SOUTHWEST PENNSYLVANIA ENVIRONMENTAL HEALTH PROJECT

Physical, Mental and Environmental Impacts of Unconventional Oil and Gas Development (UOGD)

Spring Tour 2016

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Topics of Today's Presentation

- Introduction
- Facts about Industry
- Stages of Development
- Information on Health Effects
- Q&A
- Information on Mental Health Impacts (Stress)
- Water Issues
- Moving Forward at EHP
- Q&A

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The SWPA Environmental Health Project (EHP) addresses public health concerns:

Our mission is to respond to individuals' and communities' need for access to accurate, timely and trusted public health information and health services associated with natural gas extraction.

Environmental Health Project

We are currently addressing the health effects of unconventional oil and gas development (UOGD) in

- Southwest Pennsylvania,
- New York,
- Ohio, and
- West Virginia.

Communities as far away as CA and MA have express interest in our health and emissions monitoring work.

Environmental Health Project

EHP is aware:

- of the uncertainty surrounding exposures and health effects and the lack of public awareness that is associated with living near UOGD.

- that the perception in the community of environmental dangers, along with plausible sources of hazardous substances are reasons enough to **provide a public health response.**

Before tonight's presentation about health impacts, a few words…

About how UOGD growth and production may be changing in our area in the next few years; and

Why this is unlikely to make a difference on how your health will be impacted.

You May Have Seen UOGD Headlines Like These: 2015-2016

- Oil and gas drillers facing bankruptcy as prices crash (Pennlive.com, 1/14/16)

- Fracking decline slows business in Marcellus Shale towns (The Morning Call, 12/13/15)

- Shale Production Up, Drilling Is Down And Investment Still Strong (WESA 90.5, Pittsburgh public radio, 8/11/15)

- Is the Marcellus Shale Boom Over? (WNEP News [NE PA], 3/26/15)

- Rig Counts for World, US & Marcellus/Utica Crash in February (Marcellus Drilling News, 3/2016)

What's Going On?

"…too much of a good thing is a bad thing."

(from the perspective of the unconventional oil and gas development industry)

- UOGD companies in the Marcellus Shale region broke production records here year after year

- Marcellus drillers were so efficient, they created an oversupply of gas

- There is such a stockpile of gas, as consumers we are seeing the lowest natural gas prices since the 1990s

(source: www.pennlive.com/news/2016/01/oil_and_gas_drillers_facing_ba.html)

What You'll Hear from the Industry

- Dozens of small companies have filed for bankruptcy, and larger ones could end up doing the same;

- The rig count is lower than in 2011 and falling (19 currently in the state); and

- 17,000 jobs lost in the industry nationwide last year (In SWPA, Range Resources cut 55 jobs already this year).

(source: www.pennlive.com/news/2016/01/oil_and_gas_drillers_facing_ba.html and https://stateimpact.npr.org/pennsylvania/2016/02/17/drilling-downturn-hits-marcellus-shale-industry-hard/)

But other facts to consider:

- Drillers are getting more efficient, pumping 3-4 times more gas from the average PA shale well in 2014 than a few years earlier. (i.e., they know how to drill at a low cost)

- The industry is cyclical. Almost 25% of companies failed after the oil bust of 1986.

- Companies will consolidate – uniting to survive.

- As pipelines are built out, Marcellus gas will get exported to other parts of the country and overseas ultimately.

(source: www.pennlive.com/news/2016/01/oil_and_gas_drillers_facing_ba.html)

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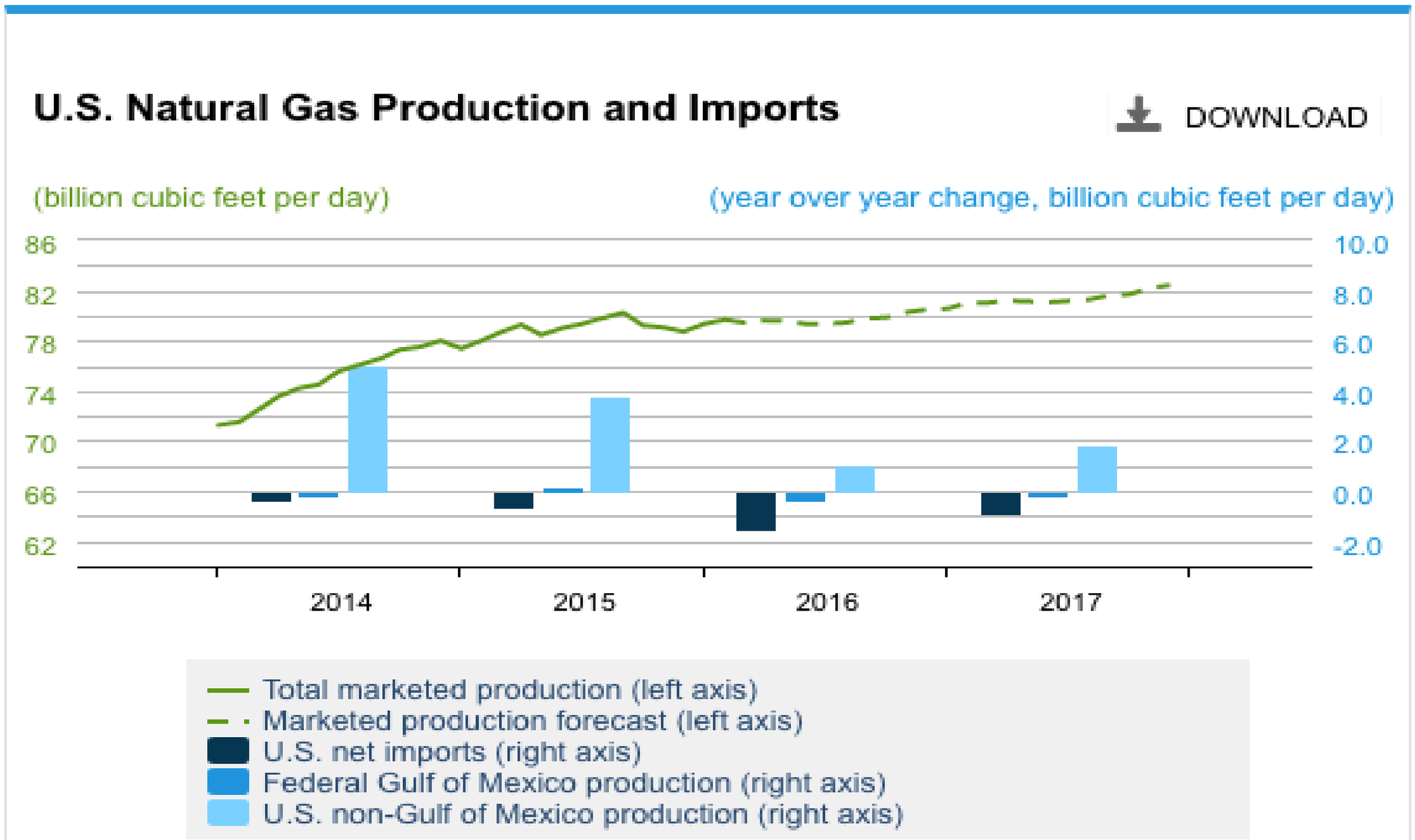
Federal Government Forecasters Predict Output Will Grow (maybe slowly)

(https://www.eia.gov/forecasts/steo/report/natgas.cfm)



What Kind of Changes Might Bring About This Growth?

- Build out of pipelines to carry gas to other US markets
- Increase in exports to other countries (pending permits for liquefied natural gas exports, which will take time)
- Colder weather that will increase demand for gas for heat
- Growth in output in other industries that use gas in their production processes

(source: www.pennlive.com/news/2016/01/oil_and_gas_drillers_facing_ba.html)

The Bottom Line….

- Until major alternatives -- renewable energy (wind and solar) really take hold -- natural gas will be in demand;

- It will be pumped from the ground in PA (and elsewhere); and

- The health impacts you hear about tonight are likely to persist!

On- Site Activities and Health

- Truck transport of water, fluids and sand
- Casing, drilling and hydraulic fracturing
- Flaring
- Condensate tank
- Flowback impoundment
- Christmas tree/Wellhead

Truck Transport of Water, Fluids and Sand

- Each well on site requires large quantities of water, along with chemicals and sand to keep the fractured shale rocks open to release the trapped gas

- One well on average requires 2,300 to 4,000 truck loads

Associated chemical emissions: VOCs, diesel fumes, particulate matter (PM)

Photo by Bob Donnan

Casing, Drilling and Hydraulic Fracturing

- The initial well site is chosen and shallow test wells drilled varying depths
- Casing (cement/steel) for permanent well put in place
- Pipes installed for barrier between flow of gas/fracking fluids and groundwater
- Drilling rig seen during hydraulic fracturing

Associated chemical emissions: VOCs, silica dust, diesel emissions, particulate matter (PM)

Photo by Bob Donnan

Flaring

- Used to burn off gas
- Released by valve when there is too much pressure in the pipeline

Associated chemical emissions: VOCs, methane, ethane

Photo by Bob Donnan

Condensate Tanks

- Gas containing a mixture of natural gas and other components such as materials that can be used to make plastics and other industrial substances

- Methane is separated out using a condensation process

Associated chemical emissions:
VOCs, methane, ethane

Photo by Bob Donnan

Flowback Impoundment

- Large ponds lined with plastic
- Used to store flowback fluids, drilling muds, and other chemicals and water used in hydraulic fracturing

Associated chemical emissions: VOCs, hydrogen sulfide

Photo by Bob Donnan

Christmas Tree/Wellhead

- Represents completion of drilling
- Provides numerous functions such as points for chemical injection, pressure relief, and well monitoring points for pressure, temperature, corrosion, erosion, sand detection and flow rate

Associated chemical emissions: VOCs

Photo by Bob Donnan

Off-Site Activities and Health

- Gas pipeline
- Compressor station
- Processing plant
- Metering station
- Pig launcher

Gas Pipelines

- After gas wells are drilled and natural gas begins to flow, gas pipelines move gas and gas liquids to compressor stations and end users by way of smaller pipelines

- Toxins accumulate on inside lining of pipelines and must be cleared by way of pig launchers (explained in up coming slides)

Photo by Bob Donnan

Compressor Station

- Compressor stations help with the transportation of natural gas from one location to another

- Gas pipelines that carry the natural gas must be constantly pressurized

- Gas along with VOCs may be vented at these locations when pressure needs to be released and/or pipes cleaned.

Associated chemical emissions: VOCs, nitrogen oxides, particulate matter (PM)

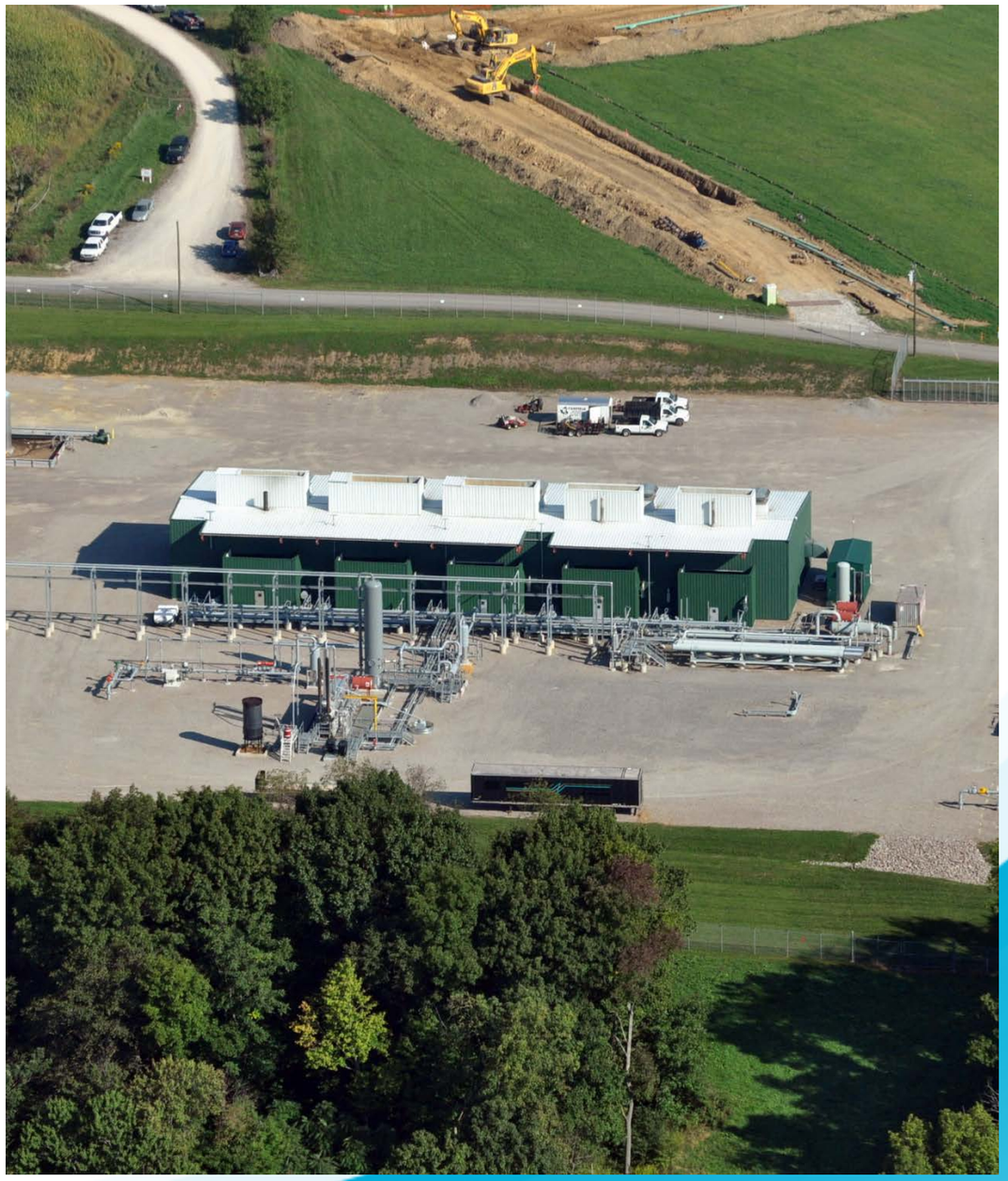


Photo by Bob Donnan

Processing Plants

- Processing stations purify natural gas from gas fields and wellheads by removing contaminants.

Associated chemical emissions:
VOCs, particulate matter (PM), diesel

Photo by Bob Donnan

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Metering Station

- Metering stations continuously analyze quality and quantity of gas in pipeline

- Located at frequent intervals along pipelines

- Gases may be vented sporadically

Associated chemical emissions:
VOCs, gas, same pollutants as compressor stations

Photo by Bob Donnan

Pig Launcher

- Devices called “pigs” are used to perform cleaning and maintenance on a pipeline

- A “pig” is inserted into a section of the pipe under pressure to “clean” the interior and push down the pipe

Associated chemical emissions:

Radioactive materials such as radon, PCBs (polychlorinated Biphenyl) among other contaminants in the pipeline

Photo by Bob Donnan

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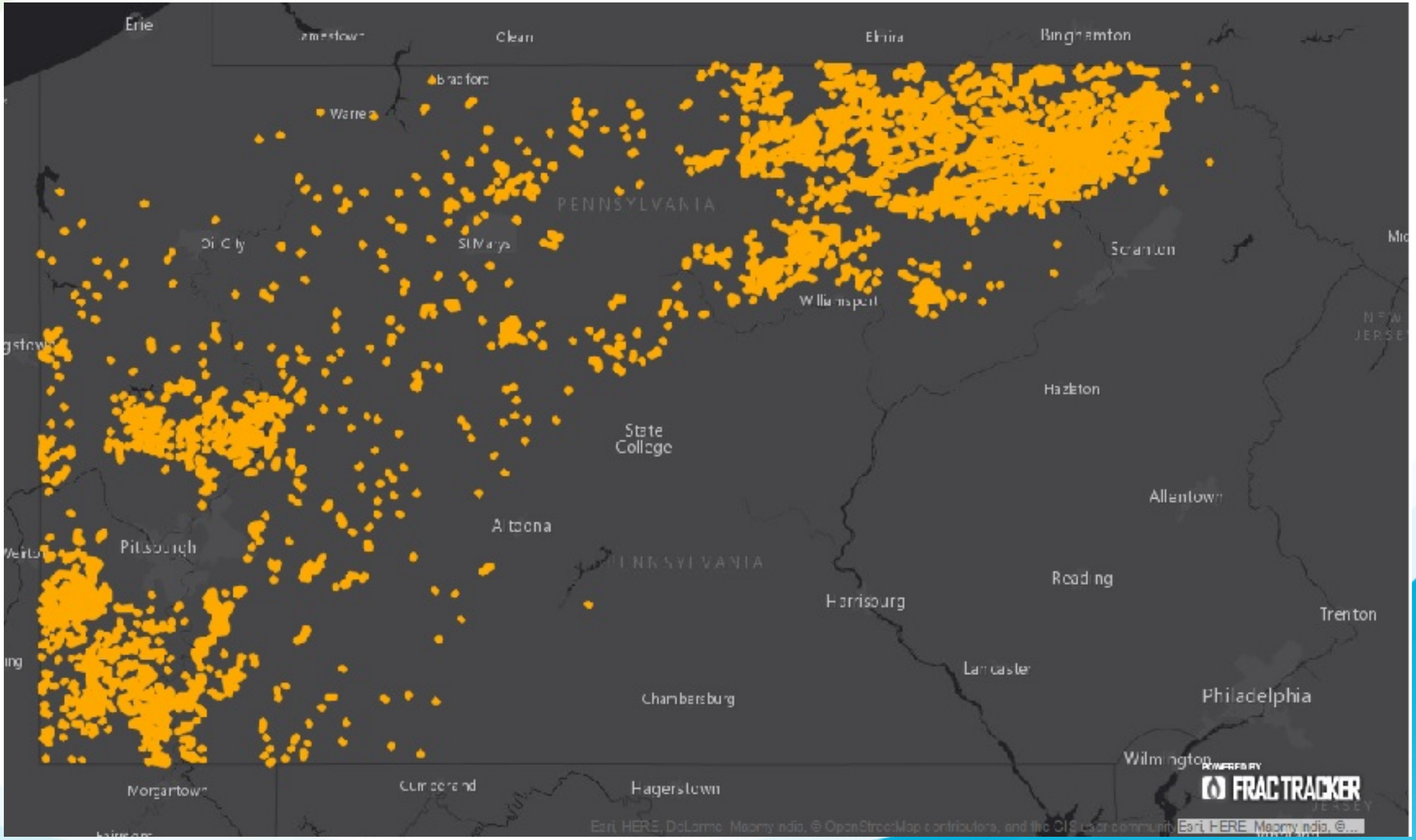
Density of Well Pads in Pennsylvania



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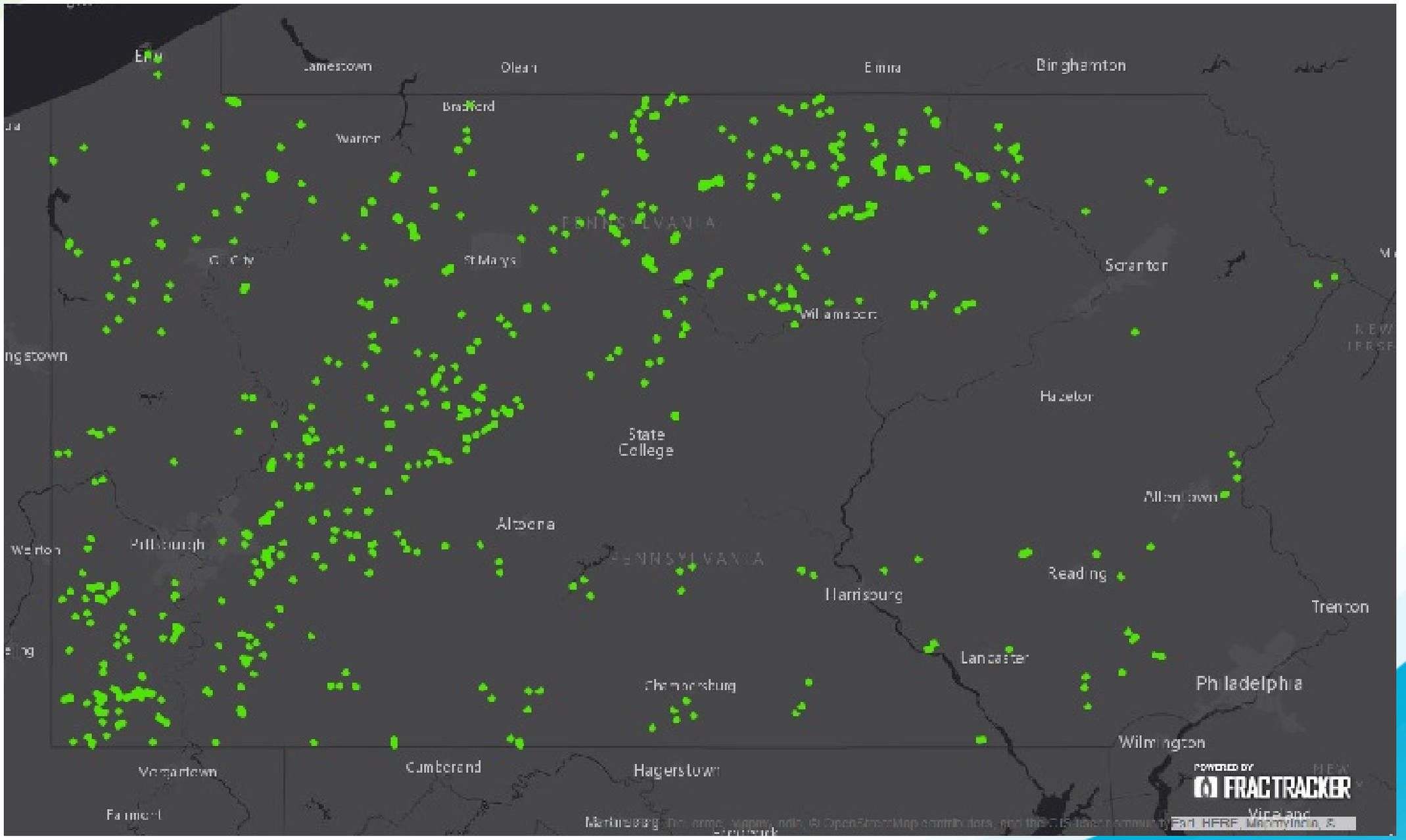
Density of Compressor Stations in Pennsylvania



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Health

Topics for Discussion

- Defining “public health” and EHP’s role in regard to public health
- The frequency and types of symptoms residents of communities experiencing UOGD report to EHP
- The emerging patterns of relationships between exposure peaks and number of health symptoms residents of communities report they are experiencing
- The emerging patterns of difference in the symptoms profile between residents living near UOGD who use well water and residents living near UOGD who use public water

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Our mission is to respond to individuals' and communities' need for access to accurate, timely and trusted ***public health*** information and health services associated with natural gas extraction.

What is Public Health?

“Public Health”
World Health Organization (WHO) Definition

“Public health refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole…”

http://www.who.int/trade/glossary/story076/en/

“Public Health”
Centers for Disease Control (CDC) Definition

- “Overall, public health is concerned with protecting the health of entire populations

- These populations can be as small as a local neighborhood…

- Public health professionals try to prevent problems from happening or recurring through educational programs, recommending policies, administering services such as collecting information about health and the environment…

- *In contrast to primary care providers like doctors and nurses, who focus primarily on treating individuals after they become sick or injured…”*

http://www.cdcfoundation.org/content/what-public-health

EHP and Health

- We include public health experts, toxicologists, physicians, nurse practitioners, social workers, environmental health educators and professionals from other disciplines;

- working together with communities and individuals who are experiencing the proliferation of UOGD; and

- to try to prevent problems from happening or recurring through educational programs and services like health assessments and air and water monitoring in homes.

What Does EHP Do with this Information?

We look for:

- patterns and symptoms,
- track symptoms over time, and
- compare to findings in other regions.

What Does EHP Do with this Information?

- This is the same public health process as when there is a suspected contamination of food – foodborne outbreak tracking and reporting done by the Centers for Disease Control.

- We offer suggestions on what the client can do to cut off pathways of exposures and generate hypotheses (a tentative explanation for an observation) for researchers to conduct epideminiological studies to further test if this tentative explanation is true or not.

What Do We Already Know?

- Emissions related to UOGD & both acute and chronic effects on health from these emissions have been identified by the National Institute for Occupational Safety and Health (refer to the Handout)

- The types of chemicals whether naturally occurring or man-made can cause health problems to those exposed

- Potential health risks associated with chemical emissions include VOCs (Volatile Organic Compounds): Benzene, Toluene, Ethyl Benzene, Xylene, formaldehyde; carbon dioxide; carbon monoxide; methane; nitrogen oxide; hydrogen sulfide; and particulate matter

- These emissions can occur **on-site** & ***off -site***

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Potential Health Effects Due to Inhalation of Low-level Environmental Air Contaminants Generate by Unconventional Natural Gas Development (UNGD) Related Activities

Please refer to this handout distributed at the start of this presentation

What EHP Knows About Health

- Activities associated with UOGD predictably result in air emissions and sometimes result in water contamination.

- Even brief exposures can precipitate symptoms.

- The potential health effects of many of the chemicals emitted from UOGD are known from studies in other settings where individuals experienced environmental exposures.

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Health Issues In the Literature

Category	Researcher/author
Gastrointestinal *	Ferrar et al. (2013) Earthworks (2012) Bamberger & Oswald (2012)
High Blood pressure *	Subra (2010)
Muscle/joint pain *	Earthworks (2012) Subra (2010) Subra (2009)
Neurological *	Bamberger & Oswald (2012) Subra (2010) Subra (2009)
Respiratory *	Rabinowitz et al (2015) Earthworks (2012) Bamberger & Oswald (2012) Subra (2009)

Category	Researcher/author
Behavioral/mood/ stress *	Ferrar et al. (2013) Perry (2013) Resick (2013) Earthworks (2012) Subra (2009)
Birth Outcomes	Stacey et al (2015) McKenzie et al (2014) Hill (2012)
Cancer risk	McKenzie (2012)
Dermal *	Rabinowitz et al (2015) Earthworks (2012) Subra (2009)
Ear, nose, mouth, throat *	Earthworks (2012) Subra (2010) Subra (2009)
Eye *	Earthworks (2012) Bamberger & Oswald (2012) Subra (2010) Subra (2009)

EHP has observed these generalized symptoms in our categorization of health symptoms

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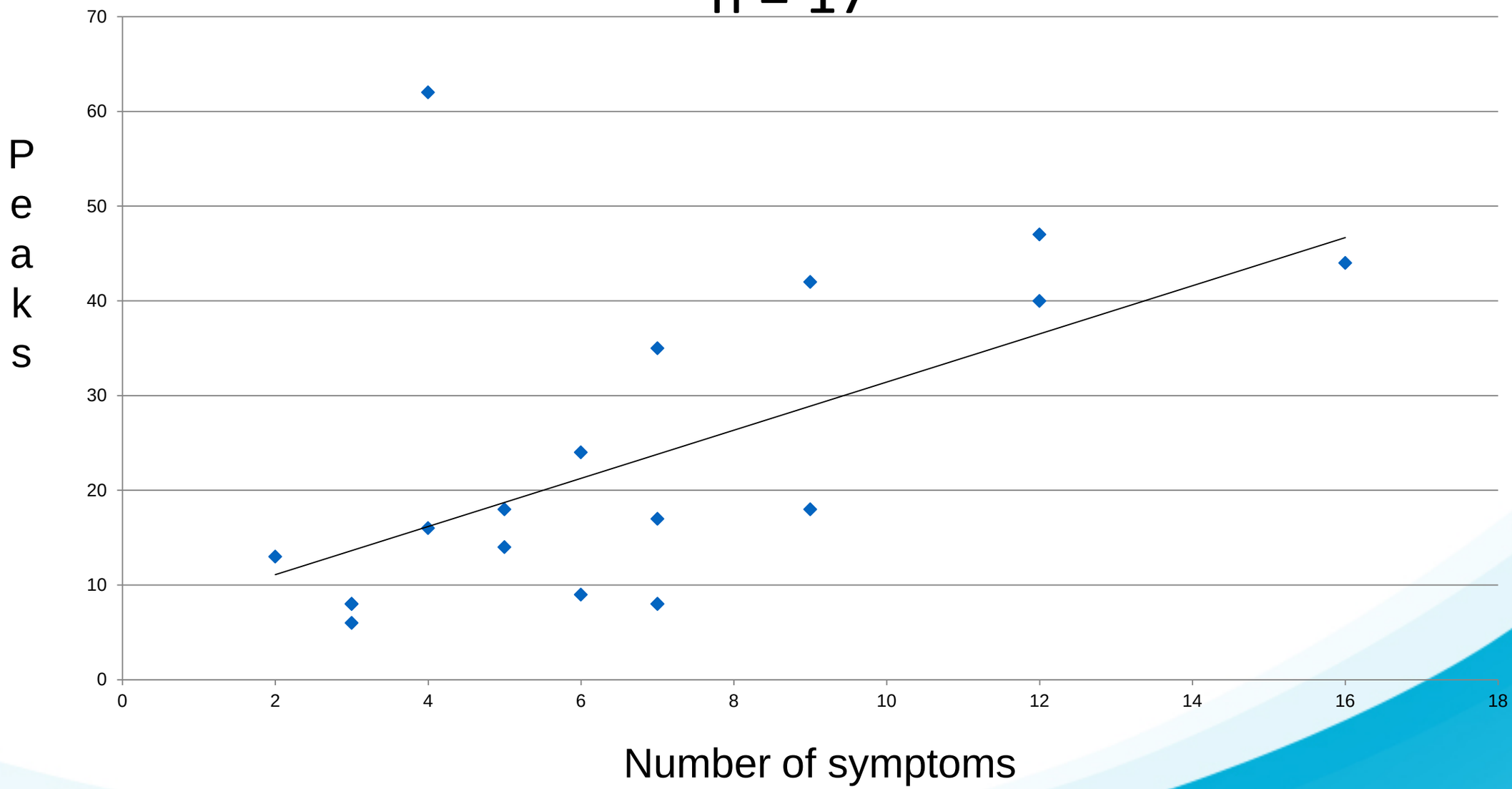
Number of PM 2.5 Peaks & Number of Symptoms



EHP Health Symptoms Analysis

Residents' symptoms time-related to the onset of UOGD activities within 1 kilometer (0.6 miles) & are not potentially explained by other exposures or medical conditions.

n=88 residents in communities experiencing UOGD who came to EHP with health symptoms
(see next slide)

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FREQUENTLY REPORTED SYMPTOM
<1 KM (0.6 miles) FROM SITE (88 residents)

CATEGORY OF SYSTEMS AFFECTED	SYMPTOMS REPORTED n=88 residents who met the criteria of living < 0.6 miles from a site
Nose and throat	Throat irritation (33), sinus (25), nose bleed (10)
Neurologic	Headache (34), dizziness (12), memory (11)
Respiratory	Cough (31), shortness of breath (29), wheeze (22)
Psychological	Sleep loss (32), stress/anxiety (28), irritable/moody (16)
Gastro intestinal	Nausea (24), abdominal pain (18)
Eye response	Itching (18), pain or dry (17)
Constitutional	Fatigue (26), joint aches (17)
Dermatologic	Rash (18), lesion/blisters (9)
Cardiac	Palpitations (7), chest pain (6)

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FREQUENTLY REPORTED SYMPTOMS OF THESE 88 RESIDENTS
(this shows 20% or more of these 88 residents)

- Headache 43%
- Throat irritation 38%
- Sleep loss 36%
- Cough 35%
- Short of breath 33%
- Stress/anxiety 32%
- Fatigue 30%
- Sinus 30%
- Nausea 27%
- Wheezing 25%
- Rash 20%
- Eye itching 20%
- Abdominal pain 20%

Patterns Observed

- The occurrence of symptoms in more than one body system suggests that exposures to multiple compounds may be happening.

- Different types of contaminants with different effects on the body have been identified at the same time near well sites and compressor stations.

- The patterns in symptoms we see are consistent with the patterns of chemicals known to be emitted.

Respiratory Symptoms Linked with Other Symptoms

(cough, shortness of breath, wheezing) (n=49 out of the 88)

CO-OCCURRING SYMPTOM FOUND IN 49 of the 88	NUMBER OF RESIDENTS OUT OF THE 49 who experienced respiratory symptoms plus this symptom	% OF RESIDENTS OUT OF THE 49 who experienced respiratory symptoms plus this symptom
Headache	26	53%
Sleep loss	21	43%
Throat irritation	19	39%
Stress	17	35%
Fatigue	17	35%
Nausea	15	31%
Sinus	14	29%

Nose & Throat Symptoms Linked with Other Symptoms: throat irritation & sinus (n=55 out of the 88)

CO-OCCURRING SYMPTOM	NUMBER OF RESIDENTS out of the 55 who reported nose & throat symptoms also reported these symptoms	% OF the 55 RESIDENTS
Headache	31	56%
Cough	23	42%
Shortness of breath	21	38%
Nausea	21	38%
Sleep loss	21	38%
Fatigue	19	34%
Rash	16	29%
Wheezing	15	27%

Well Pads and Compressor Stations

- Residents in this analysis generally lived within one kilometer (0.6 miles) of a compressor station or at least one well pad.

- Some lived within a mile of *both.*

- A small number lived within a kilometer (0.6 miles) of another kind of UOGD site like an impoundment pond or landfill used by the shale gas industry.

- We were interested in seeing whether it made a difference to live close to both a compressor station *and* a well pad, as compared to only well pads.

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Gas Well – Compressor Station Interaction

36 were within 1k (0.6 miles) of wells only
30 were within 1k (0.6 miles) of both wells & a compressor station
(out of the 88 residents)

	Wells	Wells & compressor		Wells	Wells & compressor
Sleep loss	42%	33%	Nausea	25%	27%
Stress	35%	37%			
Cough	39%	43%	Palpitations	22%	17%
Wheeze	18%	27%			
Headache	36%	43%	Itching	14%	10%
Throat irritation	36%	40%	Rash	8%	17%
Fatigue	33%	17%			

Does the Type of Water You Drink Effect Your Health?

- Some residents in this analysis live in homes with well or spring water (we refer to them here as *ground water*).

- Other residents had publically provided water or city water. We know that UOGD poses risks to ground water and we were interested to see whether the residents who came to us differed depending on whether they had ground water exposures or not.

- Water exposures can happen when you drink, cook, clean, or bathe with water that has become contaminated.

Symptoms reported in households with well water (46) and with public water (20)

	Well water- % of the 46 people	Public water- % of the 20 people
Cough	46%	25%
Headache	43%	42%
Throat irritation	43%	29%
Sleep loss	33%	46%
Nausea	33%	8%
Shortness of breath	30%	38%
Stress/anxiety	30%	33%
Fatigue	30%	21%
Sinus	30%	29%
Wheezing	28%	8%
Abdominal pain	24%	13%
Rash	24%	8%

Vulnerable Populations at Risk

All this health information is especially important in these three groups:

- Persons with Pre-existing Chronic Diseases/Elderly
- Pregnant women
- Children

Summary

- EHP provides a public health service to individuals and communities to meet health concerns related to UOGD.

- The value to you is knowledge about sources of environmental contaminants related to UOGD that could affect your health and the health of your family now and in the future.

- With knowledge you are better able to make an informed decision about how to stay healthy.

- This is part of EHP public health outreach to individuals and communities experiencing UOGD so you are aware of your health and take proactive steps to avoid exposures.

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Mental Health Impacts

Topics for Discussion

- Overview and assessment of the problem
- Effects of stress on our bodies
- Current approaches to stress at EHP

UOGD-Related Potential Health Concerns

- Both chemical and non-chemical exposures pose health risks to those living near gas production.

- This rapid change introduced into rural communities carries risk of social disruption and mental health consequences.

Credit Bob Donnan

Assessment of the Problem

The environment in which we live can contribute to our stress. Clients who live or work in a community with (UOGD) may experience environmental stressors including:

- noise, light, and vibration that accompanies drilling;
- air or water quality changes;
- increased emissions, noise, dust and travel from truck traffic; and
- uncertainty over their health and their families' health.

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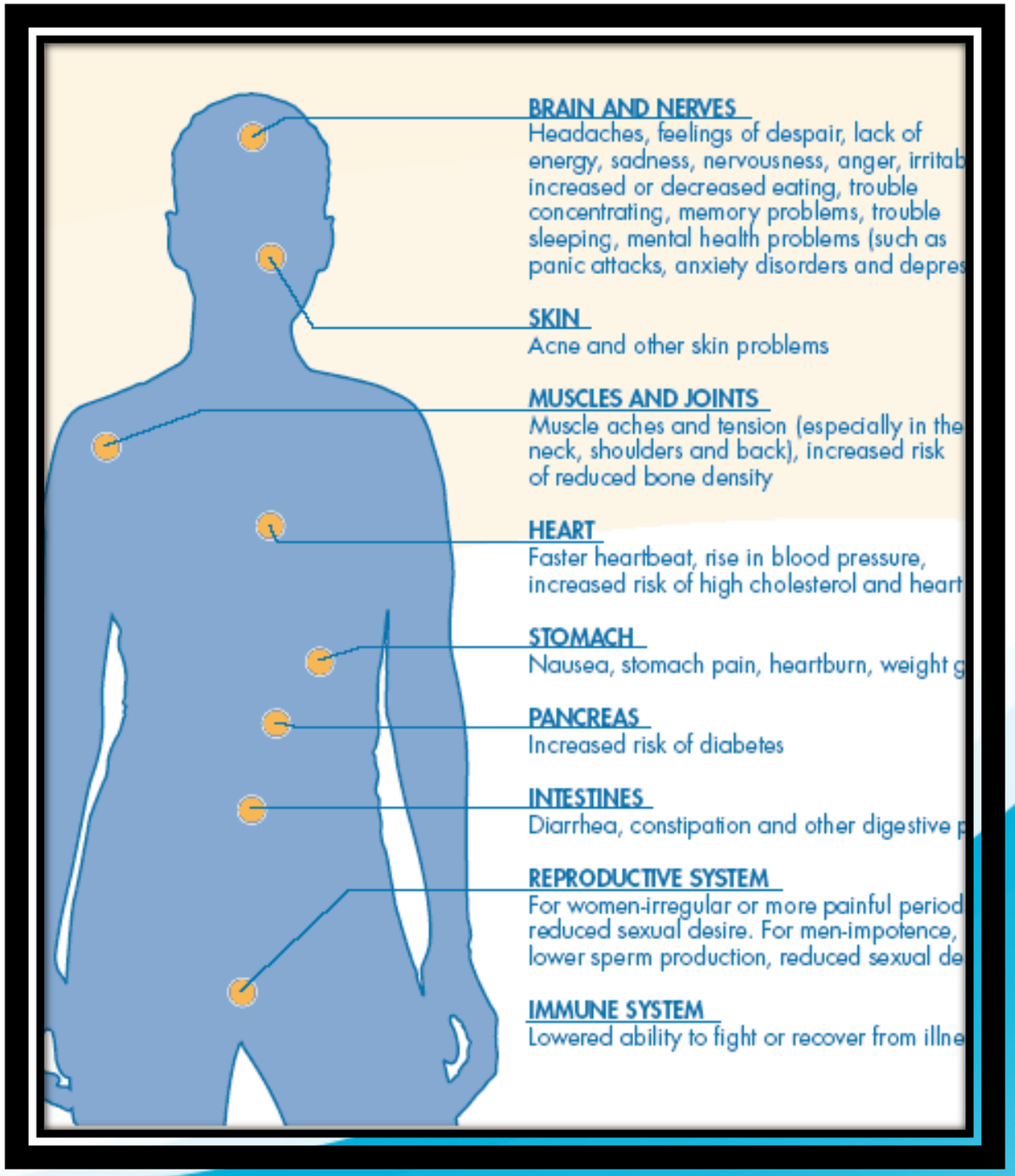
Stress on the Body

- Like all environmental stressors, these stressors surround us.
- Environmental stressors combined with your own personal stressors, may increase your stress to unhealthy levels.
- Chronic or long-term stress can weaken the immune system and lead to serious health problems.



Vulnerable Populations at Risk

All this health information is especially important for these three groups:

- Pregnant women
- Children
- Persons with Pre-existing Chronic Diseases/Elderly

Persons with Pre-Existing Chronic Diseases/Elderly

Hospitalizations: ***Increased*** rates, especially for ***cardiology*** and ***neurology*** cases (Jemielita 2015)

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Current Approaches to Stress and Mental Health Impacts

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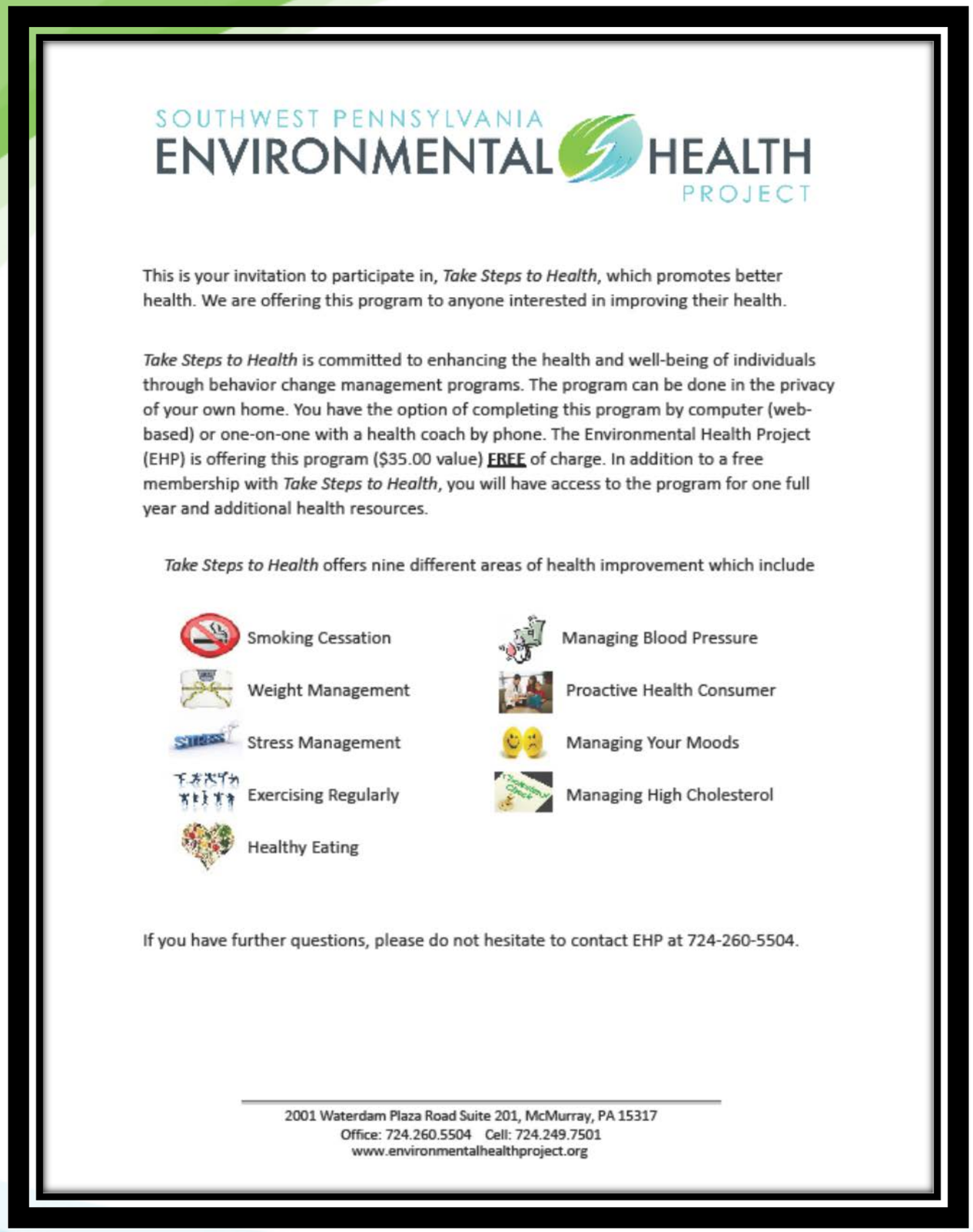

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This is your invitation to participate in, *Take Steps to Health*, which promotes better health. We are offering this program to anyone interested in improving their health.

Take Steps to Health is committed to enhancing the health and well-being of individuals through behavior change management programs. The program can be done in the privacy of your own home. You have the option of completing this program by computer (web-based) or one-on-one with a health coach by phone. The Environmental Health Project (EHP) is offering this program ($35.00 value) **FREE** of charge. In addition to a free membership with *Take Steps to Health*, you will have access to the program for one full year and additional health resources.

Take Steps to Health offers nine different areas of health improvement which include

- Smoking Cessation
- Weight Management
- Stress Management
- Exercising Regularly
- Healthy Eating
- Managing Blood Pressure
- Proactive Health Consumer
- Managing Your Moods
- Managing High Cholesterol

If you have further questions, please do not hesitate to contact EHP at 724-260-5504.

2001 Waterdam Plaza Road Suite 201, McMurray, PA 15317
Office: 724.260.5504 Cell: 724.249.7501
www.environmentalhealthproject.org

***Take Steps to Health*, a health promotion program based on your readiness to change and delivered by www.prochange.com.**

If you are an adult interested in improving your health.

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Stress Management Handouts Available on our Website

Feeling Stressed Out? Overwhelmed?

Here are some easy tips to help you relax in minutes...

The effects of stress tend to build up over time. Stress symptoms can affect your body, your thoughts and feelings, and your behavior. Being able to recognize common stress symptoms can help you manage it.

Below are some ideas for different activities you can do to lower your stress. Pick a couple that look interesting to you, and try them out. If these help you de-stress, you can include them in your daily or weekly routine. If not, you can try others on the list, or come up with a list of your own.

If you live in situations of prolonged stress, you may feel irritable, anxious or distracted and you may have other health effects such as high blood pressure and decreased resistance to infections.

If you have 1 minute...
Sit comfortably. Place one hand on your belly. Breathe in deeply as you slowly count silently "One...Two...Three". Feel your hand rise as you breathe in. Hold the breath. Now breathe out slowly, as you repeat silently "Easy...Easy...Easy". Repeat three times. Feel your body relax into the chair.

If you have 2 minutes...
Count down slowly from 10 to zero. With each number, take one complete breath in and out. Breathe in deeply, saying "10" to yourself, and then breathe out slowly. On the next breath, say "9". If you feel lightheaded, count more slowly. When you have counted down to zero, you should feel more relaxed. If not, try repeating the exercise.

If you have 3 minutes...
Sit comfortably and check your body for tension. Relax the muscles in your face, letting your jaw drop open slightly. Drop your shoulders. Let your arms fall to your sides. Loosen your hands so there are spaces between your fingers. Uncross your legs. Let your thighs sink into the chair, as your legs fall apart. Feel your lower legs become heavier and your feet grow roots to the floor. Breathe slowly in and out.

Deep Breathing

Deep breathing can be used in a stressful situation or periodically throughout the day. It is easy to learn, requires no special equipment, and can be done anywhere.

1. Place one and on your belly and one on your chest.
2. Breathe in through your nose slowly, to the count of 10.
3. Feel the hand on your belly move up as you breathe in and move down as you breathe out. The hand on your chest should not move.
4. Breathe out through your nose slowly, to the count of 10.
5. Concentrate only on your breathing and counting.
6. Repeat 5 to 10 times, several times throughout the day.

NOTE: If you cannot breathe through your nose, it is fine to breathe through your mouth, pursing your lips as you breathe out.

Modified from the Harvard Medical Publications – *Your Portable Guide to Stress Relief*

Top apps to help you relax in just minutes!

Breathe2Relax (available for Android & iPhone - Free)

Your breathing has a profound effect on your body. You know this is true if you've ever taken deep breaths to calm down when you were upset. Often just a few deep breaths can help you feel more centered and in control.

The Breathe2Relax app uses guided breathing exercises to help reduce symptoms of stress. So if you're feeling stressed, slip away into a quiet room, open your app and let the worry and stress pass by with each breath you take.

Relax Melodies (available for Android & iPhone - Free)

Stress and worrying can disrupt healthy sleep patterns. It's really difficult to fall asleep when you are worrying about something – and it can become a vicious cycle – the more you worry, the harder it is to fall asleep. Before you know it, you are worrying about how you cannot fall asleep! However, creating a calming environment may help you fall asleep and stay asleep!

So lie down and unwind to one of the app's 50 relaxing sounds. Want the music to stop once you're asleep? Set a timer, and it will stop playing. Set an alarm so you wake up on time. Then, enjoy the benefits of a good night's sleep.

Worry Box (only available for Android - Free)

Have you ever wished you could put all your worries in a box, leave them there and walk away? The Worry Box app may let you do just that!

The app functions like a journal, so write down your thoughts and worries and let the app help you think through them. In addition, this interactive app will also ask you questions and give specific anxiety-reducing support. It is all password protected, so you can feel safe sharing the details of your stresses.

Southwest Pennsylvania Environmental Health Project (EHP)

2001 Waterdam Plaza Drive, Suite 201
McMurray, PA 15317
Phone: 724.260.5504
www.environmentalhealthproject.org

A “Where to Turn” Resource Guide

- **Where to turn for answers about UOGD in your community:**
  - Contact information for relevant regulatory agencies, e.g., DEP, DOH, EPA, zoning and emergency response boards
  - Identification of different stages of natural gas development
  - On-line references and how to use them, e.g., “How to use FracTracker”

- **How to protect your family’s health:**
  - “If you have these health symptoms” guidance/talking to your healthcare provider
  - Coping mechanisms for psychosocial issues
  - How to minimize your exposures

- **What to do to track and understand chemical exposures from UOGD:**
  - List of chemicals and their characteristics
  - Where to get baseline testing for your air and water/help interpreting air and water data
  - Recommended sources for air and water filters/monitors

A Healthcare Provider's Guide to Mental Health Impacts of Unconventional Oil and Gas Development (UOGD)

The handout is broken in to 3 parts:

1. Introduction and Assessment of the Problem
2. Mental Health and the Fossil Fuel Industry
3. Mental Health and UOGD
   - Community Studies
   - Qualitative Studies

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A Healthcare Provider's Guide to Mental Health Impacts of Unconventional Oil and Gas Development (UOGD)

What the Research Says

There is a growing body of literature that reports on the potential health effects associated with UOGD activity, much of it focused on physical rather than mental health. Due to the lack of literature, this handout summarizes what has been learned from studies of communities impacted by disasters in the fossil fuel industry, such as supertanker or oil platform accidents. Immediate and some long-term mental health effects have been reported.

It also summarizes what has been learned about mental health in relationship to UOGD thus far.

"... residential proximity to industrial activity has a negative impact on mental health. This impact is both direct and mediated by individuals' perceptions of neighborhood disorder and personal powerlessness..."[10]

Introduction and Assessment of the Problem

Clients who live or work in a community with unconventional oil and gas development (UOGD) (often called "fracking") may experience environmental stressors including:

- noise, light, and vibration that accompanies drilling, often lasting days or weeks at a time;
- air or water quality changes;
- uncertainty of toxic exposures;
- increased emissions, noise, dust, and travel delays caused by truck traffic; and
- uncertainty over their health and their families' health.

Living with prolonged stress may lead to feelings of irritability, anxiety, or depression, as well as physical health effects such as high blood pressure and decreased resistance to infections.

Mental Health and the Fossil Fuel Industry

- Three months after the explosion of the Deepwater Horizon oil platform off the coast of Louisiana, residents reported symptoms that included suspiciousness, mistrust, dissention in the communities, uncertainty, anger, anxiety and symptoms consistent with general anxiety disorder and early post-traumatic stress disorder (PTSD), increased substance use, and increased violence.[1]
- One year after the Exxon Valdez tanker accident, residents of exposed communities were more likely to have generalized anxiety disorder, PTSD, and a positive screen for depression compared to residents of similar, non-exposed communities.[2] Six years later, symptoms of anxiety, depression, and PTSD persisted in a subgroup, suggesting that mental health effects may be long term in particularly vulnerable members of a community.[3]
- Immediately following the Braer tanker accident off the coast of Scotland, residents in exposed communities demonstrated changes in mood.[4] One year later residents in exposed communities demonstrated increased anxiety, insomnia, and somatic complaints, compared to non-exposed communities. There was no difference in depression between exposed and non-exposed.[5]
- A higher proportion of residents of exposed communities met criteria for depression and anxiety, when compared to residents of non-exposed communities, following the Sea Empress tanker accident off the coast of Wales.[6]
- More than one year after the Prestige tanker accident off the coast of Spain, residents of exposed communities had worse scores on standard depression and anxiety screening instruments than residents of similar, non-exposed communities. Furthermore, in the exposed communities, worse scores were associated with more intense exposure.[7,8]
- Following the Tasman Spirit accident, an increased proportion of residents of exposed communities in Pakistan reported anxiety specific to concerns about health, compared to those from unexposed communities.[9]

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Save the Date

Friday, June 10, 2016

HEALTH & SHALE GAS DEVELOPMENT: STATE OF THE SCIENCE

Hyatt Regency - Pittsburgh International Airport, PA

A one-day conference for healthcare providers and community members on unconventional gas development and related health impacts

Wetzel County Action Group photo © Ed Wade, Jr.

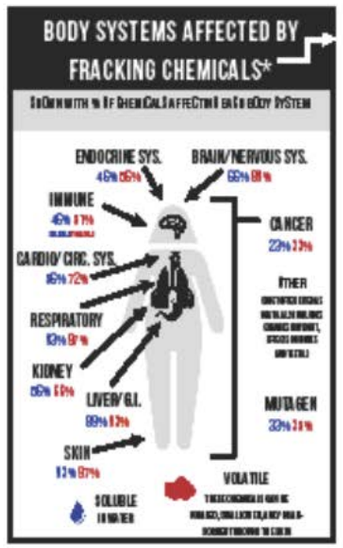

Image courtesy Physicians for Social Responsibility - Los Angeles

Photo courtesy of FracTracker, Samantha Rubright

Morning Keynote

Robert Laumbach, MD, MPH
Rutgers University

Afternoon Keynote

Brian Schwartz, MD, MS
Johns Hopkins University

Presented by

Southwest Pennsylvania Environmental Health Project
Brochure forthcoming, for more information contact EHP at 724.260.5504

Co-sponsored by

Alliance of Nurses for Healthy Environments
Physicians for Social Responsibility - Philadelphia
Pennsylvania Healthcare Professionals for a Livable Future

This activity has been approved for AMA PRA Category 1 Credit(s) TM.
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Breakout Session on Mental Health and Unconventional Oil and Gas Development

Our Response to Stress Matters…

- It is important to remember that though we cannot eliminate all the stressors in our lives, we can control how we respond to them.

- Keep in mind that you do not need to deal with stress on your own. If you or someone you know may be experiencing stress, talk with your healthcare provider or contact EHP.

- Your family may find it helpful to work with a licensed mental health professional to help develop strategies to deal with overwhelming feelings of stress.

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Unconventional Oil and Gas Drilling and Potential Water Source Impacts

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The PA DEP has reported 272 cases of private water supplies impacted by oil and gas activities.

(2008-2016)

http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/OilGasReports/Determination_Letters/Regional_Determination_Letters.pdf

Outline of Presentation

- Mechanisms of concern
  - Chemical storage
  - Fracking fluids
  - Produced water
  - Wastewater management
- Current Studies
- Environmental Health Project

Chemical Storage

- Chemicals comprise 2% overall injected fluid volume
  - But, >1 million gallons fluids injected per well
- 151 spills in 11 states January 2006 – April 2012
  - Average spill of 420 gallons
  - >30% from storage tanks
  - 0.4-12.2 spills per 100 wells in PA

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Chemical Storage

- Chemical spill causes
  - Equipment failure
  - Human error
  - Failure of container integrity
  - Other

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Fracking Fluids

- Average of 14 different chemicals used
- Total of 1,076 used nationwide
- Chemical components vary
  - Geologic formation
  - Operator preference
  - Cost

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Fracking Fluids

- Spill study
- 9% reached surface water
- 64% reached soil

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

How Can a Chemical Reach and Impact a Water Source?

- Mobility
- Solubility
- Volatility

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

How Can a Chemical Reach and Impact a Water Source?

- Mobility
- Ability of a chemical to travel throughout the environment
- Tend to be less mobile

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

How Can a Chemical Reach and Impact a Water Source?

- Solubility
- Ability of a chemical to dissolve
- Majority associate strongly with soil and organic material

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

How Can a Chemical Reach and Impact a Water Source?

- Volatility
- Tendency of a chemical to vaporize
- Majority not very volatile

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Produced/Flowback Water

- Average spill = 990 gallons
  - 2x average volume of fracking fluid spills
- 74% due to failure of integrity
- 8% reached water source

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Produced/Flowback Water

- Contains:
  - Total dissolved solids
  - Organic compounds
  - Metals
  - Radioactive material

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Wastewater Management

How can this impact water sources?

- Inadequate treatment prior to discharge
- Leakage
- Land application
- Outfalls

U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.

Wastewater Management

Why is it a problem?

- Flowback contains hydrocarbons, salts, total dissolved solids, etc.
- High salinity
- Publicly Owned Treatment Works cannot adequately treat high salinity
- DEP requires industry to take wastewater to specialized treatment facilities or reuse water

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Current Studies

"Evaluating a groundwater supply contamination incident attributed to Marcellus Shale gas development"
2015, Proceedings of the National Academy of Sciences

"Well water contamination in a rural community in southwestern Pennsylvania near unconventional shale gas extraction"
2015, Journal of Environmental Science and Health

"Fracking chemicals detected in Pennsylvania drinking water"
2015, The New York Times

How Can EHP Help You?

If you're interested in starting to monitor...

CATTFish

- Measures conductivity of well water
- Can detect changes in water quality
- Will monitor for 1-2 months
- EHP will send you a cumulative data report

How Can EHP Help You?

If you're interested in additional assistance...

- Contact local labs
  - Chain of Custody
- Contact EHP with additional questions
  - 724-260-5504
  - info@environmentalhealthproject.org

Moving Forward

- To summarize, EHP advocates for a precautionary principle. We assure that the environmental health needs of individuals and communities are met with accurate, timely and trusted information.

- We collaborate with affected individuals and provide tools such as environmental monitoring and working with our medical staff so that these affected individuals may begin to resolve their environmental and/or health complications.

- EHP works with these residents and supplements them with information that allows them to make informed decisions.

- We acknowledge and attempt to resolve gaps in knowledge, research, practice and policies to address local sources of potential adverse environmental health impacts.

Strategic Priorities & Objectives

- In order to adequately address the uncertainties of UOGD, EHP has created a list objectives that as an organization we aim to solve.

- Each objective is met with expected results, a collaborating team of professionals in their field and milestones to ensure that over time EHP takes significant steps in the right direction.

- The next few slides will cover these objectives.

Major Objective 1

- Resolve Health Impacts Associated with UOGD:
  - While this is no easy task, EHP works towards this goal each day by collecting environmental data and working with affected individuals to better understand potential health effects.
  - EHP is working on model regulations for UOGD setbacks for schools and other locations where children congregate, as well as published guidance for health providers who work with children and other vulnerable populations
  - Among many goals and accomplishments, EHP is developing a specific set of criteria to address the special issues of children's health and gas fracking, as well as creating a resource guidance for mental health and stress intervention.

Major Objective 2

- Define the Exposure Problem:
  - Working with residents who live near UOGD sites allows EHP to collect valuable data (air and water) which we then analyze to better understand the potential exposures associated with difference UOGD processes (i.e drilling, compressing, processing etc.)
  - We work towards this goal by linking exposure and medical observations, establishing specific criteria for data collection, developing protocols for chemical exposure and much more.
  - Current projects underway include multiple community monitoring sites, ‘training the trainer programs’, and identifying gaps in research.

On going and future objectives

- Other objectives which EHP plans to work towards include:
  - Including shale gas health issues in healthcare practice,
  - Evaluating our communications of UOGD risks,
  - Refining the scientific discussions of UOGD health issues,
  - And lastly, we hope to work with and educate policy makers on UOGD issues.

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