater permit requirements. Since 1987, oil and gas "operations" have not needed a stormwater permit as long as their stormwater discharges were uncontaminated.[121] In the Energy Policy Act of 2005, Congress expanded this exemption to include the construction of new well pads and the accompanying new roads and pipelines.[122]

The EPA has interpreted this new 2005 exemption as allowing unlimited discharges of sediment into the nation's streams, even where those discharges contribute to a violation of state water quality standards.[123] Oil and gas companies have been excused from putting controls in place to address the erosion and sedimentation of waters even though mounting evidence—including the EPA's own analysis—shows that such sedimentation causes numerous problems for the fish, wildlife, and people that depend on clean water.

### THE TROUBLE WITH SEDIMENT

Sediment—even without toxic substances attached to it—causes water pollution. Sediment increases water treatment costs for cities and towns responsible for delivering drinking water to their residents. Municipalities across the Rocky Mountain region are becoming increasingly concerned about the impact of oil and gas development on their water supplies.[124] The EPA has reported that "siltation is the largest cause of impaired water quality in rivers."[125] According to the U.S. Government Accountability Office, sediment "clouds water, decreases photosynthetic activity; reduces the viability of aquatic plants and animals; and, ultimately, destroys organisms and their habitat."[126]

According to the EPA, "Erosion rates from construction sites are much greater than from almost any other land use."[127] A 2005 modeling study of the Parachute Creek watershed in western Colorado estimated that oil and gas construction in a 15,000-acre area would almost double the amount of sediment entering a creek that runs into the Colorado River.[128]

## Deb Thomas

Deb Thomas lives in Park County, Wyoming, along Line Creek, one of the main tributaries of the Clark's Fork of the Yellowstone River and part of the headwaters of the Yellowstone. Although Line Creek is a source of water for drinking as well as for agricultural uses, there are drilling rigs, road construction, and pipelines associated with oil and gas exploration and production within approximately 150 feet of the creek. During rainstorms, Deb has documented large amounts of water and sediment running off the roads used by oil and gas companies directly into Line Creek. She reports that "sediment filled our irrigation ditch and clogged our irrigation pipes, making it impossible to draw water for our pastures. It threatens our drinking water supplies."

SHASTA GRENIER

Grand Junction, Colorado, has identified sedimentation due to surface runoff from areas disturbed by oil and gas activities as one of the main threats to its water supply.[129] According to Grand Junction officials, "sediment loading from gas well sites during storm events . . . has the potential to damage the infrastructure (reservoirs, canals, ditches and conveyance lines) used in Grand Junction's water supply."[130]

The Colorado River Water Conservation District has stated that "[t]he lower Colorado River within Colorado already exceeds water quality standards for selenium and is being monitored for sediment exceedances. A decrease in water quality could impair the beneficial use of water downstream of oil and gas development by requiring increased treatment by municipalities and possibly interfering with agricultural uses."[131]

Because of water pollution problems from oil and gas activities, the Colorado Water Quality Control Commission stepped in and required permits despite the federal exemption. Even with these permit requirements, problems are still occurring. In May 2007, the Colorado Oil and Gas Conservation Commission cited one company with nine wells that had insufficient stormwater runoff protections. At each of these nine wells, runoff from melting snow had overflowed a pit and flooded the well pad. Oil was seen in pits that were flooded. At one of

## Roy O'Connor

Roy O'Connor has lived in Montana for more than 15 years and has seen firsthand the oil and gas operations near the Milk River and Nelson Reservoir. He reports that he has seen large amounts of sediment running off roads used for oil and gas development into small feeder streams that flow into the Milk River or a tributary, like Beaver Creek. When fishing in the Milk River or its feeder streams, Roy has sunk up to his waist in silt. There are fewer fish now. "The buildup of sediment and silt in the Milk River and its tributaries is horrible."

these wells, runoff flowed into a creek. At another, sacks of chemicals were in the pit that had overflowed, and puddles of condensate and chemical residue were observed on the well pad.[132]

### Additional CWA Exemption for Oil and Gas

The Clean Water Act definition of "pollutant" excludes materials injected into an oil or gas well to facilitate production, such as hydraulic fracturing fluid or produced water reinjected into a well for disposal, if approved by a state and that state determines that such injection or disposal will not result in the degradation of ground or surface water resources.[133]

## Court Decisions Affecting the CWA

The Oil Pollution Act, enacted in 1990 as an amendment to the Clean Water Act, is intended to respond to substantial threats of an oil spill into American waters, and to fund any necessary cleanup. The law applies to "navigable waters," which the Clean Water Act defines as "the waters of the United States, including the territorial seas." The use of this broad term by Congress previously led the courts and administrative agencies to protect the various surface waters that make up our aquatic system, including ponds, streams, and wetlands.

Two recent Supreme Court decisions, however, as well as ambiguous "guidance" from the Bush administration, have created significant uncertainty about the degree to which many water bodies remain protected today and have suggested that some link to an actually navigable water body is needed to trigger Clean Water Act protections. Many of the waters affected by oil and gas drilling in the West do not contain water all year and thus may enjoy less protection under the Clean Water Act. While this is not a loophole in the statute, it is potentially a major rollback of a much-needed statutory protection from the toxic substances associated with oil and gas production. Congress should clearly define the protected waters of the United States and delete the term "navigable" from the law.[134]

### SPOTLIGHT ON SOLUTIONS

Developing a stormwater pollution prevention plan is not complicated. It relies in large part on general permits and known approaches that have been available and utilized for years, such as installing vegetative ground cover, berms, temporary fabric barriers known as silt fences, or turnouts (ditches extended into a vegetated area to disperse and filter stormwater runoff). Information on these approaches is widely and easily available from state and federal agencies and other public sources including the International Stormwater Best Management Practices Database.[135]

CHAPTER 4

# Toxic Substances Associated with Oil and Gas Facilities Can Pollute Our Land

According to a survey conducted by the American Petroleum Institute, the total estimated volume of waste (including drilling waste, produced water, and other wastes) generated by oil and gas exploration and production operations was 18 billion barrels in 1995, the most recent year for which data are available.[136] Most of this waste is produced water and is exempt from the Resource Conservation and Recovery Act (RCRA), the principal federal law designed to ensure safe management of hazardous waste and prevent new toxic waste sites. In addition to its significant exemption under RCRA, the oil and gas industry enjoys a major exemption under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the law known for creating the Superfund program.

While RCRA covers the management of a hazardous material from cradle to grave in order to avoid risks to human health and the environment, CERCLA provides a framework for cleanup of toxic materials that were never given a proper burial. In addition to its remedial aspect, the threat of CERCLA liability encourages strict compliance with RCRA's cradle-to-grave regulation of hazardous substances. The exemptions given to the oil and gas industry in RCRA and CERCLA limit the effectiveness of both laws in protecting communities from toxic materials.

## Where Do Oil and Gas Companies Put Their Waste?

The oil and gas industry employs several methods for discarding its waste. Sometimes waste is buried in the ground or injected underground. Another common method is to dump it into open-air pits, sometimes called evaporation pits, and allow any volatile organic compounds to evaporate into the air. In addition to potentially contaminating the air, this method may still leave waste in the pits that needs to be treated and/or disposed of.[137]

AMY MALL

The Crouch Mesa Soil Reclamation Center in Aztec, New Mexico, is a "land farm" of 66 acres where wastes generated by oil and gas exploration and production are disposed of onto the ground in piles. On a clear, sunny day with wind gusts in the area reported to be up to 25 miles per hour,[137] the dust blew across the street toward a residential development and dramatically clouded the air. It is unknown whether the dust contains harmful substances. The facility's management recently agreed to amend its operational plan to reduce the potential for this dust to blow off-site.[138]

In 1995 more than 90 percent of produced water was injected underground, and most drilling wastes were disposed of on-site through evaporation or burial.[139] Waste may also be piled on the ground in a method called "land farming," which is intended to allow the soil—and sometimes added bacteria—to digest the pollutants through a technique called bioremediation. According to the Argonne National Laboratory, "Land farming is the controlled and repeated application of wastes to the soil surface, using microorganisms in the soil to naturally biodegrade hydrocarbon constituents, dilute and attenuate metals, and transform and assimilate waste constituents."[140]

## EPA Officials Exempt Oil and Gas, Ignoring Scientific Findings

Enacted in 1976 and significantly amended in 1980, RCRA sets standards for management of hazardous waste throughout its life cycle from cradle to grave—including generation, transportation, treatment, storage, and disposal—in order to prevent harm to human health and the environment. These standards are a powerful incentive for a company to minimize waste and pollution through methods such as changing the industrial process and using substitute materials that are not hazardous.

When Congress wrote RCRA, it gave the EPA the authority to determine whether the law should cover hazardous wastes associated with oil and gas exploration, development, or production.[141] The EPA sampled drilling fluids and produced water at field sites and found pollutants at levels that exceeded 100 times the agency's standards, including benzene, lead, arsenic, and uranium. The agency found 62 documented cases where waste from oil or natural gas operations had endangered human health. The EPA also found that, while there were some federal and state regulations in place to control hazardous oil and gas wastes, there were some gaps as well as inadequate enforcement.[142]

EPA staff recommended that some hazardous oil and gas wastes be regulated, but they were overruled by senior agency officials in 1988 when the EPA exempted wastes uniquely associated with oil and gas exploration and production from RCRA's hazardous waste provisions.

At the time, the assistant to the EPA's then director of hazardous site control told a reporter, "This is the first time that in the history of environmental regulation of hazardous wastes that the EPA has exempted a powerful industry from regulation for solely political reasons, despite a scientific determination of the hazardousness of the waste."[143] The majority of exploration and production wastes are covered by this exemption,[144] and the list of exempt wastes includes drilling fluids, produced water, hydrocarbons, hydraulic fracturing fluids, sludge from disposal pits, drilling muds, and sediment from the bottom of tanks.[145]

Disposal pits, evaporation ponds, misting systems, and land farms are all in use, sometimes adjacent to or within residential communities, and guidelines vary in each state. The federal statutory guidelines of RCRA are critical to ensure that when methods such as these are used for waste management, treatment, or disposal, they are employed in ways that are safe for the environment.

The Black Mountain Disposal Facility is a 40-acre waste site with seven open-air disposal pits located near Debeque, Colorado. According to Black Mountain's management, it accepts produced water that contains only salt and hydrocarbons and has groundwater monitor wells that are tested quarterly. The facility randomly samples incoming waste but does not test all incoming waste. It uses an aeration system to mist waste into the air to accelerate evaporation and also land farms some materials from the pits, relying on bioremediation.[146]

A recent newspaper article reported that the clay liner of one of the pits was breached in 2001 and that groundwater test wells in the area still show an elevated level of benzene.[147] A 2007 inspection by the Colorado Air Pollution Control Division found that Black Mountain Disposal had violated several conditions of its permit, including excessive emissions of benzene, toluene, and xylene.[148] There are now proposals for new waste disposal facilities in the town of Debeque.

During May and June of 2007, the New Mexico Oil Conservation Division collected fluid and soil samples from 21 drilling/reserve pits, two production pits, and two closed-loop tanks. Testing found various hazardous substances including arsenic, lead, benzene, mercury, acetone, toluene, ethylbenzene, and xylenes at some of these locations.[149]

In 2003, New Mexico state officials identified more than 6,700 instances of pit-caused contamination since the mid-1980s, with more than 550 resulting in groundwater contamination.[150]

## Rick Roles

For 20 years Rick Roles has lived on property 10 miles south of Rifle, Colorado. Drilling in the area started in the early 1990s, and, according to Rick, there are now 19 wells within a quarter mile of his home and approximately 100 within a half mile. In 2002 a disposal pit was put at the end of his driveway, including an aeration system to mist the waste into the air. Three pits were within a half mile of his house. Rick reports that he started getting sick after the pits were built. His symptoms include numbness, swelling of his hands and feet, body pain, and loss of his sense of smell. As he tells it, "My symptoms are from my hair to my toenails." Rick's livestock has also suffered in recent years. His horses have become sterile and his goat herd has experienced high rates of stillbirths, small size births, and abscesses. Rick reports that he started to feel better after he stopped eating vegetables from his garden and drinking his goats' milk. In 2006 the pit at the end of his driveway was closed and filled, but Rick still experiences symptoms.

AMY MALL

Misters are used to speed evaporation of waste products such as produced water

PEGGY UTESCH

## RCRA Protections Should Apply to Oil and Gas Waste

Congress should close the RCRA loophole for hazardous wastes associated with oil and gas exploration, development, and production. This would provide a powerful incentive for companies to minimize waste, use nontoxic alternatives, recycle and reuse toxic substances where possible, and treat waste so that it is no longer toxic. When toxic waste remains, its disposal should minimize risk to the environment and human health. Protection of soil, water, and air is needed, as well as disclosure of hazardous materials and sampling and monitoring of the waste. The oil and gas exploration and production industry should not be allowed to follow a standard different than the one that applies to other industries.

**SPOTLIGHT ON SOLUTIONS**

Industry can comply with RCRA's hazardous waste provisions thanks to available technologies that minimize hazardous waste and, in some cases, are profitable for industry to adopt. For example, oil and gas companies have economical and effective alternatives available to open pits that would allow them to comply with requirements to control hazardous waste.

According to the Oil and Gas Accountability Project, one option—called a closed-loop drilling fluid system—uses storage tanks and other equipment instead of pits and is employed by many companies. Comparisons have found these systems to be cost-effective and even profitable.[151] An industry study concluded that these systems "dramatically lower"[152] the volume of waste, and they also maximize the ability to reuse and recycle drilling fluids. Any waste that is created can easily be transported to an appropriate facility instead of dumped in an open pit. While initial costs may be higher, closed-loop drilling systems create savings in the long run. There is no need to construct a pit, drilling waste is virtually eliminated, water use can be reduced by as much as 80 percent, truck traffic—which can often involve 50 truck trips each day on one road, seven days a week—is reduced by as much as 75 percent, and tanks can be reused.

Comparisons have found closed-loop drilling can result in a cost savings of up to $180,000 per pit.[153]

## Restoring the Power of CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was enacted in 1980 and amended in 1986. The reach of CERCLA is not limited to materials defined as waste under RCRA. Rather, it kicks in when there is a release—or a substantial threat of a release—of a substance hazardous to the environment. When the responsible parties cannot be identified or do not have the finances to pay for cleanup, CERCLA provides for Superfund to cover the costs.

The money for Superfund used to come from taxes on the oil and gas industry, as well as other industries that were the major sources of hazardous substance pollution. This tax was part of a political compromise: In return for the oil and gas industry's paying into the fund, petroleum and natural gas were exempted from CERCLA.[154] Although the Superfund tax expired in 1995, oil and gas have remained exempt from CERCLA's critical provisions for cleaning up hazardous sites. Clearly, the oil and gas industry got the better part of the deal.

The exemption for oil and gas created an umbrella of exemption for many substances toxic to human health, such as benzene, toluene, xylenes, polycyclic aromatic hydrocarbons, arsenic, and mercury, when they occur naturally in oil or gas. CERCLA requires the EPA to compile a National Priorities List of sites, known as Superfund sites, where there is a known or threatened release of hazardous substances, in order to prioritize investigation and cleanup. The law also requires federal agencies to compile a priority list of toxic substances most commonly found at these contaminated sites nationwide and which are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure

## The Crockett Family

The Crockett family has been ranching in the Powder River Basin of eastern Wyoming for more than 10 years. Their ranch of 14,000 acres lies over federal, state, and private minerals. Oil and gas development began 40 years ago, and the ranch is now home to numerous abandoned oil wells, pumping equipment, batteries, a diesel engine, exposed pipelines, oil leaks, debris, and open disposal pits. Oil seepage has persisted on the Crockett ranch for ten years or more and despite considerable efforts the Crocketts have still not been able to get it cleaned up. The Crocketts are very concerned about the integrity of the open holes and casings since they have been neither maintained nor monitored for years.

## The Blancett and Velasquez Families

Chris Velasquez TWEETI BLANCETT

The Blancett and Velasquez families have been ranchers in San Juan County, New Mexico, for well over 100 years. Several generations of their families have grazed their herds on both private land and public land managed by the Bureau of Land Management. They report having seen countless leaks and spills at well pads throughout the federal land where they graze their cattle. In addition to leaks, spills, breached disposal pits, and other contamination on well pads, Chris Velasquez observed a pipeline leak that flowed into an arroyo that runs into the San Juan River, killing trees along its route.[155]

In another incident, a pit that was breached and leaking contaminated a spring that flows into the Animas River. Testing of the pit and the spring in the fall of 2005 found benzene, ethylbenzene, toluene, and xylenes.[156]

These ranchers have lost cattle to toxic oil and gas waste, and testing of hair samples from ill cows by the Texas Veterinary Medical Diagnostic Laboratory in 2005 found petroleum in the hair of 54 out of 56 animals.[157] Research has found that crude oil poses serious health risks to cattle[158]—and these cows could ultimately make their way into the human food chain.

Tweeti and Linn Blancett ROBERT CASTELLINO

at these sites.[159] The latest list, from 2005, contains 275 different toxic substances. When these substances naturally occur in oil and gas, however, CERCLA has been interpreted to exempt these substances from regulation.[160]

### Tools are Needed for Pursuing Polluters, Cleaning Spills

In order to ensure that contaminated sites are made safe as soon as feasible, CERCLA generally authorizes the government to clean the sites and pursue payment from potentially responsible parties. Private parties who incur costs to clean up hazardous substance spills and other sites governed by CERLCA can also, in many circumstances, pursue payment for cleanup directly from the responsible parties. This avenue is not available for sites contaminated with oil and natural gas.

Events in Arizona and Wyoming are illustrative of the risks of placing oil and gas outside of the protective reach of CERCLA. According to a newspaper report, the residents of Red Valley, Arizona, were subject to oil spills from nearby drilling operations for more than 10 years. These spills became increasingly worse, including a 2003 spill that contaminated soil for more than 20 farmers and a 2004 spill that released the equivalent of 25 barrels of oil. A 2005 pipe break caused 80 barrels' worth of oil to mix with spring runoff that travels through 12 farms and eventually flows into the San Juan River. It was reported that this contaminated runoff led to human illness, the death of 12 head of cattle, and destruction of farmland.[161]

The National Response Center is the national point of contact for reporting oil, chemical, and other discharges into the environment. In 2006, reported crude oil spills in Campbell County, Wyoming, included a February spill of five barrels due to a breach in a production line; a March spill of 25 barrels from a pipeline into Art Creek, which flowed almost a mile before being contained; another March spill in New Castle of 265 barrels due to a loose tank valve; an April spill in Gillette of five barrels into Joe's Creek, which flowed two miles due to internal corrosion of a pipeline; and an October spill of 150 barrels due to a valve left open in Wright.[162]

Given the growth in oil and gas drilling, the likelihood of oil or gas being released into the environment and threatening human health will also increase if there is no incentive, in the form of potential CERCLA liability, for industry to take preventive measures. If oil and natural gas were covered under CERCLA, companies could be held responsible for cleaning up oil or gas where it is being released into the environment and poses a threat to human health. The EPA could add sites contaminated by oil or gas to the National Priorities List and use federal funds, as available, to clean up the site while pursuing reimbursement from the primary responsible party. The threat of a CERCLA enforcement or cost-recovery action would provide a strong incentive to industry to not only clean up hazardous waste released in the past, but to change polluting practices. Regulators and people who are affected by oilfield pollution would have a powerful tool with which to pursue the polluter to pay for cleanup.

### SPOTLIGHT ON SOLUTIONS

Closing the CERCLA oil and gas loophole need not require new technology or equipment for industry. There are economical measures to avoid leaks or uncontrolled disposal of oil and gas. Perhaps the most simple is regularly scheduled preventive maintenance on equipment, pumps, valves, and engines.

The Railroad Commission of Texas Oil and Gas Division reports that numerous companies have implemented preventive maintenance programs and found them to be "quite successful" at minimizing the occurrence of leaks and releases of materials into the environment. According to the commission, preventive maintenance programs "have resulted in more efficient operations, reduced regulatory compliance concerns, reduced waste management costs, and reduced soil and/or groundwater cleanup costs."

Other techniques recommended by the commission to reduce leaks and spills include: remote monitoring of leaks; leakproof storage containers; proper containment devices like drip pans; plating that reduces wear on valve stems and pipe threads; methods to avoid pipe corrosion; and impermeable wellhead sumps during drilling preparation. This last item collects crude oil leakage associated with workover operations, and in 2001 was reported to be available for $800.[163]

CHAPTER 5

# Solutions to Oil and Gas Pollution Problems Are Available, Often Economical, and Often Easy

Based on widely available information sources, numerous methods exist to reduce and prevent toxic pollution—and in many cases they are profitable. To best protect human health and decrease environmental contamination, oil and gas exploration and production operations should start by utilizing the internationally accepted waste management hierarchy that is based on the concepts of reduce, reuse, and recycle.

## Reduce, Reuse, and Recycle

The top priority for reducing pollution from oil and gas operations should be an effort to minimize the use of toxic substances through changes in technology or the substitution of nontoxic alternatives. Any toxic substances that must be used, such as drilling fluids, produced water, and lube oil should be recycled or reused to the greatest extent possible.

Waste products that cannot reasonably be recycled or reused should be treated to the greatest extent possible to reduce the risk to the environment and human health. Although disposal is the least preferred option for dealing with toxic materials—due to the likelihood of residual pollutants causing future environmental or health risks—when there is remaining waste, it should be disposed of safely.

## Pollution Solutions Can Be Profitable

Many methods to reduce or recycle toxic materials have been documented to produce significant cost savings after initial up-front costs. Some even help the industry to recover more of their product and increase revenue. A company in Alaska reusing drilling fluid reduced its costs from $7 million to $3.25 million.[164] Devon Energy spent $15,000 to capture methane emissions from a new well, instead of venting those emissions into the air, and sold the methane captured for $35,000. A Devon Energy official said, “It’s a win-win for everybody.” BP tested an air emissions control unit that cost $1.4 million but in two years led to income of more than $1.6 million.[165] Another company experienced annual savings of $272,000 and paid off initial capital costs in less than four years after starting to reclaim crude oil from sludge.[166]

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In instances when pollution prevention technology does not pay for itself, the industry can afford to comply with our laws. For the second quarter of 2007, 22 major energy companies reported overall net income of $30.7 billion,[167] and net income was $5.5 billion for 38 independent energy companies.[168] Since 1990, the oil and gas industry has ranked in the top 20 industries for total campaign giving to federal candidates and political parties.[169] Surely it also has enough money to protect human health and our environment.

## Resources for Learning How to Reduce Pollution

Public sources provide information on hundreds of ways to utilize the waste management hierarchy and minimize the potential for toxic substances to be released into the environment. Some of the approaches recommended by these sources include:

- planning and design of site construction and equipment to minimize waste, such as minimizing the number of wells;
- using less-toxic product alternatives, such as low-toxicity glycols, lead-free and biodegradable pipe dope, chrome-free lignosulfonates, or nontoxic solvents;
- modifying equipment, such as adding lubricating oil purification units or vapor recovery systems in condensate tanks;
- modifying processes, such as implementing downhole separation of produced water, reclaiming water, or increasing efficiency of drilling fluid use; and
- implementing preventive maintenance, alarms, and monitoring.

Implementing these solutions is possible: In the Rocky Mountain region, for example, two companies have signed agreements to use some methods that are less hazardous to the environment, such as closed loop drilling, nontoxic fracturing fluids, VOC controls, and stormwater management. They have also agreed to test and monitor water and air.[170]

Voluntary efforts by a few companies should be applauded if they use the best available technologies to keep our environment clean, but they are not a solution to the problem. According to Denver energy attorney Lance Astrella, exemptions from environmental laws discourage innovation in the oil and gas industry: "A pitless drilling technology which won the prestigious Stewardship Award issued by the industry—and which industry itself found to result in a net operating cost savings—was mothballed and never used again after the award was given."

Legal requirements and standards are essential to ensuring that all companies institute the best available methods to reduce hazards to public health and the environment and make information about their operations available to the public.

Information on the universe of approaches and technologies for reducing pollution is publicly available and easily accessible. Some examples include:

- A 2000 EPA report on oil and gas extraction discusses dozens of pollution prevention opportunities that companies have used to "improve efficiency and increase profits while at the same time minimizing environmental impacts."[171]
- The website of the U.S. Export-Import Bank encourages several ways to reduce environmental contamination such as minimizing hazardous air pollutants to the extent possible, using closed loop systems, minimizing or avoiding toxic additives to drilling fluids, using the least toxic alternative chemicals, and actively monitoring hydrogen sulfide wherever it may accumulate.[172]
- "Waste Minimization in the Oilfield," published by the Oil and Gas Division of the Railroad Commission of Texas in 2001, offers more than 100 ways for companies to minimize wastes, including those currently exempt from RCRA.[173]
- The Illinois Environmental Protection Agency website lists close to 100 best management practices for oil exploration and extraction to reduce and prevent pollution.[174]

- Argonne National Laboratory offers an online Drilling Waste Management Technology Identification Module to help companies identify drilling waste management strategies for a given well location and circumstances. The module uses a hierarchy based on level of impact to encourage waste management options with the lowest environmental impacts.[175]

- Research is ongoing; the Integrated Petroleum Environmental Consortium is a joint effort of four research universities established to develop cost-effective technologies and tools to comply with environmental regulations in the industry.[176] For more than 10 years it has held an annual conference at which research papers on new methods to solve environmental problems are presented.

# Conclusion and Recommendations

Oil and gas operations that can emit hazardous substances into the environment are booming in the Rocky Mountain region, many of them moving closer and closer to where people live and where children go to school in western communities. Although this report focuses on oil and gas operations in the Rocky Mountain region, statutory exemptions allow toxic releases into the environment from oil and gas operations throughout the country, as well as offshore.

The network of interrelated exemptions from environmental regulation given to oil and gas companies is a regulatory void unique to the industry.[177] And while some state laws regulate the hazards of oil and gas operations, these laws vary widely. The health of Americans should not be harmed—or even put at risk—by toxic contamination that can be readily and economically controlled; modernizing the regulation of oil and gas exploration and production is long past due.

At a minimum, oil and gas exploration and production should be subject to the same environmental measures with which other industries must comply to adequately protect human health and the environment. Technologies are readily and often economically available to reduce environmental contamination and to protect the health of communities across the nation. The free pass to pollute given to the oil and gas industry is unjustifiable when weighed against the potential harm that will come from continued unchecked pollution by oil and gas companies. The time for Congress to step into the void is long overdue.

## Close the Loopholes for the Oil and Gas Industry

Close all the loopholes in federal environmental laws that allow oil and gas exploration and production to pollute our environment and jeopardize the health of communities.

**Ensure the Public's Right to Know**

1. Require oil and gas exploration and production companies to report to the Toxic Release Inventory to provide information to the public regarding chemicals that may pose a risk to the health of local communities.

**Protect the Air**

1. Require aggregation of the emissions of oil and gas exploration and production activities under the National Emission Standards for Hazardous Air Pollutants.
2. Include oil and gas wells and their associated equipment on the list of small hazardous air pollutant sources wherever they are located.
3. Add hydrogen sulfide to the list of hazardous air pollutants.

**Protect Underground Sources of Drinking Water**

1. Subject all hydraulic fracturing by the oil and gas industry to the Underground Injection Control program of the Safe Drinking Water Act.
2. Increase daily fines for violations by the oil and gas industry to equal those for other industries.
3. Require that the underground injection of materials associated with the oil and gas industry that meet RCRA's definition of hazardous waste meet the standards of Class I injection.

**Protect Our Waters**

1. Delete the term "navigable" from the Clean Water Act.
2. Require stormwater permits for all oil and gas industry activities.
3. Apply the Clean Water Act definition of "pollutant" to all materials used in oil and gas operations.

**Protect the Land**

1. Include all toxic wastes associated with oil and gas exploration and production under RCRA's cradle-to-grave hazardous waste provisions.
2. Include oil and gas under the Superfund law (CERCLA).

## Evaluate the Health Risks Associated with Oil and Gas Exploration and Production

While the science on the hazards and toxicity of many of these substances is long established, the exposure from living near oil or gas operations must be further studied, as outlined below. The lack of such research, however, should not dissuade Congress from taking immediate legislative action as discussed above.[178]

**Ensure extensive independent environmental monitoring** of air, water, and soil that could be affected by oil and gas exploration and production sites. Monitoring includes recording observations of existing conditions and collecting various data and samples of air, water, soil, and more to measure changes in the environment and contamination.

**Assess the toxic exposures of families living near oil and gas exploration and production sites.** An exposure assessment attempts to determine who is being exposed to a particular substance or chemical, how the exposure occurs (through breathing air, drinking water, skin contact, or any other routes), how much exposure is occurring, and the frequency and duration of exposure. The results of an exposure assessment are often considered in coordination with a hazard assessment of the chemical. Exposure assessments based on monitoring data are important to provide real-world data for risk assessment.[179]

**Identify the toxic effects of the typical chemical mixtures found at oil and gas sites.** In order to fully analyze all risks, federal agencies, independent researchers, and the public must have comprehensive information on the chemicals used by industry. This information is combined with the results of monitoring and exposure assessment to help develop a full profile of the risks to human health.

**Utilize the best available methods to monitor and track health outcomes in communities and workers exposed to oil and gas exploration and production activities** in comparison with similar but unexposed groups. Tracking the rates of medical problems along with information on geography, lifestyle, occupation, and other indicators will provide essential information pertaining to whether chemical contamination may be contributing to illness in workers and nearby residents and to monitoring the overall health impact of living near oil and gas activities.

**Conduct health impact assessments for oil and gas activities on public land.** Under the National Environmental Policy Act (NEPA), an Environmental Impact Statement (EIS) is required for federal projects likely to have significant environmental effects. Environmental Impact Statements analyzing the impacts of oil and gas exploration and production on federal lands should include a comprehensive assessment of potential human health impacts.

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