

UNGD and Health what needs to be looked at next.

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The Central Questions

- What are the health issues associated with UNGD of shale and implications for health care providers?
- What is the evidence that would indicate a clinical problem for providers?
- What characteristics define the health issues of immediate concern, and what is needed to mitigate the damage?

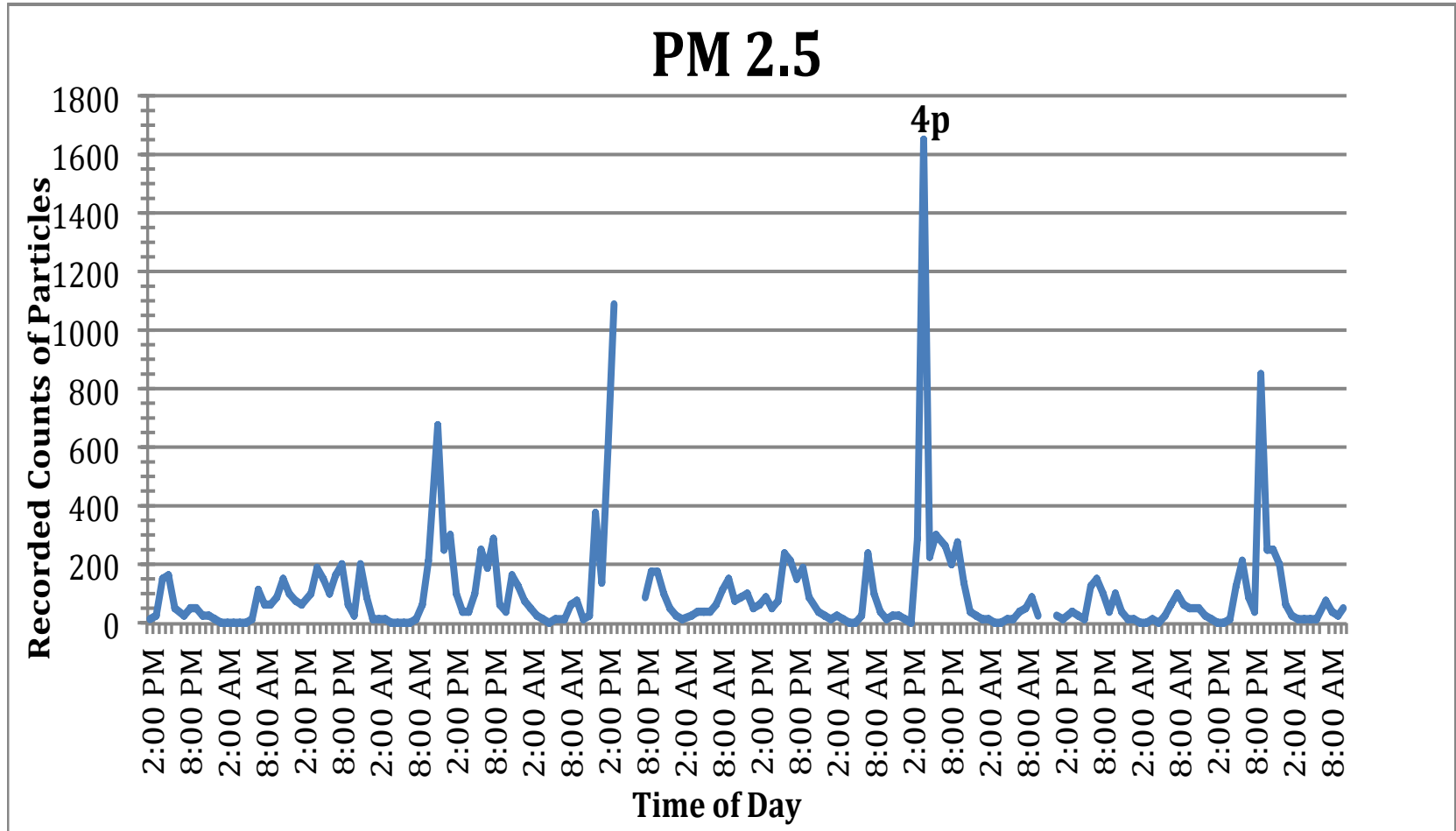
Human exposure timeline with UNGD activities and human health risk
(0 is none and 10 is certain)

Site activities	Human exposures										
	Diesel fumes	Frac fluids	Drilling fluids	Produced water	Biocides	Gas volatiles	Radio activity	outdoors	indoors	Food	water
Pad preparation	7	0	0	0	0	3	0				
Vertical drilling	7	0	8	0	4	4	7	Yes	yes	No	Yes
Frac drilling	10	10	8	0	4	3	8	Yes	yes	No	Yes
Frac process	10	10	0	0	7	4	0	Yes	yes	No	Yes
Well Finishing	5	8	7	10	7	10	9	Yes	yes	yes	Yes
Flaring	3	8	7	10	7	10	9	Yes	yes	yes	Yes
Frac ponds	3	7	7	10	10	10	10	Yes	yes	no	Yes
Gas processing											
(dehydrators)	3	2	0	6	4	9	7	yes	yes	no	no
(condensers)	0	2	0	0	4	9	7	Yes	yes	no	no
Compressor stations	10	0	0	0	0	9	8	yes	yes	Yes	no
Pipe line venting	0	0	0	0	0	9	8	yes	yes	yes	yes
Pipe line failures	0	0	0	0	0	9	9	yes	yes	yes	yes
Service traffic	8	0	0	8	0	3	0	yes	yes	no	no
Spills	5	4	4	8	6	6	9	yes	yes	yes	yes
Disposal sites	5	0	3	10	10	10	10	yes	yes		
Metering stations	2	0	0	0	0	9	8	yes	yes	no	no

EXPOSURES ARE HIGHLY VARIABLE



A one-week sample of Dylos results for a house monitored in March 2013





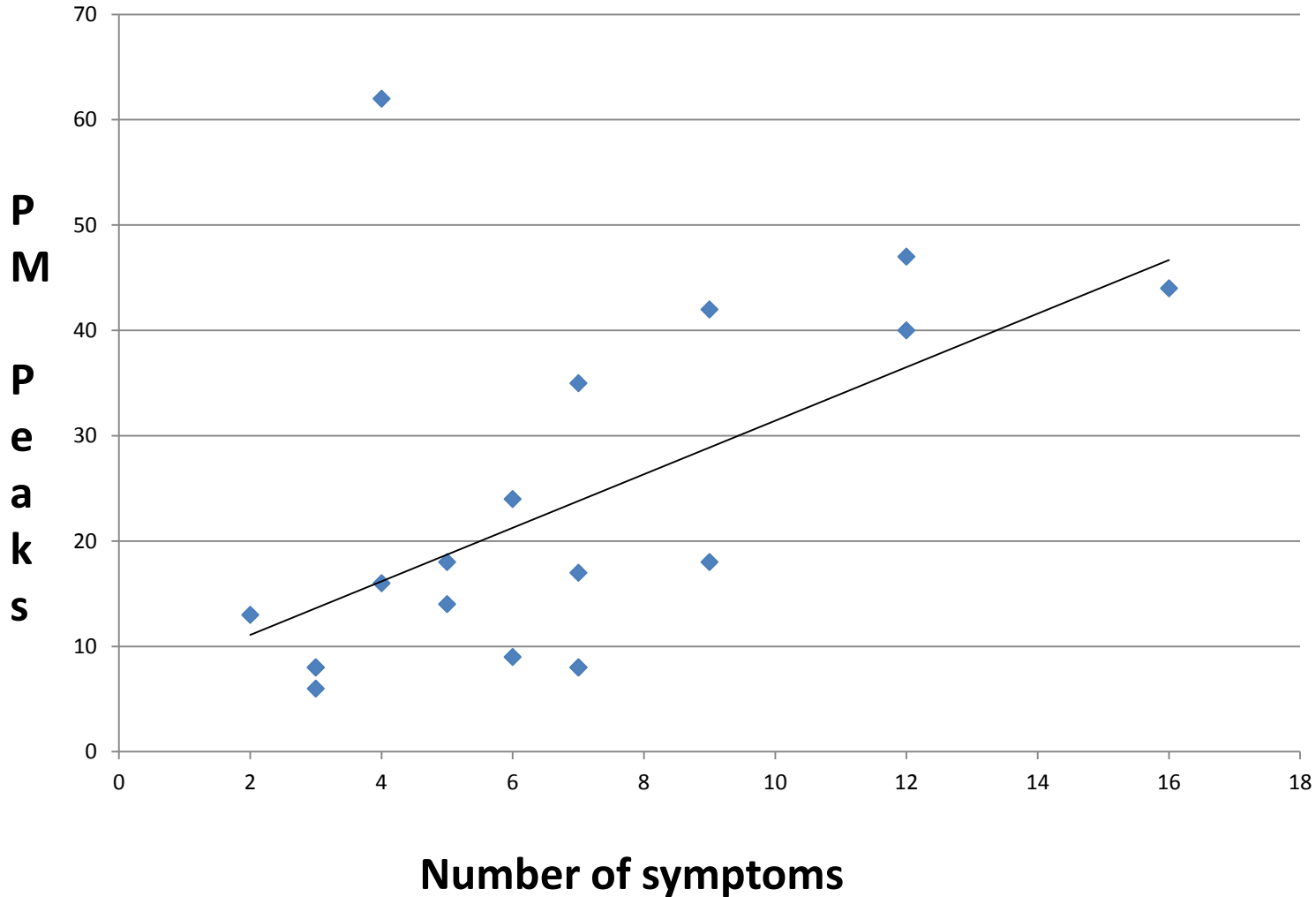
Summary of peak PM2.5 count values for each house, given in number of hours, % total hours, times of day, and maximum peak value.

(Median 50 cts/0.01ft³)

6 hour average: night, morning, afternoon, evening

House	Number of hours with peaks	% of total hours with peaks	Times of day of peaks*	Maximum Peak Value
1	12	8.5	N	2711
2	11	5	M, N	756
3	3	2.5	M	171
4	1	0.5	N	201
5	8	2.5	A, E	556
6	11	7.7	A, E, N	576
7	31	8.7	M, A, E	1654
8	29	15	M, A, E	991
9	9	12.6	M, E, N	1057
10	23	32	M, A, E, N	844
11	7	16	M, E	3846
12	2	1.4	E	203
13	3	4.3	M	164
14	57	34.3	M, A, E, N	1761

PM 2.5 Peaks vs Number of symptoms



EHP Pilot Data: Human Health Impacts

common complaints from the client population:

- Anxiety/Stress
- Nervous system including headaches and dizziness
- Cardiac symptoms
- Urinary symptoms
- Eye and throat irritation
- Low birth weights and APGAR Scores
- Reproductive concerns

The Health Issues

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

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

12 Emissions of concern for immediate toxic responses

1. Barium, Arsenic
2. Fluoride salts*
3. VOCs *
4. PAHS
5. BTX*
6. Methylene chloride,
(halogenated alkanes)*
7. Acetaldehyde/Formaldehyde
8. Fine particulate matter*
9. Carbon monoxide
10. Glycols*
11. Silica dust*
12. Radium and radioactive decay
products*

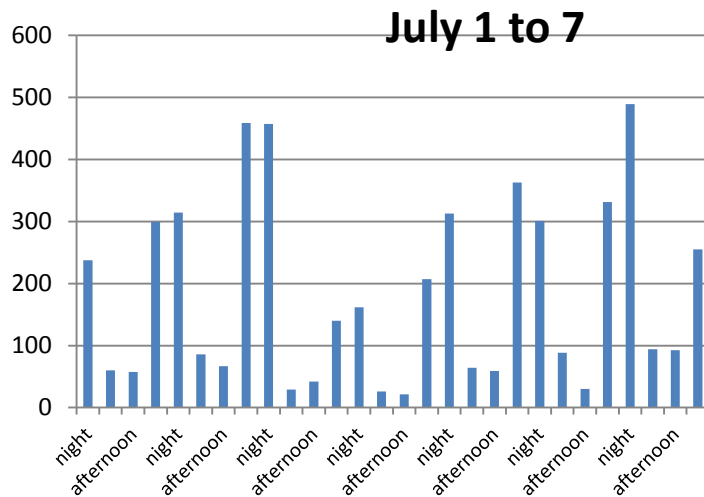
EXPOSURES ARE HIGHLY VARIABLE

Modeled Hourly VOC Concentrations

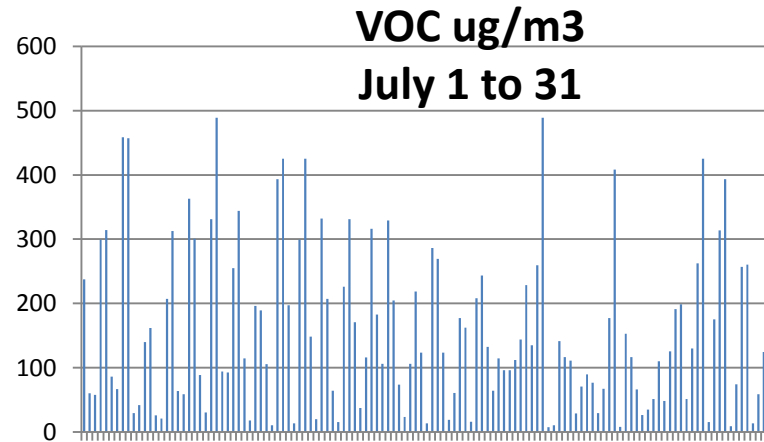
1 km from compressor

(6 hr averages)

Variation in
weekly air

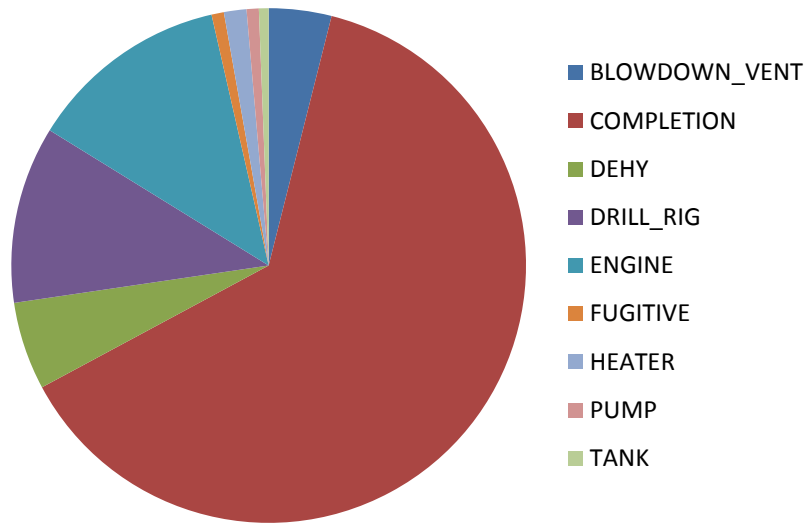


Variation in
monthly air

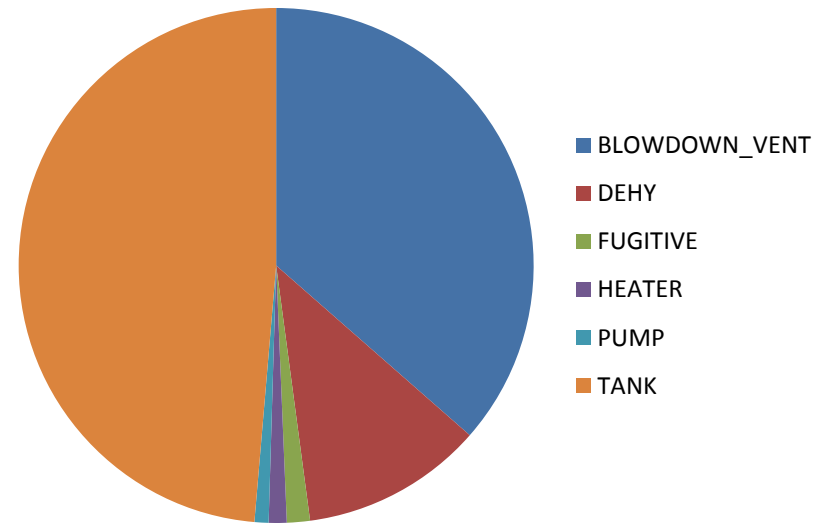


UNGD Ambient Air Emissions (PA) not including Methane, CO2 and NOx

All UNGD Activities



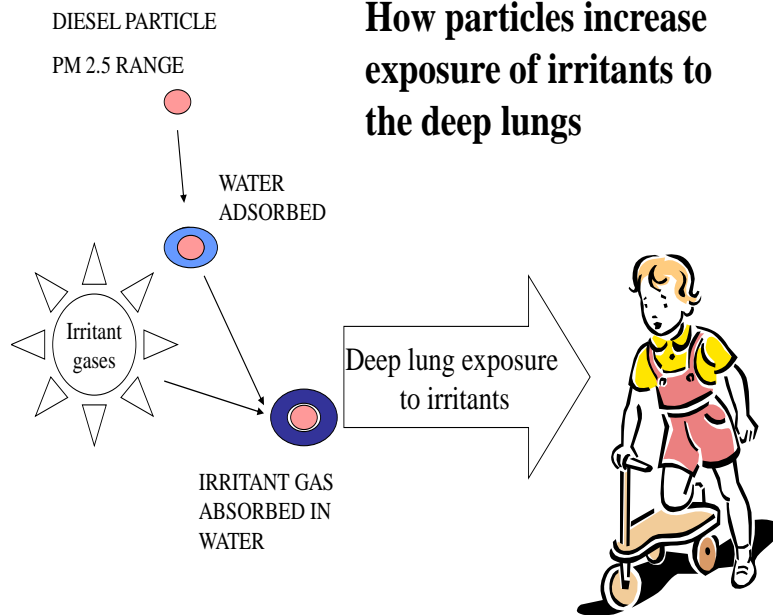
Operating wells only





A serious synergistic toxic action; Fine particles increase transport of toxics into deep lung

Cartoon



- Bypass protective actions in upper respiratory tract
- Action is related to size and number of particles
- Increased surface area increases toxic responses
- Water solubility increases the attachment to particle surface
- Particles do not need to be reactive
- 3 to 20 fold increase in uptake
- PM prevalent toxic at UCGD Sites

Conclusions

- People are exposed to toxics through air, water and soil.
- The exposures are periodic and intense for several hours.
- Regulatory Air and water screening will not detect the hazard.

- Most likely acute physical symptoms “rash”, headache/ fatigue, respiratory, nose bleeds, GI, depression.
- Biomonitoring methods need to be developed.

- Interventions and support at the patient level help coping.
- Individuals must monitor their health and exposure status.
- Sense of community trust and social capital is destroyed.
- Federal, State and Local public health and environmental agencies are not able to effectively respond. ***The Public Health Process has become rule bound, restricted to standard environmental tests of air and water and research health protocols.***

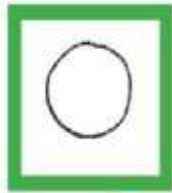
What needs to be looked at next?

1. Start with Steinzor, Subra and Sumi (2013) “New Solutions”
 - a. Look at pattern of health effects
 - b. Look at the exposure findings
 - c. Compare to other studies and reports
2. The impact of the Non Disclosure Agreements
3. The capacity of the county Health Districts to respond to personal outbreak reports
4. Proximity to schools, hospitals etc.
5. Housing options for the poor.
6. Training of medical providers
7. Can there be disclosure when there are multiple sub contractors? (R8 to R13)
8. Air emissions R19 a-e Illustrates the scope the limitations
9. Drinking water threat cannot be addressed using present methodology.
10. Social disruption goes beyond the traffic impacts and set back distances

Help individuals at risk

- Real time air and water monitors.
- Devices to remove particulate and gases from home air.
- Provide an air model to determine periods of high risk.
- Management guidance for cleaning homes.
- Warning signs of health effects.
- Worry and anxiety support systems.
- Access to immediate safe locations.
- Need to know conditions that make them susceptible to injury.
- Clear understanding of the limitations of government to assist them.

Guide to Air Quality Near Shale Gas Sites



Sunny Day

any wind or no wind



Cloudy Day

no wind or light wind



Cloudy Day

windy



Calm Night

scattered to no clouds



Night

scattered to no clouds,
windy



Cloudy Night

no wind



Cloudy Night

light wind to windy

Healthy:
No associated
health risks/concerns.

Moderate to Healthy:
Unusually sensitive
people, older adults
and children
should avoid exertion
and outdoor work.

Unhealthy:
Avoid extended or
heavy exertion,
close windows,
go somewhere else,
turn on air filter.

Very Unhealthy:
Avoid extended or
heavy exertion,
close windows,
go somewhere else,
turn on air filter.

SOUTHWEST PENNSYLVANIA ENVIRONMENTAL HEALTH PROJECT

WWW.ENVIRONMENTALHEALTHPROJECT.ORG

FOR DETAILED INFORMATION, CONTACT 724-260-5504

How to protect against health impacts from unconventional natural gas development (UNGD)

Cut off contamination from air

Clean your house often, especially areas where your children play. Use a vacuum that can fit a HEPA filter. Don't sweep with a broom.

Vent the air in places where you use water. Open windows or run an exhaust fan in the bathroom, kitchen and laundry room. If you have a stove fan, always use it while cooking.

Let fresh air in your home when it is breezy outside, usually in the middle of the day. Unhealthy air can collect closer to ground level when the air is still, usually in the morning and evening.

Take off your shoes and wipe off pets' paws and fur before going inside. This will help to keep contamination from soil out of your home.

Cut off contamination from water

Don't rely on one-time water tests to tell you if your water is safe to drink and use. Accidents and contamination can happen at any time.

Consider using bottle water for drinking, cooking and making drinks like baby formula, coffee, juice.

If you must drink or cook with your tap water, leave it *uncovered* in a pitcher or bottle in the refrigerator overnight before using it.

Stop drinking your water if you or someone in your family has stomach pain or discomfort, confusion, nosebleeds, muscle pains or other unusual symptoms.

If your water burns your skin or causes a rash, take showers and baths somewhere else. Go see your doctor and call our office to see our nurse practitioner.

Monitor changes in your health and environment

Keep a health diary. Write down changes in your health and changes you notice in your water or air. Share this information with your health care provider.

Remember that children, senior citizens or people with chronic health conditions are more sensitive. Pay special attention to changes in their health.

Check the conductivity of your water. This can tell you if your water changes and if there may be a problem with your water. EHP offers the CATTfish, to monitor conductivity, to individuals on well or spring water.*

Monitor particulate matter (PM) in the air. EHP offers the Speck air monitor to help individuals identify times when particulate matter concentrations are high within their home, and other times when exposures may not be occurring.*

Find ways to cope with the changes in your environment. EHP offers a free program, *Take Steps to Health*, to help individuals improve their health and manage some of life's stressors.

*The Speck and CATTfish cannot identify specific chemicals in your air or water. They warn you that changes that may warrant extra testing are occurring.



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