HEI Energy Research Program
Plans for Exposure Literature Review and Research Planning

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What might explain associations reported in the epidemiology literature?

• 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

- 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

UOGD-Related Literature Review
- Epidemiology
- Exposure
- Toxicology
- Risk Assessment

Publication of Findings

Release of Request for Qualifications
- Population-Level Exposure Research in Multiple U.S. Regions
The general approach to literature review and research planning

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

Timeline graphic modified from: USEPA. Draft 2015 assessment
Potential non-chemical exposures related to UOGD

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:  

DOI 10.1007/s11469-017-9792-5

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

Jameson K. Hirsch¹ · K. Bryant Smalley² · Emily M. Selby-Nelson³ · Jane M. Hamel-Lambert⁴ · Michael R. Rosman⁵ · Tammy A. Barnes⁶ · Daniel Abrahamson⁶ · Scott S. Meit⁷ · Iva GreyWolf⁸ · Sarah Beckmann⁹ · Teresa LaFromboise¹⁰
Potential exposures related to nearby non-UOGD sources

Anthropogenic

Coal-fired power plants and other industry

Natural

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

Source: http://www.nyfalls.com/newsletter/images/eternal-flame-falls.jpg
The literature so far...UOGD exposure studies

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

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*


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
2. Coons and Walker 2008
3. McKenzie et al. 2018
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
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

“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.”

“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

<table>
<thead>
<tr>
<th>July 2018 Workshop</th>
<th>Summer-Fall 2018 Interim Analyses</th>
<th>Fall 2018 Workshop</th>
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<tbody>
<tr>
<td>Review UOGD operations</td>
<td>Conduct interim analyses and additional review of the literature to support discussion of research options at a second workshop</td>
<td>Review and discuss Interim Analyses and new literature since the July workshop</td>
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<tr>
<td>Review and develop a conceptual model of potential UOGD exposures</td>
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<td>Formulate recommendations for population-level exposure research that the Research Committee should consider for funding</td>
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<tr>
<td>Discuss criteria for identifying and prioritizing research options</td>
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<tr>
<td>Formulate preliminary recommendations for research that the Research Committee should consider for funding</td>
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Frame literature review in a conceptual model to support research planning

- Potential source of UOGD-related exposure
- Transport mechanisms and pathways for each agent
- Media of exposure (e.g., outdoor air and drinking water)
- Routes of exposure (inhalation, ingestion, and dermal)
- Exposed populations (including sensitive subpopulations)
- Potential for Adverse Health Outcome

Frame literature review in a conceptual model to support research planning

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One Example: Could people be exposed to UOGD wastewater?

Source of UOGD exposure

- Wastewater from the development of a well
- Storage (e.g., tanks or impoundments)
- Inject for disposal
- Re-use
- Discharge to surface water after treatment
- Other?

Exposure Media → Exposure Route → Exposed Population → Potential for Adverse Health Outcome

- Is any one exposed under routine or accidental conditions?
- Does the exposure persist for brief (acute) or longer (chronic) periods?
- How important might the exposure be?
Example of regulations influencing the potential for exposure

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

“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

Southwest

Reports & Peer Reviewed Publications

Technical Meetings with Stakeholders

Winter 2018

- Scoping Meeting for Human Health Study Review

Spring/Summer 2018

- Exposure and Risk Screening Committee Workshop #1
- Exposure and Risk Screening Committee Workshop #2

Fall/Winter 2018

- Human Health Study Review
- Exposure Study Review #1
- Exposure Study Review #2

Final RFQ
Population-level research beginning in Year 2 to address important knowledge gaps

Year 1

- Literature Review
- Research Planning

Year 2

- Literature Updates
- Phase I Research

Year 3

- Literature Updates
- Phase I Workshop
- Phase II Research

Year 4

- Literature Updates
- Publish Phase I Research
- Phase II Workshop

Year 5

- Publish Phase II Research
- Final Reports & Communication
- Research Planning
Thank You

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