

**The Problem of
Setback Distance for
Unconventional Oil &
Gas Development:
An analysis of
expert opinions**
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“Consensus from expert scientists, public health professionals, and medical professionals confirms that setback distances of less than a quarter-mile are simply not health protective for people living, working, or playing near unconventional oil or gas development. Moreover, vulnerable populations including pregnant women, children, the elderly, people with pre-existing illness, or compromised health deserve additional protections wherever they may be.”

— *Raina Rippel,
EHP Director*

Introduction

The Environmental Health Project (EHP) is a public health organization working at the forefront of the response to health impacts from unconventional oil and gas development (UOGD). As such, we constantly field health-related questions from residents, researchers, government officials, legislators, and journalists. One of the most common and pressing questions asked is “How close is too close?” for residents living, working and playing near wells and distribution infrastructure.

Numerous research studies have indicated that proximity to UOGD activities is associated with health risks that include negative birth outcomes and increased cancer risk, as well as immediate short-term health effects. Direct, comprehensive measurement and analysis of exposure levels is ongoing, yet there remains intense debate on the issue of how to protect public health. Given that definitive conclusions await additional studies, expert advice is needed to provide pragmatic guidance for dealing with health risks, including the determination of setback distances.

In this study the Delphi Technique was used to arrive at expert consensus on the question of appropriate setback distances for UOGD from human activity including residences, schools, workplaces, farms, etc. The Delphi is an accepted method for reaching convergence of expert opinion about a specific topic, particularly when available data are inconclusive. For this Delphi, consensus was defined as 70% agreement of panelists, a level frequently used in similar studies.

Results

In this Delphi 89% of the participants agreed that the minimum safe distance from UOGD is ¼ mile. Additionally, 50% of the participants agreed on 1-1 ¼ mile as a minimum. Others voiced concerns about setback distances up to 2 miles.

- Any and all steps in the process from drilling through delivery of the product to the consumer should be located at least ¼ mile from places where people live, work, or play.¹
- Vulnerable groups in communities should be afforded additional protection where possible, with longer setback distances for settings such as schools, day care centers, and hospitals.²

The Delphi Process

The Delphi is a systematic method of surveying experts (referred to as panelists) to determine their opinion regarding a complex issue. The surveys are completed in a series of rounds. In each round, the participants respond anonymously to a set of questions and in following rounds receive information about the responses of all other panelists, including their own. Panelists are encouraged to re-assess their own responses on subsequent rounds with a goal of reaching consensus. Three rounds are usually sufficient to reach consensus. For this study consensus was defined as agreement of 70% of panelists.

For this Delphi panel, selection criteria included only:

- Researchers whose work has been published in peer-reviewed journals and/or presented at national scientific meetings;
- Scientists employed in government and regulatory agencies;
- Leaders in public policy and environmental advocacy who have been published in the grey literature.

Potential panelists included representatives of federal and state agencies, environmental advocacy groups, health care providers, public health practitioners, and a range of researchers in areas including health, environmental science, toxicology, and social science. Eighteen experts from across the USA agreed to be panelists and returned the completed Round 1 questionnaire and consent form. All panelists fit into at least one of the selection criteria (Tables 1 and 2).

Table 1. Delphi Panelist categories of expertise

Self-reported profession	Self-reported areas of expertise	Professional field of employment
Researchers/scientists	Air quality; Environmental science; Environmental health; Public health; Medicine/Health; Social science; Water quality; Toxicology	Academic research
Health care providers	Medicine/Health; Environmental health	Private practice; University health centers
Public health practitioners	Epidemiology; Environmental health	State health department; Federal government
Environmental advocates	Policy/Law; Air quality; Environmental science; Environmental health; Public health; Water quality	Environment and Public health organizations
Other	Air quality; Environmental science; Environmental health; Public health; Social science; Epidemiology; other: Risk analysis	Health policy

¹ No panelist agreed with the statement “Recommend setback distances of less than ¼ mile; 11% were unsure, 89% disagreed.

² 89% of panelists agreed with the statement “Recommend additional consideration for vulnerable groups; 11% were unsure; no panelists disagreed.

Table 2. Delphi Panelist participation in Rounds 1-3

Self-reported Profession	Round 1 N=18	Round 2 N=15	Round 3 N=18
Researcher/scientist	9	6	9
Health care provider	3	3	3
Public health practitioner	2	2	2
Environmental advocate	3	3	3
Other	1	1	1
Gender			
Men	9	6	9
Women	9	9	9

Round 1

The first round of the Delphi began with five open-ended questions (Figure A). Experts were instructed, “Where possible in your responses, please address all steps in the process from drilling site construction through delivery of the product to the consumer (e.g., well pad construction, well drilling, hydraulic fracturing, compressor stations, pumping stations, processing plants, impoundments, pipelines, and other steps in the process). In the questions below, the steps in this process are referred to as ‘related activities’.”

Figure A. Open-ended questions for Round 1.

1. What do you believe are appropriate set-back distances for hydraulic fracturing and related activities from places where people live, including single homes, multiple family dwellings, etc.? Please specify if your response is related to oil or gas extraction.
2. What do you believe are appropriate set-back distances for hydraulic fracturing and related activities from indoor places where people work including offices, hospitals, and schools? Please specify if your response is related to oil or gas extraction.
3. What do you believe are appropriate set-back distances for hydraulic fracturing and related activities from outdoor places where people work such as farms? Please specify if your response is related to oil or gas extraction.
4. What do you believe are appropriate set-back distances for hydraulic fracturing and related activities from places where people recreate or play such as parks? Please specify if your response is related to oil or gas extraction.
5. Should set-back distances differ for settings that include groups of vulnerable individuals, such as schools, day care centers, long- term care facilities, and if so, how? Please specify if your response is related to oil or gas extraction.

Content Analysis in Round 1. The qualitative responses from Round 1 were individually coded for subject matter. Categories of responses emerged and responses were grouped by these categories.

In the responses to Round 1 most panelists provided similar responses to each of the questions of setback distances from home, places of work, and places of recreation. Thus all responses to these questions were considered together in the content analysis and two categories of responses emerged: those that recommended specific setback distances and those that focused on the difficulties of establishing setbacks (Charts 1 and 2). The examples for the latter category in Chart 2 reflect the panelist's perspectives that there is insufficient information available to make recommendations. For example, one panelist pointed out that his lack of a specific recommendation did not imply that setback distances were not needed, but that he did not think it was possible to make a recommendation.

The content analysis revealed that responses to the last question concerning setback distances for vulnerable populations differed from those to the first four questions. Vulnerable populations were defined by panelists to include: children, neonates, fetuses, embryos, pregnant women, elderly individuals, those with pre-existing medical or psychological conditions, and those with pre-existing respiratory conditions. Panelists included the following settings as places where vulnerable populations might be concentrated: schools, day care centers, hospitals, and long-term care facilities.

As shown in Chart 3, panelist's responses fit into one of two categories: responses that argued for additional setback distances and responses that focused on the difficulties of establishing setback distances for vulnerable populations. In the latter case, the panelists focused on the distribution of vulnerable individuals throughout the population, making the determination of setback distances to protect all vulnerable members of society difficult if not impossible.

See attached document for Charts 1, 2, and 3

Round 2

All responses from Round 1 were included within four categories on the questionnaire for Round 2. Each panelist was able to see the complete range of responses in each category. Panelists were asked to indicate their level of agreement with each statement using a 5-point scale: strongly agree, agree, not sure, disagree, and strongly disagree and to provide a rationale for their decisions for those statements for which they strongly agreed or agreed.

Round 3

For Round 3, the responses were categorized and consolidated to reflect emerging consensus. For this final round, panelists were asked to review the rationales and the distribution of responses to each category and then indicate their level of agreement with each statement.

Table 3: Distribution of panelist’s responses to the categories and statements used in Round 3 with median scores.* 1= strongly agree; 2=agree; 3=not sure; 4=disagree; 5=strongly disagree

Round 3 Statements	1	2	3	4	5	Median Score
Recommend setback distance of less than ¼ mile	0%	0%	11%	11%	78%	5
Recommend setback distance of ¼ - ½ mile	0%	11%	22%	22%	44%	4
Recommend setback distance of 1 - 1¼ miles	6%	44%	28%	11%	11%	2.5
Recommend setback distance of 2 miles	17%	17%	44%	11%	11%	3
It may not be feasible to recommend setback distances for the general population	28%	39%	6%	22%	6%	2
Recommend additional consideration for vulnerable groups	67%	22%	11%	0%	0%	1
It may not be feasible to recommend additional considerations for vulnerable groups	6%	33%	6%	33%	22%	3

* % may not equal 100% due to rounding

To define consensus, we combined responses of “agree” and “strongly agree” to determine the percent of panelist agreement with a statement and responses of “disagree” and “strongly disagree” to determine the percent of panelist disagreement with a statement. Within the category “recommended setback distances,” panelists reached consensus on the statement “less than ¼ mile.” Eighty-nine percent of panelists disagreed with that statement, exceeding the 70% needed for consensus in this Delphi and rejecting the ¼ mile recommendation. The median score was 5, indicating strong disagreement with the statement.

Panelists did not reach 70% required for consensus on the statement “¼ - ½ mile” although 66% of panelists disagreed, thus there is limited support for consideration of ¼ to ½ mile setbacks. This is reflected in the median score of 4, indicating disagreement. Only 11% of panelists agreed with this statement.

For the statements “1 - 1¼ miles” and “at least 2 miles”, the panelists did not reach consensus. For the former statement, 50% agreed, for the latter statement, only 34% agreed with 44% unsure. A total of 67% of panelists agreed with the statement “It may not be feasible to recommend setback distances for the general population,” almost but not quite reaching the 70% required for consensus.

Regarding setback distances for vulnerable populations, panelists reached consensus on the statement “Recommend additional consideration for vulnerable groups” with 87% agreeing. Panelists did not reach consensus on the statement “It may not be feasible to recommend additional considerations for vulnerable groups”, with panelists closely divided between agreement and disagreement with the statement.

Summary and Conclusions

The Delphi Technique provides a unique opportunity to understand how experts on a particular topic apply their knowledge and experience to a complex problem, and to determine whether a convergence of opinion can be established. EHP applied this method to the question of appropriate setback distances for UOGD from human activity including residences, schools, work places, farms, etc. We used the Delphi because the question of “how close is too close?” is one often posed to our team; we wanted to gather and provide expert opinion on this important health-related concern. Using this systematic approach, panelists identified the need for setback distances to protect health and the lack of scientific data needed to establish sufficient distances. These experts also provided their best judgment on setbacks based on current knowledge.

The process began with four open-ended questions about recommended setback distances for particular types of occupied spaces. The responses to Round 1 generated a set of statements that shifted the overall question of setbacks. According to these experts, the issues are not only about what setback distances are appropriate, but also whether there is enough evidence to provide adequate answers and/or whether establishing setbacks is the correct method to use for protecting public health.

Panelists ranked their agreement/disagreement in Round 2 to the Round 1 statements of their peers. Based on emerging consensus, statements were collapsed down to seven for Round 3: four suggestions for setback distances and three statements on the appropriateness of using setbacks. For their final response, panelists were able to see where consensus was building, and had an opportunity to shift their own opinions. Based on the definition of consensus for this Delphi (70% agreement among panelists), two statements reached consensus.

In the first case, panelists agreed that a setback distance of ¼ mile was not sufficient for public health safety. The examples shown for this category refer to existing regulations and results suggest that experts do not believe these current setbacks are adequate. For the longer setback distances, the number of panelists who agreed increased, but never reached consensus. The distance of 1-1 ¼ mile came closest, reaching 50%, with 28% unsure. Forty-four percent of panelists were unsure whether a 2-mile setback would be appropriate.

The degree of uncertainty on setback distances is also apparent in the response to the next statement: *It may not be feasible to recommend setback distances for the general population*; 67% percent agreed with the statement. The most common responses indicated that there is not yet enough evidence available to accurately set these distances. It may be that the complexity of the processes and infrastructure of UOGD, and of local topography, preclude using a generic setback distance. The implementation of Health Impact Assessments (HIA) was suggested by one panelist as an alternative method for addressing risk factors.

Two statements emerged regarding setback distances and the protection of vulnerable populations: *recommend additional consideration for vulnerable groups* and *it may not be feasible to recommend additional considerations for vulnerable groups*. There was consensus that vulnerable groups should have additional consideration, but panelists were divided as to whether such consideration was feasible. The most common responses indicated that since vulnerable populations, such as children and the elderly, are embedded in the general population it would be difficult if not impossible to give them extra consideration. Yet some responded that where vulnerable individuals gather, such as schools, day care centers, hospitals, and long-term care facilities additional setbacks would be effective.

EHP Report Authors

David Brown, ScD
Celia Lewis, PhD
Lydia Greiner, MSN

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Our mission is to respond to individuals' and communities' need for access to accurate, timely and trusted public health information and health services associated with natural gas extraction.

Conclusions

In conclusion, implications from the results of this Delphi are:

- 1. All UOGD facilities should be located at least ¼ mile from places where people live, work, or play.**
- 2. The setback distance of 1 – 1 ¼ mile for UOGD received the strongest agreement (50%) among the panelists.**
- 3. The lack of greater consensus on a recommended setback distance indicates a need for focused health and exposure information. Future studies should be designed to determine setback distances based on scientific research.**
- 4. Critical attention should be paid to the potential health impacts on vulnerable groups in our midst. Children, neonates, fetuses, embryos, pregnant women, elderly individuals, those with pre-existing medical or psychological conditions, and those with pre-existing respiratory conditions are at greatest risk.**
- 5. Other methods of assessing the risk to public health need to be implemented, including Health Impact Assessments, which can be used to establish regulatory policy.**

For more information contact:

Southwest Pennsylvania Environmental Health Project
2001 Waterdam Plaza Drive, Suite 201
McMurray, PA 15317
724.260.5504
www.environmentalhealthproject.org

