

# Natural Gas Development, Hydraulic Fracturing, & Public Health

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California Energy Commission

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# Rising Concerns about Health Impacts from Natural Gas Production



The National Institute for  
Occupational Safety and  
Health (NIOSH)



National Environmental Public  
Health Tracking Network



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Agency for Toxic Substances and Disease Registry

# Health Threats From Oil & Gas Development with Fracking

## **Air Quality**

Diesel Particulate Matter (PM) (*respiratory and cardiovascular*)

Ozone (*respiratory*)

Air Toxics (*respiratory, neurological and immune system, carcinogens*)

Silica (*lung disease*)

## **Noise & Light Pollution**

(*Sleep disturbances, cardiovascular impacts*)

## **Public Safety**

Accidents, Explosions,  
Fires, Community Disruption

## **Water and Soil Contamination**

Spills and Leaks

Methane in Drinking Water (*explosive & asphyxiation hazard*)

# Types of Air Pollution from Natural Gas Development and Processing

- **Local**
  - Diesel Particulate Matter (PM)
  - Air Toxics (i.e. benzene, formaldehyde, etc.)
  - Silica
- **Regional**
  - Ozone Precursors (VOCs and NO<sub>x</sub>)
- **Global**
  - Global warming pollutants (methane)

# Pollutants and Sources from Shale Gas Development and Production

## Local Impacts

Source	NOx	VOC	PM	Air Toxics	Data Quality
<b>Well development</b>					
Drill Rigs	●	●	●	●	Medium
Frac Pumps	●	●	●	●	Medium
Truck Traffic	●	●	●	●	Medium
Completion Venting		●		●	Poor
Frac ponds		●		?	Poor
<b>Gas Production</b>					
Compressor Stations	●	●	●	●	Medium
Wellhead compressors	●	●	●	●	Medium
Heaters and dehydrators		●	●	●	Medium
Blowdown venting		●		●	Poor
Condensate Tanks		●		●	Poor
Fugitives		●		●	Poor
Pneumatics		●		●	Poor



= major source



= minor source

**CarnegieMellon**

Table used with permission from Robinson AL. 2012 Air Pollutant Emissions from Shale Gas Development and Production. IOM Roundtable <http://www.iom.edu/Activities/Environment/EnvironmentalHealthRT/2012-APR-30.aspx>

OSHA•NIOSH

# HAZARD ALERT

## Worker Exposure to Silica during Hydraulic Fracturing

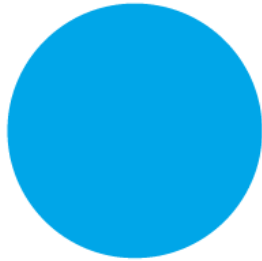
The National Institute for Occupational Safety and Health (NIOSH) identified exposure to airborne silica as a health hazard to workers conducting some hydraulic fracturing operations during recent field studies.



Photo credit: NIOSH

Silica dust clouds from delivery trucks loading into sand movers.

- 79% showed silica exposures **greater than** the NIOSH REL of 0.05 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ).
- 31% of **all** samples showed silica exposures 10 or more times the REL, with one sample more than 100 times the REL.

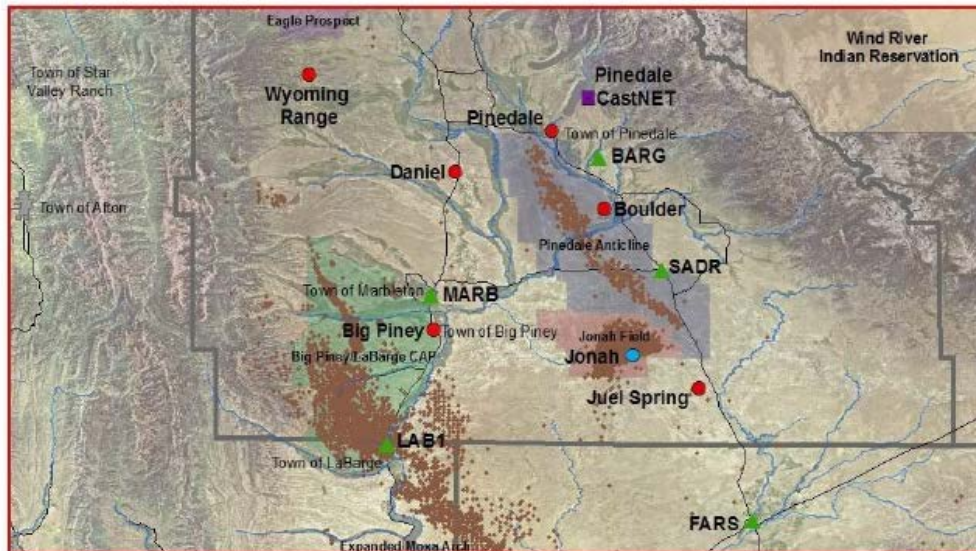


**USA  
TODAY**  
A GANNETT COMPANY

Mar 09, 2011

# Wyoming's smog exceeds Los Angeles' due to gas drilling

Figure 1: Monitoring Stations, Towns, and Wells Sublette County, Wyoming<sup>21</sup>





# Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania



**Source signature of volatile organic compounds (VOCs)  
from oil and natural gas operations in northeastern Colorado**

Jessica B. Gilman, Brian M. Lerner, William C. Kuster, and Joost de Gouw

## **Reducing Air Pollution from the Oil and Natural Gas Industry**

EPA's Final New Source Performance Standards and  
National Emission Standards for Hazardous Air Pollutants

April 17, 2012







## Human health risk assessment of air emissions from development of unconventional natural gas resources☆☆☆

Lisa M. McKenzie \*, Roxana Z. Witter, Lee S. Newman, John L. Adgate

*Colorado School of Public Health, University of Colorado, Anschutz Medical Campus, Aurora, Colorado, USA*

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# Proximity to well sites was linked to increased levels of contaminants and health risks

- Median levels of xylenes were 9 times higher
- Elevated risk for respiratory and neurological impacts

# Threats to Drinking Water Quality

## **Surface Contamination**

- Waste Disposal
- Spills
- Resource Depletion

## **Sub-Surface Threats**

- Faulty Well Construction
- Faults and Fractures
- Old Wells
- Unintended Fracturing

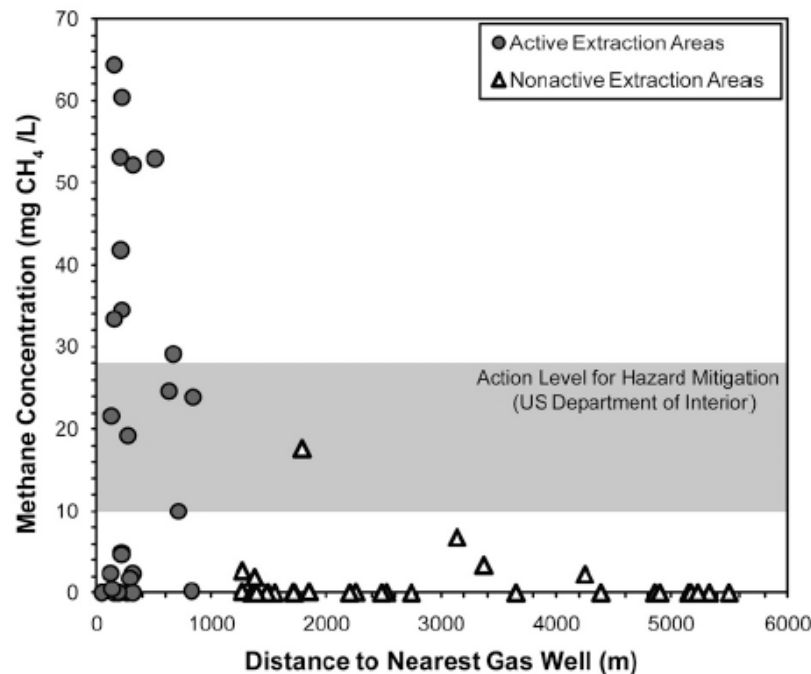


## **Contaminants:**

Methane, Hydrocarbons, BTEX,  
Radioactivity, Metals, Other ?

# Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing

Stephen G. Osborn<sup>a</sup>, Avner Vengosh<sup>b</sup>, Nathaniel R. Warner<sup>b</sup>, and Robert B. Jackson<sup>a,b,c,1</sup>





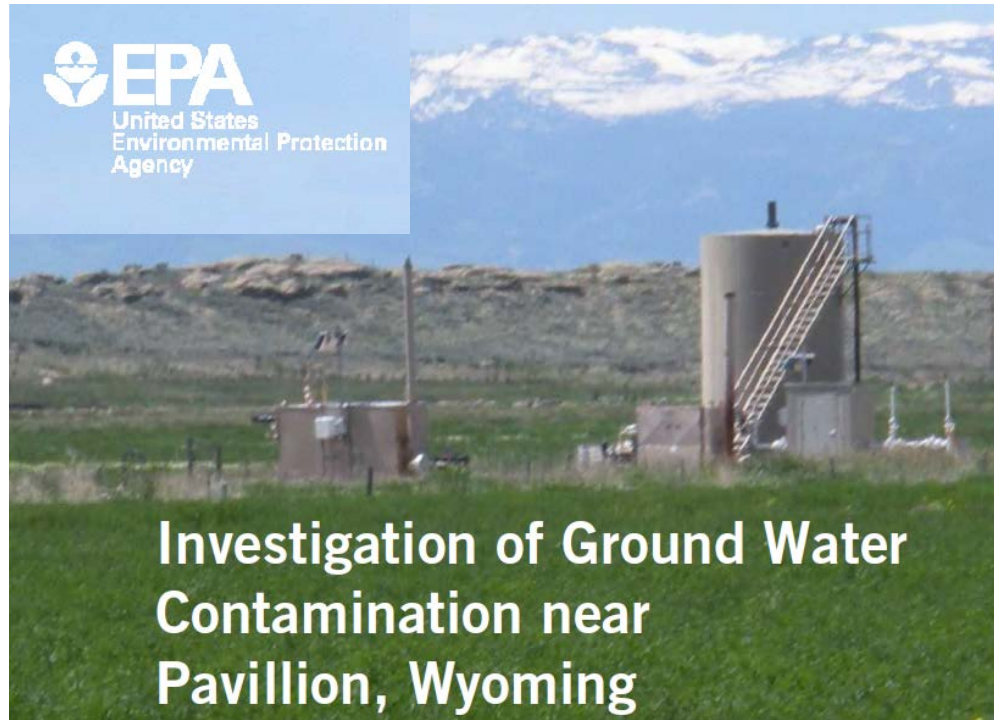
# Health Consultation

Public Health Implications of Ambient Air Exposures to Volatile Organic Compounds as Measured in Rural, Urban, and Oil & Gas Development Areas

GARFIELD COUNTY, COLORADO

Elevated benzene levels  
in the air near well sites

- Methane and dissolved hydrocarbons found in private wells.
- Shallow ground water contaminated with: benzene, xylene, and hydrocarbons.
- Suspected contamination of deeper groundwater resources



Investigation of Ground Water Contamination near Pavillion, Wyoming



MEDICAL NEWS  
& PERSPECTIVES



## Rigorous Evidence Slim for Determining Health Risks From Natural Gas Fracking

### **Lack of Comprehensive:**

- Chemical Disclosure
- Monitoring of Emissions, Releases, Wastes
- Ambient or Targeted Monitoring
- Health Impact Surveillance

# Policy Gaps Threaten Public Health

## **Exemptions from Federal Laws**

Safe Drinking Water Act, Clean Water Act, Clean Air Act, Resource Conservation Recovery Act, National Environmental Protection Act

## **Patchwork State Regulations**

## **Missing Public Health Expertise**

## **Insufficient Funding for Research**