



RESEARCH ARTICLE

# Exposure Experiences of Area Residents Near a Chronic Environmental Contamination Site

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## ABSTRACT

**Background:** The study aims to analyze and interpret the exposure experiences of local residents living within 5 miles of the Fernald Feed Materials Production Center, a former uranium processing site. The goal is to enhance public health efforts addressing psychological stress resulting from environmental exposure.

**Methods:** Semi-structured interviews were conducted from July 1998 to February 2001 as part of the Fernald Living History Project. The study focuses on 4 key phenomenological events: air releases of uranium by-products, Ohio Environmental Protection Agency public notifications of water contamination, a citizens' class action lawsuit against the US Department of Energy and National Lead of Ohio, Inc, and extensive media coverage. Researchers used descriptive inductive coding to analyze data from these events, involving 34 participants.

**Results:** The study identified 5 central themes in the residents' exposure experiences: disruptions to life, loss of trust, seeking answers, interpreting ambiguous threats, and adaptive responses. Participants recounted how these events affected their lives and triggered emotional responses.

**Conclusion:** This research provides valuable insights into the experiences of individuals living near environmentally contaminated sites and offers guidance for future prevention and mitigation strategies.

**Keywords:** Mental health; Rural health; Qualitative research; Environmental exposure; Chronic contamination

## INTRODUCTION

Chronic environmental contamination (CEC) is the experience of living in a region where toxic substances are known or expected to be present in the air, water, and soil at elevated levels for a prolonged and unknown period of time.<sup>1</sup> Chronic environmental contamination sites are highly prevalent around the world and in the United States. Globally, hazardous waste is a public health concern as 300 to 500 million tons of hazardous waste are estimated to be produced annually, and improper transportation, storage, and disposal can lead to biological and environmental harm.<sup>2</sup>

In the United States, nearly one-fourth of the general population currently resides within 3 miles of a site listed on the US Environmental Protection Agency (EPA) National Priorities List (NPL) of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites, commonly known as "Superfund sites."<sup>3,4</sup> These sites result from improper hazardous waste management and require long-term, costly cleanup efforts aimed at implementing a permanent solution. The "chronic" contamination spans years, to even decades, encompassing initial toxic contamination, EPA discovery, NPL listing, remedial action, and cleanup completion.<sup>5</sup> Additionally, persistent organic pollutants with long half-





lives threaten human health, persisting in soils, sediments, and the human body over extended periods.<sup>6</sup>

A growing body of literature has evaluated associations between residential proximity to a CEC site and psychological distress in the form of general stress, anxiety, depression, and reduced health-related quality of life and has identified that mild-to-moderate relationships exist.<sup>7</sup> Proximity to various sources of environmental hazards, such as waste landfills, incinerators, factories, abandoned gas stations, and crops with excessive pesticide use has been shown to increase the risk of adverse health outcomes.<sup>8</sup> Residents living near CEC sites may experience increased stress due to reduced safe neighborhood space, increased cost and inconveniences related to managing their exposure to environmental pollutants, communication with government health officials, and the experience of daily hassles such as increased traffic, household, and social conflict.<sup>9</sup> Individuals living with psychological distress over time may be at an increased risk of chronic illnesses such as cardiovascular disease and obesity; they are also at an increased risk of taking up smoking tobacco and binge drinking, which can perpetuate chronic illness.<sup>10,11</sup> Additional research is needed to determine if area residents near a CEC site should be considered a vulnerable population at risk to adverse mental and physical health outcomes.

Area residents near the Feed Materials Production Center (FMPC), the CEC site of interest in this phenomenological study, were directly exposed to toxic materials, mainly radon and uranium waste and by-products, that were generated and stored at the site through surrounding air and water contamination. The FMPC was located in Fernald, Ohio, nearly 20 miles northwest of Cincinnati, Ohio. It produced 500 million pounds of pure uranium metal and thorium products for the nation's defense program from 1952 until its closure in July 1989 in order to refocus resources on environmental restoration.<sup>12</sup> The FMPC was operated by the site contractor, National Lead Company of Ohio, Inc (NLO), under the management of the US Atomic Energy Commission, now known as the US Department of Energy (DOE).

The Fernald Living History Project organization was established in 1997 with the goal of recording and preserving all aspects of Fernald's history.<sup>13</sup> Participants were recruited using a purposive sampling technique by seeking individuals from the community who were considered representative based on their exposure to the phenomena and who expressed interest in the site. Participants were ages 18 years and older, resided near the Fernald FMPC borders during its operation, were willing to participate in on-camera interviews, and voluntarily engaged in an informed consent process to participate in the interviews. To document the oral history of Fernald, Ohio, residents, in-depth, one-on-one interviews were conducted between July 15, 1998, and February 22, 2001, at the Fernald visitor's site private reading room or in participants' homes by trained interviewers and members of the Fernald Community Alliance. Each interview lasted an average of

90 to 180 minutes and was recorded using a single digital video recording system. The interviewers completed the in-person interviews that were recorded on video and then later transcribed verbatim by trained graduate students within the University of Cincinnati Department of Environmental Sciences. In-depth, semi-structured interviews were conducted, with the interviewer tailoring their questions according to how the interview was progressing, while also having standard questions prepared for each participant. General probes were introduced into the interview (eg, "Can you tell me more about that?").

The purpose of the present study is to explore the lived exposure experiences, the personal, embodied, and unique understanding of chronic exposure among nearby residents, using a qualitative phenomenological approach.<sup>14</sup> This qualitative phenomenological research presents an opportunity to identify themes of exposure experiences by local residents of the FMPC. This analysis may help explain underlying causes of mental health diagnoses and chronic illnesses among the participants presented later in life.<sup>15</sup> This qualitative study synthesizes and interprets the exposure experiences to 4 main phenomena of interest: (1) air releases of uranium by-products from various plants within the FMPC first detected in 1984, (2) Ohio Environmental Protection Agency public notification of potential water contamination in 1985, (3) litigation between Fernald Citizens versus National Lead of Ohio, Inc initiation in 1985 and settlement awarded in 1989, and (4) excessive exposure to local and national media attention. Additionally, this study seeks to advance prevention and mitigation strategies for environmental stressors by public health officials by raising awareness and understanding of contamination from the perspective of local area residents. A thematic analysis was performed to answer the overarching research question, "What were the exposure experiences of local community residents near the FMPC between 1984 and 1989?"

## METHODS

The present study aimed to depict the experiences of residents in the area, with the goal of enhancing public health initiatives for communities residing near environmental contamination. The underpinning philosophy of the study is the direct investigation and description of phenomena as consciously experienced.<sup>16</sup> The philosophical assumption of the study was based upon ontology, the nature of reality, described as "reality is subjective and multiple, as seen by participants in the study."<sup>17</sup> The interpretive framework, or worldview, that was used to shape the interpretation of themes is social constructivism; as a result, the researchers sought to understand the world in which they lived and worked near the FMPC. Therefore, the goal was to rely, as much as possible, on the participants' views of the phenomena.<sup>17</sup> The descriptive methodology and use of inductive coding methods in the study allowed for the exploration of the residents' exposure experiences without any pre-assumptions in order to reveal how living near an environmental contaminated site affected their lives.<sup>18</sup>



The University of Cincinnati institutional review board determined the study is not considered human subjects research. All transcripts are available publicly online through the Fernald Community Alliance website. Informed consent was secured from all participants.

### Procedure

The current study conducted secondary descriptive analysis using publicly available transcripts from the Fernald Community Alliance website (fernalddcommunityalliance.org).

The present study's focus is to understand 4 primary events of interest. Discussion topics, such as land acquisition and plant closure, at the time of the interview that did not pertain to air releases of uranium by-products from various plants within the FMPC, the Ohio Environmental Protection Agency's public notification of potential water contamination, class action litigation and settlement, or resident exposure to local and national media were excluded from the analysis.

Inductive coding was used where each uniquely coded description was carefully read and reread in every transcript by the 2 reviewers assigned to coding to increase the researchers' robust familiarity and recognition of subtleties within the text.<sup>19</sup> The individual codes were assessed for completeness by the primary author. Each unique code was compared under each of the 4 phenomena of interest and assessed for patterns as part of the thematic cluster analysis methodology.<sup>20</sup> Next, the 2 researchers met to discuss patterns observed from the data to generate sub-themes. Sub-themes consisted of 2 or more codes that were similar in topic and were used to generate holistic patterns from the list of codes. Finally, the research team grouped sub-themes to form the final overarching themes from the analysis. Discrepancies between the researchers' interpretation of the participant codes and theme development were reviewed by an expert in qualitative analysis.

To support the validity of the study, the themes were triangulated with the senior author of the study, a subject-matter expert in the events of interest and the Fernald Community Cohort. The expert researcher concluded the themes identified were comprehensive and congruent with previous studies elicited from the cohort.

### Participant Recruitment and Selection Criteria

The present study focused exclusively on analyzing the experiences of local area residents, including both current and former residents. Consequently, individuals including researchers, journalists, former FMPC employees, EPA regulators, physicians, and trustees were not included in the analysis, despite their participation in the oral history project interviews available on the Fernald Living History Project website. A total of 139 interviews were conducted for the project, with 41 of them involving area residents. Six of these interviews were excluded from the current analysis as the participants were both area residents and former employees of the FMPC. One resident interview was excluded as it

focused on a university professor's research role rather than the individual's resident experience.

As the interviews were lengthy and semi-structured in nature, the investigators chose to extract data codes from the 34 participants as part of the analysis, as each interview provided new insights into the events of interest. Each individual contributed to the study uniquely, and participant's direct quotes are included in the findings.

### Reflexivity

Before commencing the study, the 2 researchers assigned to read and code the participants' transcripts engaged in a phenomenological reduction exercise known as bracketing. The purpose of this exercise was to synthesize the conventional knowledge of the phenomena under study and to mitigate any unacknowledged preconceptions that could potentially skew the data collection and reporting process.<sup>21,22</sup> The researchers agreed they had a basic understanding of the events that occurred at the FMPC, but neither fully understood the collective and varied realities of exposure experiences within the local community. The researchers did not report conflicts of interest, including reason for bias, and both agreed to honest coding and maintaining the integrity of the research as core values in their personal belief system.

## RESULTS

### Participant Characteristics

A total of 34 Fernald area residents aged 43 to 92 years ( $M = 61.7$ ,  $SD = 13.3$ , missing data=8) were included in the analysis. There were an equal number of males and females in the study ( $n = 17$  each). The majority of residents were participants in the medical monitoring program which was created in the aftermath of the 1989 class action settlement; the program ran for 18 consecutive years through 2008 ( $n = 26$ ). All participants were White ( $N = 34$ ), which is representative of the source population residing within 5 miles of the FMPC borders in Butler and Hamilton counties (Table 1).<sup>23</sup> To address the research question of interest, 5 overarching themes and 19 sub-themes were developed from 294 unique participant codes (Table 2).

**Table 1. Demographic Characteristics of Study Participants**

| Sample Demographics                                | N=34  |
|--|-------|
| Age (years) at the time of interview               | Count |
| 40 – 50  | 7     |
| 51 – 60  | 6     |
| 61 – 70  | 5     |
| 71 – 80  | 6     |
| 81 – 90  | 1     |
| 91+  | 1     |
| Unknown  | 8     |
| Sex  | Count |
| Female   | 17    |
| Male   | 17    |
| Enrollment Characteristics                         | Count |
| Enrolled in the Fernald medical monitoring program | 26    |


**Table 2. Thematic Analysis of the Fernald Living History Project Study Participants' Experiences**

| <b>Theme #1: Disruptions to Life</b>  |                                    |
|---|------------------------------------|
| Participant Descriptions  | Sub-themes                         |
| <p>"One of the telltale signs as I look back was that we were not getting the repeat campers. We were filling the camp and getting the campers every summer but with each new splash of information, we were losing more folks."<br/>– Participant #1, male, age 48</p>   | Fear, loss of security             |
| <p>"Nobody would buy this property. Would you buy my house?"<br/>– Participant #26, male, age 50</p>  |                                    |
| <p>"You don't know because you're not educated and it's not your field. And you feel very helpless. And we went home that night, and we, you know, talked to our families. And, you know, what do you say to a 7-year-old? You don't, you can't say anything to a 7-year-old because I, I knew he wouldn't understand."<br/>– Participant #22, female, age 43</p> | Processing distressing information |
| <p>"We just felt bad about it. There wasn't anything that we could physically do about that, you know. It was a problem that had been created, and um, there was just nothing that we could do."<br/>– Participant #11, male, age 63</p>  |                                    |
| <p>"Well, I think the whole thing was a bad situation. Looking back, you know, I mean, now that we're, we're told how harmful it is, and releases come out in the paper how much more likely we are to get cancer, and I think it's a real bad deal now. But you know hindsight is 20-20 I guess."<br/>– Participant #13, male, age 49</p>                        | Assessing the damage               |
| <p>"I think as time went on it was well proven you know that it did result in a lot of damage. Not only the people on plant but the people probably off the plant. And there again, it's one of those situations that is very difficult to prove."<br/>– Participant #7, male, age 67</p>   |                                    |
| <p>"We were asked at one time to have a family picture of my brothers and all of our family and kids sitting around the kitchen table looking sad. We were all supposed to sit there and look like we were all dying, and they wanted to take a picture."<br/>– Participant #4, female, age unknown</p>   | Discovering the new reality        |
| <p>"It was a very traumatic time. It I, was sort of like we didn't have a Christmas, because we were always being interviewed, and meetings."<br/>– Participant #26, male, age 50</p>   |                                    |
| <b>Theme #2: Loss of Trust</b>  |                                    |
| Participant Descriptions  | Sub-themes                         |
| <p>"You trust the government and trust that they know what they're doing, and you expect them to do the right thing."<br/>– Participant #14, female, age 49</p>   | Expectation to be protected        |
| <p>"It seems to me that perhaps they just weren't as, as sensitive to the type of material that they were dealing with."<br/>– Participant #24, male, age unknown</p>   |                                    |
| <p>"I think probably one of the thoughts that crosses your mind is up until then [is] the government had been a little less than honest with reporting what was going on because I think that they didn't have very much community contact."<br/>– Participant #6, female, age 74</p>   | Mismanaged disaster                |
| <p>"Uh, I'll choose a nice word, MAD, uh, DECEIVED. And I think that the deceit was the biggest thing because I don't really like to be lied to...And here, you know, your own government who would do that to somebody else had been doing that for years and they were in a denial stage too."<br/>– Participant #10, female, age 45</p>                        |                                    |
| <p>"My opinion of the whole thing: they should have never given anybody any money; they should have come in here and put water in our whole area. The water that they contaminated."<br/>– Participant #17, male, age 71</p>  | Settlement Dissatisfaction         |
| <p>"I think that the little, few little measly bucks that we got out of the settlement was not satisfactory."<br/>– Participant 32, male, age 61</p>  |                                    |
| <b>Theme #3: Seeking Answers</b>  |                                    |
| Participant Descriptions  | Sub-themes                         |
| <p>"If one something like that [a tornado] was to come through the area and those lids on there were lifted, what would happen to the community? You know, if that stuff got spilled out into the air too far and with the heavy concentration of it would, you know, our concerns are for that."<br/>– Participant #30, male, age 77</p>                         | Searching for truth                |
| <p>"But, uh, that worries me you know, is it hereditary? I mean nobody-my mother didn't have it...my grandmother didn't have it. Is it something in the environment or am I just that unlucky?"<br/>– Participant #27, female, age unknown</p>  |                                    |
| <p>"Well, back then, at that time I really didn't believe it. I thought it was overblown by the media and I didn't think there was any real danger for us."<br/>– Participant #2, female, age 57</p>  | Making sense of mixed messaging    |
| <p>"I think a lot o' times, the news releases over there that are purely informational, are intended to be sensationalized."<br/>– Participant #21, male, age 52</p>  |                                    |



**Table 2 (continued). Thematic Analysis of the Fernald Living History Project Study Participants' Experiences**

| <b>Theme #4: Interpreting Ambiguous Threats</b>  |                                      |                                    |
|--|--------------------------------------|------------------------------------|
| Participant Descriptions   |                                      | Sub-themes                         |
| "To be honest with ya, we didn't pay any attention to it. It was just another article in the news, uh we just didn't pay any attention to it."   | – Participant #23, female, age 62    | Indifference to the media          |
| "I don't know that I actually processed enough of the information to remember it."   | – Participant #8, female, age 52     |                                    |
| "It was never an issue."   | – Participant #6, female, age 74     | Perception of safety               |
| "I got a well. My water's good and I'm not worried. I'm on the safe side of it."   | – Participant #9, male, age 81       |                                    |
| "Um, I didn't react to it at all. I mean, it never bothered me or affected me or anything else. I just thought at the time, if somebody intentionally knew that dust collector was leaking and let it leak, then they should be punished."                                   | – Participant #5, male, age unknown  | Perceived to be unaffected         |
| "At that time, I didn't have any emotional distress. I filled out everything; oh, I'm fine. Everything's fine... I didn't think there was real danger."  | – Participant #2, female, age 57     |                                    |
| <b>Theme #5: Adaptive Responses</b>  |                                      |                                    |
| Participant Descriptions   |                                      | Sub-themes                         |
| "And at that point I said, "We'll stay, and we'll fight."  | – Participant #22, female, age 43    | Developing autonomy                |
| "We educated ourselves very quickly."  | – Participant #22, female, age 43    |                                    |
| "I'm concerned about my family's health and safety. And I wanted their health and safety to be secure. And then, too, if my community's health and safety isn't well, my family's health and safety isn't well. I only want my family to have a better quality of life."     | – Participant #18, female, age 56    | Motivation                         |
| "I was very angry, and that's why I got involved with FRESH, to see if through them I could ah, find out any more."  | – Participant #16, female, age 67    |                                    |
| "Ten thousand dollars is a good chunk of money but it doesn't buy you a life. And it doesn't buy my kids a life. And I mean I appreciate the money but there is only so much that money can buy."  | – Participant #29, female, age 43    | It's not about the money           |
| "I go over to the examinations I think every 2 years now. So, I think it's a wonderful thing that people can do that."   | – Participant #20, female, age 79    |                                    |
| "We did it by sitting at the table, too. Sitting at meetings and help designing the public water system. The ground was contaminated also. We made sure the pipes were certain kind of pipes formed. We made decisions in that area also. So again, we all worked together." | – Participant #18, female, age 56    | Community action                   |
| "The government tries to protect everybody, and you can't do it. People have got to protect themselves."   | – Participant #19, male, age unknown |                                    |
| "I was terrified, um, because I was afraid they were going to find cancer."  | – Participant #3, male, age 56       | Resilience in the face of conflict |
| "We were really tired of our lives kind of being an open book and being splashed everywhere."  | – Participant #22, female, age 43    |                                    |

**Disruptions to Life**

The greatest threat to the participants' well-being and quality of life was the emotional distress caused by living in close proximity to the FMPC. Initial emotional responses to the revelation that their community's water may be chronically impacted by persistent pollutants were wide-ranging, with a primary focus on concerns for personal and familial health and safety. Additionally, residents found some of the scientific language used to describe the contamination to be 'technical' and 'difficult' to understand. One example given was the reporting of radioactivity levels in picocuries, which can be challenging to interpret. Many participants used phrases such as 'frightened,' 'scared,' 'felt bad,' 'upset,'

'helpless,' and 'powerless.' One mother reflected on her experience explaining the situation to her young son:

*"You don't know because you're not educated and it's not your field. And you feel very helpless... And, you know, what do you say to a 7-year-old? You don't, you can't say anything to a 7-year-old because I, I knew he wouldn't understand."* —Participant #22

Participants described the day-to-day disruptions to their daily life by simply living near the FMPC. Multiple participants recalled the loss of security felt when they were notified of the potential contamination of pollutants to the ground and surface water. The residents recalled their use of bottled water to suffice their daily needs for drinking, cooking, cleaning, and bathing. The concern for



ground and surface water contamination extended to nearby business owners.

Other disruptions that reduced quality of life included fear of property devaluation of their homes, business properties, and farmland. One resident expressed her concerns about her and her brother's lost inheritance of the family farm if they would be unable to sell it. Another worried about the negative effects of media attention on selling their property. One resident said, "Nobody would buy this property. Would you buy my house?"

### Loss of Trust

Participants were distressed by the actions of the DOE and the site contractor, NLO. Many expressed an expectation that the authorities and operators should have protected the community from contamination, but they ultimately failed to do so. One participant stated, "You trust the government and expect them to know what they're doing and to do the right thing." Another resident said she didn't think the uranium oxide release was dangerous because, "Surely they would let us know and try to help us settle someplace away from it." Other residents suspected that they were being taken advantage of because they lived in a rural Midwest community, using words such as 'rural no-man's land' and 'lack of community knowledge.' One resident, who had lived on her grandfather's family-owned farm for her entire life, described her initial expectations regarding the role of the authorities:

*"Because we'd lived there all our life and we had a sort of opinion that they were kind of going to take care of us and they were going to do things right and that's why they sent us the letter to let us know." —Participant #4*

Residents echoed their experiences of the disaster events being mismanaged by the authorities regarding cooperation, communication, transparency, and knowledge sharing.

### Seeking Answers

A common thread in participant responses was their search for the truth. Residents desired to be equipped with knowledge and the power to make informed decisions to support their families' health and well-being. Because they felt they were not receiving transparent information from authorities, it fell upon them to ask the necessary questions to uncover the truth about their exposure to toxic pollutants. The extensive media coverage of the events was one important source of information for area residents as they too were learning about their potential risk of exposure from news outlets.

One resident mentioned feeling 'vindicated' upon learning what the FMPC produced because she had suspected her husband's premature death was caused by his employment with FMPC. However, the messaging from different sources was often confusing and conflicting. Residents believed it to be exaggerated so it was not treated as a trustworthy source of information. Residents used the terms 'extreme,' 'sensationalized,' and 'somewhat real' to de-

scribe the news reports. A local business owner expressed his frustration with the media coverage:

*"There's lots of frustration on both, both sides o' this... I just don't understand why we can't do a quicker job? Or at least a better public relations job on getting this figured out?" —Participant #21*

Participants reflected on questions to which they may never have answers such as the true health effects caused by living near the FMPC. Residents expressed guilt related to their children's health, wondering if they caused endangerment to their kids by living near the FMPC. Multiple residents described loved ones who had experienced health problems but also expressed uncertainty about whether these issues were related to exposure from the FMPC. One participant described her daughter who had died from cancer, but she did not know if the site was to blame. Another resident described her fear of going to the doctor, where routine appointments always seemed to lead to cancer screenings.

### Interpreting Ambiguous Threats

Many participants in the community did not immediately express negative emotional responses to the events, especially when the threat to their health was not clearly conveyed by the local health authorities or media coverage of the events. Some residents stated, "I guess I wasn't interested enough" and "I don't remember that I was afraid or worried or anything." Others admitted that they didn't acknowledge the media coverage, "I may have read it, but I don't even remember it."

Under these circumstances, residents may have been overwhelmed by the media coverage, felt the information they were given was untrustworthy, were too young to remember a first-hand account of the events, or did not perceive themselves to be as significantly impacted by the events as their neighbors. One resident stated, "I hate to admit that I was ignorant, but I was only a kid." Another resident described why she did not immediately react to the news of contamination:

*"Well, back then, at that time I really didn't believe it. I thought it was overblown by the media and I didn't think there was any real danger for us. I was not at all concerned." —Participant #2*

Some residents reported feelings of safety and security because they did not believe their water, property, emotions, or quality of life were adversely impacted at the time. Residents used the phrases 'wasn't involved,' 'wasn't interested,' 'not upset,' 'not worried,' and 'never an issue' to describe their responses to the events. The residents' perceptions may have been influenced by their lack of perceived exposure to the events.

The various mentalities of the residents represented a broad spectrum of psychological impacts that a community faces and how these impacts change over time as new mental and physical health conditions arise in themselves or their loved ones.

### Adaptive Responses

Participants were growing increasingly 'alarmed' and 'frustrated' with the authority figures who were responsible for managing the



risk to the community. Residents described many reasons to get involved with the class action lawsuit from feeling ‘angry’ and using the legal system to demand answers to simply seeking a transparent share of knowledge so they can be better equipped to protect their families. One resident described her motivation to get involved:

*“I think one of the main reasons was trying to gain the information because they weren’t really forthcoming...” —Participant #10*

Many noted that their motivations were not based solely on financial restitution but other grounds that were important to the residents. One resident described her experience with the lawsuit as ‘having no other option’ because ‘nobody would answer our questions.’

The community began to act autonomously. They attended public meetings and described the meetings as ‘mobbed’ and ‘packed,’ where they began to ask questions directly to the authorities face-to-face. Collectively, they mailed letters to the DOE and ‘worked together’ to ‘gather as much information’ as they could about their situation. One resident said, “The first book I got was about how to hire an attorney.” Members of a community organization described how they ‘educated themselves quickly’ and made a commitment that ‘this will not happen again, not here.’

Although the lawsuit was ultimately a success for the area residents, their exposure to the class action lawsuit took an emotional toll on many of the participants. One resident says that he took ‘flak from people’ who did not want to attract attention to the area that would further devalue their properties if they did not win the case. He went on to describe how this fractured some of his relationships within the community, stating, “We found out that people we thought were our friends, aren’t our friends at all.”

## DISCUSSION

Ultimately, the exposure experiences of the area residents are characterized by the belief that the authorities mismanaged the Fernald, Ohio, FMPC operations and failed to protect their community from environmental contamination of toxic pollutants. Residents expected to be protected by the US federal government, and many felt that there was a duty from the operators who worked for the NLO to prevent contamination. The residents felt a wide range of emotions to learning that their community had been polluted by the federal government including helplessness, frustration, anger, concern, and fear. Interestingly, the residents seemed to focus more on water contamination than the airborne exposure which was subsequently found to contribute over 80% of the body burden.<sup>24</sup> The media propagated confusing, contradictory, or exaggerated messages and, concurrently, health authorities did not tailor or limit the excessive coverage to promote a singular truthful account that may have had positive benefits for the community.<sup>25</sup> The residents channeled these emotional responses into organized community action by attending public meetings, communicating independently with officials, initiating a grassroots community organization group, and suing the NLO and DOE for

\$300 million. The lawsuit was eventually settled in 1989 for \$78 million on the grounds of property devaluation and emotional distress.<sup>26</sup>

There were 2 important subsequent events not covered in the current study that improved the relationship between the Fernald area residents and the US government: (1) closure of the FMPC in 1989 that refocused resources on the remediation of the site and (2) conversion of the site to a nature preserve in 2008.<sup>27</sup> The Fernald FMPC was deemed a Superfund site in 1990 by the EPA and the cleanup date predictions for the groundwater under the waste storage area onsite is 2045.<sup>28,29</sup> Additionally, the restoration project returned indigenous animals and plants to the area and transformed the site to a green space with wetlands, ponds, and forest. The DOE Office of Legacy Management manages the preserve to monitor the ongoing groundwater cleanup activities and status of ecological restoration.<sup>27</sup> In addition, the experiences of these residents led to the creation of 3 educational modules which inform community members of the best practices for addressing hazardous waste cleanup, with Fernald being 1 of the 3 example communities (Lessons Learned on the Road to Environmental Cleanup <https://www.med.uc.edu/depart/eh/centers/ceg/lessons-learned>).

This study presents limitations. First, the exposure experiences drawn from the Fernald participants of this study are not transferable and, therefore, do not represent the varied experiences of local residents near all environmental waste sites in the United States or globally. The goal was not to transfer the results to the broader population but instead to understand the unique perspectives of the local community residents in relation to the nearby CEC site. Secondly, we chose an exclusive time period for the present study. Additional topics discussed as part of the interviews that were not covered within the scope of this project include the government seizure of property from local landowners to build the site, relationships with FMPC employees, and ongoing environmental remediation. Transcripts of the FMPC former employees are available on the Fernald Living History website for public viewing but were not included in the present study, as the aim was to gain an understanding of the specified phenomenological events from the lived experiences of the local community members.

## PUBLIC HEALTH IMPLICATIONS

Residents surrounding the Fernald FMPC experienced various mental and emotional burdens simply due to their proximity to the uranium processing facility during a tumultuous period in American history, marked by the Cold War. This study focuses on events from the late 1980s, and its findings hold relevance for contemporary public health audiences. On February 8, 2023, in East Palestine, Ohio, 20 railcars carrying the human carcinogen vinyl chloride, used in the production of polyvinyl chloride plastic and vinyl products, derailed, releasing hazardous substances into the surrounding soil, streams, and air.<sup>30,31</sup> Since the incident, community members have reported experiencing headaches, sore throats, and difficulty breathing, along with expressions of distrust



and challenges in interpreting official environmental sampling records.<sup>32</sup> The findings of this study underscore the importance of a centralized, clear, and timely response from health officials. They also advocate for the inclusion of a robust mental health mitigation plan in emergency response toolkits to enhance the emotional well-being and long-term quality of life for local residents.

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#### Author Contribution

Sara Burcham: conceptualization, methodology, investigation, formal analysis, writing—original draft, project administration. Daniella Saul: investigation, formal analysis. Rachael Nolan: conceptualization, methodology, writing—review and editing, supervision. Susan M. Pinney: conceptualization, writing—review and editing, validation, supervision, funding acquisition.

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