

# Concerns about Shale Gas Risks among Interested and Affected Parties

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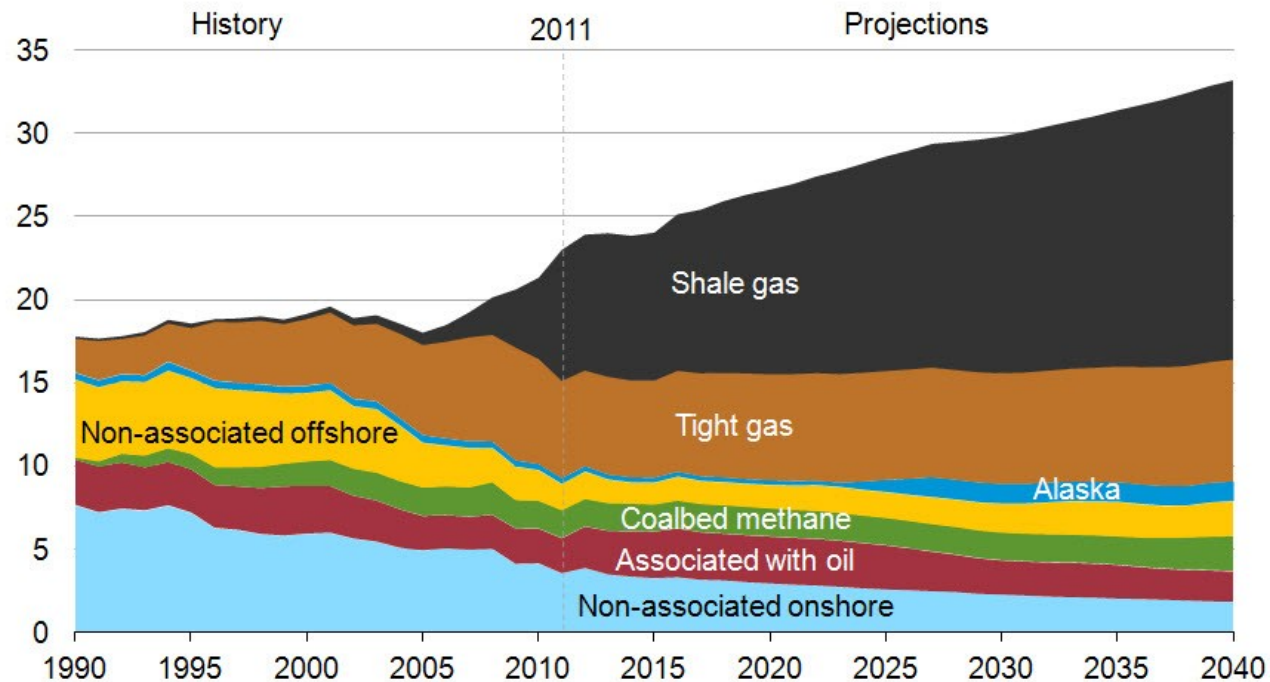
The Pennsylvania State University

**Paul C. Stern**

National Research Council

# Shale gas development is a growing, significant phenomenon of national interest

**U.S. dry natural gas production  
trillion cubic feet**



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2013 Early Release*

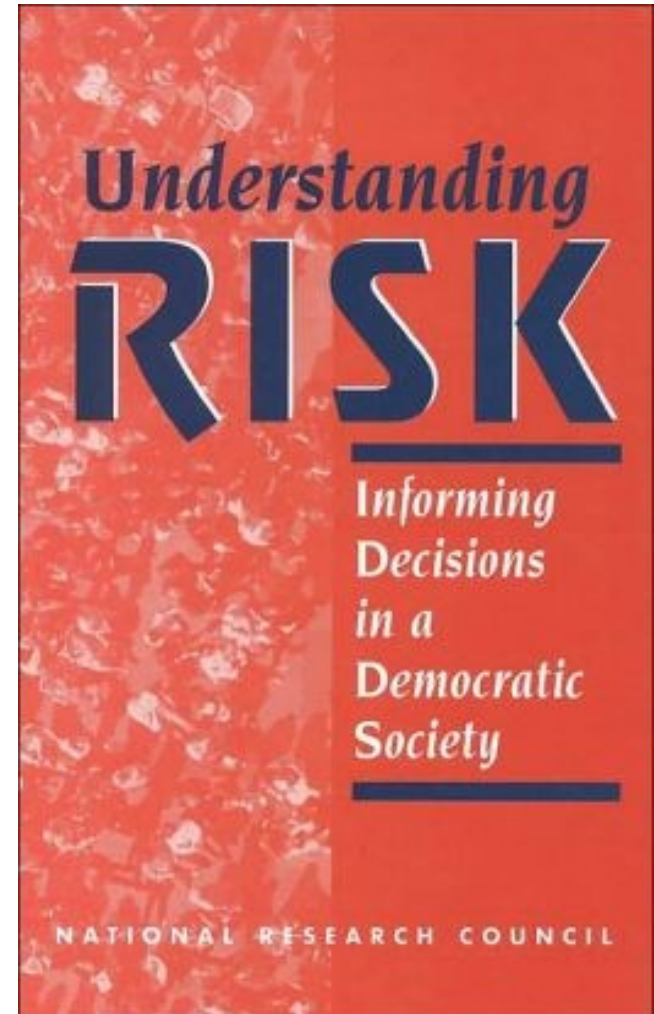
[http://www.eia.gov/energy\\_in\\_brief/article/about\\_shale\\_gas.cfm](http://www.eia.gov/energy_in_brief/article/about_shale_gas.cfm)

# Unconventional shale gas development presents significant, novel risks

- Emerging technology
- Emergent and dynamic risk landscape
- Multiple risks
- Need for thorough risk characterization

# *Understanding Risk* (1996) as a guide

- 1) A broad view of potential risks is essential.
- 2) Must address concerns of interested and affected parties.



# Our approach: Elicit concerns

- Target population:
  - Interested and affected parties who are knowledgeable
- Method:
  - Anonymous Internet-based elicitation instrument

# Recruitment methods

- Search via Facebook and Internet for groups concerned about (or likely to be concerned about) shale gas development
- Invitation email to group contact
- Encouragement to forward invitation
- Post to group Facebook pages

# Initial contacts

## Local anti-fracking groups (24)

- Catskill Citizens for Safe Energy
- Responsible Drilling Alliance
- PennEnvironment
- Food and Water Watch
- No Fracking Way
- 350.org
- Ban hydro-fracking in Greenfield Ohio

## Regulators (17)

- Arkansas Oil & Gas Commission
- Wyoming State Geologists
- N. Dakota State Water Comm.
- Colo. Water Conservation Board
- Texas Comm. on Environ. Quality

- Nat'l Assoc of County & City Health Officials
- National Tribal Air Association

## Gas company groups (7)

- American Gas Association
- Ohio Oil & Gas Energy Education Program
- MK Energy Group
- Michigan Oil & Gas Assoc.
- Energy in depth

## Consumer gas industry (6)

- Lennox heating and cooling
- Ballard Sparh - Process Gas Consumers Group
- US Chamber of Commerce

## Financial matters (6)

- National Association of Royalty Owners
- NY Society for Security Analysts
- Packer-Thomas

## Media (3)


- The Energy Report
- Energy Boom
- Shale Gas Reporter

## Renewable energy (3)

- American Solar Energy Society
- American Council on Renewable Energy
- Energy Citizens

# Instrument to collect concerns

1. Please use the space below to describe your concerns about shale gas extraction involving fracking. Concerns may be about fracking itself, about other activities of the industry, or about actions to limit or regulate it.





# Instrument to collect concerns

2. Please use this space to describe specific things about shale gas extraction that you would like to learn more about.



# Instrument to collect concerns

3. Do you live in a community where fracking is happening now?

Options:

- Yes
- No
- No, but it could occur here sometime in the near future

4. What state do you live in?

# Instrument to collect concerns

5. Please mark any box(es) below that applies to you.
- land owner with existing lease for fracking
  - employee of the oil or gas industry
  - member of a group opposed to fracking
  - member of a group in support of fracking
  - public official
  - involved in fracking in some other way (please describe)
  - none of the above

# Descriptive Results

# Responses

- 372 total responses
- 2-2555 words per response
- Wide range of length, format, tone

## Example response

“As a retired geologist one of my concerns is the integrity of wells 50 -75 years into the future. I know that industry says that they will line the wells with steel pipes and will pump cement into the wells and that this will seal them....” (368)

## Example response

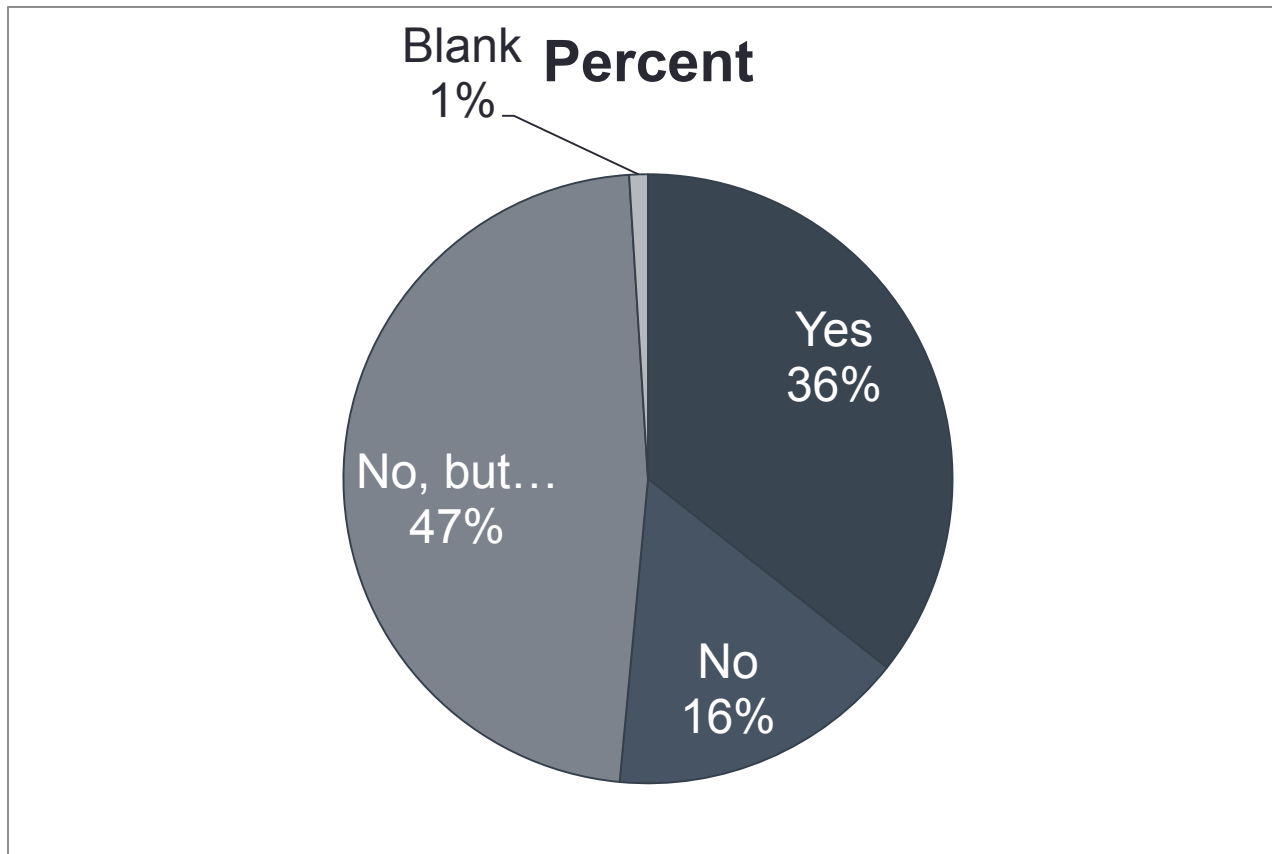
“water contamination, local air pollution, global warming pollution; chemicals used unregulated; Clean Air/Clean Water Act exemption” (345)

## Example response

“Our groundwater is at risk here! I do NOT want the chemicals associated with fracking (which are dangerous and cause great health problems) injected into the ground around any humans or animals!”  
(332)



# Do you live in a community where fracking is going on now?



# State of residence

State	Number	Percent	Normalized Response Rate*
New York	145	39.5%	6.34
Ohio	60	16.3%	4.45
West Virginia	36	9.8%	16.60
Pennsylvania	33	9.0%	2.21
Colorado	32	8.7%	5.28
Maryland	13	3.5%	1.89
Texas	6	1.6%	0.20
California	5	1.4%	0.11
Michigan	5	1.4%	0.43
Arkansas	4	1.1%	1.16
Illinois	3	0.8%	0.20
Connecticut	2	0.5%	0.48
Massachusetts	2	0.5%	0.26
New Jersey	2	0.5%	0.19
North Carolina	2	0.5%	0.18
Oregon	2	0.5%	0.44
Missouri	1	0.3%	0.14
North Dakota	1	0.3%	1.22
Oklahoma	1	0.3%	0.22
Rhode Island	1	0.3%	0.81
Virginia	1	0.3%	0.10
Washington	1	0.3%	0.12
District of Columbia	1	0.3%	1.35
Wisconsin	1	0.3%	0.15
Wyoming	1	0.3%	1.48
No answer	6	1.6%	

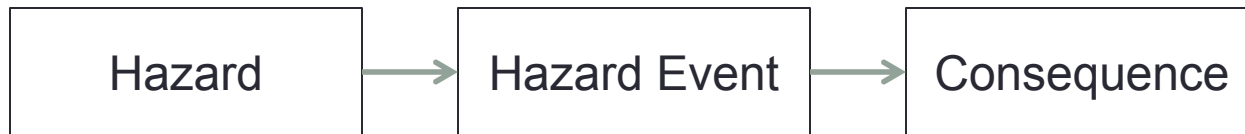
\*Normalized response rate = state response rate / nationwide response rate

# Involvement in shale gas issues

Type of involvement	Number	Percent
Lease holder	26	7%
Employee in industry	5	1%
Opposition group	205	56%
Support group	8	2%
Public official	20	5%
Other	108	29%
None	62	17%

# Basis for qualitative analysis

# Causal structure of hazard events



# Causal structure of hazard events



# Causal structure of hazard events



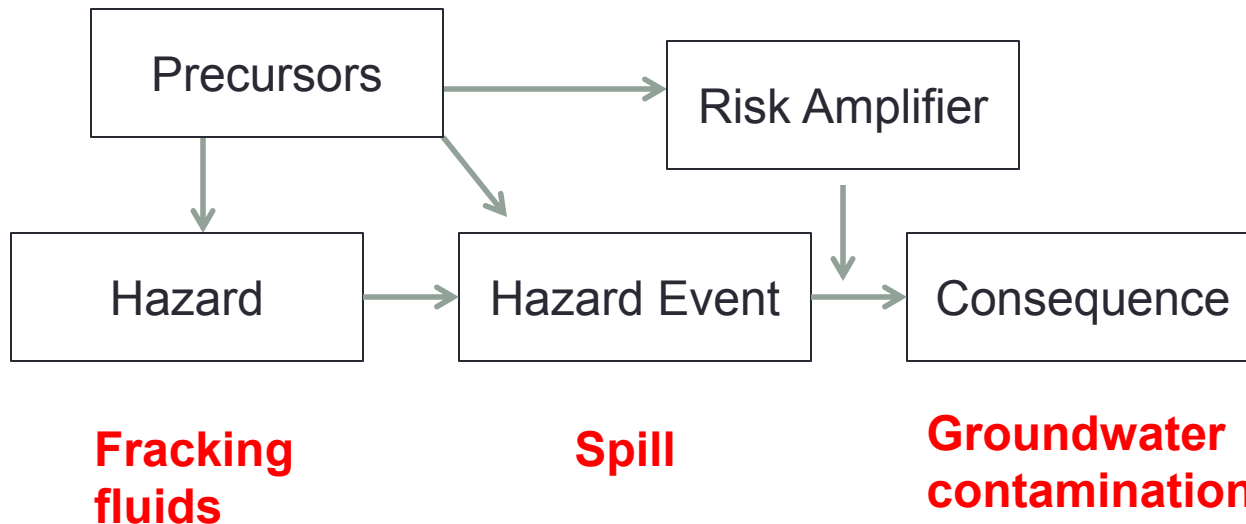
# Causal structure of hazard events



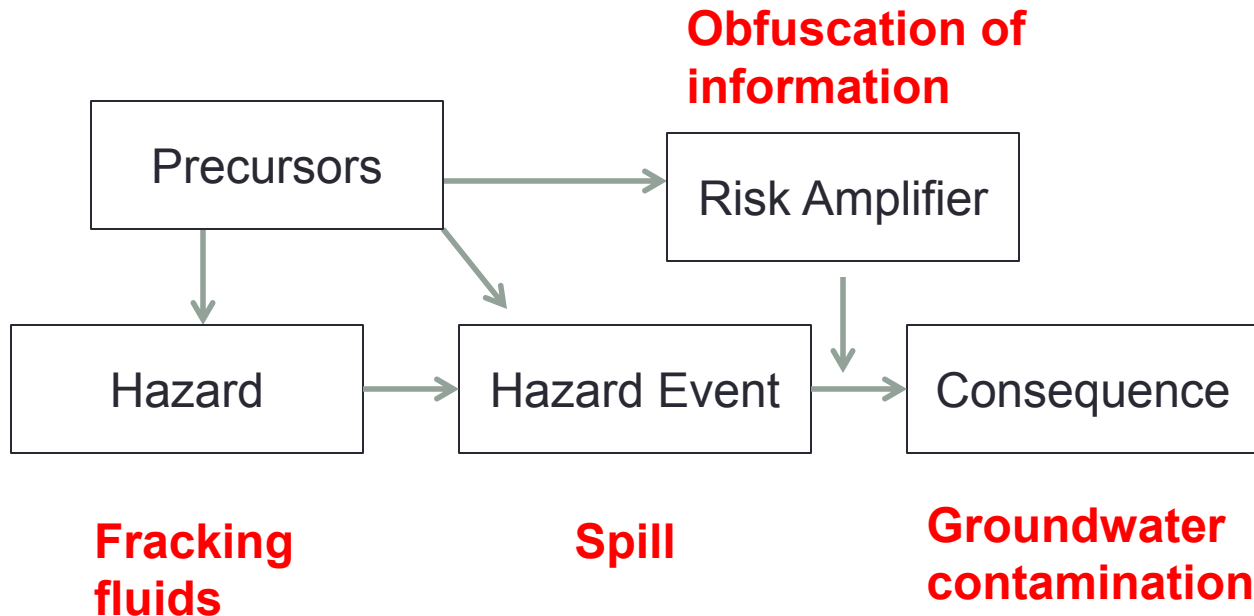
**Groundwater  
contamination**



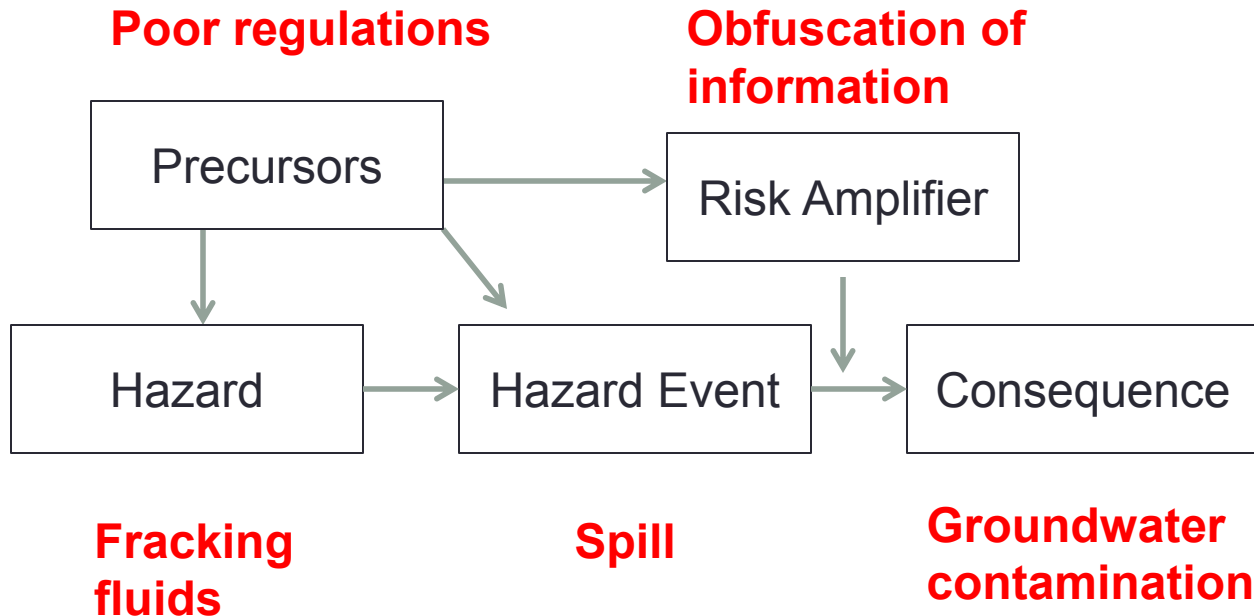
# Causal structure of hazard events



# Causal structure of hazard events



# Causal structure of hazard events



# Coding procedures

- Constant comparison method (Glaser & Strauss)
- First-round codes
- Inter-coder conference
- Revision of codes

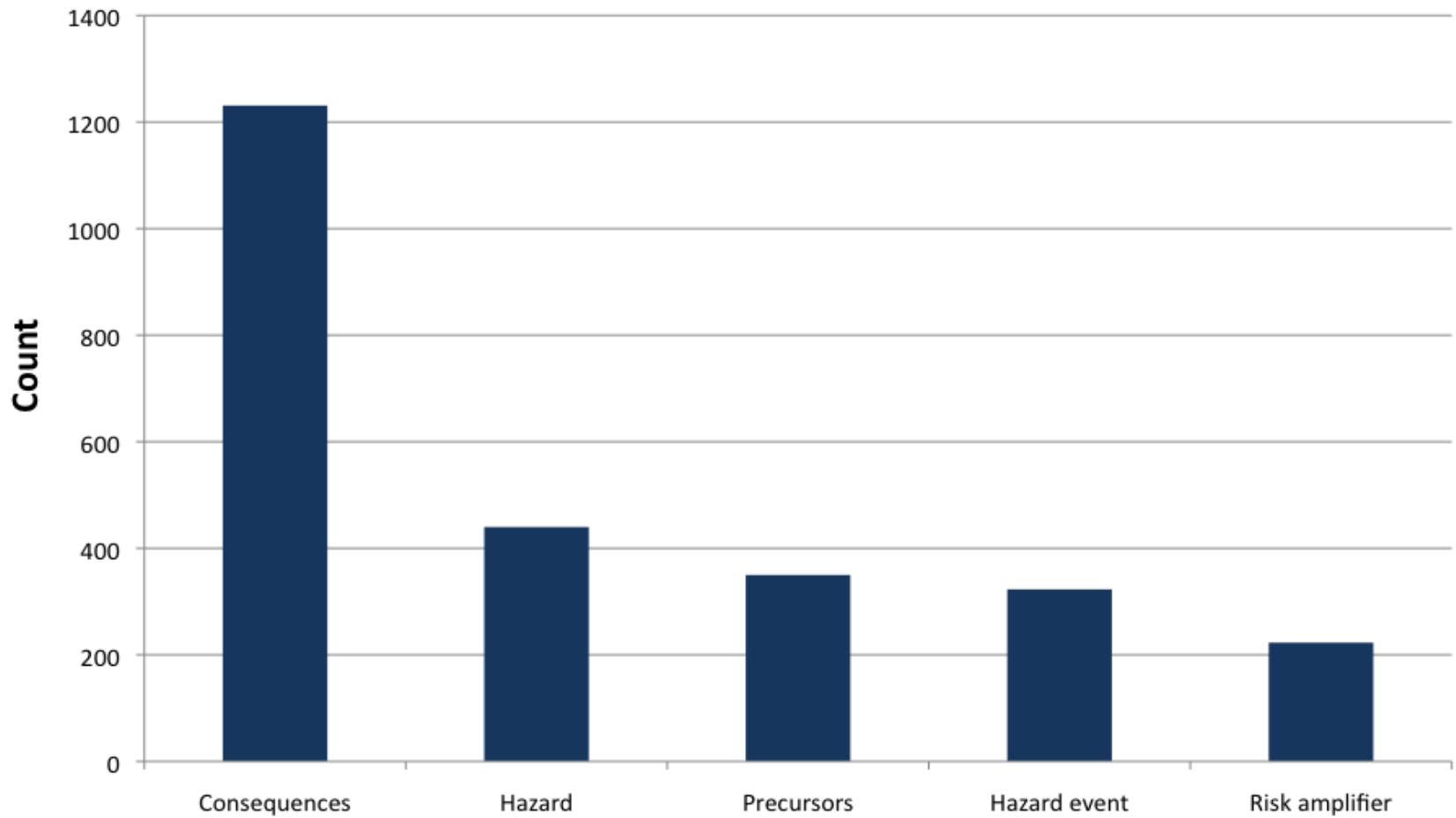
# Analytic Results

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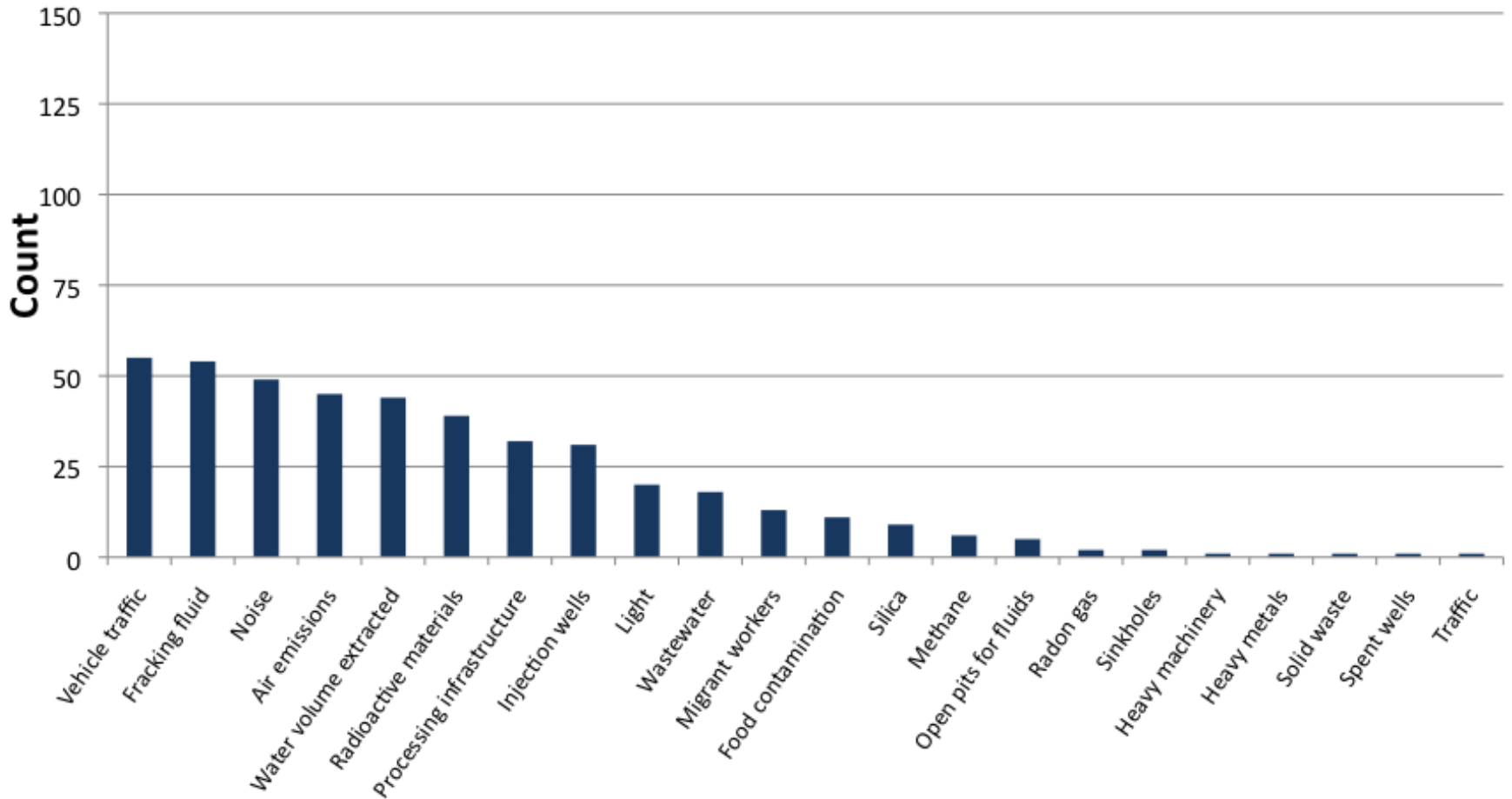
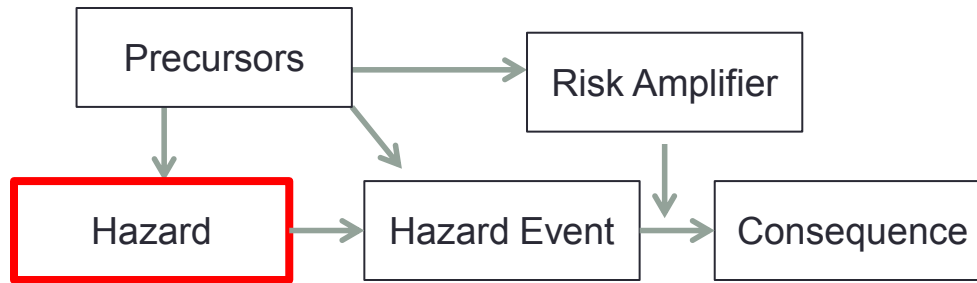
- 131 unique codes developed
- 2,567 total codes applied
- Range per respondent: 0-46 codes
  - Median: 5

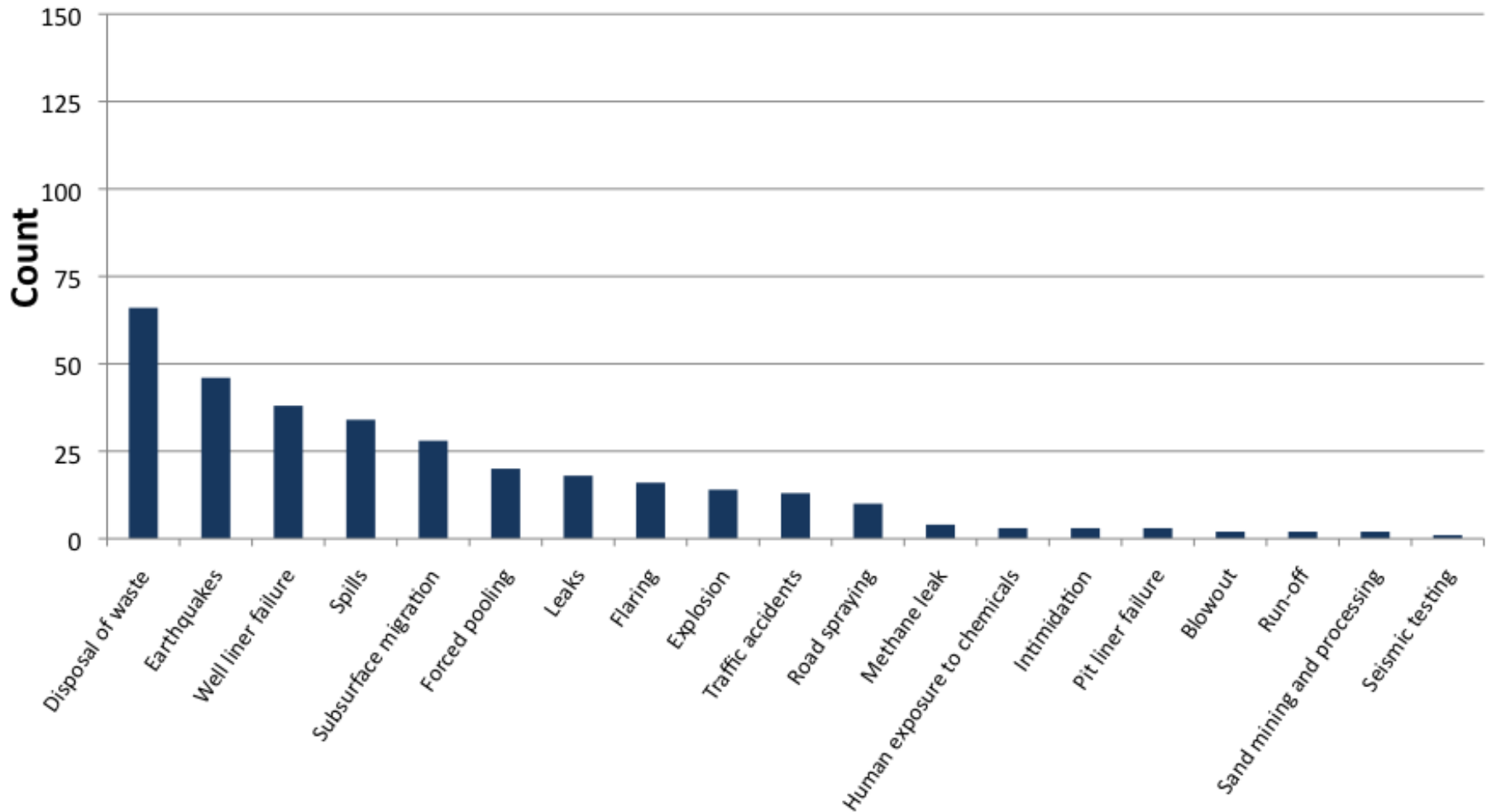
# Analytic Results: Caveats

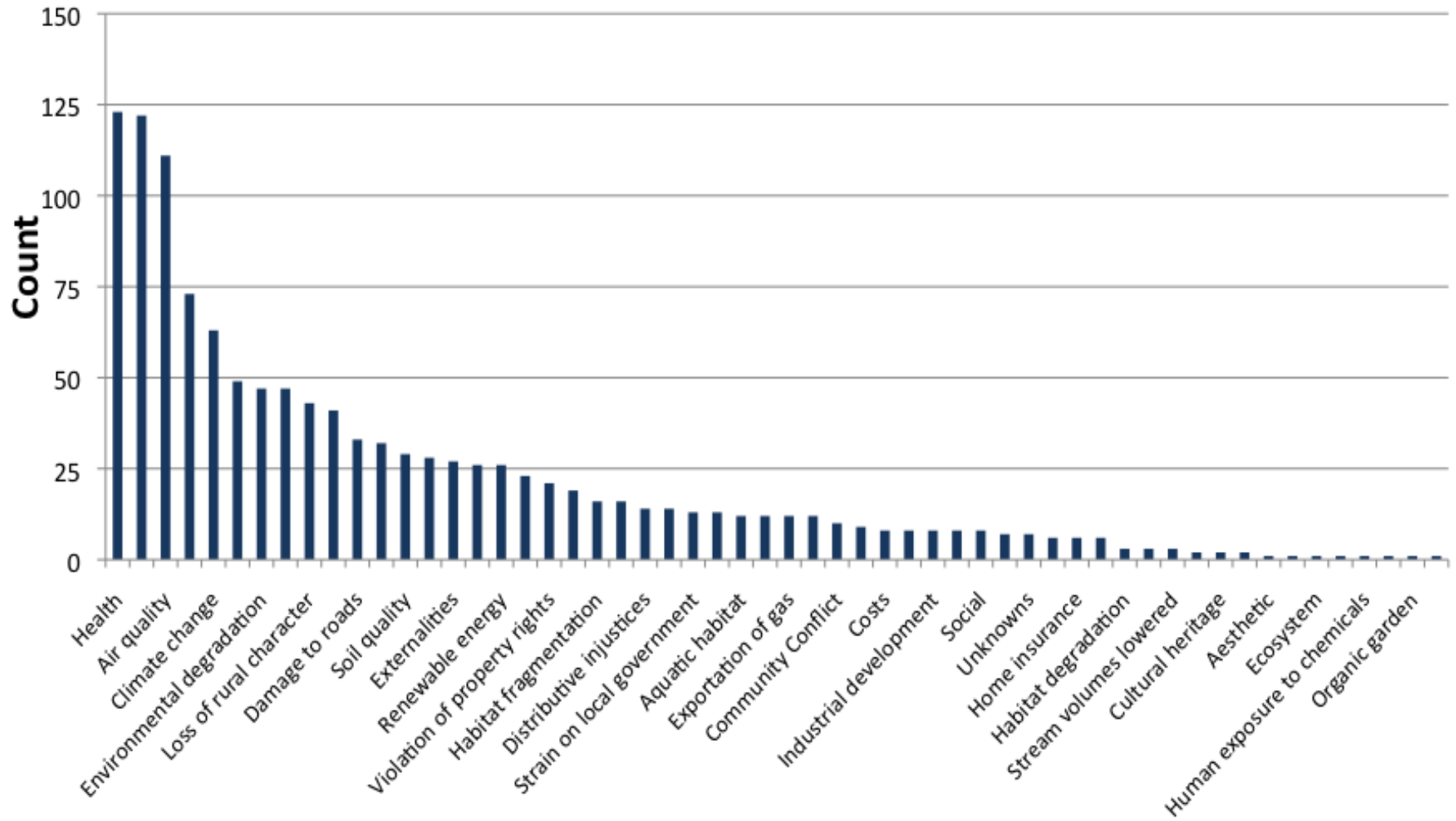
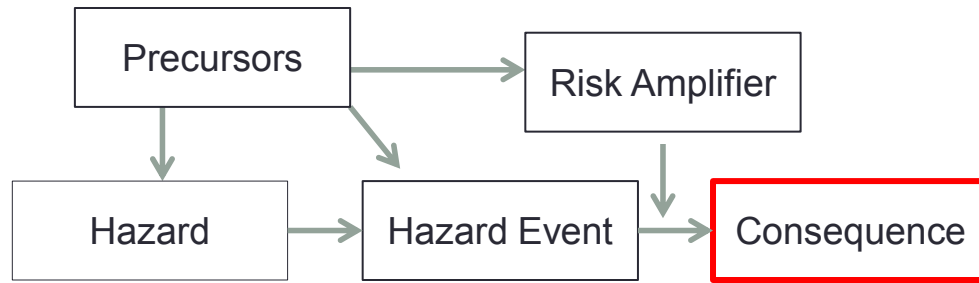
- Not a representative sample
- Frequencies are meaningful
  - oft-mentioned concerns should be investigated
  - some may prove not to be important
- Rarely mentioned concerns may be important
  - e.g. sand mining

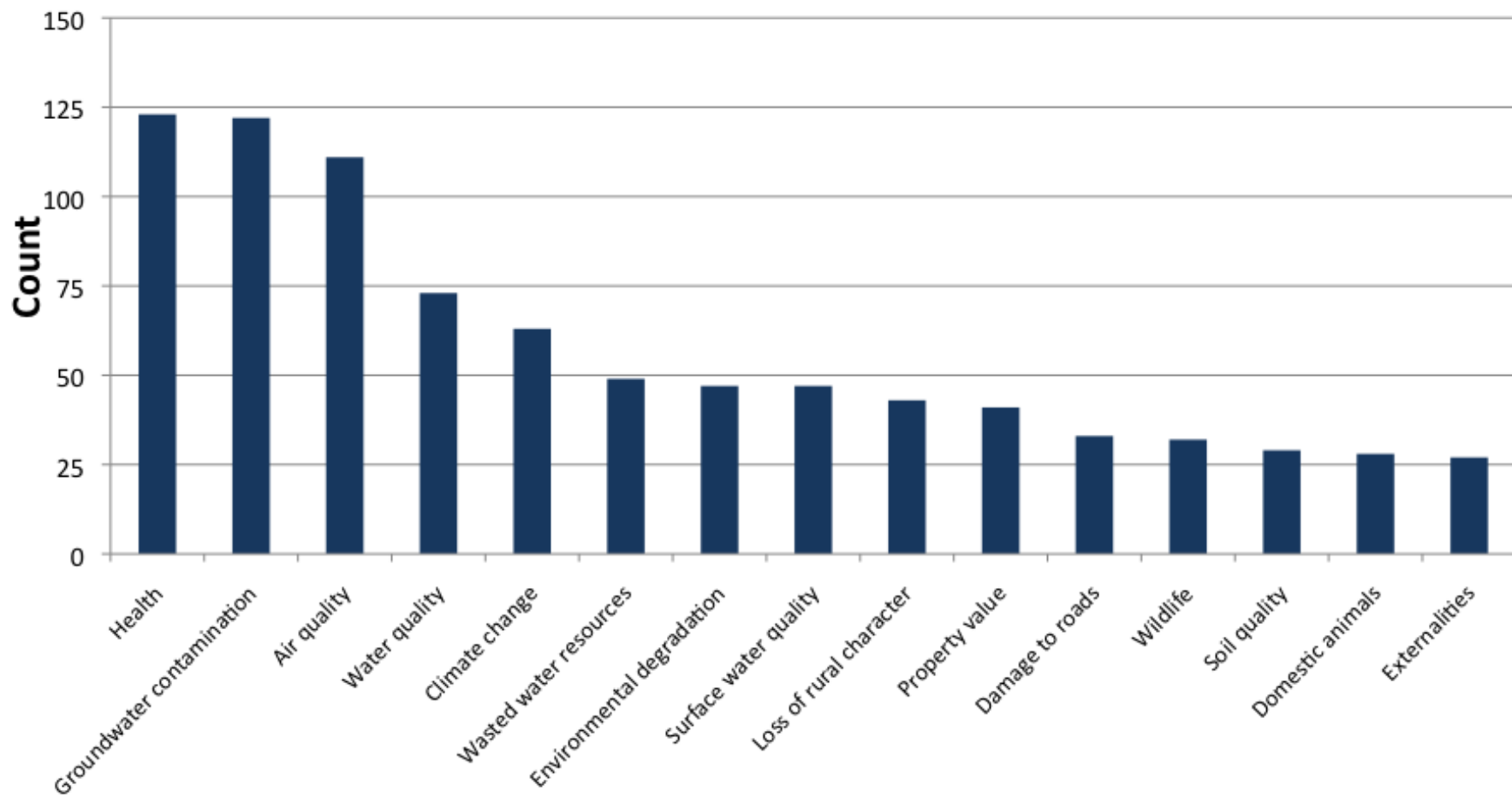


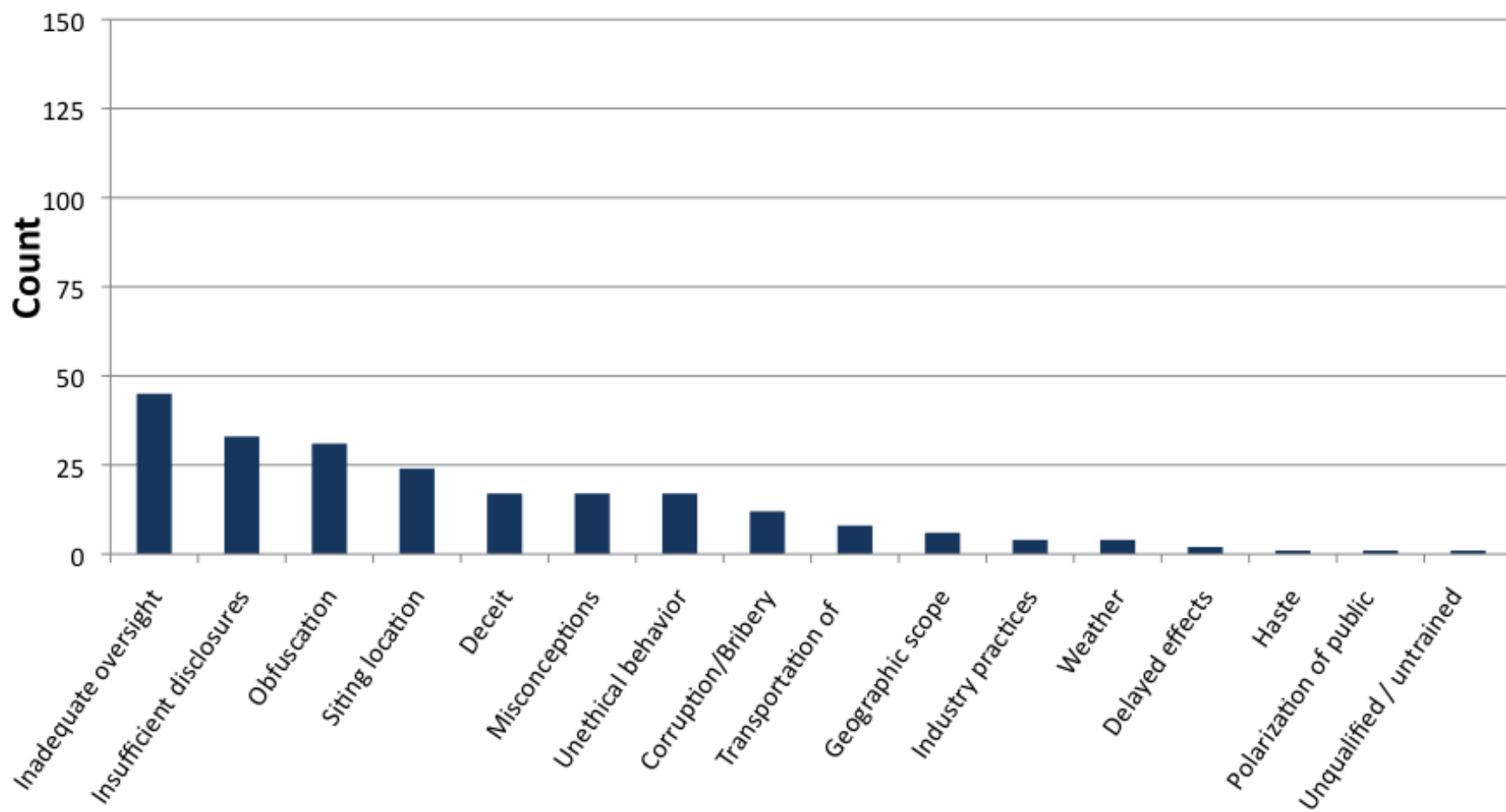


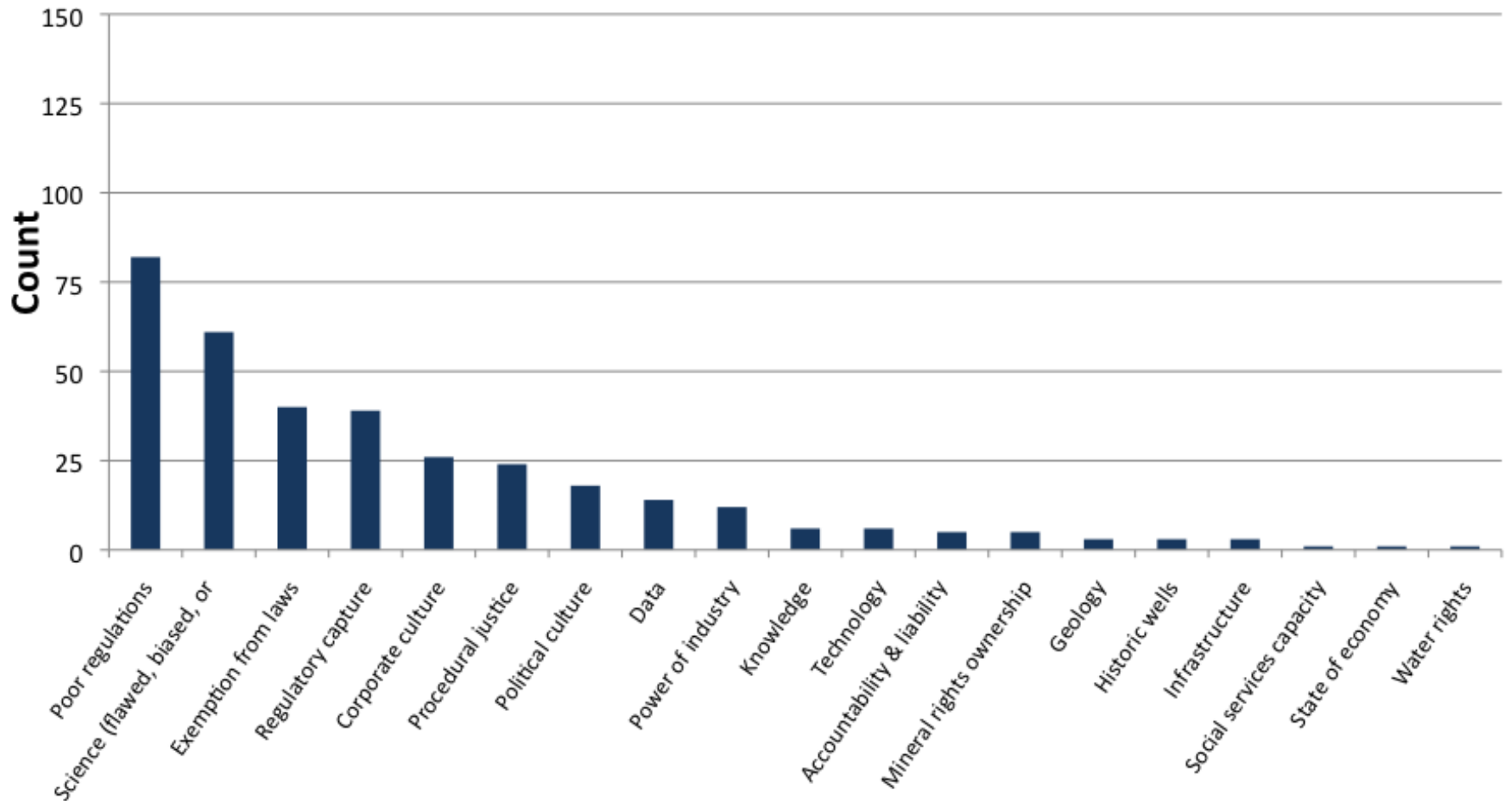












# Key findings

- Nine themes that emerged in the analysis
- Issues that have received little or insufficient analytical attention

# Finding 1: Quality of life impacts (25% of respondents)

Concern	Frequency	Percent of respondents
Loss of rural character	43	11.7%
Crime	23	6.3%
Loss of beauty	14	3.8%
Community conflict	10	2.7%
Industrial development	8	2.2%
Quality of life	8	2.2%
Social	8	2.2%
Lost happiness	6	1.6%
Lost sleep	3	0.8%
Cultural heritage	2	0.5%
Aesthetic	1	0.3%
<b>Total</b>	<b>126</b>	

Note: "Percent of respondents" does not add up to 25% because some respondents cited more than one of these concerns



# Quality of life

“Our quality of life has been ruined because we now have fracking going on just 1600 feet from our well water, our quiet, tree-lined gravel road has been turned into an industrial zone, trees torn down, road widened for the trucks.”

“Shale gas extraction sets neighbor against neighbor and tears apart communities.”

## Finding 2: Economic impacts (18%)

Concern	Frequency	Percent of Respondents
Property value	41	11.2%
Disruption to existing businesses	19	5.2%
Tourism	16	4.4%
Home insurance	6	1.6%
Health insurance	1	0.3%
<b>Total</b>	<b>83</b>	

Note: "Percent of respondents" does not add up to 18% because some respondents cited more than one of these concerns

# Economic impacts

“At best this is a boom and bust industry, not a solid economic building block.”

“Disruptive effects of industrialization on traditional economic drivers in small up-state NY communities including farming, wine/beer making, tourism, [and] higher education.”

## Finding 3: Impacts distant from well site (24%)

Concern	Frequency	Percent of Respondents
Earthquakes	46	12.5%
Injection wells	31	8.4%
Wastewater	18	4.9%
Transportation of hazardous materials	8	2.2%
Sand mining and processing	2	0.5%
Solid waste	1	0.3%
<b>Total</b>	<b>106</b>	

Note: "Percent of respondents" does not add up to 24% because some respondents cited more than one of these concerns

# Impacts distant from well site

“There also seems to be a lot of devious behaviors (like dumping waste in neighboring states)”

“Drilling companies have proposed transporting waste water from states as far away as Texas to be disposed of in Ohio.”

## Finding 4: Climate change (22%)

Concern	Frequency	Percent of respondents
Climate change	63	17.2%
Renewable energy	26	7.1%
Energy consumption behavior	12	3.3%
<b>Total</b>	<b>101</b>	

Note: "Percent of respondents" does not add up to 22% because some respondents cited more than one of these concerns

# Climate Change

“[Shale gas development] would increase our carbon output and hence increase global warming.... We must cut back on our use of fossil fuel and switch to real renewables like wind and solar.”

“Natural gas extraction worse than coal extraction as far as global warming is concerned.”

“Promoting continued role of fossil fuels as energy solution is bad policy.”

## Finding 5: Quality and availability of information (18%)

Concern	Frequency	Percent of respondents
Insufficient disclosures	33	9.0%
Obfuscation	31	8.4%
Data	14	3.8%
<b>Total</b>	<b>78</b>	

Note: "Percent of respondents" does not add up to 18% because some respondents cited more than one of these concerns



# Quality and availability of information

“I am concerned about the lack of data that tells long term effects of fracking and health issues to those near fracking wells.”

“Gag orders silencing doctors treating patients impact by frack fluid. New gag order making it illegal to report sick livestock near gas well.”

“Too many obstructions to collecting and/or publicizing hard data about most impacts”

## Finding 6: Regulations and regulatory capture (46%)

Concern	Frequency	Percent of respondents
Poor regulations	82	22.3%
Science (flawed, biased, or limited)	61	16.6%
Inadequate oversight	45	12.3%
Exemption from laws	40	10.9%
Regulatory capture	39	10.6%
<b>Total</b>	<b>267</b>	

Note: "Percent of respondents" does not add up to 46% because some respondents cited more than one of these concerns

# Regulations and regulatory capture

“The record of Ohio EPA as an effective, independent or proactive agency is not reassuring.”

“Political and Legal implications - namely, corruption or the perception of government bias to oil and gas industry officials and subversion of the political process. For example, how did it come to be that long-standing environmental and community laws were circumvented in states like PA and NY (i.e., Compulsory Integration).”

“Regulations are too weak. They are established by state agencies which have a vested interest in promoting natural gas development. the Regulations that do exist are not rigorously enforced. in some cases, state agencies are in collusion with industry to cover up problems.

## Finding 7: Ethics and justice (10%)

Concern	Frequency	Percent of respondents
Procedural justice	24	6.5%
Distributive injustices	14	3.8%
<b>Total</b>	<b>38</b>	

Note: "Percent of respondents" does not add up to 10% because some respondents cited more than one of these concerns

# Ethics and justice

“My concern is that the federal and state gov[ernments] have taken away the rights of local citizens to determine if they want fracking in their communities.”

“profits for a few landowners and some large international companies will come before quality of life, health and safety for the majority of people in our community and all the other communities where fracking is occurring.”

## Finding 8: Wasted water resources (13%)

Concern	Frequency	Percent of respondents
Wasted water resources	49	13.1%

# Wasted water resources

“In a time of increasing water scarcity, we cannot afford to permanently remove water from the hydrological cycle.”

“I am concerned about the huge quantities - millions of gal - of water used for each frack. This water is contaminated and disposed of in deep injection wells and sealed off. Thus it cannot evaporate and remain a part of the water cycle.”

## Finding 9: Ecosystem and domestic animal impacts (22%)

Concern	Frequency	Percent of respondents
Wildlife	32	8.7%
Domestic animals	28	7.6%
Habitat fragmentation	16	4.4%
Terrestrial habitat	13	3.5%
Aquatic habitat	12	3.2%
Deforestation	8	2.1%
Habitat degradation	3	0.8%
Aquifer depletion	2	0.5%
Invasive species	2	0.5%
Ecosystem	1	0.3%
Loss of biodiversity	1	0.3%
<b>Total</b>	<b>118</b>	

Note: "Percent of respondents" does not add up to 22% because some respondents cited more than one of these concerns



# Ecosystem and domestic animal impacts

“A vast network of roads, towers, trucks, pipelines and flaring can disrupt species' migration, mating, hunting and ability to survive.”

“The farmers are reporting dead or ill animals”

# Conclusions

- Interested and affected parties have a broad range of concerns about shale gas development.
- While some of the concerns identified have received careful study, others, including some that were cited quite often, have received little analytic attention.
- Intangibles are important elements of public concern (quality of life, quality of information, justice issues).
- Concerns go beyond NIMBYism (e.g., climate, ecosystems).
- A major underlying issue seems to be a lack of trust that current institutions will protect people and the environment from whatever risks shale gas development may pose.

# Discussion points

- Are the hazards and risks associated with the concerns we identified receiving adequate study?
- Are there concerns or hazards absent from our report?
- How do the concerns identified here compare with those identified through other methods, such as expert elicitation or public opinion surveys?
- Are there methods available to characterize the risks associated with these concerns?
- Are there existing data gaps?
- Are there methods available to identify newly emerging risks?