THE BOYSEN RESERVOIR AND DOWNSTREAM FLOW

To: Governor Gordon, the Commissioners of Fremont and Hot Springs Counties and the Wyoming Department of Environmental Quality

Dear Friends,

As representatives of the Wyoming Interfaith Network, we urge you to deny permits for fracking water to be disposed in Bad Creek, and its flow into Boysen Reservoir. The extravagant impact of such large qualities of "produced" water put both downstream communities and wildlife at risk for years to come. It is unhealthy and negligent of the complexity of life to take such an immense risk, and grant permission to release ***8.27 million gallons of "produced" water per day*** into Bad Creek, and to encourage ***4150 new wells*** in such a vunerable area. The Physicians for Social Responsibility call this: "**High Intensity Hydralic Fracking**" As an experienced Wyoming geologist, Dr. Ron Frost, stated: "The Department of Environmental Quality must both be informed and inform the public of the persistent toxicity of dangerous chemicals that do not dissipate, like cadmium and arsenic, and other heavy metals. If the proposal includes "processed water" from past fracking operations, it is critical to test the "processed water" regularly and make the test results transparent.

To measure the quantity of fracking disposal against the quantity of local water takes NO ACCOUNT of the meaning of toxicity or the duration of pollution's damage. Most heavy metals do not dissipate—they remain in the water, in the sand, in the soil.*

It is important to be aware of the health consequences of both fracking and fracking, or "produced," water. A highly respected organization, the Physicians for Social Responsibility, has offered six "compendium studies" and the 361 page 2018 study concludes:

"As fracking operations in the United States have increased in frequency, size, and intensity, and as the transport of extracted materials has expanded, a significant body of evidence has emerged to demonstrate that these activities are dangerous to people and their communities in ways that are difficult—and prove impossible—to mitigate. Risks include adverse impacts on

water, air, agriculture, public health and safety, property values, climate stability, and economic vitality, as well as earthquakes."

In specific, the study concludes: ***Fracking fluids consist of millions of gallons of fresh water to which is added a sequence of chemicals that include biocides, lubricants, gelling agents, anti-scaling, and anti-corrosion agents. Some of the water used to frack wells remains trapped within the fractured zone…The remainder travels back up to the surface. This flow back fluid contains not only the original chemical additives, many of which are toxic, but also harmful substances carried up from the shale zone, which often includes heavy metals and radioactive elements.*** ***(Physicians for Social Responsibility, Compendium, June, 2018, page 18)***

Clean-Up has never been a priority of the energy industries in the state of Wyoming, as Jeffrey City will "attest." It is the tax-payers who have to fund restoration, <u>if it is possible at all</u>. The University has been working on fracking water for over twenty years, and no viable solution is evident. All that is known now is NOT to pass the toxicity downstream, but to create pools where the production water can evaporate. The pools must be lined with clay and, once evaporation occurs, only toxic waste is left. Dilution is a health risk, especially for the quantities of produced water which are proposed.

The Wyoming Interfaith Network is located in communities of faith all around the state and it has extensive experience in Wyoming's vulnerability. It was formed after the first energy boom, in the 1970's, and has continued to be a state-wide voice for the quality of life in towns great and small. Throughout the years, WIN (formerly the Wyoming Church Coalition) has fought for mitigation of "Leaky Underground Storage Tanks," "Ground Water Pollution," and "Storing Nuclear Waste." Granting permits to dump toxic waste into clean waters is even a more serious threat to the life of those of us who call Wyoming home.

Sincerely,

715 S. 11th St.

Rev. Dr. Sally Palmer, Laramie, Wyoming 82070

for the Wyoming Interfaith Network

A few pages from 361 of the report. You are welcome to download it all
Dr. T

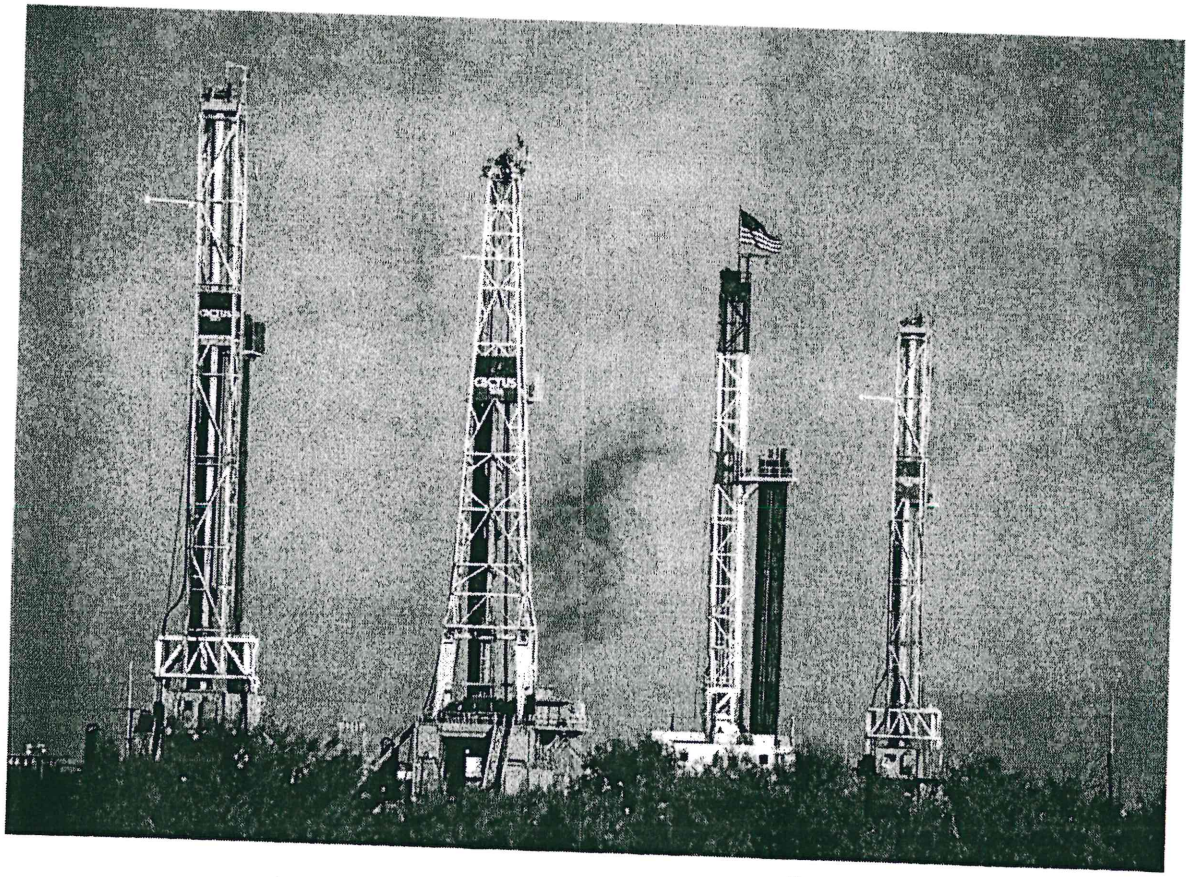
Concerned Health Professionals of NY

PSR PHYSICIANS FOR SOCIAL RESPONSIBILITY

Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction)

Sixth Edition

June 2019



Fracking rigs off of Interstate 20
West of Midland, Texas, in the Permian Basin ©2018 Julie Dermansky

About this Report

The Compendium is organized to be accessible to public officials, researchers, journalists, and the public at large. The reader who wants to delve deeper can consult the reviews, studies, and articles referenced herein. In addition, the Compendium is complemented by a fully searchable, near-exhaustive citation database of peer-reviewed journal articles pertaining to shale gas and oil extraction, the Repository for Oil and Gas Energy Research, that was developed by PSE Healthy Energy and which is housed on its website (https://www.psehealthyenergy.org/our-work/shale-gas-research-library/).

For this sixth edition of the Compendium, as before, we collected and compiled findings from three sources: articles from peer-reviewed medical or scientific journals; investigative reports by journalists; and reports from, or commissioned by, government agencies. Peer-reviewed articles were identified through databases such as PubMed and Web of Science, and from within the PSE Healthy Energy database. We included review articles when such reviews revealed new understanding of the evidence.

Written in non-technical language, our entries briefly and plainly describe studies that document harm, or risk of harm, associated with fracking and summarize the principal findings. Entries do not include detailed results or a critique of the strengths and weaknesses of each study. Because much of medicine's early understanding of new diseases and previously unsuspected epidemiological correlations comes through assessment of case reports, we have included published case reports and anecdotal reports when they are data-based and verifiable.

The studies and investigations referenced in the dated entries catalogued in the Compilation of Studies & Findings are current through April 1, 2019. The footnoted citations here in the front matter represent studies and articles that are not referenced in the Compendium itself or which appeared as we went to press in June 2019.

Within the compiled entries, we have also provided references to articles appearing in the popular press, when available, that describe the results of the corresponding peer-reviewed study and place them in context with the results of other studies. For this purpose, we sought out articles that included comments by principal investigators on the significance of their findings. In such cases, footnotes for the peer-reviewed study and the matching popular article appear together in one entry. We hope these tandem references will make the findings more meaningful to readers.

Acronyms are spelled out the first time they appear in each section.

News articles appearing as individual entries signify reports that contain original research. In many cases, this reportage is based on data collected by industry or government agencies that were ferreted out by investigative journalists and not otherwise known to the scientific community.

While advocacy organizations have compiled many useful reports on the impacts of fracking, these, with few exceptions, do not appear in our Compendium unless they provide otherwise inaccessible data. We also excluded papers that focused purely on methodologies or instrumentation. For some sources, cross-referenced footnotes are provided, as when wide-

ranging government reports or peer-reviewed papers straddled two or more topics.

In our review of the data, seventeen compelling themes emerged, and these serve as the organizational structure of the Compendium. Readers will notice the ongoing upsurge in reported problems and health impacts, making each section top-heavy with recent data. In accordance, the Compendium is organized in reverse chronological order within sections, with the most recent information first.

The Compendium focuses on topics most closely related to the public health and safety impacts of unconventional gas and oil drilling and fracking. These necessarily include threats to climate stability.

Additional risks and harms arise from associated infrastructure and industrial activities that necessarily accompany drilling and fracking operations. A detailed accounting of all these ancillary impacts is beyond the scope of this document. Nevertheless, we include in this edition a section on impacts from fracking infrastructure that focuses on

- compressor stations and pipelines;
- silica sand mining operations;
- natural gas storage facilities;
- the manufacture and transportation of liquefied natural gas (LNG), and
- natural gas power plants.

(Research on gas-fired power plants appears in this edition for the first time. Note that threats from flare stacks are included in the section on air pollution.)

Many other relevant concerns—such as disposal of solid waste drill cuttings and the use of fracked gas as a feedstock in petrochemical manufacturing—are not included here. We hope to take up these issues in future editions.

Similarly, this edition of the Compendium does not examine the harms and risks posed by other forms of unconventional oil and gas extraction, such as cyclic steaming (which uses pressurized, superheated water to release oil), microwave extraction (which points microwave beams into shale formations to liquefy oil), and artificial lift (which uses gases, chemicals, or pumps to extract natural gas).

Given the rapidly expanding body of evidence related to the harms and risks of unconventional oil and gas extraction, we plan to continue revising and updating the Compendium approximately every year. It is a living document, housed on the websites of Concerned Health Professionals of New York and Physicians for Social Responsibility, which serves as an educational tool in important ongoing public and policy dialogues.

The Compendium is generally a volunteer project and has no dedicated funding; it was written utilizing the experience and expertise of numerous health professionals and scientists who have been involved in this issue for years.

We thank our external peer readers for their comments and suggestions: Casey Crandall; Laura Dagley, BSN, RN; Barbara Gottlieb; Robert Gould, MD; Jake Hays, MA; Douglas Hendren, MD, MBA; Lee Ann Hill, MPH; Robert Howarth, PhD; Anthony Ingraffea, PhD, PE;

with a massive natural gas plant over concerns that gas was a risky investment "if alternatives decline in price."[30]

With an economic lifespan of between 30 and 50 years, new gas and oil infrastructure projects are now at risk for becoming stranded assets. Evidence shows that, even in the absence of new climate policies, continuing investments in fossil fuel exports may substantially harm the U.S. economy.[31]

Expanding Knowledge Base

Even as we compiled entries for this sixth edition, the authors of the Compendium continued to see evidence of, and appreciate, the rapid expanse of our knowledge base. The Compendium exists within a moving stream of data.

As is revealed in the Repository for Oil and Gas Energy Research (ROGER), the database of literature maintained by PSE Healthy Energy, the number of peer-reviewed publications relevant to assessing the environmental, socioeconomic, and public health impacts of shale gas development doubled between 2011 and 2012. It doubled again between 2012 and 2013.[32]

This trend continues. More than half of the peer-reviewed scientific papers on the risks and harms of fracking have been published since January 2016. Indeed, 20 percent (355 studies) of the now more than 1,700 available studies were published in 2018 alone.

As of April 16, 2019, there were 1,778 published peer-reviewed studies that pertain to shale and tight gas development archived in the ROGER database.[33]

This body of evidence clearly reveals both potential and actual harms. Specifically, PSE's statistical analysis of the scientific literature available from 2009 to 2015 demonstrates that:

- 69 percent of original research studies on water quality found potential for, or actual evidence of, fracking-associated water contamination,
- 87 percent of original research studies on air quality found significant air pollutant emissions, and
- 84 percent of original research studies on human health risks found signs of harm or indication of potential harm.[34]

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[30] Bade, G. (2019, April 25). Indiana regulators reject Vectren gas plant over stranded asset concerns. *Utility Dive*. Retrieved from https://www.utilitydive.com/news/indiana-regulators-reject-vectren-gas-plant-over-stranded-asset-concerns/553456/

[31] Mercure, J.-F., Pollitt, H., Viñuales, J. E., Edwards, N. R., Holden, P. B., Chewpreecha, U., . . . & Knobloch. F. (2018). Macroeconomic impact of stranded fossil fuel assets. *Nature Climate Change 8*, 588-593. doi: 10.1038/s41558-018-0182-1

[32] PSE Healthy Energy (2016, April 20). The science on shale gas development [infographic]. Retrieved from http://www.psehealthyenergy.org/data/PSE_FrackingStudy_Summary_Infographic_4-20-2016_00.jpg

[33] PSE Healthy Energy. Repository for Oil and Gas Research (ROGER). https://www.psehealthyenergy.org/our-work/shale-gas-research-library/