

# Community Health Survey Results

Pavillion, Wyoming Residents



  
EARTHWORKS™  
OGAP— Oil & Gas  
Accountability Project



# Community Health Survey Results Pavillion, Wyoming Residents

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*and*

Powder River Basin Resource Council  
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# Table of Contents

<b>Executive Summary</b> .....	<b>3</b>
<b>Introduction</b> .....	<b>4</b>
<b>Health Survey Participants</b> .....	<b>4</b>
Participant Ages .....	4
Years Lived in Pavillion, Wyoming.....	4
General Health of Individuals Surveyed.....	5
General Health .....	5
Frequency of Illness .....	5
Access to Doctors and Health Care Providers .....	5
Occupational Exposure .....	5
Smoking History .....	5
<b>Survey Responses: Facility Odors and Health Impacts</b> .....	<b>6</b>
Facilities in Pavillion Associated with Odor Events.....	6
Duration of Health Impacts Associated with Odor Events.....	6
Distance from Surveyed Individuals to Facilities Associated with Odor Events .....	7
Health Conditions Reported in the Pavillion Health Survey .....	7
Respiratory Impacts .....	8
Respiratory Impacts as it Relates to Smokers and Non-Smokers .....	8
Individuals with Most Health Conditions.....	9
<b>Comparison of Chemicals Detected by EPA Water Investigation with the Health Impacts of Survey Participants</b> .....	<b>9</b>
Human Health Effects Associated with Chemicals Detected in the Pavillion Drinking Water .....	10
<b>Reported Health Impacts Compared to Known Health Effects of Drilling, Production and Processing Chemicals</b> .....	<b>11</b>
<b>Conclusion and Recommendations</b> .....	<b>12</b>

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## Executive Summary

The following community health survey results for Pavillion, Wyoming residents were compiled by Wilma Subra on behalf of Earthworks' Oil & Gas Accountability Project and Powder River Basin Resource Council. This community health survey was completed by a total of 16 individuals between the ages of 37 and 82 in March 2010. Participants anonymously and voluntarily provided information on their past and current health conditions, and they described their individual exposure to contaminants through occupational and smoking behavior, and through odor events in their community.

Since the development of the oil and gas resources in the area, Pavillion residents have reported water, air and soil contamination and associated health impacts. In August 2009, the Environmental Protection Agency (EPA) publicly released data from their investigation of 39 drinking water wells in the Pavillion area. Eleven of those drinking water wells were significantly contaminated. The health information that was gathered from participants in this survey is compared to the known health effects of the chemicals that EPA reported were in these 11 drinking water wells. Survey results also include information as to other chemicals that are known to produce the health effects being reported by Pavillion community members.

Important to a full understanding of these community health survey results is an understanding of how humans are exposed to contaminants. Human exposure to oil and gas associated chemicals or other contaminants occurs through air, water and soil pathways. While odors in an oil and gas producing community are often a result of direct releases into the air from industrial facilities, or from the volatilization of contaminants at or near a facility, they also occur through the volatilization of contaminated water and soil that is transported into or near residences. Humans living amongst oil and gas operations are often exposed to contaminants by not only ingesting contamination, but from breathing contaminants during household chores that mobilize contaminants from the water, soil and air, such as bathing, showering, gardening, or doing laundry, dishes or other activities.

The survey results below identify odors that community members associate with facilities in their community. They also reveal prevalent health conditions existing in the community. These health conditions may be related to exposure to contaminants through any one or all of the above mentioned pathways.

Finally, notable results from the survey are twofold.

- First 94% of participants report health impacts that are known to be associated with contaminants identified by EPA in August 2009 in the area's drinking water.
- Second, and perhaps most notable, is that 81% of participants report respiratory health impacts. This may indicate that in a community with established water contamination residents are experiencing significant exposure to this contamination through its mobilization into airways. It may also indicate that the source of contaminants being released into the air has not yet been fully identified.

**81%** of  
participants report  
respiratory health  
impacts.

### Recommendations based on this survey include:

1. The original sources of air and water contamination in the community must be identified by EPA and the State of Wyoming.
2. Additional air testing is required by the State of Wyoming and/or EPA. This testing should

address cumulative air quality in the Pavillion area, releases from industrial facilities and household level volatilizations suspected to be causing health impacts to residents.

3. Health symptom tracking systems for both contamination events through water and air pathways must be put in place by the State of Wyoming's health and environmental agencies.
4. The Agency for Toxic Substances and Disease Registry and State of Wyoming's health agency must establish a medical monitoring program in which individuals suffering from health impacts may receive blood and urine testing.

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## Introduction

A health survey instrument for current and former Pavillion, Wyoming residents was compiled on behalf of EARTHWORKS' Oil and Gas Accountability Project and Powder River Basin Resource Council. The health survey instrument was distributed to current and former Pavillion residents. The health survey forms were filled out during the month of March 2010 and the results were evaluated by Wilma Subra of Subra Company.

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## Health Survey Participants

A total of 16 individuals between the ages of 37 and 82 participated in the health survey. The individuals consisted of 14 current residents of Pavillion and two previous resident of Pavillion. The individuals participating in the survey consisted of seven females, six males, and three individuals who did not identify their sex or age.

### Participant Ages

- 16 Total Participants between the ages of 37 and 82
- 7 Females between the ages of 49 and 73
- 6 Males between the ages of 37 and 82
- 3 Individuals who did not provide sex or age

Age Range	Number of Females	Number of Males
37-40	0	1
41-50	2	0
51-60	1	1
61-70	3	2
71-80	1	1
81-82	0	1

### Years Lived in Pavillion, Wyoming

The 16 participants in the survey lived in Pavillion an average of 28 years and ranged from seven years to 56 years. One individual surveyed had lived in Pavillion for his entire life (56 years). Two individuals no longer live in Pavillion. They lived in Pavillion for 18 and 19 years and moved away nine and 11 years ago.

## General Health of Individuals Surveyed

Of the total of 16 individuals surveyed, 12 considered themselves healthy, 3 individuals considered themselves sick and one individual did not respond to the question.

General Health		
12 Individuals between the ages of 37	Healthy	75%
3 Individuals between the ages of 49	Sick	19%
1 individual	No Response	6%

## Frequency of Illness

One individual who reported their general health as healthy, reported the frequency of their illnesses as one to two days per month. Two individuals, reporting their general health as healthy, reported seldom being sick. One individual who reported their health as sick, reported the frequency of their illness as 7 days per week. One of the individuals, who reported their general health as sick, died.

## Access to Doctors and Health Care Providers

Of the 16 individuals responding to the survey, 13 individuals (81%) had access to doctors as well as access to other health care providers. Two individuals did not have access to doctors and one individual did not respond.

## Occupational Exposure

Nine of the 16 individuals surveyed (56%) reported occupational exposure. The occupational exposure occurred over an average period of 30 years and ranged from 18 to 46 years. Two of the individuals surveyed reported exposure to chemicals from family member work places transported into their homes.

The individuals reporting occupational exposures, reported exposures associated with cleaning materials, pesticides and herbicides, oils, diesel, oil field products, solvents, paints, and fly ash. The individuals reporting exposure to chemicals from family member work places transported into their homes reported being exposed to gasoline, oil and chemicals.

## Smoking History

Of the 16 individuals surveyed, nine individuals have never smoked, one individual is a current smoker, five individuals previously smoked and one individual did not respond to the question.

The previous smokers, smoked as average of 19 years and their smoking history ranged from 1 year to 40 years. The current smoker has smoked for 45 years. The smokers smoked up to one pack of cigarettes per day.

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## Survey Responses: Facility Odors and Health Impacts

### Odor Events

Twelve of the 16 individuals surveyed experienced odor events. Three individuals did not report experiencing odor events, one of the three is not able to taste or smell. One individual did not respond.

### Frequency of Odor Events and Number of Individuals Experiencing the Odor Events

Frequency of Odor Events	Individuals Experiencing Events
2 times per day	1
2-3 days per week	1
4 days per week	1
2-3 days per month	5
20 days per month	1

### Odors Experienced in the Pavillion Area

- Gas
- Rotten Eggs
- Fuel Oil
- Nail Polish Remover
- Nail Polish
- Airplane Model Glue
- Propane
- Sulfur

### Facilities in Pavillion Associated with Odor Events

- Compressor Stations
- Gas Wells
- Natural Gas Production Facilities
- Production Tanks
- Condensate Tanks
- Water Tanks
- Pneumatic Chemical Pumps
- Pavillion Waste Water Treatment Facility

### Duration of Health Impacts Associated with Odor Events

Health Impact	Duration of Health Impacts
Diminished Sense of Smell	Ongoing
Headaches	Persistent, a day or two
Sore Throat	30 minutes to several hours
Burning Eyes and Nose	5-30 minutes
Eye Pain and Dryness	½ day
Nausea	Fifteen minutes to several hours
Itchy Skin	Persistent
Dizziness	Persistent

### Distance from Surveyed Individuals to Facilities Associated with Odor Events

Distance	Number of Households
250 feet	2
600 feet	1
50 yards	2
600 yards	1
½ to 1 mile	5
1 mile	1
4 mile	2

### Health Conditions Reported in the Pavillion Health Survey

In addition to the requested information concerning odor events and related health impacts, the health survey requested information on specific medical symptoms and diseases from each individual completing the survey. A total of 128 medical symptoms and diseases were reported by the 16 individuals who completed the Pavillion Health Survey forms. Thirteen health conditions were the most prevalent conditions reported by the 16 individuals surveyed in the Pavillion Health Survey.

Most Prevalent Health Condition	# of Individuals Surveyed
Memory Loss	9
Feeling Weak & Tired	8
Throat Irritation	8
Sinus Problems	7
High Blood Pressure	7
Muscle Aches or Pains	7
Forgetfulness	6
Recall Problems	6
Breathing Difficulties	6
Eyes Burning	6
Joint Pain	6
Decrease in Vision	5
Sleep Disorder	5



In addition to these 13 most prevalent medical conditions, the survey identified 14 medical conditions reported by four individuals.

Other Medical Condition	# of Individuals Surveyed
Arthritis	4
Difficulty in Concentrating	4
Difficulty in Hearing	4
Extreme Droziness	4
Frequent Urination	4
Inability to Recall Numbers	4
Increased Fatigue	4
Loss of Sexual Drive	4
Nasal irritation	4
Persistent Indigestion	4
Ringing in Ears	4
Reduced Muscle Strength	4
Severe headaches	4
Tingling in Hands	4

Additional medical conditions occurring in a small number of individuals ranged from liver and thyroid problems, and loss of sense of smell to depression, frequent irritation, nausea, suicidal thoughts, and agitation.

### Respiratory Impacts

Thirteen of the 16 individuals surveyed (81%) reported having respiratory ailments.

Throat Irritation	8/16	50%
Sinus Problems	7/16	44%
Breathing Difficulties	6/16	38%
Nasal Irritation	4/16	25%
Wheezing	2/16	12%
Bronchitis	1/16	6%
<b>TOTAL</b>	<b>13/16</b>	<b>81%</b>

### Respiratory Impacts as it Relates to Smokers and Non-Smokers

Of the 13 individuals that had respiratory ailments, 7 never smoked, 4 were previous smokers, one was a current smoker, and one individual did not respond to the smoking request for information.

## Individuals with Most Health Conditions

The 16 individuals surveyed had an average of 20.6 health conditions reported in the Health Surveys (range 4 to 48). The individuals with the largest number of reported health symptoms:

Individual age & sex	# of Health Conditions
37 year old male	48
Individual did not report age or sex	42
49 year old female	40
82 year old male	29

The 37-year-old male with the most medical conditions (48) is a farm manager who is a nonsmoker. He reported his general health as healthy and reported being sick 1-2 days per month. The individual with the second highest medical conditions (42) did not provide information on age, sex, occupation, health situation and smoking history. The 49-year-old female with the third highest medical conditions (40) is an Administrative Assistant, previous smoker (1 year), and reported her general health as sick. She reported being sick 7 days per week. The 82-year-old male with the fourth largest number of medical conditions (29) is a rancher, non-smoker and reported his general health as healthy and seldom ill.

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## Comparison of Chemicals Detected in Drinking Water with the Health Impacts Experienced by Pavillion Survey Participants

Private water wells in the Pavillion area were sampled by the Environmental Protection Agency in March and May 2009. The results of the analysis of the water samples demonstrated the presence of a number of chemicals in the well waters.

- Petroleum Hydrocarbons
- Methane
- Chlorides
- Fluoride
- Nitrate
- Nitrite
- Sulfate
- Arsenic
- 2-Butoxyethanol Phosphate
- 2,4-bis (1-phenyl)-phenol
- Caprolactam
- Bisphenol A
- Terpeneol
- 5-Hydroxymethyl dihydrofuran
- Limonene
- Dimethyl Phthalate
- Bis(2-Ethylhexyl)Phthalate

### Human Health Effects Associated with Chemicals Detected in the Pavillion Drinking Water

The known health impacts associated in Material Data Safety Sheets and by state and federal agencies with the chemicals detected in the well water samples correspond to health impacts experienced by community members surveyed in Pavillion. Fifteen individuals, or 94% of participants report health impacts that are known to be associated with the contaminants identified by EPA in the area's drinking water.

# of People Reporting from Pavillion Community	Reported Health Impact	Corresponding Chemicals Found in Pavillion Drinking Water
8	Weakness and Fatigue	Arsenic
8	Throat Irritation	Arsenic, 2-Butoxyethanol Phosphate, Bisphenol A, bis(2-ethylhexyl) phthalate, Caprolactan, Dimethyl phthalate
7	Sinus Problems	2-Butoxyethanol Phosphate
7	Muscle Aches and Pains	Arsenic
6	Breathing Difficulties	Dimethyl phthalate
6	Eye Irritation, Vision Impairment	Arsenic, 2-Butoxyethanol Phosphate, Bisphenol A, bis(2-ethylhexyl) phthalate, Caprolactan, Dimethyl phthalate
4	Nasal Irritation	Arsenic, 2-Butoxyethanol Phosphate, Bisphenol A, bis(2-ethylhexyl) phthalate, Caprolactan, Dimethyl phthalate
4	Severe Headaches	Arsenic, Bisphenol A
3	Nausea	Arsenic, Bisphenol A,
2	Wheezing	Arsenic, Bisphenol A, Dimethyl phthalate
1	Bronchitis	2-Butoxyethanol Phosphate

The chemicals present in the water well samples are also associated in Material Data Safety Sheets and by our state and federal agencies with these other health impacts:

Other Health Impacts	Corresponding Chemicals Found in Pavillion Drinking Water
Liver Damage	Arsenic, 2-Butoxyethanol Phosphate, Bisphenol A, bis(2-ethylhexyl) phthalate
Nervous System Impacts	Arsenic, bis(2-ethylhexyl) phthalate
Decreases Fertility in Males and Females	bis(2-ethylhexyl) phthalate, Caprolactan, Dimethyl phthalate
Hemolysis (break down of red blood cells)	2-Butoxyethanol Phosphate
May be a Carcinogen	Arsenic, 2-Butoxyethanol Phosphate, bis(2-ethylhexyl) phthalate
May be a Teratogen	bis(2-ethylhexyl) phthalate, Dimethyl phthalate

The Endocrine Disruption Exchange, Inc. (TDEX), in Paonia, Colorado has also identified the health impacts of 2-Butoxyethanol Phosphate to include: immunotoxicity and severe eye damage.<sup>1</sup> TDEX's research underscores the lack of long-term studies or studies using standard testing protocols in order to detect prenatal damage, birth defects and organ damage, cancer, mutations, convulsions, and skin and eye irritation as health effects of 2-BE.

<sup>1</sup> <http://www.earthworkSACTION.org/pubs-others/coalbedmethane2-becomments.pdf>

## Reported Health Impacts Compared to Known Health Effects of Drilling, Production and Processing Chemicals

Fifteen of 16 individuals, or 94% of those surveyed, reported health impacts associated with chemicals associated with oil and gas drilling, production and processing.

Reported Health Impact	Corresponding Chemicals Known to be Released from Drilling, Production and Processing Activities
Memory Loss	1,2-Dichloroethane
Weakness and Fatigue	Carbonyl Sulfide, Carbon Disulfide, Dimethyl Disulfide, Naphthalene
Throat Irritation	Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Sinus Problems	Benzene, Xylenes, Naphthalene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Muscle Aches and Pains	Carbonyl Sulfide
Forgetfulness	1,2-Dichloroethane
Recall Problems	Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Breathing Difficulties	Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Benzene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Eye Irritation	Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbon Disulfide, Carbonyl Sulfide, Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Vision Impairment	Carbonyl Sulfide, Naphthalene
Nasal Irritation	Benzene, Xylenes, Naphthalene, Diethyl Benzene, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Severe Headaches	Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbon Disulfide, Methyl Pyridine, Dimethyl Pyridine
Difficulty in Concentrating	Naphthalene
Frequent Irritation	Carbon Disulfide
Skin Irritation	Benzene, Xylenes, Naphthalene, Trimethyl Benzene, Methyl-Methylethyl Benzene, Tetramethyl Benzene, Diethyl Benzene, Carbon Disulfide, Carbonyl Sulfide, Methyl Ethyl Disulfide, Ethyl-Methylethyl Disulfide
Frequent Nausea	Benzene, Xylenes, Naphthalene, Diethyl Benzene, Carbon Disulfide, Carbonyl Sulfide, Dimethyl Disulfide, Methyl Pyridine, Dimethyl Pyridine
Bronchitis	Trimethyl Benzene
Wheezing	1,3-Butadiene, n-Butyl Alcohol
Dizziness	Benzene, 1,3-Butadiene, n-Butyl Alcohol, Chlorobenzene, 1,2-Dichloroethylene, Ethyl Benzene, Ethylene, Ethylene Oxide, Propylene, 1,1,1,2-Tetrachloroethane, 1,1,2,2-Tetrachloroethane, Toluene, Trichloroethylene, Xylene
Nausea	n-Butyl Alcohol, 1,2-Dichloroethylene, Ethylene Oxide, n-Hexane, Naphthalene, 1,1,1,2- Tetrachloroethane, Toluene, 1,1,2-Trichloroethane, Trichloroethylene, Xylene

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## Conclusion and Recommendations

The survey results identify odors that participants associate with facilities in their community, compare community health impacts with known health impacts of chemicals identified by EPA in drinking water, and reveal prevalent health conditions existing in the community. A notable result from the survey is that 13 individuals or 81% percent of participants report respiratory health impacts. This may indicate that, in a community with established water contamination, residents are experiencing significant exposure to this contamination through its mobilization into airways, and/or the source of contaminants being released into the air has not yet been fully identified. Additionally, 15 individuals or 94% of participants report health impacts that are known to be associated with the contaminants identified by EPA in the area's drinking water. Finally, 15 individuals or 94% of participants report health impacts that correspond to chemicals known to be released from drilling, production and processing activities. It is critical that the sources of both water and air contamination are identified in the Pavillion community and that human health impacts are assessed.

### **1. The original sources of air and water contamination must be identified by EPA and the State of Wyoming**

In order to fully characterize the chemical exposure of community members in Pavillion, additional water well testing needs to be performed, pathways of contaminant migration into the drinking water resources need to be identified and sources of chemical contamination defined, and testing of chemicals in the air need to be performed.

Currently the Environmental Protection Agency has performed additional water well testing in the Pavillion area. Based on the results of this second round of water well testing, which are scheduled to be released at the end of August 2010, specific recommendations will be developed.

The contaminants in the drinking water resources in the Pavillion area need to be identified as to sources of the contaminants and pathways of migration into the drinking water resources. The sources of drinking water being utilized by individual homes and businesses, as well as changes in sources of drinking water, need to be documented.

### **2. Additional air testing is required by the State of Wyoming and/or EPA. This testing should address cumulative air quality in the Pavillion area, releases from industrial facilities, and household level volatilizations.**

The chemicals in the air being released by the drilling, production and processing of natural gas in the Pavillion area needs to be characterized. The state and/or federal environmental agency should establish a continuous air monitoring network, which measures Speciated Volatile Organic Chemicals, Hazardous Air Pollutants, Methane, Sulfur Compounds and meteorological conditions. Additionally, there is a need for community members to have available canisters to collect air samples for VOCs during odor events.

### **3. Health symptom tracking systems for both contamination events through water and air pathways must be put in place by the State of Wyoming's health and environmental agencies.**

To track the health impacts being experienced by community members in Pavillion, a health symptom tracking mechanism should be established in conjunction with the health and environmental regulatory agencies. The source of drinking water, as well as changes in drinking water sources, should be documented in conjunction with health symptoms. In addition Odor and Symptom Logs should be provided to community members with a mechanism to record odor events and associated health impacts. The Odor and Symptom Log should contain the reporting of date, time, location, description of odors, wind speed and direction, health impacts associated with the odor event, possible sources of the odors, duration of the odor event and duration of health impacts.

In association with the health tracking mechanism, the environmental agency should initiate a system of increased tracking of operational upsets, spills, releases and permit violations associated with the gas drilling, production and processing units in the Pavillion area. The information obtained from the Odor and Symptom Logs and the data from the operational tracking system should be evaluated to determine the sources of odor events that result in health impacts and the operational conditions associated with these events. The environmental agency should work with the operators of the gas facilities to address the operational conditions causing spills, leaks, odors and health impacts.

**4. The Agency for Toxic Substances and Disease Registry and the State of Wyoming's health agency must establish a medical monitoring program in which individuals suffering from health impacts may receive blood and urine testing.**

The health agencies should establish a medical monitoring program to test the blood and urine of health impacted individuals in Pavillion for the chemicals known to be present in the environment in which the community members are living.