

# HEI Energy Research Program

## Plans for Exposure Literature Review and Research Planning

Donna Vorhees, HEI Director of Energy Research

HEI Annual Conference  
Chicago, IL, May 1, 2018



# What might explain associations reported in the epidemiology literature?

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- UOGD-related exposure?
  - Chemical agents (e.g., air emissions)
  - Non-chemical agents (e.g., noise, light, changing landscape, social disruption)
  - Psychosocial stress
- Non-UOGD-related exposure?
- Population differences between those who live near and far away from UOGD?



# Purpose of Energy Research Program

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- Fill knowledge gaps left by past and ongoing research about potential population exposures and health effects from unconventional oil and natural gas development (UOGD) across the United States

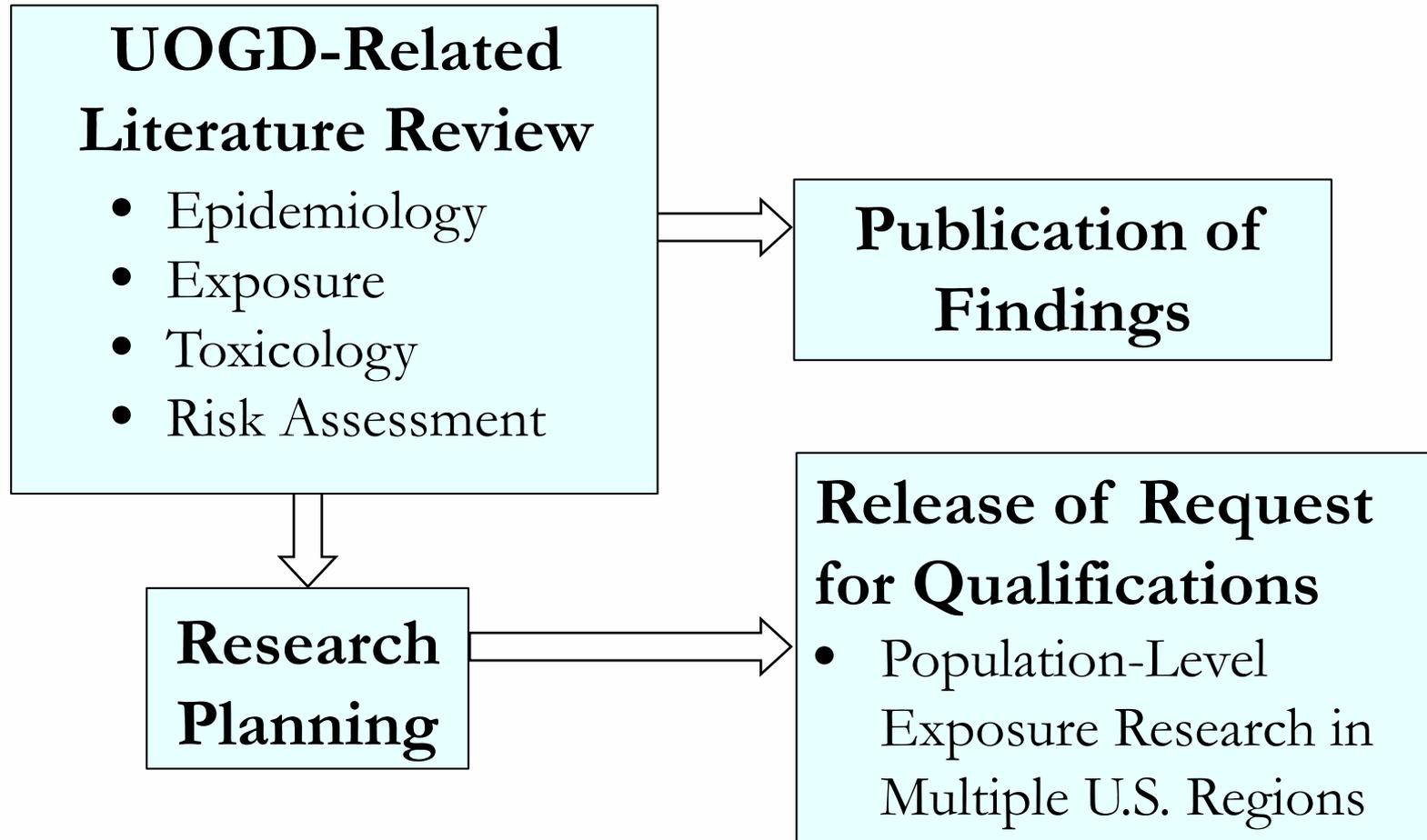
From a member of a community organization at a recent HEI meeting:

*“We just want to know if it [UOGD] is okay.”*



# Year 1 Tasks and Products

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# The general approach to literature review and research planning

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1. **Develop a good understanding of UOGD** operations across regions and over time
2. **Gather and review literature**, including peer-reviewed and gray literature and other data sources, to understand the potential for UOGD-specific exposure, toxicity, and risk
3. **Solicit information and recommendations** from a broad range of stakeholders (including two workshops)
4. **Frame the review in a conceptual model of potential UOGD exposures** to guide research planning
5. **Define research priorities** for funding



# UOGD: we're talking about more than just exposure to hydraulic fracturing



Photo courtesy of Schlumberger

# Potential chemical exposures related to UOGD

~5 – 60+ years

Timeline graphic modified from: USEPA. Draft 2015 assessment

Site assessment and development

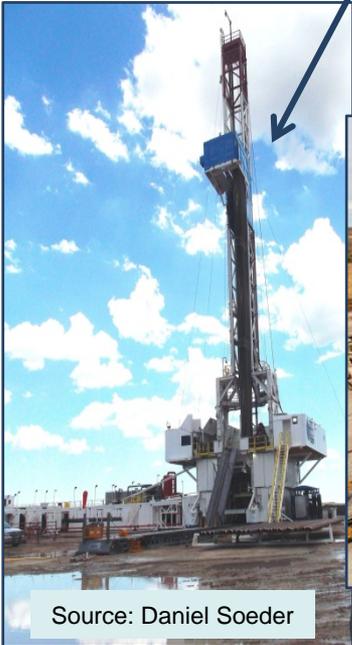
Well drilling and construction

Hydraulic fracturing

Fluid recovery and management

Oil and Gas Production

Site and well closure



# Potential non-chemical exposures related to UOGD



## Odor log

Oil & Gas Health Information & Response Program

### What types of odors might come from oil and gas operations?

- Some people that live near oil and gas operations have reported many different types of odors.
- Most commonly, people report a solvent odor (such as nail polish remover), gasoline odors, and diesel odors.
- While it's rarely reported in Colorado, some people

### What causes these reported odors?

*Excerpt from:*

<https://www.colorado.gov/pacific/cdphe/categories/services-and-information/environment/oil-and-gas/oil-and-gas-and-your-health>

Int J Ment Health Addiction (2018) 16:1–15  
DOI 10.1007/s11469-017-9792-5



ORIGINAL ARTICLE

## Psychosocial Impact of Fracking: a Review of the Literature on the Mental Health Consequences of Hydraulic Fracturing

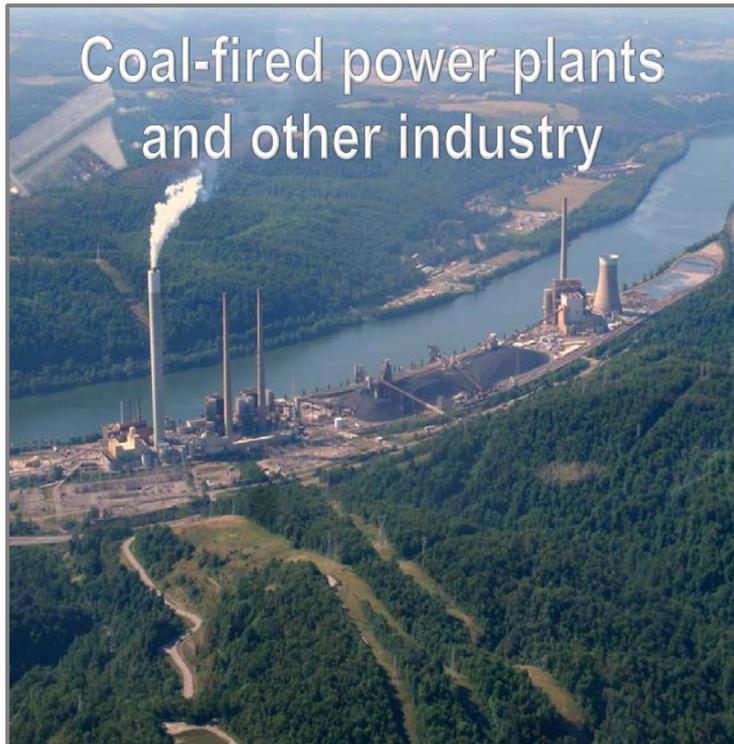
Jameson K. Hirsch<sup>1</sup> • K. Bryant Smalley<sup>2</sup> •  
Emily M. Selby-Nelson<sup>3</sup> • Jane M. Hamel-Lambert<sup>4</sup> •  
Michael R. Rosmann<sup>5</sup> • Tammy A. Barnes<sup>6</sup> •  
Daniel Abrahamson<sup>6</sup> • Scott S. Meit<sup>7</sup> • Iva GreyWolf<sup>8</sup> •  
Sarah Beckmann<sup>9</sup> • Teresa LaFromboise<sup>10</sup>



# Potential exposures related to nearby non-UOGD sources

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Anthropogenic



Source: <http://lagniappeslair.blogspot.com/2012/06/flying-back-to-see-family.html>

Natural



Source: <http://www.nyfalls.com/newsletter/images/eternal-flame-falls.jpg>

# The literature so far...UOGD exposure studies

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**Air studies** provide a snapshot of potential exposure in some locations under some conditions

**Water studies** are not as prevalent, and more challenging to study because the investigator is generally looking for a problem

**Potential for exposure depends on numerous variables;**  
some examples:

- Effectiveness of operator and regulatory controls
- Resource type (oil vs wet gas vs dry gas)
- Operational phase and practices
- Local and regional environmental conditions (e.g., meteorological and hydrological factors affect the fate and transport of UOGD-related agents)



# The literature so far...UOGD toxicology information

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Kassotis et al. 2016. Adverse Reproductive and Developmental Health Outcomes Following Prenatal Exposure to a Hydraulic Fracturing Chemical Mixture in Female C57Bl/6 Mice. *Endocrinology*

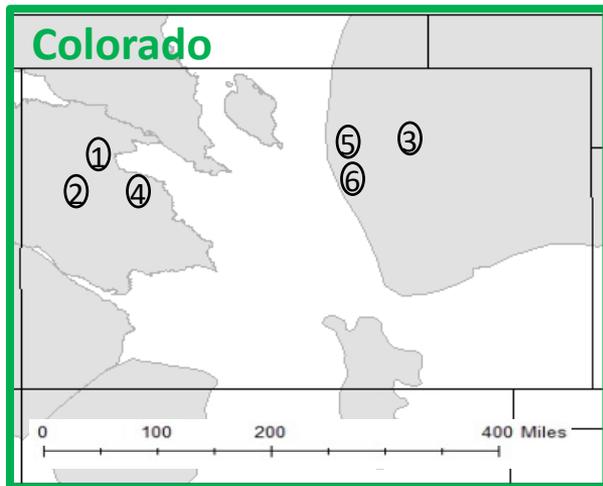
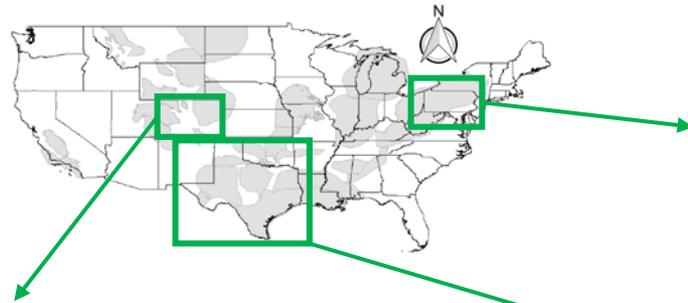
Kassotis et al. 2016. Endocrine disrupting activities of surface water associated with a West Virginia oil and gas industry wastewater disposal site. *Sci Total Environ*

Elliott et al. 2017. A systematic evaluation of chemicals in hydraulic-fracturing fluids and wastewater for reproductive and developmental toxicity. *J Expo Sci Environ Epidemiol*

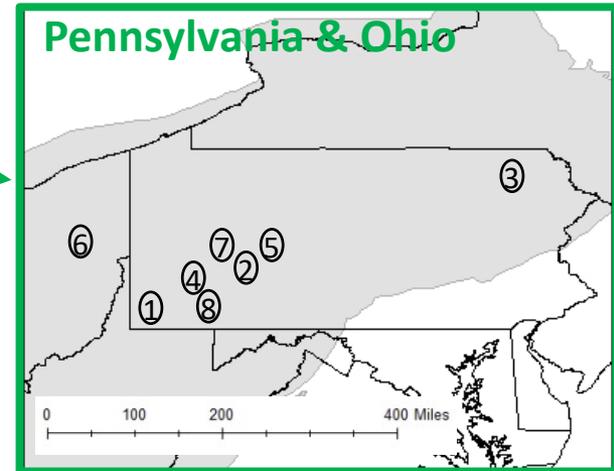
Elliott et al. 2017. Unconventional oil and gas development and risk of childhood leukemia: Assessing the evidence. *Science of The Total Environment*

Sapouckey et al. 2018. Prenatal exposure to unconventional oil and gas operation chemical mixtures altered mammary gland development in adult female mice. *Endocrinology*

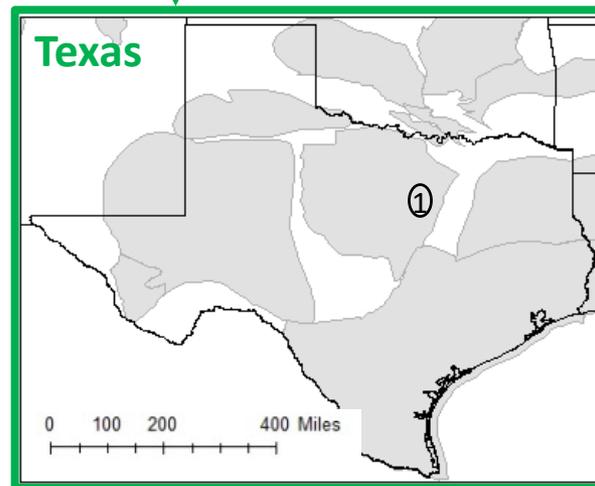
# The literature so far...UOGD human health risk assessments



- Colorado:**
- |  |                         |
|--|-------------------------|
| 1. ATSDR Division of Community Health Investigations, 2010 | 3. McKenzie et al. 2018 |
| 2. Coons and Walker 2008                                   | 4. McKenzie et al. 2012 |
|  | 5. McMullin et al. 2017 |
|  | 6. McMullin et al. 2017 |

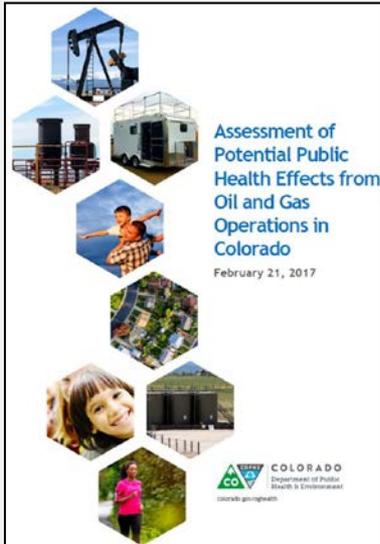


- Pennsylvania & Ohio:**
1. Abualfaraj et al. 2018
  2. ATSDR Division of Community Health Investigations, 2016
  3. ATSDR Division of Community Health Investigations, 2016
  4. Chen et al. 2017
  5. Mitchell et al. 2016
  6. Paulik et al. 2016
  7. Rish and Pfau, 2017
  8. Zhang et al. 2015



- Texas:** 1. Bunch et al. 2014

# Will take a closer look at the reasons for apparent discrepancies in the literature



February  
2017

“Exposure and health effect studies do not indicate the need for immediate public health action, but do indicate the need for more detailed exposure monitoring and systematic analyses of health effects of residents living near oil and gas operations.”

ENVIRONMENTAL  
Science & Technology

Cite This: *Environ. Sci. Technol.* 2018, 52, 4514–4525

Policy Analysis  
pubs.acs.org/est

## Ambient Nonmethane Hydrocarbon Levels Along Colorado's Northern Front Range: Acute and Chronic Health Risks

Lisa M. McKenzie,<sup>\*,†</sup> Benjamin Blair,<sup>†</sup> John Hughes,<sup>‡</sup> William B. Allshouse,<sup>†</sup> Nicola J. Blake,<sup>§</sup> Detlev Helmig,<sup>||</sup> Pam Milmo,<sup>⊥</sup> Hannah Halliday,<sup>§</sup> Donald R. Blake,<sup>§</sup> and John L. Adgate<sup>†</sup>

March  
2018

“This study provides further evidence that populations living nearest to O&G [oil and gas] facilities bear the greatest risk of acute and chronic health risk from exposures to NMHC [nonmethane hydrocarbon] air pollutants emitted from upstream O&G facilities.”

# Two *Exposure and Risk Screening Workshops* with broad range of experts and stakeholders

## July 2018 Workshop

- Review UOGD operations
- Review and develop a conceptual model of potential UOGD exposures
- Discuss criteria for identifying and prioritizing research options
- Formulate preliminary recommendations for research that the Research Committee should consider for funding

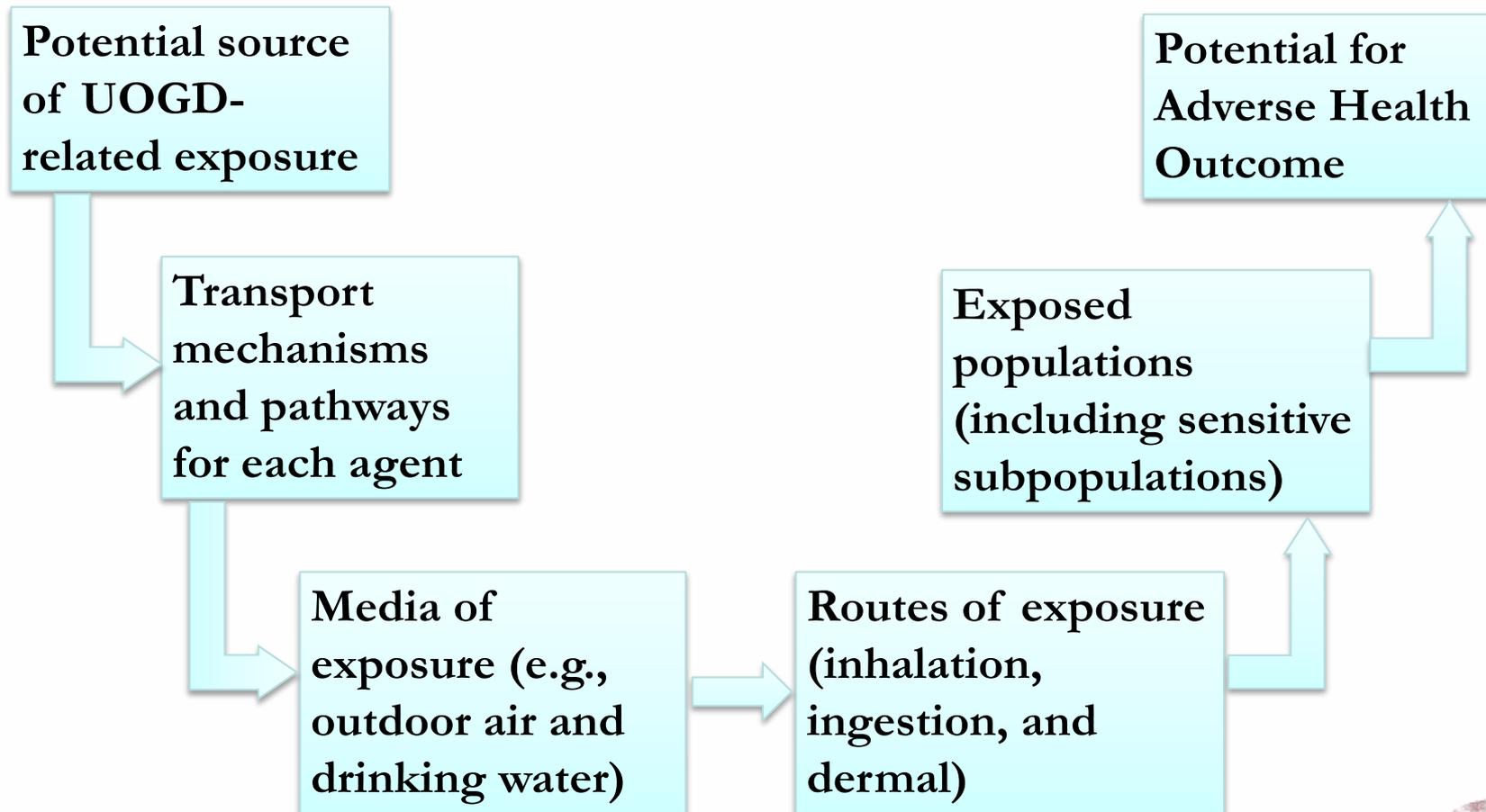
## Summer-Fall 2018 Interim Analyses

- Conduct interim analyses and additional review of the literature to support discussion of research options at a second workshop

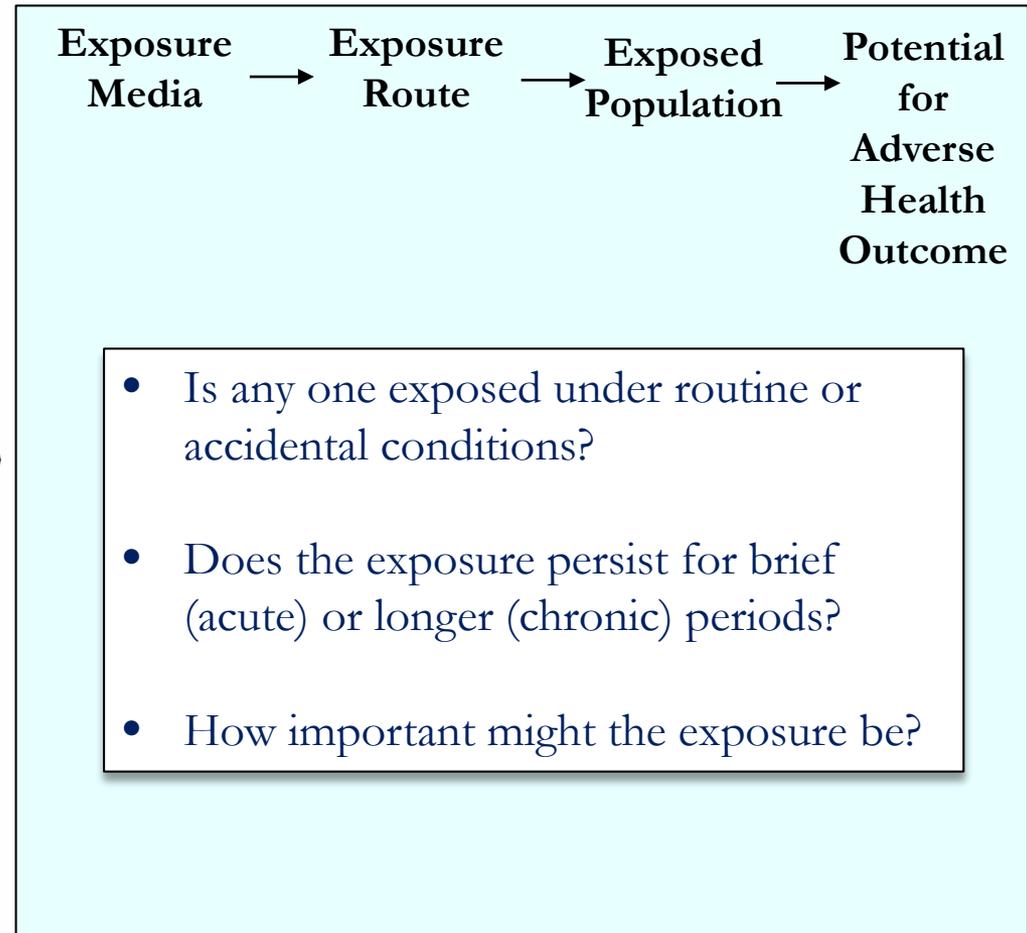
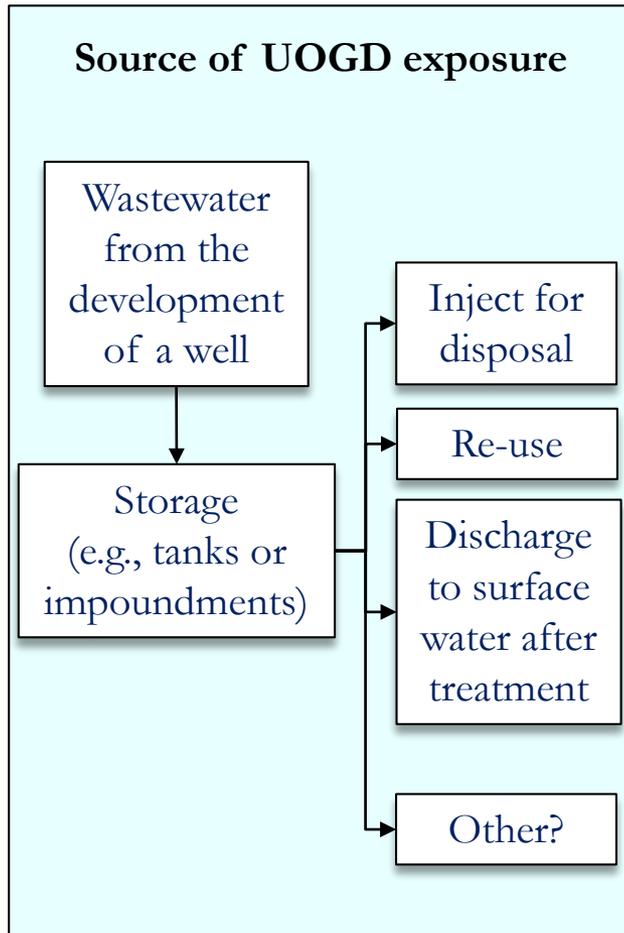
## Fall 2018 Workshop

- Review and discuss Interim Analyses and new literature since the July workshop
- Formulate recommendations for population-level exposure research that the Research Committee should consider for funding

# Frame literature review in a conceptual model to support research planning



# One Example: Could people be exposed to UOGD wastewater?



# Example of regulations influencing the potential for exposure

## Ohio's Regulations: A Guide for Operators Drilling Shale Oil and Gas Wells

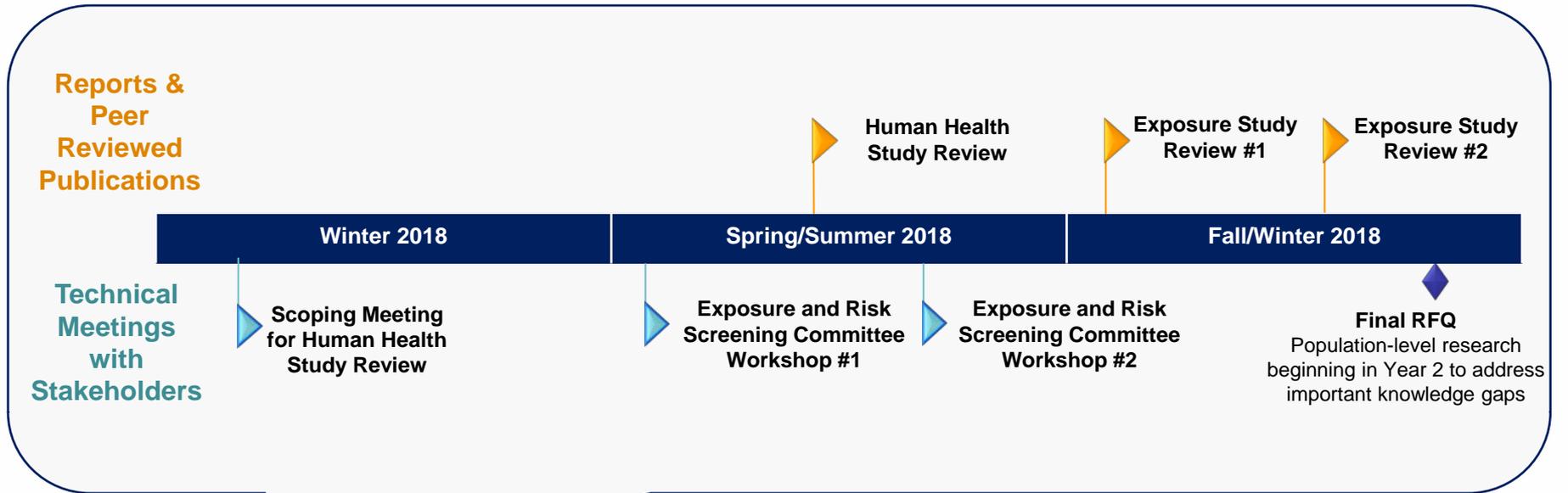


October 2017



“If certain conditions are met..., brine [i.e., a form of wastewater] that is not from a horizontal well may be approved for road surface dust and ice control. Brine collected from a horizontal well...shall not be spread on a road.” (emphasis added)

# Year 1 of a multi-year program



Year 1	Year 2	Year 3	Year 4	Year 5
<ul style="list-style-type: none"> <li>Literature Review</li> <li>Research Planning</li> </ul>	<ul style="list-style-type: none"> <li>Literature Updates</li> <li>Phase I Research</li> </ul>	<ul style="list-style-type: none"> <li>Literature Updates</li> <li>Phase I Workshop</li> <li>Phase II Research</li> </ul>	<ul style="list-style-type: none"> <li>Literature Updates</li> <li>Publish Phase I Research</li> <li>Phase II Workshop</li> </ul>	<ul style="list-style-type: none"> <li>Publish Phase II Research</li> <li>Final Reports &amp; Communication</li> <li>Research Planning</li> </ul>



# Thank You

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<https://www.healtheffects.org/energy>

