From:	Kreusch, Arleen K LRB
To:	"Amy Witryol"
Cc:	Joseph Gardella Jr.; christopher.zeltmann ; Laura Monte ; Melissa Fratello; Busse, John H LRB; "christopher.clayton
Subject:	RE: 4th REQUEST: Fernald facilitator agreements (UNCLASSIFIED)
Date:	Wednesday, January 12, 2011 1:55:38 PM
Attachments:	RE Scope of work for RFCLoGRFSC.msg DRAFT Professional Services Agreement PCAB 122308.doc FCABHist2.doc FOF 02-001.pdf FOF mmsept297.pdf FOF Vision Brochure 2001.pdf

---

Classification: UNCLASSIFIED
Caveats: NONE

Hello Amy,
As we indicated in our initial response, the Department of Energy has been unable to locate the Fernald Scope of Work. Please refer to input provided by Chris Clayton of the Department of Energy below.

The Department of Energy provided the attached reference materials which are similar in services provided at Fernald.
Sincerely,
Arleen K. Kreusch, APR
Outreach Program Specialist
US Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, NY 14207

Phone: 800-833-6390 (option 4)

-----Original Message-----
From: Clayton, Christopher
Sent: Wednesday, January 12, 2011 9:53 AM
To: Busse, John H LRB
Cc: Widdop, Michael; Gillespie, Joey; Kothari, Vijendra
Subject: FW: Response to Amy for the USACE

Dear John,

I want to inform you that the DOE Office of Legacy Management (LM) has been unable to fulfill your request to provide the specific statement of work used to define the activities of a technical facilitator for the Fernald Citizens Advisory Board (FCAB). The FCAB functioned during the Fernald cleanup under the DOE Office of Environmental Management (EM). DOE-LM requested a search of EM files at the Cincinnati, OH, Consolidated Business Center (EMCBC), where the EM procurement records are maintained. The EMCBC conducted a reasonable search, but was unable to provide the requested document.

I asked Fernald staff to look in the site collection, but they were also unable to locate the document. In addition, we contacted the original contractor who provided the technical facilitator services for the Fernald CAB; however, he did not have a copy either. We will continue to look in several more possible locations but at this time we believe the document no longer exists in DOE files.

Other sources of examples and information have been provided over the course of our numerous conversations with the USACE since the Nov. 3, 2010 community meeting and are attached again as part of this correspondence. These include information on stakeholder support activities from other LM and EM sites (including Rocky Flats, CO, and Paducah, KY). I also have attached additional information on the Fernald CAB.

For your convenience I have listed below the documents we have provided and attached copies of

those documents to this e-mail.

* E-mail from David Abelson (Crescent Strategies), current Executive Director of the Rocky Flats Stewardship Council, providing (attachment) his scope of work as a contractor to the Rocky Flats local stakeholder organization and executive director services scope of work (body of email) provided by Mr. Abelson to Los Alamos County for similar services.
* Draft professional services agreement for the Paducah Gaseous Diffusion Plant CAB
* Website addresses for the Paducah CAB and Portsmouth, OH, Site Specific Advisory Board (SSAB)
o www.pgdpcab.org
o www.ports-ssab.org
* Additional Fernald information
o A history of the Fernald CAB
o Fernald CAB minutes, Nov. 15, 1997
o Radiation Risk Perception and Communication: A Case Study of the Fernald Environmental Management Project
o A Stakeholder Vision of the Future of Fernald

Consistent with the Memorandum of Understanding between DOE and the USACE, DOE can support to USACE to the extent requested by USACE. In this case, DOE has provided public-domain information to USACE. However, the DOE role is clear that DOE has no role in determining how USACE performs work on either assessment or remediation activities at the Niagara Falls Storage Site or any other FUSRAP site.

I will let you know immediately if we find the requested document. Please email me at if I or the members of my team can be of further service/assistance.

Very respectfully,

Chris

Christopher J. Clayton
Office of Legacy Management
Department of Energy

-----Original Message-----
From: Amy Witryol
Sent: Tuesday, January 11, 2011 3:32 PM
To: Kreusch, Arleen K LRB; Busse, John H LRB
Cc: Joseph Gardella Jr.; christopher.zeltmann@ Laura Monte ; Melissa Fratello
Subject: 4th REQUEST: Fernald facilitator agreements (UNCLASSIFIED)

John - Did you receive the Fernald DOE information (below) sent Nov. 12th? If you did not, I'd like to follow up. Therefore, would appreciate your reply.

Thank you.

Amy

-----Original Message-----
From: Amy Witryol
Sent: Wednesday, January 05, 2011 5:01 PM
To: 'Kreusch, Arleen K LRB'
Cc: 'Busse, John H LRB'; Joseph Gardella Jr.; christopher.zeltmann ; Laura Monte ; Melissa Fratello
Subject: 3rd REQUEST: Fernald facilitator agreements (UNCLASSIFIED)

That's contradicted by information from DOE that "the [Fernald] CAB's agreement with Doug Sarno and similar information from Rocky Flats was sent to John Bussey November 12, 2010"

Pursuant to my request at USACE public meetings, could you please send me (or post) this information? (If the Corps has received nothing in relation to facilitator engagements or technical assistance information from DOE, please let me know so I can circle back.)

Thank you,

Amy

-----Original Message-----
From: Kreusch, Arleen K LRB
Sent: Wednesday, January 05, 2011 4:31 PM
To: Amy Witryol
Cc: Busse, John H LRB
Subject: RE: 2nd REQUEST: Fernald facilitator agreements (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Hello Amy,
We have contacted the DOE several times in regard to your request. They are unable to locate the Fernald facilitator scope of work. They will continue to look and if it is located will send it to us. If we receive it, we will post it on the web.
Arleen

-----Original Message-----
From: Amy Witryol
Sent: Wednesday, January 05, 2011 3:11 PM
To: Kreusch, Arleen K LRB; Busse, John H LRB
Cc: Joseph Gardella Jr.
Subject: 2nd REQUEST: Fernald facilitator agreements

John - Could you please respond or refer me to the area of your website where this has been posted?

Amy

-----Original Message-----
From: Amy Witryol
Sent: Monday, January 03, 2011 11:21 PM
To: 'Kreusch, Arleen K LRB'; Busse, John H LRB
Cc: Joseph Gardella Jr.
Subject: RE: Fernald facilitator agreements

John -

Status of responses to the requests from the Nov. 3rd meeting? Copies of the engagement letters with Fernald CAB facilitator and the 3 CAB technical consultants? You were going to post them when received . . .

Amy

Classification: UNCLASSIFIED
Caveats: NONE

From:	David Abelson
To:	Darr, Bob; Powell, Jane
Subject:	RE: Scope of work for RFCLoG/RFSC
Date:	Friday, November 19, 2010 5:22:48 PM
Attachments:	Crescent Strat 2008 Exec Dir Services 10-07 Exhibit A.doc

Hi Bob,

Attached is my current scope of work. It is an attachment to our contract. Below is a scope of work that Los Alamos County used for a similar position. It is based on our RF work. I do not have the Coalition info.

Since Jane Powell asked for the same info, I am copying her on this email.

David

SCOPE OF WORK
The Contractor shall provide the following services:

* Help the Regional Coalition become an effective advocacy organization.

* Manage the organization and help ensure the legal and financial responsibilities are met.

* Advise the Board of Directors on the group's strategic direction and policies, including legislative strategies, to achieve the organizational mission. Make recommendations where appropriate.

* Provide technical assistance to the organization. Summarize and analyze issues, and provide comment and advice as necessary or requested. Prepare technical memos and issue briefs as needed.

* Serve as an independent facilitator for the Board meetings.

* Develop and circulate agenda items and briefing memos for the Board meetings.

* Prepare and distribute meeting minutes of the Board meetings.

* Develop and maintain a website.

* Negotiate with outside entities, and convey and advocate for organizational policies, as directed by the Board.

* Implement public information strategies on behalf of the organization.

* Serve as spokesperson with the Department of Energy, state and federal agencies, the media and the public.

* Monitor regional and national issues and coordinate with outside agencies on issues affecting LANL.

* Make presentations to the Board and at other forums on a range of issues.

* Represent organization at national meetings.

* Prepare periodic updates on relevant congressional and DOE policies and actions.

* Report on progress on the strategic plan, and annually provide an updated plan for the Board's discussion and approval.

* Prepare the draft annual budget for approval by the Board, and implement as appropriate.

* Such other tasks that are identified by the Board.

David M. Abelson
Executive Director
Rocky Flats Stewardship Council

-----Original Message-----
From: Darr, Bob
Sent: Friday, November 19, 2010 11:45 AM
To: David Abelson
Subject: Scope of work for RFCLoG/RFSC

David, just a reminder about the scope of work statements you send you would send me that I can pass on to the USCOE as an example for their hiring search for a technical facilitator for public meetings. I know that title doesn't exactly reflect your position with the RFCLoG or RFSC, but they are looking for ideas to include in their own scope of work.
Thanks,

Bob Darr
Public Affairs
S.M. Stoller Corp.
DOE Legacy Management Support

EXHIBIT A

Responsibilities

1. Manage organization and help assure compliance with state and federal requirements.

2. Advise Board on strategic direction and specific policies to achieve organizational mission and make recommendations where appropriate.

3. Review technical data and provide technical assistance to the organization. Summarize, analyze, and provide comment and advice as necessary or requested. Prepare technical memos and issue briefs as needed.

4. Negotiate with outside entities, convey and advocate for organizational policies, as directed by the Board.

5. Serve as spokesperson with Department of Energy, Department of the Interior, state and federal agencies, the media and public. Monitor regional issues and coordinate with outside agencies on issues affecting Rocky Flats.

6. Prepare legislative strategies and positions for Board consideration.

7. Prepare work plan and budget for consideration by Board and implement as appropriate.

8. Implement public information strategies on behalf of the organization.

9. Make presentations to the Board and at other forums on a range of technical and policy issues.

10. Prepare periodic newsletter updating on relevant congressional and DOE policies and actions.

11. Represent organization at national meetings.

12. Ensure legal, financial, and office responsibilities (including minutes) are met.

13. Report on progress on work plan.

Responsibilities exclude:

1. Providing legal advice
2. Managing organization's finances
3. Managing website
4. Take meeting notes and prepare draft minutes

DRAFT (12/23/08)
Professional Services Agreement

This agreement is entered into between EHI Consultants (Client) and Sapere Consulting, Inc (Subcontractor) for professional services in support of the Paducah Gaseous Diffusion Plant – Citizens Advisory Board (CAB).

Effective Date: January 5, 2009

End Date: September 30, 2009

Scope of Work:

As part of their support services provided to the United States Department of Energy under contract (_____), EHI Consultants will subcontract to Sapere Consulting Inc for the following services:

Task 1: Facilitation of monthly CAB meetings in Paducah Kentucky. Facilitation services include:

- Input to CAB on agenda development and coordination with members of the CAB between meetings as necessary to resolve issues and/or gather information
- Facilitation of the face-to-face meeting at the Memorial Drive facilities
    - Assumes meeting notes continue to be managed by EHI with input from Sapere Facilitator between meetings.

Task 2: Facilitation of the Paducah CAB End State Vision Initiative. Services include:

- Research and benchmark other End State Vision Initiatives from across the DOE Complex.
- Agenda development and coordination with members of the CAB and interest groups between meetings as necessary to resolve issues and/or gather information
- Facilitation of the face-to-face brainstorming sessions at the Memorial Drive facilities:
    - 6 brainstorming sessions with individual interest groups
    - 2 sessions for End State Vision Report development (one on the draft and one on the final)
- Development and maintenance of a secure, collaborative web site for the End State Vision Initiative
    - Results of brainstorming sessions will be posted after each meeting as opposed to formal meeting notes. The information compiled and posted on the website will evolve into the content of the End State Vision Report.
- Drafting, distributing, and finalizing the End State Vision Report

Deliverables

- 9 meeting facilitations for CAB
- 8 meeting facilitations for ad hoc End State Vision Initiative
- Collaborative website for End State Vision Initiative
- Draft and final End State Vision Report

Level of Effort Assumptions and Cost Estimate

- To Be Developed

ENVIRONMENTAL MANAGEMENT SITE-SPECIFIC ADVISORY BOARD
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Formation Process

- In Spring 1993, DOE officials at Fernald decided that a citizens advisory board would be the most effective means of obtaining focused stakeholder input on the pressing issues regarding remediation of the site. This decision was made after numerous meetings with key stakeholders in the Fernald area.
- DOE decided to employ an independent convener in order to provide timely and fair identification of potential members. Dr. Eula Bingham, a professor at the University of Cincinnati and former Director of OSHA, was selected as the convener in May 1993.
- In Summer 1993, Dr. Bingham identified and interviewed potential candidates for membership. Candidates were selected using a combination of public meetings, mass mailings, and personal recommendations from local officials and stakeholder groups. Dr. Bingham sought candidates who ensured a balanced and diverse representation of the parties affected by activities at the Fernald site. Her objective was to ensure that all affected parties saw one or more persons on the board who they could respect and expect to represent their interest.
- Dr. Bingham held a public work session in July 1993 to discuss how the board should operate and who should serve as members. This meeting was advertised in area newspapers, direct mailings, flyers and announcements at other public meetings. Throughout the convening process, efforts were made to keep the public informed about opportunities for participation. Dr. Bingham recommended 14 members and 2 alternates to serve on the board. One of these nominees declined, and another became an alternate member instead. Another individual petitioned for membership, and was appointed to the board.
- DOE requested that Dr. Bingham identify a chair and develop a draft charter for the board in consultation with DOE, U.S. EPA and Ohio EPA. John Applegate, a professor of environmental law at the University of Cincinnati, was identified to serve as chair. Dr. Bingham drafted a charter that outlined the group's mission statement and purpose, and identified four specific and far-reaching concerns for the board: future use, remediation levels, waste disposition, and remediation priorities for the Fernald site.
- Dr. Bingham's membership recommendations were accepted by DOE, and the board was formally established in August 1993 as the Fernald Citizens Task Force. In 1994, the task force officially became the EM Site-Specific Advisory Board, Fernald, established in accordance with the requirements of the Federal Advisory Committee Act, 5 U.S.C., Appendix 2.
- The first board meetings were held in September 1993. During its first few months, the group focused on site orientation and development of a path forward. Using Dr. Bingham's recommendations, the board worked to clarify its mission, approve the charter, and develop ground rules. As a result of the convening process, an additional member was added to represent transportation health and safety concerns of residents of Morgan Township.

- Representatives from DOE, U.S. EPA, and Ohio EPA were placed on the board as non-voting ex officio members. The original members served on the board for their entire appointment terms. The alternates were fully informed of all board activities, but did not attend meetings or participate in deliberations.

Organization and Strategy

- Members represent a broad spectrum of interests and backgrounds that are critical to the remediation decisions at Fernald. Ten members live or work in the immediate vicinity of the site. The remaining members were selected to reflect a combination of skills, interests, and constituencies that are important to the remediation of the Fernald property. All live and work within the greater Cincinnati area.
- In accordance with its charter, the chair is responsible for overall organization and administration of the board. DOE's site contractor, FERMCO, which later became known as Fluor Fernald, Inc., provides technical liaison support. Members receive no compensation for their time.
- During its first months, the board established a general strategy for conducting business. Its decision-making process would be organized around questions related to future use of the Fernald site. All meetings were open to the public and widely publicized in local papers and through mass mailings. Sufficient space for public attendance was provided, and there was opportunity for public comment at each meeting. Most of the board's work was conducted at regular monthly meetings. However, four committees were originally formed to address the following issues: technical support, membership, groundwater remediation standards, and waste disposition.
- The board realized the need for significant technical support to help gather and synthesize pertinent information and develop a detailed decision-making process. The board decided to obtain technical and facilitation support from a source other than DOE and the site contractor to ensure independence and neutrality. A selection subcommittee was created and, after consultation with DOE, Douglas Sarno of Phoenix Environmental was contracted in December 1993 to serve as a consultant directly to the board. In December 1993, Mr. Sarno developed a detailed work plan for the group to achieve its mission. As of Fiscal Year 2003, Mr. Sarno continues to function as independent facilitator and technical consultant for the board.
- From the beginning, the board recognized that no single group could represent every viewpoint of the public interested in the Fernald environmental remediation. A number of activities were used to ensure that broader public input was considered. Personal invitations were mailed to stakeholders, identifying the issues and decisions to be addressed at upcoming meetings. The board sponsored two workshops in 1994 and 1995 to enhance public understanding and involvement in the remediation levels, future use, and waste disposition issues. Presentations were given at DOE community meetings in 1994, 1995, and 1997. There were also face-to-face meetings between board members and other stakeholder groups, and board members and staff attended DOE public meetings and workshops. A board mailing address and message line for public comments was also announced. Information was disseminated through community channels, news releases, and advertisements of all task force meetings in local papers.

- In 1996, the board formally changed its name from Fernald Citizens Task Force to Fernald Citizens Advisory Board, in order to better align itself with other Site-Specific Advisory Boards across the DOE complex. The Board began to rely more fully upon a committee structure and changed meetings to every other month.
- In mid-1998, John Applegate resigned as chair of the board in order to accept a position at Indiana University School of Law; Jim Bierer, vice-chair of the board since 1997, was elected chair, and Thomas Wagner was elected vice-chair.

Recent Events

- In 1999, the Board established the Future of Fernald project to bring broader community participation into establishing future public use plans for the Fernald site. The FCAB worked with other area citizen groups to sponsor three workshops that ultimately resulted in a community vision for the Future of Fernald.
- In 1999, the FCAB hosted all of the SSABs throughout the DOE complex at the National Stakeholder Transportation Workshop.
- Since going to a committee structure in 1996, the board evaluates the committee structure annually to ensure it is meeting the needs of the Board. In January 1999, the Board created three committees: Remediation (to monitor basic cleanup activities), Stewardship (to plan for the future of the site) and Steering (to address membership and other administrative details). In September 2000, the Board decided to begin meeting monthly as a full board except for December and August. The functions of the remediation committee were incorporated into the full board to ensure that all members had a complete understanding of site activities. The Stewardship committee continues to work on Future of Fernald issues and activities.
- The primary Board issues as of Fiscal Year 2003 are: progress on remediation of the Fernald Silos Project; budget issues, including flat-line budgets anticipated through site closure; reprioritization of work in order to deal with accelerated closure; and stewardship issues related to eventual public use of and access to the Fernald site after remediation.

Social and Environmental Research Institute
278 Main Street, Suite 404
Greenfield, MA 01301
(413) 773-9955
www.seri-us.org

Radiation Risk Perception and Communication: A Case Study of the Fernald Environmental Management Project

By
Seth Tuler
SPTuler@seri-us.org

Abstract

The aim of this exploratory study was to learn about the manner in which perceptions of low dose radiation risks develop in a social setting. The Fernald Environmental Management Project (FEMP) provides a case study about two risk issues: 1) public health risks from historical releases during site operation and 2) residual contamination from onsite disposal of wastes and the future use of the site. Both are associated with low level exposures to radiation in the community. The research reported here inquires into the ways that risk perceptions develop through social interaction. Specifically, I investigate: 1) the ways that social networks shaped the flow of risk information and 2) the ways that interaction within and among networks shaped individuals' risk perceptions of the public health risks from historical contamination and future use of the site. The report finds that networks can have three functions in risk communication: a) facilitate learning about risks, b) mediate the flow of information from one group to another, and c) generate their own information about risks that they communicate to others. Second, networks establish and modify relationships that can influence how risks are perceived. Third, new networks can emerge through the actions of agencies by being a point of convergence for individuals from other social networks. These findings suggest that theories of risk perception and risk communication need to account for social interactions to capture the relevance that existing or newly established groups play in the social understanding of risks.

Table of Contents

Chapter 1: Introduction

Overview

The Fernald Environmental Management Project (FEMP) is a former nuclear production facility located in a rural, residential area 18 miles northwest of Cincinnati, Ohio. The Fernald site is located in two Townships: Ross and Crosby. A third township, Morgan Township, has also been involved in clean-up related decision-making. The site operated from 1951 to until production was suspended in 1988. The main activity of the facility was to produce highly purified uranium metal products ("feed materials") for US defense programs. In December 1989 the site was added to the U.S. EPA National Priorities List. In 1991 DOE officially ended production and the site was renamed the Fernald Environmental Management Project, or FEMP. It is now one of many sites that is being "cleaned" as part of the DOE's Environmental Management Program.

Soils, debris, ground water, and surface water in the Fernald vicinity are contaminated with uranium, radon and other radioactive materials. In 1984 the site contractor announced that an accident released uranium dust.[1] At first they denied that any contamination occurred off-site. Subsequent investigations showed that was untrue. This was the first time that the community received such news and the response was anger, disbelief, and a sense of betrayal. Trust and credibility of DOE, Ohio state agencies, and site management was severely eroded. These feelings were exacerbated when news was released that the wells of several abutters were contaminated – and that the site had been testing the wells secretly for several years prior to the residents' being informed. The response was a lawsuit brought by local residents against Fernald and the DOE (settled in 1989).

Extensive risk communication has taken place about public and worker health risks from production operations and clean-up activities. Risk communication experiences about two types of risks will be discussed in this report: a) the assessment of historical releases of radiological contaminants and b) the disposal of wastes on-site. In the case of risk communication about historical releases we focus on the public health risks. In the case of the on-site disposal cells and future use of the site the risk communication efforts centered on future risks to the community from residual contamination. They provide a rich source of data about how the risk communication efforts were experienced and how social networks played key roles in the formation of opinions about the risks.

Our approach to understanding the dynamics of risk communications about these risk sources is to enquire into how social networks generated, mediated the communication, and facilitated learning of risk-related information. Two pairs of social networks are discussed. The first pair were existing social networks within the community that concerned themselves with risks arising from Fernald: local government officials in the three townships affected by Fernald and the citizens watchdog group Fernald Residents for Environment, Safety, and Health (FRESH). The second type of networks were two advisory boards established by federal agencies, the Fernald Health Effects Subcommittee and the Fernald Citizens Advisory Board (formerly the Fernald Citizens Task Force). These boards were points of convergence for members of other social

[1] There have been three site contractors: National Lead of Ohio (1951-1986), Westinghouse (1986 - 1992), and Flour Daniels (1992 – present).

networks. Yet, through sustained periods of meetings and deliberations they emerged as new, formal social networks in their own right.

The DOE established the FCAB to obtain advice about clean-up and environmental restoration activities. The DOE Environmental Management Program points to the Fernald SSAB as one of its key successes in its set of site-specific advisory boards. Community members have praised the contractor's efforts to be more open and inclusive in its planning. The Fernald Citizens Advisory Board has played a key role in defining the strategies for disposing of radiological and mixed wastes. One key recommendation made in 1994 concerned the long-term disposal of certain wastes on-site rather than requiring the removal of all contamination off-site and disposal in other locations. More recently the board has taken a lead role in obtaining input from the community and developing recommendations about the future use of the site with the understanding that some contaminated materials will remain on-site in disposal cells.

The Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and health (NIOSH), and Agency for Toxic Substances and Disease Registry (ATSDR) have also played important roles in risk communication activities in the Fernald community. They established a Fernald Health Effects Subcommittee to obtain advice about health studies and risk communication. Several studies were subsequently completed that have characterized public health risks from off-site contamination. The results of a dose reconstruction study and two risk assessments were used to evaluate the feasibility of conducting an analytic epidemiological study in the community. Because it was unlikely that outcomes could be detected with epidemiological methods, the FHES and the CDC decided not to conduct such a study.

The remainder of this report provides a description of our methodology and conceptual framework for understanding the roles of social networks in the formation of risk perceptions and the flows of risk communication messages. Chapter 3 provides an overview of the site, including its history and the risk controversies associated with historical off-site releases of contamination and construction of the onsite waste disposal cells and decision-making about the future use of the site. The characteristics of the community and important groups are also described. Chapter 4 provides a detailed discussion of findings about flows of risk related information and the ways that meanings are attributed to different events. Specifically, we delve into the ways that the four social networks facilitated the generation of risk information, mediated the flow of risk information, and facilitated learning of risk information among its members. Chapter 5 is a brief summary discussion and Chapter 6 includes suggestions for future research.

Chapter 2: Methodology

The intention of this research was to develop a better understanding of how social interactions influenced people's perceptions about low dose radiation risks. The study focused on individuals who were highly engaged in deliberations about risks in the Fernald community. Specifically, we sought to understand how individuals' social settings – and the ways that meanings were attributed to events and risk estimates within those settings – played a role in the way they developed their personal perceptions of low dose radiation risks.

Rationale for selection of case

Fernald was chosen as a case study based on several criteria. Each of them helps to make this case both interesting for the exploration of how social networks affect the formation of risk perceptions and the flows of risk information and accessible for qualitative social science research.

First, the community and a variety of risks have been studied. There is a very good historical record of risks, how they were assessed, and risk management implementation. These are accessible through Fernald staff and the DOE public information center. Interactions between key players (e.g., DOE, CDC, Fernald contractors, community members, local officials) are well documented.

Second, there have been extensive and multiple efforts of risk communication and public participation on radiation related risks from Fernald. The processes have evolved, and there are diverse opinions about their quality. In addition, risk messages have been multiple, spanning a range of years, and at times inconsistent. For example, health studies have reached inconsistent findings, and the community has received information about the inconsistencies and controversies. These efforts have occurred within the recent past making access to individuals who were involved more readily accessible. The fact that copious quantities of documents, risk communication handouts, meeting agendas, and other written materials exist in their original form allowed us direct access to the types of communications that ensued. There are also extensive audio and videotape collections that capture some of the risk communication efforts.

Third, there are a variety of players around Fernald. They range from strongly engaged (members of the advisory committees, FRESH, federal and state agencies) to less engaged and more peripheral. Those that are engaged from the community have dealt with complicated, and uncertain, risk-related decision making. For example, they have debated and reached consensus on whether to conduct an epidemiology study for lung cancer and what levels to set soil contamination clean-up standards. They engaged in extensive deliberations about the advantages and disadvantages of disposing of wastes on-site versus shipping them all to a disposal facility off-site (in Nevada).

Data collection

We collected data for this study include through on-site visits, formal and informal interviews, document retrieval, and other published sources of information including websites. The on-site visits were useful for collecting written materials from Fernald as well as becoming familiar with the surrounding environs. We took a tour of the site. In addition, we familiarized ourselves with the neighboring community. A logbook of notes was kept from each visit. An important

secondary source of data was transcripts from interviews conducted by the *Fernald Living History Project*.

Specifically, our information for the case study came from:

- informal interviews for background information;
- formal interviews with key informants;
- review of interviews conducted as part of the "Living History Project" at Fernald; and
- review of technical reports, meeting minutes, newsletters, video tapes, and audio tapes from Fernald, federal agencies (e.g., DOE, CDC, ATSDR), and advisory boards (Fernald Task Force/Citizens Advisory Board, Fernald Health Effects Subcommittee, and Fernald Community Reuse Organization).

Several site visits were made for data collection; they are shown in Table 1.

Table 1.
Site visits to Fernald[2]

1) December 11 - 12, 2001: Seth Tuler and Jennifer Wilhoit
2) March 12-14, 2002: Jennifer Wilhoit
3) April, 2002: Jennifer Wilhoit
4) June 20-23, 2002: Seth Tuler and Jasmine Tanguay

We sought to interview people who participated in important ways in the deliberations about low dose radiation risks at Fernald. Our goal was to interview a diverse mix of people from the contractor, DOE, regulators, citizen groups, local officials, and research scientists.

A pre-defined interview guide was created to structure the interview conversations around the social aspects of risk communication (Appendix A). An interview guide is intended to provide general sets of queries that are asked with approximate wording. It is intended to facilitate a conversation, rather than dictate the precise wording of the questions. There were ten sets of nested questions that were asked in a semi-structured order. Interviews lasted from one hour to two hours in duration. Almost all of the interviews were conducted with one respondent at a time and with only one researcher present.

Informal interviews were not taped but extensive handwritten notes were made. We conducted approximately 10 informal interviews, sometimes with multiple conversations per person. The formal interviews numbered about 25 and were all tape recorded, except for 4 that were conducted over the telephone. Some of those informally interviewed were later formally interviewed. The list of people we interviewed is shown in Table 2. Any phone conversations or email exchanges with potential or actual respondents were also mined for relevant data. Data also were derived from informal conversation that occurred prior to and following the formal interviews.

[2] Jasmine Tanguay and Jennifer Wilhoit were graduate student research assistants who assisted with some parts of the field work.

Table 2.
Interview subjects, listed by primary affiliation[3]

FRESH members

1) Marvin Clawson, member of FCAB, former member of FRESH
2) Lisa Crawford, core member of FRESH President, member of FCAB
3) Vicki Dashlung, core member of FRESH, Vice President
4) Pam Dunn, FRESH member, core member of FCAB, CRO member[4]
5) Edwa Yocum, core member of FRESH and FHES

Local officials

6) Karl Dilhoff, Morgan Township Trustee
7) Jane Harper, Crosby Township Trustee, FCAB member
8) Daryl Huff, former Ross Township Trustee, prior member of the FCAB, CRO member (see footnote 4)
9) Gary Storer, former Crosby Township Trustee, member of CRO (see footnote 4) and FHES
10) Warren Strunk, Jr., Crosby Township Trustee
11) Don Theim, former Ross Township trustee, CRO member (see footnote 4)
12) Tom Willsey, Ross Township Trustee
13) David Young, Ross Township Trustee

Federal agency staff and advisory board staff

14) Owen Devine, Radiation Studies Branch, NCEH, CDC
15) Ken Morgan, DOE Ohio Field Office (formerly Public Affairs Office, FEMP)
16) Judy Qualters, Radiation Studies Branch, NCEH, CDC
17) Doug Sarno, Facilitator and Technical Advisor, FCAB

State regulatory staff

18) Tom Ontko, Ohio EPA

Site management/employees

19) Gary Stegner, Public Affairs Office, FEMP
20) Robert Tabor Sr., FEMP union representative and worker, member of FCAB, CRO (see footnote 4), and FRESH.

Others

21) Nancy Abbott, local resident
22) Jim Bierer, member of FCAB, Chair, Ross High School and Middle School teacher
23) Dr. Stephen Depoe, Professor of Communications, UC, member of FCAB, FRESH member, Director of Living History Project
24) Greg Young, Principal of Ross High School
25) Dr. Chandra Gravely, member of FHES, and resident in nearby community
26) Anita Holmes, resident of Ross, lives nearby FEMP site
27) Dr. Susan Pinney, Department of Epidemiology, University of Cincinnati, part of the Fernald Medical Monitoring Program, member of FHES
28) Susan Verkamp, member of FHES, 2nd chair, local resident
29) Randy Welker, Chair of Community Reuse Organization, Greater Cincinnati Chamber of Commerce

[3] As noted, individuals can be associated with more than one of the groups in Table 2. Secondary affiliations are listed. Membership in the FCAB and FHES are also identified.

[4] The *Fernald Community Reuse Organization (CRO)* was another board created by the Department of Energy under the Office of Worker and Community Transition in 1996. The CRO's purpose was to develop recommendations for offsetting economic and social consequences from the downsizing and closure of the Fernald site.

Interviewees were asked to sign a consent form, which explained the project, guaranteed that their input would be anonymous, and explained their rights as human subjects involved in a research project. In this report, all references to statements made by participating individuals during the interviews to the researchers are considered confidential.[5]

Data analysis

The author of this report was responsible for all the analysis of this case study. He reviewed all of the field notes, transcripts (and some tapes) of interviews, and the gathered archival literature. The first goal was to reconstruct the history and dynamics of the Fernald public health studies and clean-up activities. The next task was to identify the networks in the community and to identify interviewees. Interviews were then conducted to characterize their views about the low dose radiation risks and how they formed their beliefs.

Following the data collection tasks, the author mined all of the gathered data. He focused on the salient themes of this study: risk perceptions, how information flowed and was generated, importance of stigma, importance and dynamics of trust, life histories of nodal networks. These subjects were examined one at a time, for each network. The interactions among networks were also examined. The report represents a depiction of the case as understood through the eyes of the interviewees we met with as well as through news clippings, meeting minutes, technical reports, workshop summaries, and Living History Project interviews.

Conceptual framework

There are many groups that have played important roles in risk controversies and risk communication about the public health risk legacy and the clean-up and longterm stewardship of the site. These groups form a network within the socio-political system at local, regional, and national levels. We call these groups *nodal networks* to distinguish them from the larger web of interacting stakeholder groups and organizations. Nodal networks are not defined, necessarily, by ideologies, membership or employment, or even shared risk perceptions. Rather, we define such networks according to flows of information. Thus, nodal networks are groups of individuals connected by channels of information flow about a central identifying theme or purpose that is shared. The links between members can arise from direct personal interactions, sharing of written materials, and other forms of communication. Of course, each of these groups is by itself a network of individuals. In our study, the data do not allow us to evaluate the formation of risk perceptions and the flows of information at such small sociological scales. Finally, we recognize that individuals can be part of more than one network.

Our approach to deciphering the complexity of the social environment, the sharing of information, and the attribution of meanings to information was to identify the primary active nodal networks within the defined socio-political system network of the community that experienced a controversy about a lose dose radiation risk. In this case study that is the community around the FEMP site. Each network had the opportunity to influence the risk perceptions of their members and of people outside of the network, through their interpretation and reinterpretation of information, as well as their "gatekeeper" roles in the flow of information. Specifically, each network had the potential to be:

[5] Some quotations are taken from interviews conducted as part of the Fernald Living History Project. Citations for these quotations are given in the text, as they are part of public documents.

- A generator of risk information. Social networks can analyze existing data in a new way or conduct their own research to gather new data. In either case, the network provides new information to people that can inform risk perceptions. Usually the information is generated and shared in a social context.
- A mediator in the transfer of existing risk information. Social networks can act as channels for conveying existing information from one group to another. Information can be transferred among members within a network and from one network to another. The transfer of risk information does not imply that no reinterpretation or reframing occurs. Rather, it is to be expected that meanings are *not* preserved completely as information is provided to others.
- A facilitator of learning of risk information. Social networks can support the learning of risk related information by its members and by people outside of the network. Learning often occurs within a social setting, and can have a major influence on the ways that risks are perceived.

Each of these functions will be discussed in more detail in Chapter 4. Next, however, we turn to an overview of the history of the site and characterization of the community.

Chapter 3: Context and history

Overview of the site and contaminants

The Fernald facility, formerly known as the Feed Materials Production Center (FMPC), is located on 1050 acres northwest of Cincinnati, Ohio (Figure 1). During operations the site received shipments of uranium ore or recycled materials to process into highly refined uranium metal products for the US nuclear weapons program. Some thorium metal products were also produced. These metals were extracted through a series of chemical processes. Waste materials were stored on-site, including some wastes from the Manhatten Project era that were shipped from elsewhere. During its peak production years over 3000 employees worked at the facility; by the 1970's the number of employees was less than 1000 (OHEPA 2000).

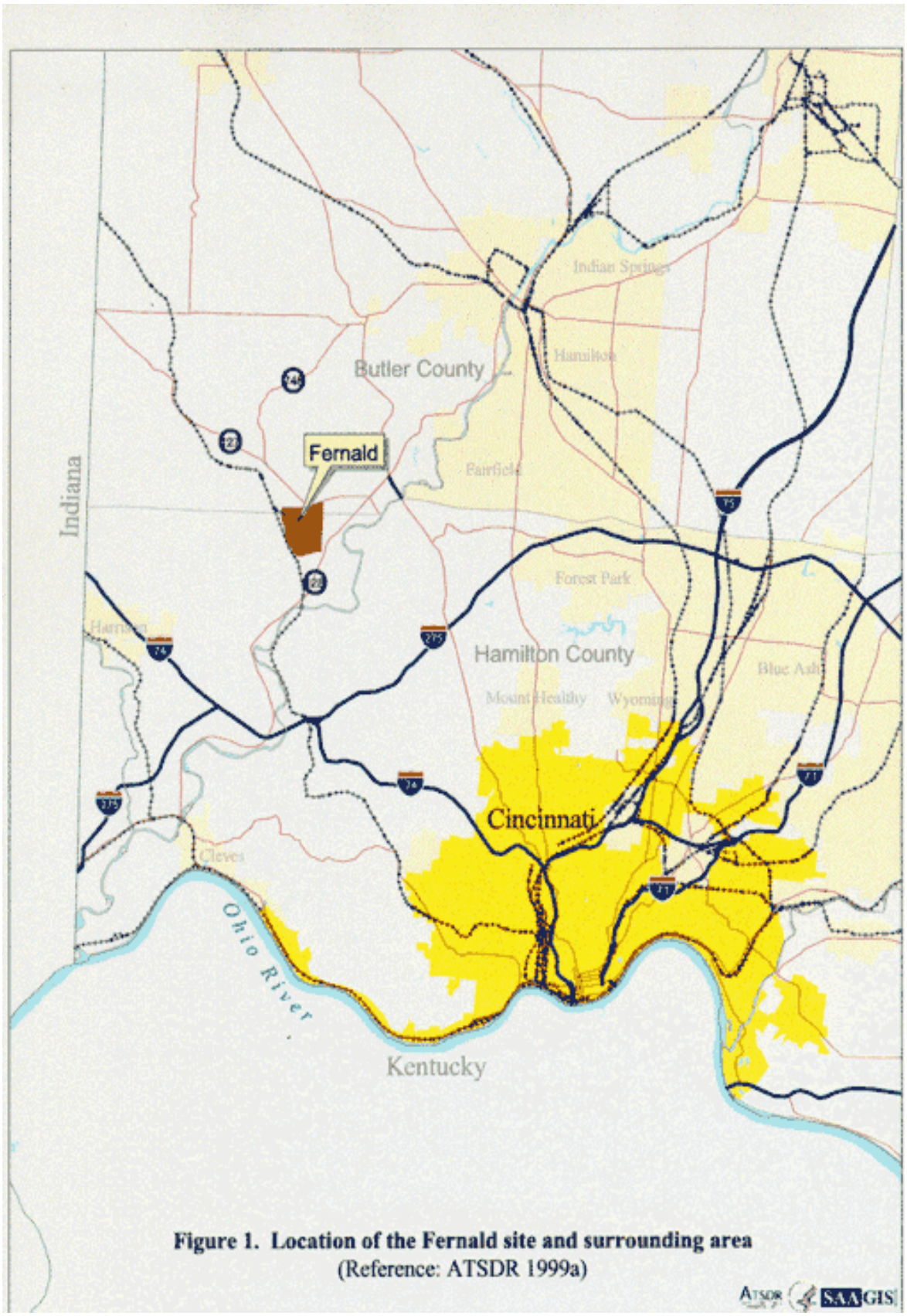

Figure 1. Location of the Fernald site and surrounding area
(Reference: ATSDR 1999a)

Operations at the Fernald facility resulted in on-site and off-site contamination. An independent dose reconstruction study estimated uranium and radon released during production at the FEMP, as shown in Table 3 (RAC 1998). Uncertainties in estimates of releases occur because accurate logs and measurements were not kept. Waste materials that were stored on-site have been an important source for the releases. For example, four concrete silos were constructed to store radioactive materials in 1952. Two of them, referred to as the K-65 silos, contain high radium-bearing residues. The dose reconstruction study estimated that 170,000 curies of radon were released from the K-65 silos (RAC 1998).[6] In addition, waste pits were used during past operations. They contain approximately 475,000 tons of waste, including uranium, thorium and other radioactive and chemical contaminants.

Dose reconstruction estimates of uranium and radon releases from FEMP, 1951-1988

Source term	median	5th percentile	95th percentile
Uranium to atmosphere	310,000 kg	270,000 kg	360,000 kg
Uranium to surface water	99,000 kg	85,000 kg	120,000 kg
Radon to atmosphere	17,000 Ci	110,000 Ci	230,000 Ci
Radon-222 daughters	130,000 Ci	87,000 Ci	190,000 Ci

[From Till, J. 1996, The Fernald Dosimetry Reconstruction Project: Overview and update. Radiological Assessment Corporation. Presented to the Fernald Health Effects Subcommittee June 12, 1996.]

In addition, the waste pits are contributing to contamination of ground water. The Fernald site is located over the Great Miami Aquifer, which is designated a sole source aquifer and considered a valued natural resource. The Southwest Ohio Water Company operates a production wellfield approximately one mile east of the FEMP former production area. Ground water is contaminated with above background concentrations of uranium approximately one mile south of the site in the "south plume." DOE provided bottled water for residents in the south plume area until 1996 when a public drinking water system became operational. Private wells had maximum readings of 170, 410, and 578 ppb of uranium in the 1980s (ATSDR 2000). DOE contributed approximately $5.4 million toward this project. Residents living within a certain area were eligible to have the initial installation of the water service paid by DOE.

To address on-going environmental health risks from these and other contaminants, remediation work has been conducted and planned. They include the Waste Pits Remedial Action Project, capping and placing berms around the silos to reduce radon releases, and facility closure and building demolition. High level wastes are being shipped off-site. On-site engineered disposal cells are being filled with wastes that meet specific acceptance criteria. Mainly, they will contain contaminated soil and debris. No off-site waste will be allowed in the disposal cells.

[6] To reinforce the K-65 silos, a soil berm was added in the 1960s and enlarged in the early 1980s. In 1991, bentonite clay was injected into the tops of the two K-65 silos to cap the high radium residues and reduce radon and radon progeny emissions from the silos. A third silo contains lower-level dried uranium residues. The fourth silo has never been used.

The community context

The Fernald site is located in three Townships: Ross, Crosby, and Morgan. Local government in Ohio is rooted in the Townships; the governing bodies are the Ross Township Trustees, Crosby Township Trustees, and Morgan Township Trustees. These Townships are located in Hamilton and Butler Counties. Within the Townships are local towns or villages. The primary towns around FMPC are Harrison and Ross. Some, but not all, workers live in these communities. While they have a history of stability, they are becoming more like bedroom communities for Cincinnati. Longterm residents often express that their motives for moving to the area were connected to the quiet, rural character of the community.

The properties abutting the Fernald site are mainly farmlands. People residing on these farms, as well as many in Ross and Harrison, have long roots in the community, with the most disruption arising when the federal government took lands under eminent domain for the site itself. Many of the farms have been in the same families for generations. The 1990 census reported that 922 people in 333 housing units resided within 1 mile of the site boundary (ATSDR 2000).

The controversies that have grown out of the FMPC –whether releases actually occurred, whether the releases posed risks to offsite communities, whether production operations should cease and the site closed, and how it should be managed into the future – have torn at the social fabric of the nearby community. From a community standpoint, relationships have been strained or ruined.

For example, in 1980's, when Fernald was still in production, there was lots of anger toward those who were opposing the site and worried about health risks. Members of the local watchdog group, Fernald Residents for Environment, Safety, and Health (FRESH), were seen by many as agitators and activists, not as "community members," even though virtually all of the core members lived very close to the site. Others have talked about how family disagreements arose because of Fernald.

There are many groups that have played important roles in risk controversies about the public health risk legacy, risk communication, and the clean-up and longterm stewardship of the site. These groups are themselves networks of individuals and subgroups. We call these nodal networks, to distinguish them from the larger web of interacting stakeholder groups and organizations.

The most active nodal networks involved with risk-related communications about the FMPC can be divided into:

- FMPC contractors. There have been three site contractors: National Lead of Ohio (1951-1986), Westinghouse (1986 - 1992), and Flour Daniels (1992 – present);
- Federal government agencies and regulators. They include the Department of Energy (DOE), Environmental Protection Agency (EPA), Centers for Disease Control and Prevention (CDC), and Agency for Toxic Substances and Disease Registry (ATSDR). The Fernald Citizens Advisory Board (FCAB; formerly known as the Fernald Citizens Task

Force) was sponsored by the DOE. The Fernald Health Effects Subcommittee was set-up by the CDC[7];

- State government agencies and regulators. The Ohio EPA works closely with U.S. EPA under judicial consent decrees and enforceable inter-agency agreements to oversee the cleanup effort at Fernald. A 1991 Consent Agreement was signed by DOE and U.S. EPA which sets schedules for CERCLA documentation and implementation, and clarifies methods for assessing risk. Using state and federal legislation along with negotiated agreements, both EPAs are to ensure an effective cleanup at Fernald. In 1994, Ohio EPA created the Office of Federal Facilities Oversight (OFFO) to coordinate and manage regulatory activities at several federal facilities. OFFO was created to provide a consistent and comprehensive approach to oversight activities. Ohio EPA's activities at Fernald are funded a DOE Cost Recovery Grant. The Ohio Department of Health has played a minor role in activities associated with public health risks;
- Local governments. Three Townships have played roles in Fernald-related risk communication: Ross Township, Crosby Township, and Morgan Township; and
- The citizen, watchdog group Fernald Residents for Environment, Safety, and Health (FRESH).

Two additional networks at this site are:

- The Fernald Living History Project is a collaborative effort between Fernald, volunteers from the local community, the University of Cincinnati's Center for Environmental Communication, and Miami University's Institute of Environmental Sciences. The project involves community members conducting video-taped interviews with members of the Fernald community about their experiences. Its goal is to preserve a record of the environmental and social impacts of nuclear weapons production and clean-up and remediation activities at the Fernald site and in the surrounding communities. The Project was begun by Fernald, but is now being conducted by the independent group of collaborators. Over 120 interviews have been video-taped. Those interviewed include local community residents, local government officials, DOE staff, and Fernald workers and management. Transcripts of each interview are available. We have used some of these interviews in our analysis.
- The Fernald Medical Monitoring Program, medical surveillance program of the population residing or working within a 5 mile radius of FMPC. Participation is voluntary and eligibility was mandated by a lawsuit settlement. The program began in 1990 and is administered by the Fernald Settlement Trust Fund and implemented by the College of Medicine at the University of Cincinnati and Mercy Health Partners (Fairfield, OH). Participants receive regular physical exams. Data from the program are now being used for health studies of the population nearby Fernald. Information and researchers from the FMMP played key roles in discussions about health studies in the Fernald community.

[7] The *Fernald Community Reuse Organization (CRO)* was another board created by the Department of Energy under the Office of Worker and Community Transition in 1996. The CRO's purpose was to develop recommendations for offsetting economic and social consequences from the downsizing and closure of the Fernald site.

The risk management and risk communication context

The perceptions of government agencies and institutions within the Fernald context are complex, and characterized by evolving feelings of trust, betrayal, and distrust. Individuals' feelings about the trustworthiness, honesty, and accountability of the federal government, Department of Energy, and Fernald contractors have evolved over time. Feelings toward other regulators, such as the Ohio Environmental Protection Agency have also evolved.

Risk communication activities varied significantly during the history of the site, including post-production. Prior to the 1980's very little information was provided to the communities around the facility about what type of work was being done on-site and risks. Workers and the community were told that they were safe.

In addition, there was a high degree of secrecy. Workers at the facility were required to have relatively high security clearances (Q clearance). As part of their conditions of work, they were told they could not talk about what they did with family or friends. In fact, security went much further than these conditions, as people recount in Living History interviews that they were watched in bars to ensure that they did not reveal any classified information. As a result of this secrecy, some nearby residents claim to have not known what was done on the site. As one resident stated in her Living History interview:

> It was understood to be that they made paint. It was called National Lead of Ohio and I automatically was thinking lead paint. And someone had told me that it was paint. (Yocum, pg. 1)

This view was repeated by one of those we interviewed:

> The water towers were red and white checkerboard, had a lot of cows out in the fields in the front. The name of the site was Feed Materials Production Center, which would have led you to believe that maybe it is Purina Dog Chow.

At the same time, many that we interviewed claimed they new it was the "atomic plant," even if they were not quite sure what that meant:

> You really didn't know much about this place. All you knew is somebody worked at the atomic plant.
>
> We always called it the bomb factory as kids. We knew from the beginning that it wasn't a feed plant. When people said a feed plant we knew that it meant it was a processing plant…we always referred to it as the bomb plant. (Harper, pg. 3)

During much of this time, Fernald was generally felt to be a good neighbor (aside from the lingering feelings among some residents about the federal government's taking of land via eminent domain). It was a good employer of people from the community. The site supported and coordinated with local emergency response services. The federal government was viewed as caring about the welfare of the nearby community, the health of its neighbors and workers, and the local environment. It appears that many of these feelings were based on *not* knowing what

was really happening at the site or about the potential risks of site activities and releases. As one local resident stated in an interview:

> Nobody really had any sense there was any danger other than the danger in the manufacturing process itself. There wasn't any sense that the community would be at risk…like radiation.

In the mid-1980's more information began to filter out. The first key risk communication event occurred in 1984 about air emissions of uranium from an accident involving a dust collector. A second major event occurred with the release of information about water contamination of abutters' wells. During this period risk communication was provided mainly through public meetings with regulators and the contractor (National Lead of Ohio). Many of the initial public meetings were very hostile. At times, people felt that they were not being told the full truth and that the site contractors and DOE were trying to hide.

In part, the hostility can be attributed to feelings within the community that the site contractors and DOE lied to the community. During the early years of information about the extent of contamination, many people felt a strong sense of betrayal. They were patriots, they were supporting the protection of the US against the Soviet Union, and they trusted the government. Later, they felt as if they were unwilling guinea pigs. Such feelings were expressed by many during our interviews. For example, one person said that"

> [National Lead of Ohio] would tell us half truths and lies and if we didn't ask the right question they wouldn't give us the right answer. They wouldn't give you any information. So all that made me furious when I would go to those meetings and I would ask questions, and you would just look at them and say Bloodsuckers! Liars! And then you would find out later you were right! And you would find out the real information.

Such feelings were also expressed in Living History interviews:

> I guess you don't think your government's going to work against you. It is just something you feel, like, well that's our government, they're our leaders, they'll do everything to protect us. And it was really a sense of, as I said before, betrayal. That the company, the people you place the most trust in were undermining the health of the area. (Harper, pg. 17)

By the early 1990's the contractor, Ohio EPA, and federal agencies began to establish more open, interactive ways of communicating with the public about risks. They sought to reduce the anger and sense of betrayal. Flour Daniels became the contractor in 1992 and made a strong effort to learn from prior mistakes of National Lead of Ohio and Westinghouse. For example, the *Fernald Envoy Program* was established in 1994 by Flour-Daniel. Its purpose is to promote "one-on-one communication between team members and representatives of the local community" and facilitate two-way communication. In addition, Flour-Daniel has a very active Public Relations Office.

It is in the context of such risk communication activities that we discuss how social interaction helped to shape people's beliefs about the low dose radiation risks from FEMP. A history that

created feelings of betrayal followed by more meaningful efforts to provide information within a small, rural community contribute in critical ways to the processing of risk information within social networks.

Chapter 4: Perceptions and beliefs in the community

In this chapter, we will present findings about perceptions of members of nodal networks in the Fernald community and the ways that judgments about risks were formed. We focus on two risk issues involving low level radiation exposures:

1. public health risks from historical releases during site operation and
2. residual contamination from on-site disposal of wastes and the future use of the site.

Four nodal networks, and their interactions, are discussed:

1. Township Trustees in Ross, Crosby, and Morgan;
2. core and peripheral members of Fernald Residents for Environment, Safety, and Health (FRESH),
3. Fernald Health Effects Subcommittee (FHES), and
4. Fernald Citizens Advisory Board (FCAB).

As part of our discussion of each of these networks we focus on the ways that they played a role in the formation of people's risk perceptions. Each network, as discussed above (Chapter 2), had the potential to be a generator of risk information, a mediator in the transfer of risk information, and a facilitator of learning of risk information. Within each nodal network we focused on the following:

- the way that information flowed inside the nodal network and between networks,
- the kind of interactions that happened among individuals within the nodal networks that helped people shape their risk perceptions,
- the ways that nodal networks generated their own information and then shared it with others,
- the ways that networks were formed and emerged, and
- socio-psychological dimensions of risk that were important to the formation of beliefs about the risk, such as trust and stigma.

In the following sections, each of the four networks is discussed. Findings from interviews (and other data as described in Chapter 2) are used to illustrate the risk perceptions held by members of the network. The key factors influencing members' risk perceptions are discussed in relation to the roles played by the network in the flow and interpretation of risk communications. Finally, at the end of each section, the way each network interacted with the others is described.

Township Trustees

Local government in Ohio is centered in the Township. Elected officials are Trustees, and they have responsibilities for myriad issues and functions, including emergency response and zoning. Three townships played prominent roles in the risk communication activities related to the public health risks of radiological releases from FEMP and risks from residual contamination resulting from the onsite disposal facility and future use of the site. The three townships that played a part were: Ross Township, Crosby Township, and Morgan Township.

While there might not be complete agreement on issues and priorities among Trustees within a township or among those from different townships, the Trustees form a nodal network because of their common concerns about the areas and people they represent. These concerns are illustrated by the following two quotations:

> My involvement of course concerned the residents of my community and I wanted to make sure this was cleaned up in a timely manner.
>
> I think my main responsibilities are to the citizens to make sure that the cleanup continues and that the government is responsible for continued perpetual care of the site. I think we have to kind of serve as a watchdog to see that its never allowed to go into an abandoned condition. We need to be alert and keep in communication with them because we certainly don't want them to abandon the site completely. We want them to accept responsibility for it forever. (Harper, pg. 19).

Risk perceptions

A variety of factors helped to shape the risk perceptions of the Trustees that we interviewed for this project. They included the level of technical understandings of radiation (or the lack thereof), familiarity with radiation, evaluations of the scientific understanding of risks, the availability and use of technical reports and presentations, quality of experiences with FEMP and DOE management, concerns about stigma (e.g., economic impacts), and personal experiences and observations.

The following quotes illustrate how Trustees expressed their views about the risks.

Some made comparisons to other risks, such as the "background" rates in Ohio:

> There's never really been any determination exactly what the health risks are. I think there is a lot of speculation about that… Although there are health problems in the community, I am not sure they are from Fernald…This part of Ohio already has a high incidence of cancer and a lot of it is just living in this industrial valley.

Others on the basis of their limited knowledge about radiation:

> It would appear to me that if you are around radiation, and radiation is not good for the human body, that yeah, the health risks in this area would be greater than they would be in Maine, or wherever. You know, it's like, my chances of getting shark-bit are much greater if I'm in the ocean than if I'm sitting here talking to you…We're living next to this

> thing, we don't understand it, we're not sure it is killing us, but we know it's not good for us.

In addition, perceptions grew out of factors that were not associated with the potential health effects from radiological contamination, such as stigma associated with the site:

> I quite frankly don't have a problem with the low-level radiation. I have a problem with the 90 acre cell that we are going to have to look at for the rest of our lives.

The risk perceptions of the Trustees evolved over time – they were not static. New information and a renewed faith and trust in FEMP management and regulators played roles in the evolution of risk perceptions. For example, this quote illustrates evidence for learning by trustees:

> Trustee: I don't feel that the contamination threat to the community was as bad as at one time I felt it was.
>
> Interviewer: What changed your opinion?
>
> Trustee: A lot of the studies they did, a lot of the information they've given us. They had their [water] monitoring devices all over the community. . .and I tend to believe that it's not as bad as I thought it possibly could have been…I thought that there was a possibility that it could [have been] a lot worse.
>
> You can really see the progress. Form the first tour we took…I was kind of horrified at all the things sitting around. [Now] you can really see cleanup being done….Everything is much, much cleaner. Looking good, I 'm impressed. (Harper, pg. 18)

Risk communication

In the context risk of communication about our two issues of concern, the network of local government officials played two roles. It

1. facilitated learning of risk-related information among LGOs that played a role in formation of their risk perception and
2. mediated the transfer of risk-related information between others groups and LGOs, that helped in the formation of perceptions of trustees and others.

The network of Township Trustees did not play a role in generating new risk-related information.

Trustees as learners of risk information

Trustees received risk-related information from a variety of sources. They actively sought out information. The information they sought consisted of more than just factual information about risk magnitude; they were also interested in the quality of risk management, economic impacts, trust in the DOE, and other qualitative factors that have been found to be important in risk perceptions.

In the 1980's Trustees knew very little about the site. They were often – especially at the beginning – in the same situation as the general community. They did not know what was being

done at the site, they did not know what was being released at the site, and they did not know what the risks were from the site. In the course of our interviews, local Trustees recounted for us how little they knew about the site:

> Well, unfortunately the Trustees did not know a whole lot about what was going on. A lot in the community thought we did, but I mean, we were in the dark just like they were.
>
> I mean people didn't know and they weren't willing to tell us what was going on out there, at first. It took a long time before we actually started getting the facts. We got a lot of suppositions, no facts.
>
> In December of the year of the dust collector leak I was interviewed, a television crew came out here and I've only been in office maybe eleven months and of course never been interviewed or had
>
> a TV camera or anything like that stacked on my face, and all that occurred in December of that first year I was in office…[They asked] how I felt about the situation and at the time the operators of the plant, I felt strongly that they were truthful and telling the community the truth…I made a commitment on the air that I was with [National Lead of Ohio] and that I believed what they were telling us and so forth, and I am sure the situation isn't bad, and kind of stuck up for them…I was being interviewed as a trustee so I stood behind the company and of course that was aired all over and I always felt embarrassed about that because it was found out that they were lying, it was found out that there was contamination beyond the fence.

Much of their information came from the FEMP contractors and the DOE. Trustees attended meetings with DOE officials, Ohio EPA officials, and FEMP management at public meetings.

> Yeah, I went to them all (DOE meetings). I was one of the few Trustees that did. A lot of the Trustees at the time just called the place a bomb plant and hated the plant and never attended anything like that, but I was attending them all…

Trustees did not always feel that public meetings were informative. For example, the formal presentations by regulators and the contractors were described in this way by a Trustee:

> I tend to call it the dog and pony show, they would put on their dog and pony show for us, and they would, when they can't blind you with brilliance, they baffle you with bull. So they would go for the dog and pony show, and of course, the majority of the people didn't have a clue what they were talking about, including me. Well they would talk about they monitored this thing, they monitored that there's so many rems and so many whatever, all these measures, so that nobody understands accept people that deal with it.

In more recent years, the Trustees relied heavily on Flour-Daniel' *Fernald Envoy Program*, established in 1994. Its purpose is to promote "one-on-one communication between team members and representatives of the local community" and facilitate two-way communication. In the Envoy Program, Fernald employees act as formal, designated liaisons with stakeholder groups, including Township Trustees. Trustees received information from the liaison and they

were able to share opinions and information with the liaison to take back to the site contractor. A Trustee stated:

> We have an envoy that comes from [FEMP]. We meet twice a month. And I know he comes once a month, and he's also on the school board, so it's difficult for him to come twice a month, so he's done a real good job supplying information. And ever since they started that program, I think we've gotten a lot more information, and I think he's taken a lot of our concerns back that weren't getting back to them before, so it's worked well, a lot better.

The Envoy Program was successful in part because it relied on trusted members of the community to act as sources of information about the site. Trust between the Envoy Program liaison and the Township Trustees played a key role in how risk information was understood – how well learning took place. For example, without trust, the Trustees were unwilling to believe what the site was saying about risks. By using a trusted person as a liaison, the site was able to break through the resistance to listening:

> Trustee: Now, in the beginning it was a person from the plant, we could contact somebody from the plant, and then that person would … come to the meeting and then tell the answer. But the trust level was so low that the community people out here didn't want to hear from anybody from the plant. So then we got a liaison, a community member, and that person would then contact the plant and the plant would give them the answer and the community person would come back and give the answer [to us].
>
> Interviewer: The information was coming from the same place: Fernald, right? But they would trust it if it came from a community member?
>
> Trustee: Yeah.

Distrust with the site contractor and with DOE created a barrier to learning among the Trustees. For example, some Trustees expressed the conditional nature of how they understand the risks and the quality of the site's risk management:

> *Hopefully* they're being a lot more honest with us. Communication is much better. When there are problems they do call the Trustees…I think there's a lot more open communication that there was in '84. We *hope* its honest and above board. We *hope* nothings being concealed. They *seem* like they really are trying to work with us and avoid any more scandal and any more scenes with newspapers and reporters gathering around. It *seems* like they're much more cooperative. *Hopefully*, that's what's going on. (Harper, pg. 21; emphasis added).
>
> I'll never be convinced, ever in my life, that the DOE is cleaning this up for my people. I think they're cleaning it up to take the heat off the DOE. It's got nothing to do with whether they give a damn about anybody down here, because, in my opinion they don't.

Many Trustees learned that they could not all be fully engaged in Fernald-related issues. There were many other concerns that they had to address. Thus, in at least one Township the Trustees divided responsibilities. Only one Trustee attended FCAB meetings. Some Trustees described for us how they felt overwhelmed by the amount of information they were provided and needed to learn to be effective participants. Too much information was a barrier to learning within this network.

One Trustee claimed that the DOE intentionally created a situation where people felt overwhelmed by the amount they needed to learn:

> You know, they have overwhelmed me with information, and I mean that in a snide way. They've given me more information than I could possibly ever consume. I have an office at home, and I have a file about that size, oh that's not counting the things I've thrown away. I just have so much information that I don't understand. I'm sure a lot of people feel that way, and I think that was by design too.

Trustees as mediators of risk information

Trustees played important roles as sources of information to others in the community about Fernald related risks. They helped to form the risk judgments of others. Trustees devoted time to discussions about Fernald at Township meetings. They were approached on occasion by members of the community outside of official activities (e.g., in neighborhood stores). Most importantly, Trustees created the opportunities for FEMP staff and others to provide information about Fernald at Trustee meetings. They did this for two reasons.

First, they found, as discussed above, that they could not attend all the meetings and digest all the information they were provided in reports, etc. Consequently, in at least one Township they began to rely more heavily on other groups to be sources of information about Fernald at Township meetings. The Trustees, then, acted in a way to convey information from one group to another.

> Fernald is not the big issue for the Trustees of towns anymore, people go to FRESH meeting for information. Right now the trustees are focused on keeping this highway out of the township, I mean, the focus of the trustees is constantly changing. Sure, during those hot years so to speak, I mean, that was our main focus but even at that time we had problems, emergency service problems. So we couldn't sit there all night and just talk about Fernald cleanup. It was a segment of our meeting and then we'd moved on. Now FRESH has a segment in our meeting. They have a representative there, and they'll tell when the FRESH meetings are, where the meeting is going to be, and if there is going to be a speaker and that type of thing… Or even a question that could be funneled to them too, like the… you know, one of the K65 silos is going to be emptied of the radon gas. Well, if that question came up in the Township meeting, we may address that to FRESH, and FRESH would say 'we'll get an answer for you on that' or we can contact [Envoy Program liaison] if we wanted to, he could come back and give us an answer or FRESH would come back and give us answer.

Secondly, the Trustees took their responsibility as elected officials and leaders in the community seriously. It was important for them to create opportunities for informing residents in the community about important issues.

> we always tried to disseminate information at our Trustees meetings, to the audience of people in attendance. Rather than talk in general terms, if we would have a discussion on it, we would try to tell the people in the audience where we got our information, and why were talking, and what was going on.

Interestingly, we found that Trustees did not only rely on formal channels of communication as recipients of risk-related information. They also relied on informal relationships. For example, a Trustee felt he received more information from informal interactions in this small rural community than from other "official" sources like DOE or the site contractors:

> I know that at one time there was a guy, I won't mention his name, he would call me at home, and tell me things that were going on, that weren't actually for public knowledge. And he was in a position that he would always call and he would always say, that this is an anonymous phone call. And he knew that I knew who it was. He was a site guy, and he said now this anonymous phone caller wants you to know that this is happening, and you need to ask this question, and you need to find out about this.

> I know a lot of people that work there now and worked there through the clean up process and I talked to them first hand so I had first hand conversations with people that work there currently so that has provided another source of information as well.

The information they learn from these informal contacts was part of the information the Trustees then shared with others both inside and outside of their nodal network.

Interactions with other nodal networks

Trustees were mediators of risk information because they were members of multiple networks. They were also members of, for example, FRESH (although, not core members), the Fernald Citizens Advisory Board, and the Fernald Health Effects Subcommittee. These are discussed below in sections on the other nodal networks.

Fernald Residents for Environment, Safety, and Health (FRESH)
FRESH is a key community group stakeholder, described as "watchdogs" of FEMP. Established in the mid-1980s, FRESH has emerged as a powerful voice in all issues related to Fernald risks and environmental management, including public health risks from historical exposures from FMPC.

For the purposes of this study we distinguish between two types of members in the FRESH network. First, there is a small group of "core members." The core members consist of longtime members who are highly engaged in public processes related to Fernald public health and clean-up issues. They are the core organizers, setting the agenda of FRESH meetings and the agenda of the group. Many of the core members trace their initial involvement to the dust collector uranium release and to the news that residents' wells were contaminated. They attend public meetings regularly, and have been members of the advisory boards. Second, a large group of FRESH members we call "peripheral members." Over a 100 individuals pay dues and receive the newsletter. They may write letters and attend public meetings sponsored by the agencies or DOE. They attend FRESH meetings, regularly or intermittently. Peripheral FRESH members include residents of the nearby communities, university researchers, workers, and others.

The early history of FRESH is one of finding voice and learning about the issues facing the community. FRESH members we interviewed recalled the feeling of being shut-out as a group by DOE and Fernald management during the 1980s and early 90s. But they were persistent in seeking information and having a voice:

> There was a point where FRESH was sitting in the front row, and we just could not take it any more, you could just see the lies coming out. And that's when FRESH actually did some demonstrating. We got up and we wouldn't sit down. Because they just kept ignoring our questions, we would raise our hand and ask questions, and they would go to the other community people, and so finally we just got upset that we just stood up, and started asking these questions, and they finally started answering.

In this context, people became very angry – and they began to organize:

> [What I first heard was] that there had been a release at the Fernald plant. When they said that there was this release, that there was no real problem, I didn't believe it. So, I had heard that they were going to have this public meeting at Crosby Elementary. I went to that meeting to get some more information, and I wasn't real happy with what I heard because I went and specifically asked one of the scientists that were there… 'I grow a garden and I feed this produce to my children, can you tell me with certainty that there is no risk to my kids?'… and he kind of hemmed and hawed and he couldn't say if there was a hundred percent no risk. So that propelled me into getting more involved in finding out more about what they did at the site… If the scientists couldn't give me the hundred percent assurance then I knew I had to look into it to see what the risks were for my own family.

Initially, FRESH was seen by many within the DOE, Fernald management, and the community as a group of agitators or activists:

> In the beginning we were ostracized in the community as radical nuts that were stirring up a pot of brew that should just be left lay. We had many people come up to us and say, 'why don't you keep your mouth shut, you are destroying our property values.' They didn't say it in those exact words but you got the inclination and that is what they meant. So everywhere we went, we weren't very popular. We were really on the bottom of the list. We lost some friends, actually the community at that time would rather just throw a blanket over it, put a fence around it, put a padlock on the gate and just let it lay. That is what they wanted. They didn't want it brought up.

Much of the anger towards them came from workers who were afraid of losing their jobs and those who thought that the risks were being overblown and creating a stigma in the community. Two FRESH members described encounters in their Living History interviews. They were told:

> Go home and put apron back on (Yocum, pg. 2)

> You need to go home and be pregnant and barefoot and you need to keep your mouth shut (Crawford, pg. 7)

FRESH understood that their credibility within the community was part of a struggle over how they and the issues would be framed. Thus, they worked hard to frame the issue as one of community health, rather than opposition to nuclear weapons, the mission of Fernald within the nuclear weapons production system, or the workers. They made a clear choice to not be "anti-nuclear" but rather to focus on health of the community. This effort was described in Living History interviews of core FRESH members:

> If I went in the door screaming and ranting and raving, ban the bomb, no more nukes, you know, that I wasn't gonna get anywhere [with important political figures]. That they were gonna just kind of disregard me and not listen to what I had to say. So, [FRESH] made a conscious decision when we began to talk to the, to the kind of the public arena here, that we are going in as concerned mothers, people caring – that cared about our environment and care about our community and cared about our issue" (Crawford, pg. 11)

> [people in the community] still have the impression that we as the FRESH group are activists where the CAB and the CRO are more community oriented….I don't like the word activist. I am just a concerned citizen. I am 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 isn't well. (Yocum, pg. 6)

According to a core FRESH member we interviewed, DOE attempted to paint a different picture of FRESH, and influence the community's attitudes toward the group. DOE tried to characterize FRESH members as "activists," a rhetorical move resisted by FRESH because of the way that term was reacted to by residents in this rural community:

> DOE kept referring to us as activists, demonstrators. They were giving us a negative, coming across that we were negative, and so people would not relate with us, or become members with the grassroots groups, thinking that we were nothing but trouble-makers. That was at the time, where you would see demonstrators at the Fernald site, that had nothing to do with the community. A lot of people was upset, because their farm roads were crowded with these people, and they didn't want this out there in their community, and so when FRESH was formed [they thought] that we were basically the same type of people. And to this day, the DOE refer to us as activists. And we are not activists. We are concerned citizens about our community.

Ultimately, FRESH's approach – and their support of workers concerned about losing their jobs when the site switched from production to clean-up focus – helped to build a more positive relationship with workers and the unions.

> It wasn't easy here sometimes saying, 'Hey, there's a problem,' because some of the workers thought 'you are going to shut this place down and nobody's going to have any jobs.' They weren't happy with community people who they thought didn't know anything getting involved with it-- especially a bunch of housewifey women! It didn't go over real good with some of them. But over the years employment has gone up, not down. I think a great many of the workers understand, and we've had such staying power for so long and have worked with trying to find solutions rather than just ranting and raving. And we haven't picketed or anything like that, that they have begun to realize that these people are sincere about this and so a lot of people have come around to understanding why we have worked so hard. And we really do care about our kids and the community!

Risk perceptions

A variety of factors influenced the formation of risk perceptions among the members of this network. They included perceived competence of management and regulators, access to information and independent technical experts, understandings of scientific information, familiarity with radiation, information gleaned from presentations and reports, perceived quality of the decision making processes, trust in the DOE and FEMP contractors, and personal experiences and observations.

In the beginning shared perceptions of the risks were based on fear and lack of knowledge. As the FRESH members became more active and educated about the site and its contamination, their perceptions emerged from a sophisticated understanding of technical issues, wariness of uncertainties and lack of scientific knowledge, and distrust of the responsible federal agencies.

The first experiences of FRESH members with the site as a source of risk came as a surprise and set the stage for their early risk perceptions. The core members were mainly people living near the facility who were unaware of risks from offsite contamination. They were not a coherent nodal network at this time, but their early, common experiences helped to shape the way that the network judged and responded to risk. One of the most dramatic illustrations comes from FRESH president Lisa Crawford. Her story is representative of the experiences of core FRESH

members that played a key role in the character of this nodal network. In the 1980's she, her husband, and child rented a home abutting the site. In 1985 they discovered that the DOE had been testing their well for contaminants – without their knowledge – for several years. In her Living History interview she describes how she discovered, upon returning home from work, in 1985,

> a man climbing out of our well. A man in a white …jump suit….he wouldn't talk to me. He would not answer my questions. He would not look at me. He had water samples in his hand and I dogged him all the way to his little white van that said 'US Department of Energy' on the side of it. And he would not talk to me at all. And I think that played a part in making me more angry. You know, I am this ranting, raving, angry housewife now, who is furious. That no one will talk to me. No one will answer my questions. (Crawford, pg. 5)

Not only was it hard to get information. Early risk communications were inconsistent. For example, the Ohio EPA and Ohio Dept. of Health gave conflicting assessments about the risks from wellwater contamination measurements of 190 piciocuries/liter. The US EPA advised Lisa Crawford and her family to not drink water from their well and to find an alternative source. On the other hand, the Ohio Department of Health told them that 190 picocuries/liter was within DOE limits and that they could drink the water, not to worry.

One of the important, early formative events that influenced risk perceptions among FRESH members we interviewed was the residents' class action lawsuit against DOE; many FRESH members were part of the class action lawsuit. They learned of how workers were exposed to radiological and chemical contaminants, often without their knowledge or after being told there was no risk. A DOE memo stating that there are no safe levels of radiation exposure was particularly memorable to one of the FRESH members we interviewed.[8]

> Actually your eyes got opened up during the trial. We were part of the trial, we were there every day for 8 days. Huge volumes of information. I took notes. I got a big notebook to write that all down, and I spent a lot of time writing. And I always like facts and figures, that is just a part of me, so I would write that all down and it was alarming, really. That is where the alarm come in for me.

The specific health-related concerns of core FRESH members are for cancer and non-cancer health effects from radiological and chemical contamination. They believe that there are health risks, but that they are not always measurable to a high degree of accuracy. They feel that the risk assessments done by the CDC, as well as more recent studies by ATSDR and the Fernald Medical Monitoring Program, show that there are real risks from historical exposures (CDC 1998, 2000, ATSDR 2000). For example, a peripheral FRESH member stated that:

[8] In the Fernald lawsuit settlement, the DOE "Admit that, for purposes of radiation protection, it is assumed that any amount of unnecessary radiation exposure, however small, carries with it some increased risk of adverse health effect. Admit that, for purposes of estimating health effects of ionizing radiation, scientific groups, such as the BEIR committees of the National Academy of Sciences, assume that any exposure above zero increases the risk of adverse health effects…" (Fernald Litigation Master File Number C-1-85-0149, Admission #89)

> I think that the difficulty that we have with the workers, as well as the residents, is that a lot of the exposure happened in the 1950s and '60s. There are a lot of confounding factors, smoking and other health behavior issues that make it tough to pinpoint exactly X amount of cancer was caused by this radiological [release]. One thing that I am growing increasingly concerned about is some research that is coming to light here with non-cancer or non-cancerous illness such as birth defects or liver, kidney problems, and urinary tract cancer, bladder cancer.

Such statements were also made by core FRESH members:

> The medical monitoring program has done a study on urinary systems, and it's not cancers. And see that's the other thing too, we keep talking about cancers, and people keep thinking, keep relating, well I don't have cancer, but yet I have this other illness. So they don't realize that radiation doesn't only cause cancer, there are the non-cancerous illnesses too, and that's what we're finding, a lot in this area.
>
> As far as the risks involved, most of the people that were exposed were exposed earlier on. And we can't change those exposures. Whether there is more or less risk than we perceive, it is hard to tell. Time kind of tells you a lot of those things. Hopefully it is not as bad as some people in the community think.

FRESH never concerned itself solely with risk communication about risk estimates. For this group, risk related concerns were much broader. They were very concerned about the processes by which risks were studied and bringing out the truth, such as the transparency of decision-making processes, accountability of agencies, and access to information. Other non-technical concerns, such as cost-effectiveness of studies and remediation activities, potential economic impacts to the community, and employment, played important roles in how the core group of FRESH formed opinions about the risks and the risk management agencies.

> We tried to keep everything as public as possible.
>
> We looked at [clean-up recommendations] in dollar signs, but we also had to look at it from the scientific side too.

Risk communication

In the following sections we discuss how FRESH, influenced by these factors, has played all three risk communication roles. This nodal network:

1) facilitated learning, or receiving, information that played a role in formation of risk perceptions among FRESH core and peripheral members;
2) mediated the transfer or information among stakeholder groups and between FRESH core and peripheral members;
3) created or generated information that played a role in the formation of risk perceptions among FRESH core and peripheral members.

FRESH as learners of risk information

Oftentimes, members of FRESH were receivers of risk communication messages. FRESH – both core and peripheral members – were not passive recipients of information. They were actively engaged in learning and interpreting risk communication messages.

FRESH members worked hard to become educated about the issues. They did this on their own, by reading for example. One FRESH member was supported by the CDC to take a distance learning course on epidemiology. The FRESH member with responsibility for taking the lead on health related activities participated in a national working group of a federal advisory committee to the CDC and NIOSH on radiation health research efforts at DOE sites.[9] Another core member was appointed to the DOE Environmental Management Advisory Board (EMAB). FRESH invited people to give presentations. When they did not understand the technical issues, they would reach out to independent scientists and concerned citizens for assistance, both locally and nationally, as well as to staff from regulatory agencies (i.e., US EPA, Ohio EPA).

For example, according to those we interviewed:

> EPA was a lot of help, because if we did not understand a situation, we would ask them to give us a workshop, and see what their viewpoint was…
>
> We would come to the reading room oftentimes, and get the documents from that. The state of Ohio was involved early on, so the Ohio EPA became a source of information.
>
> If I found out some of the diseases or cancers I was not familiar with, I would read up on them and see how they were related to radiation, and chemicals, because chemicals were also used at the site, and were also found in the water, and how they were transmitted. How did uranium get into the food, and how, by eating the food raised in our area, where it would go in the body and things like that.

An underlying rationale for a focus on learning within FRESH was that core members felt that they had to be well-informed in order to be credible participants in decision-making processes about site clean-up and health studies of risks from historical exposures. As one member described in her interview:

> Experts were the best, as far as getting information that helped us. And reports. [FRESH members] could use that information to show them the other side, and when we could show another side of what they were talking about, then that's what made them start saying that these people are not as dumb as what we thought they were…and then we could ask more questions. That is why we would always ask to see the information. If there was a hearing or a meeting, we would be able to look over the information for a day or two, before we came to the meeting, so we would have the right questions to ask.

Social interaction in deliberative settings was a critical mode of learning and important in the formation of risk perceptions. Learning was not just based on individual efforts or information per se. Relationships were critical. According to a core member's Living History interview:

[9] The Advisory Committee on Energy Related Epidemiologic Research (ACERER).

> We read a lot of books and *we found friendly people…You find these people or they find you. And you forge relationships with them and they help to educate you.* You learn quickly who you can trust and you can't trust. (Crawford, pg. 18; *emphasis added*)

Important relationships were also formed when FRESH reached out to other communities that were facing contamination from DOE nuclear weapons facilities. They became members of the Military Production Network (now called the Alliance for Nuclear Accountability), a national network of over 35 groups. By meeting people from other communities they became aware of the inter-connectedness of the Fernald clean-up with the operations and clean-up of other facilities:

> In the early years, I think we were so naïve. We were saying let's just clean this shit up and get it out of [Fernald], quick. Then all of a sudden we began to go to MPN meetings, we began to meet people from around the country and we began to see that they have this really big problem with Hanford and Nevada…And then all of a sudden it became like, we are shipping all of this stuff to Nevada and should we, consciously, should we really be doing that? Aren't we hypocritical by saying get it the hell out of here and give it to someone else and have them worry about it? That was our learning piece that we had to go through.

Social interactions at national meetings of the MPN were critical to their arriving at this understanding. Through their interactions at the meetings FRESH members learned about the risks faced by other communities and the impacts that would result from transfer of wastes *with their new colleagues/friends*.

More evidence for the importance of relationships and social interaction in the learning of risk information is found outside of formal meetings. FRESH would discuss detailed aspects of risk studies in informal settings that they felt were more conducive to honest dialogue, as one interviewee described:

> [The contractor for the dose reconstruction study] was looking at a span of years that we didn't agree with, they were not high release years…We brought [the contractor for the study] to one of those public meetings and bickered and argued it out and we ended up going out to the bar and drinking it and changing it.

Finally, an important factor in the confidence that FRESH had in the credibility of risk communication messages was the stability of the agency staff and FMCP management. Longterm relationships have been formed with key individuals, and it has increased trust, credibility, and access. On the other hand, there is a difference between trust felt toward individuals and trust felt toward institutions. This is particularly apparent in feelings that FRESH core members we interviewed have toward the DOE. For example, a FRESH member stated in her interview that:

> the level of trust toward the agency as a whole hasn't probably changed-- I still don't trust information [from DOE]. Unless I can verify it. But trust in certain individuals, like at the site, has increased. Because at the time it seemed like they were changing people

> constantly, and we pushed real hard to have them not do that, so we could develop some trust and some communication with people-- and that helped a lot. When you get to know people and been in enough meetings and you started working on projects with them, hopefully you can tell whether they're telling you the truth.

Parallel with the experience of a Township Trustee we interviewed, communication of risk information also occurred through informal networks. FRESH would also learn information from anonymous sources at the site, as told to us in our interviews:

> [DOE] wasn't wanting to reveal information, and because we kept digging and some of the people at the plant new of things and weren't happy necessarily with what was going on… so Lisa would get little calls-- a heads up, 'you know you might wanna do this or do that.'
>
> I come home from work and find little manila envelopes in my mailbox with very damaging information sometimes…I've got a bunch of faxes. I've got a lot of stuffed envelopes with no return addresses on them…

While the media is often viewed as a source of for risk-related information, FRESH members we interviewed did not view the media as reliable. For example:

> Sometimes we get good information from the press, sometimes we don't. Since we are involved with it, a lot of the times you could be at a meeting where you heard exactly what was said, and then you read the article or the TV is on and you are going 'Huh?' They don't get it because they don't have consistent reporters oftentimes that have the time to really learn what was going on. I know one time the Hamilton Journal wrote of rather scathing editorial about our group, and how we weren't doing our job. We had had heavy rains and some uranium was going out to the river in some overflow-- and we were aware of that and it happens frequently, and it is diluted in the river and we don't like to see it happen but it wasn't like there was an immediate danger to somebody and so wasn't like you know… they acted like we should have warned the community. Well this is the same stuff that had been going on for years and years and years and they had been trying to eliminate these situations, but nature has its own mind and there was this really nasty editorial on our group and we thought, 'well, where did this come from?' If they had looked at the monitoring reports they would know how much flowed out to the river and this was a normal thing. And anybody who had gone to the meetings would know that. But it hurt…. Then about a year later they had another editorial that was praising FRESH to the hilt for protecting the community.

Learning within FRESH was dynamic – their beliefs and positions evolved. For example,

- As FRESH was formed and public deliberations began about how to clean-up the site after closure, they had a very clear position: clean-up the site completely, remove all contamination. As they learned more about the technical feasibility of such a goal, the economic costs, ecological impacts, and consequences to other communities that would receive removed wastes, FRESH members began to consider the option of onsite disposal of some wastes. They grappled with the question: what was an acceptable future risk to the community from waste cells onsite? During FCAB discussions on this subject,

FRESH core members changed their position, and supported the option of onsite disposal for wastes meeting certain criteria (see below in discussion of FCAB).

- FRESH was an early advocate of having CDC conduct an epidemiology study in the community. They felt, initially, that such a study would validate the patterns that were being observed. However, after learning about epidemiology methods and limitations within the FHES and other venues, the positions of FRESH core members began to evolve. They began to understand that the utility of an epidemiology study in the community would be limited because of low power. Consequently, they supported CDC's decision to not do an epidemiology study. However, they opposed the CDC's decision to disband the FHES and not do any more health studies within the community. FRESH continues to be concerned with addressing the broad picture, uncovering the puzzle of all contaminant releases and health risks in the community. In fact, both core and peripheral FRESH members have been instrumental in forming a new, non-profit, organization that will support research and education on public health risks because "CDC did not finish the job."

The evolution of risk perceptions within FRESH was a difficult process. The issues – and preferences for options --were controversial within FRESH. They were arrived at through extensive deliberations among members of the group. This process was described in a Living History interview of a core member:

> I mean meeting after meeting after meeting you know, learning and educating, and reading documents and commenting on documents, and you know, arguing amongst everybody about what's clean and what's not clean. And how much waste – and it gets a little contentious at times and not everybody agrees. (Crawford, pg. 18)

FRESH as mediators of risk information

FRESH played a mediational role in the communication of information between its members, the federal health agencies, Fernald Medical Monitoring Program, and others within the local community and outside of the region (e.g., with national stakeholder groups). This role was important in the formation of risk judgments, particularly for peripheral members. FRESH meetings frequently include presentations by researchers, independent scientists, and regulatory agency staff. In addition, FRESH distributed information about the process of conducting health studies, assessment of clean-up technologies and alternatives, the activities of the Fernald Health Effects Subcommittee and FCAB, and findings from the health studies in its newsletter. Often, its newsletter would provide information about how people could obtain copies of the studies themselves.

The mediational role of FRESH in the communication of risk-related information was often active. They were persistent in their search for information and monitoring the status of the site. Moreover, they tried to ensure that information provided by the agencies and scientists would be understandable to its members:

> The health stuff is really hard because when they do the studies it is really complicated and your average folk, they get a little confused. When they come into these public meetings and they've got all these scientists and docs, they are talking a totally different

> language. [Contractor for study] did a really good job explaining the dose reconstruction study. We had to yank his chain a couple of times but once that was done it set the stage…The challenge we made to him from day one was: 'when you come and talk to us you have to talk to us as lay people.' You have to speak to us in terms that your average Joe out here understands. You can't come in here and use these big fancy words.'

In her Living History interview, a core member made a similar observation:

> And the [FRESH] board on a lot of occasions had to read a lot of the stuff and then kind of water it down enough so the average person sitting in the audience at these [FRESH] meetings could get it. (Crawford, pg. 19)

FRESH was viewed as a credible source of information. Sometimes they were viewed as *the* source of information, because people would not hear it from other sources. As a Trustee and a non-FRESH resident of the community stated in their interviews:

> In our community, the only place you would hear this information was from the FRESH organization.

> I think originally [the CDC] just blew it off as there weren't any health risks. I think through the efforts of the FRESH organization, that they brought [knowledge of public health risks] to light.

Although they were viewed as credible, FRESH positions could be controversial and not be fully supported. For example, when FRESH began advocating for the OSDF, a core member remembered in her interview that:

> We took a beating about the first year or so [after changing their position on the OSDF]. We took a royal beating.

Of course, people's interest in risk-related information was also a function of factors external to FRESH. They could depend on what issues were salient within the community. For example, a CDC staff person noted in her interview how initial meetings about the findings from the dose reconstruction study were well-attended, but after that interest (as measured by numbers of people attending public meetings) declined. One of our FRESH member interviewees stated that:

> There were times when more people would get involved-- if there was talk of a new release, or something else that hit the news. The more things were in the news or on the TV then the more people would be at the meetings. And also since, I hate to say it, but since the lawsuit's been settled and the money… you know, for a while a lot of people were coming to [FRESH] meetings to find out how to get their share of the pot. And now that that's solved, a lot of people just have kind of faded off.

FRESH as generators of risk information

One way that FRESH initiated learning about risks was to gather their own data. Newly generated information became an important factor in the formation of risk perceptions. In the late 1980's FRESH core members began to gather information from other community residents about the incidence of cancers and other diseases. They did this via informal discussions with neighbors, family members, and friends. What eventually became known as "the health map" grew out of the core group's question: what is our risk?

> It was very crude. We'd have pins, it's a very crude 5 mile radius map that has red and black pins on it. And [a FRESH member in the community] began to write down people's names who had died of cancer, had cancer, and that is how it started. But, we depended on the community folks because once we got it on paper and got it together we put the word out and depended on them to feed that information to us too.

FRESH felt that no one else had useful information about potential public health risks in the community that might be attributable to historical releases from FMPC. As one core member put it: "we felt that if we made a map someone might listen." That is, federal public health agencies might conduct health studies in the community and the community might become more alarmed and supportive of health studies. In a Living History interview we learned that:

> We were trying to reach out to the community…trying to show them that there is a problem. So we started talking about the health concerns [within FRESH], lets form something that can be an educational tool…we though we could use this as an educational tool and that people could see that there are health concerns, and if DOE could see that there are health problems here, and also we were trying to get health studies and get CDC and our public health department involved…if people would start seeing [the map patterns] they would start asking for help from these agencies (Yocum, pg. 3)

This was also reflected in our interview with a peripheral FRESH member:

> The more meetings you went to the more pins you saw. And there are still pins being added. And when you look at that you realize that there has got to be something wrong. There is no way there can be that many pins on that map that close together. There has got to be a problem…I think it does have an impact. I think that maybe its like one of the greater impacts, because you see that, its something tangible. Its visible, and you know that each one of those little pins, it is or was a real live person. That was somebody's loved one.

By creating the health map FRESH engaged in risk communication in a variety of ways:

- It generated information that played a role in the formation of opinions about public health risks in the community. In fact, it helped garner the support of Ohio senate and congressional members for legislation asking that CDC consider conducting an epidemiology study in the Fernald community.
- The map was used extensively as a tool for communicating with the community about the potential health risks from Fernald. FRESH discussed the map in its newsletters and always displayed it at public meetings. It was also used as a tool for networking with

individuals within the community – locating them and educating them, bringing them in as FRESH members.

- The creation of the map played a role in the forging of relationships within the community, including expanding FRESH membership.
- For some in the community, the map provided legitimacy and credibility to FRESH as a citizen watchdog: the distribution of pins showed a pattern that was later confirmed by the dose reconstruction study estimation of downwind releases. Another way that the health map may have helped to influence perceptions of FRESH as a credible and trustworthy watchdog group was that the core members were adamant about refusing to provide contact information to the CDC about who specific pins on the map represented. FRESH promised confidentiality to its informants and strictly maintained that confidentiality.

At the same time, its limitations were understood by FRESH. They did not push its use in deliberations within the Fernald Health Effects Subcommittee (see below). According to CDC staff, FRESH "had feelings of the map's limitations in health studies." When NCEH first started to meet with community members, FRESH presented its "health map" showing pins for each known cancer or death in the community. Staff had, according to those we interviewed, extensive discussions about how the map data could be used in their assessments. Ultimately, staff decided it could not be used – the methods of gathering the information and medical bases for diagnoses were unscientific (e.g., lacked validation). The uncertainties could not be quantified.

Interactions with other networks

FRESH is a key player in efforts to understand the public health legacy of historical exposures to radiation from Fernald and to clean-up activities onsite. They interacted with Township Trustees in ways that influenced the communities' understandings and perceptions of risk. In the remainder of this section, we discuss their interactions with Township Trustees. As will be discussed in sections on the advisory boards (see below), they have participated as advocates outside of and within frameworks set-up by the agencies. In particular, FRESH core members have been active participants in two other nodal networks, the DOE Fernald Citizens Advisory Board (FCAB) and CDC's Fernald Health Effects Subcommittee (FHES).

In some cases, Trustees we interviewed spoke of tensions that emerged between nodal networks within the Fernald community, particularly FRESH. The tensions were related to who speaks for and represents "the" community. For example, two Trustees spoke of their discomfort with not being perceived as fully informed spokespeople and representatives of the community, even while they simultaneously respected and supported the critical communicative role played by FRESH:

> I was always a little resentful [about the dust collector release event] because all the interviewers, the papers, the TVs and that type of thing did not really seek interviews with the township officials. They always sought interviews with FRESH. And my attitude was, well, if they can get at the truth better than us go ahead and let them. But I think sometimes people forget that the elected officials are the ones that represent the people, not FRESH. FRESH did an effective job in seeking the truth, putting pressure on people

> and forcing the truth out, which is fine, you got to have those kind of people but still, they are not elected. They don't represent the view of people like the public officials.
>
> Well, of course a lot of our information was limited to what people on site wanted to give us, also the FRESH organization, they did a lot of information on their own, and quite frankly, they brought a lot of things to light that I don't know would have ever came out. They have done a tremendous, tremendous job, and I can't give 'em enough credit. But they were a watchdog group. They're a special interest group. Their interest is in the residents that live around the Fernald site. It is not the Township as a whole.

As the above quotes illustrate FRESH was also a respected actor within the socio-political system network involved with risks at Fernald. This is reflected further, in the understanding that FRESH played a key role as a watchdog group in bringing "truth" to light. They were persuasive in controversial situations, and influenced Trustee's perceptions and opinions. Trustee's concerns about who represented the community did not prevent them from learning from FRESH or adopting its views. FRESH was viewed as credible and it was respected within the community. For example, as quoted above, a Township Trustee stated in regard to the on-site waste disposal cells:

> Well, actually I was hoping that all of it would have been shipped out, personally. And there were a lot of people who, not a lot, I guess there were some people that really were opposed to building that disposal cell. But FRESH, I think, felt that that was probably the best solution to the mixed waste…I kind of defer to FRESH, I mean, that they felt that that was a decent solution.

The Fernald Health Effects Subcommittee

The Public health risks from historical contamination

The Centers for Disease Control and Prevention's National Center for Environmental Health was asked by Congress in 1988 to consider conducting an epidemiologic study of the community surrounding Fernald. The CDC felt that an epidemiologic study would not be possible without first developing information about radiation doses to residents in the surrounding area. In addition to the need for reliable estimates of off-site exposures, the CDC and community also considered whether there were adequate data about plausible health outcomes and availability of demographic and health outcome information.

Subsequently, the Fernald Dosimetry Reconstruction Project was begun in 1990 to estimate off-site radiation exposures during 1951-1988. The NCEH Radiation Studies Branch worked with its contractor, Radiological Assessments Corporation (RAC), to complete the project in 1996 (RAC 1998). Scientific and public reviews were conducted for another two years and the final report was released in Sept. 1998.

The study's results indicated that most of the estimated dose to the public came from inhalation of radon and radon decay products. These exposures came mainly from the wastes in the K-65 silos. The highest exposures occurred in the 1950 – 1970s. Structural modifications to the silos in 1979 substantially reduced releases of radon and its decay products from the K-65 silos. The primary risk from radon exposure is lung cancer. Other isotopes of uranium and thorium contributed to the exposure of other organs, such as the kidney, bone marrow, bone surfaces, and liver.

There were multiple opportunities for the public to learn about and participate in discussions about the potential of an epidemiologic study to find positive relationships between exposure and outcomes. For example, preliminary estimates were made available – and discussed in a public workshop – by 1993 (CDC 1993). Even before the study was completed the CDC engaged independent experts and members of the community in discussions about the most appropriate means for following-up public health concerns with further epidemiologic studies.

An important step of the Fernald Dosimetry Reconstruction Project was the communication of the findings to the community. Considerable effort went into developing a communications program. To make the results more meaningful to the lay public, the CDC and RAC used nine scenarios to describe the estimated doses to representative people with different lifestyles. These scenarios, in a brochure, were widely distributed to the community, along with materials explaining the meaning of the scenarios. The implications of uncertainties and placing risks into a wider perspective were a focus of the communications efforts. On the other hand, the CDC acknowledged that "the risks estimated for the nine exposure scenarios did not provide a comprehensive summary of the potential health effect of the FMPC on all residents in the surrounding community. Many individuals, who could not relate their own experiences to those defined in the nine exposure scenarios, were left with questions about their risk" (CDC 1998, pg. 15). The CDC did not rely on comparisons to radiation protection standards in its communications efforts.

At the same time the dose reconstruction study was being completed and reviewed, the CDC's National Center for Environmental Health set-up the *The Fernald Health Effects Subcommittee (FHES)* in 1996. The FHES was established as a committee under the Federal Advisory Committee Act. It held 18 meetings between June 1996 and August 2001, when it was formally dissolved. It had work groups with special emphasis on three topics: medical/educational, position papers, and community outreach.

The FHES played a significant role in the continuing consideration of whether an epidemiological study would be conducted in the community. Soon after the FHES was established the CDC initiated the Fernald Risk Assessment Project, in part based on input from the subcommittee. The Risk Assessment Project was intended to provide further information to inform a decision about the feasibility of conducting an epidemiologic study of the community. It was also initiated to help respond to the concerns of residents about their potential health risks from radioactive releases from the FMPC.

The Risk Assessment Project was conducted in two phases. Phase 1 focused on lung cancer risks from radon and radon daughter exposures (CDC 1998). Phase 2 focused on risk estimates for kidney cancer, female breast cancer, bone cancer, and leukemia (CDC 2000). Risks were estimated for exposures during the operation of the facility to residents living within a 10 km (6.2 miles) radius from the facility during 1951-1988. Risks from exposures after site closure were not estimated in these studies; the Agency for Toxic Substances and Disease Registry conducted a study of "current" exposures finding that no significant risks to the off-site community are occurring at this time from remaining contamination (ATSDR 2000).

The Phase 1 report, *Estimation of the Impact of the Former Feed Material Production Center (FMPC) in Lung Cancer Mortality in the Surrounding the Community* (CDC 1998) estimated mortality risks for the community and for specific sub-groups (e.g., smokers vs. non-smokers, sex, age). Overall, a median estimate of 85 deaths was calculated, with a 90% confidence range of 25 to 309 lung cancer deaths. The percentage increase in the number of lung cancer deaths over background rates due to FMPC-related exposures were 1-12% with a median value of 3%. The size of the community residing in the study area around FMPC during 1951-1988 was 40,000 to 53,000 people.

The Phase 2 report *Screening Level Estimates of the Lifetime Risk of Developing Kidney Cancer, Female Breast Cancer, Bone Cancer, and Leukemia Resulting from the Maximum Estimated Exposure to Radioactive Materials Released from the Former Feed Materials Production Center (FMPC)* was completed in March, 2000 (CDC 2000). The calculated risks are lifetime risks for hypothetical exposures during the years of FMPC operation. Many conservative assumptions were made to calculate maximum doses, including lifespans of 100 years, all local food products were contaminated (e.g., eggs, milk, vegetables), and all irrigation water and air was contaminated: "it is important to remember when evaluating these estimates that they are based on the unrealistic assumption that everyone who ever resided within an area of the assessment domain received the estimated maximum dose associated with that area" (CDC 2000, pg. 16).

The risk estimates were called "screening levels" because the estimated increase in life time cancer risks to the target organs were calculated to a) provide members of the community with a

reference point for evaluating their own potential risks associated with FMPC radiation exposure and b) guide further discussions of public health activities, including epidemiological studies, for the community. Based on the results, the CDC – with FHES agreement -- did not recommend a more detailed analysis of the cancers studied in the Phase 2 assessment.

In addition, based on the findings from the dose reconstruction study and the Phase 1 and Phase 2 risk assessments, the FHES recommended that the CDC *not* conduct an epidemiological study of lung cancer in the Fernald community. FHES members agreed with CDC staff that the power of the study would be too low to identify effects. According to a CDC staff person we interviewed, he "did not want to be a salesman." He stated that his approach was to tell the FHES members what he knew and let them reach their own conclusions, even though he had a strong opinion that an epidemiology study should not be done due to low power. At the same time he was clear that if the FHES did recommend that CDC conduct such a study, he would have argued strongly against it within the agency's own deliberations and decision-making structure. When the FHES finally did recommend that such a study not be done, it was a position that was very different than the one advocated by many members of the FHES in the beginning, including those who were core members of FRESH. Through their interactions at committee meetings members established a new nodal network, with its own identity, structure, and processes. Through the intentional efforts of bring together diverse individuals the agencies created a place of *convergence* that led to the *emergence* of a new network.

The Subcommittee included 14 members representing a variety of groups, including:

- residents of the nearby communities, including core and peripheral members of FRESH;
- current and former workers;
- scientists, including individuals playing key roles in the FMMP;
- Township Trustees;
- members of the medical community;
- four liaisons were from the Ohio EPA. Ohio Department of Health, and the county health district.
- Staff from the federal health agencies, including the CDC NCEH Radiation Studies Branch, ATSDR, and NIOSH. Several staff usually attended meetings to give presentations and respond to questions from subcommittee members. A Designated Federal Official was from CDC NCEH Radiation Studies Branch (12 meetings from June 1996 – March 1999 and then again after March 2000) and from the National Institute of Occupational Safety and Health (three meetings, March 1999-2000.

While the importance of the FHES was understood by many, its purposes were often a subject of dispute. The lack of clarity had implications for how well its risk communication activities were viewed and caused friction between members of the FHES and agency staff. Agency staff defined its primary purpose narrowly as providing "consensus advice to the agencies on research and public health activities at [Fernald]" (COSMOS 2001b, pg. 2-5). On the other hand, FHES members identified other purposes.[10] As part of an evaluation project conducted by a contractor (COSMOS 2001b, pg. 2-4)[11], a variety of purposes were expressed by participants:

[10] In August 2001 the CDC formerly ended the activities of the advisory board, saying that its work was completed. This is a position that was contrary to the views of most community members and advisory board members and was

- identifying, learning, and characterizing about health concerns in the community,
- learning about health effects in the community,
- providing advice on research and public health activities,
- representing the public,
- providing outreach and education,
- increasing government credibility,
- advocating for dose reconstruction,
- improving community health,
- advocating for health monitoring,
- providing agencies with information about the concerns of the community,
- sharing information from the agencies with the workers and from the workers with the agencies, and
- serving as a watchdog for the community against the site and monitor what happens.

For example, two descriptions of the purpose of the FHES from our interviews were that:

> one was to air the community's concerns; the other was to try to help the people in the community with some of their medical problems, and to also get the government to acknowledge the things that happened and that indeed there were some medical things, some cancers or chronic health problems that occurred as a result of what happened at Fernald. I know there's that major lawsuit, and I think that they wanted to somehow get some compensation for that as well.

> I think what people were looking from the Fernald Health Effects Subcommittee was, we've proven that this [site] has impacted our family, has caused this cancer, now what are you going to do about it? I think the public was looking for some leadership and to answer that question, what are you going to do about it now? The people didn't need a million-dollar committee to be set up to give them an answer, yeah, that's where you got your lung cancer, it was from Fernald. I hope that is not the purpose of the committee…I think people had a higher expectation for that committee rather than just putting money into a study…I think until we get treatment for these people or sounder systems, I think we fall short of our goal. That you got your cancer from Fernald is kind of like telling the person that their arm hurts because they have a cut on it, I mean, they already know that.

Risk perceptions within the FHES

A variety of factors influenced the formation of risk perceptions among the members of this network. They included perceived access to information and independent technical experts, understandings of scientific information, familiarity with radiation, information provided through presentations and reports, perceived quality of the decision making processes, trust in the DOE,

a cause of ill-feelings within the community toward the NCEH. In part this was a result of the lack of clarity about the purposes of the committee.

[11] In 2001 the Radiation Studies Branch of NCEH received a completed evaluation of Health Effects Subcommittees from a contractor (COSMOS 2001a, 2001b, 2001c). The evaluation of the FHES was based on seven interviews with Fernald community members, an unspecified number of interviews with NCEH, NIOSH, and ATSDR staff, and 10 completed surveys (COSMOS 2001b; the contractor reported 11 returned surveys, but one was returned uncompleted).

CDC, ATSDR, and FEMP contractors, perceptions about the degree to which agency staff cared about the community and its needs, and personal experiences and observations.

In the beginning the level of knowledge about Fernald and its risks from historical exposures within the FHES varied greatly. Some members, such as core members of FRESH, were very familiar with the history of the site and had followed the dose reconstruction study closely but they did not have a strong background in health research methods. Other members were more technically adept. Still others were not very familiar with Fernald or the kinds of risks posed by historical releases from the site when they became members, as these quotes from our interviews illustrate:

> Someone called me and asked me if I might be interested in being on the subcommittee. I'd heard about Fernald, didn't really know anything about it—I'd just heard the name.

> Three-fourths of the people in the health-effects subcommittee were people who really had not paid that much attention to Fernald, other than reading what was in the papers and really did not understand the health issues, or the health impacts... We met quarterly, and it would take us a year to really get going and to see what we were wanting from the health effects subcommittee.

> There were people that were put on the board that never should have been put on that board. While I know that [CDC] looked at diversity and educational issues, these people had never even been to Fernald. I mean, why would they give a damn?

The education efforts and openness of the agencies about the risks had unexpected effects on risk perceptions among FHES members. According to a CDC staffperson, in the beginning most FHES members felt that if the CDC would do studies, then they would learn that "people died" from exposures caused by Fernald. By the time that the FHES was dissolved the members we interviewed felt that they understood the risks better. They perceive risks as low but not zero, as a result of the findings from the Phase 1 and Phase 2 risk assessments. According to one CDC staffperson, FHES members in general felt "vindicated" by the findings that "good science" found that a small risk existed: "There was a belief that there could be a smoking gun but we won't be able to find it even after spending $10 million."

On the other hand, there were negative consequences to the openness and findings. One FHES member expressed that:

> Well, now that everything about it is in the open, there's a lot more mistrust than trust, because in the beginning you people would say, my government would not do anything to harm me, and the very same they were making bombs to protect us, they were also harming us.

The views of FHES members were also affected by their perceptions that the CDC was not willing to study the full range of potential health effects from Fernald and that the CDC was not able to address the community's "real" needs of, for example, improving community health and advocating for health monitoring (although as mentioned above, these aims were not within the mission of the agency). In addition, FHES members felt that more studies should have been

conducted, even if an epidemiology study was not going to be done. While the CDC was, for the most part, perceived as a credible source of information about risks that were studied, they were not viewed as fully committed. This had an important effect on the risk perceptions of those we interviewed: even if the risks of the diseases that were studied were viewed as low, other, unassessed risks were viewed as potentially being significant and the "real" needs of the community remained unmet.

Risk communication

The Fernald Health Effects Subcommittee played only two of the three risk communication roles. While the FHES did not generate risk related information, it:

1) mediated the transfer or information among stakeholder groups with FHES members and between others groups and the FHES and
2) facilitated learning, or receiving, of information that played a role in formation of risk perceptions among FHES members and between FHES members and other stakeholder groups.

FHES as mediators of risk information

The FHES was a source of risk-related information for the community. The FHES helped to convey information to others in the community that was generated by the health agencies (and the Fernald Medical Monitoring Program). For example, some of those we interviewed believed that the community had greater access to information and is more aware of health issues related to Fernald as a result of the FHES activities. Health care providers have received information about the risks of contamination from FEMP, as part of FHES sponsored seminars for health care providers. The FHES attempted to provide outreach to the broader community through newsletters, media announcements, and open meetings.

However, members of the FHES were divided about the quality of the process for informing the public of the subcommittee's meetings. They were also dissatisfied with the level of public involvement in meetings, and the subcommittee had repeated discussions about the need for meetings that would be more accessible to the public. Thus, the success of these efforts are unclear, but there are indications that not all goals were achieved, as these two quotes illustrate

> I know that on two separate occasions they had a conference over at the Mercy-Fairfield Healthplex. It was more to try to educate the medical community and I thought that was a very nice idea. Not well attended-- especially by physicians-- mostly by the ancillary staff, nurses and the like.
>
> Because we had meetings in the evening, they had an opportunity to come and have their opinions voiced as well. Unfortunately a lot of times there were other meetings at that same time, so there wasn't a very good turnout.

FHES as learners of risk information

The FHES was not a network that, by itself, created or generated information that played a role in the information of risk perceptions. Rather, the federal health agencies, such as CDC, generated new information through health studies and they reported the findings and their significance to the FHES. Thus, the FHES was intended to be a forum for learning and dialogue

among its members and agency staff. On the basis of deliberations within the FHES input into the design of health studies was received by the agency (e.g., what health outcomes would be assessed in the Phase 2 risk assessment).

The FHES was not completely successful at facilitating learning among its members. While considerable information was provided to FHES members, there were many complaints that the process was not conducive to constructive dialogue. For example, according to an evaluation report provided to the CDC by a contractor, overall, most subcommittee members were satisfied or very satisfied with the quality of materials they received (COSMOS 2000b). However, they were less satisfied with the timeliness of receiving the materials and their ability to review them prior to meetings.

On the one hand, as a newly established convergence network, considerable effort within the FHES was given to education of members. Because of a lack of familiarity with the issues, understanding of the history, or understanding of the relevant technical or methodological topics, the Subcommittee had to go through a year plus process of self-education. As part of the education process, agency staff gave multiple presentations on relevant topics, including the requirements for epidemiological studies, statistical power, and health effects of radiation. FHES members also requested special presentations on topics of interest to them, such as endocrine disrupters. A few of the members were supported in a distance learning course on epidemiology, including one person who would eventually become chair and a core member of FRESH. Another was the community resident member who was one of the few that continued to believe that an epidemiological study should have been conducted.

Agency staff that we interviewed felt that the education effort was successful. For example, they told us that:

- they were very "upfront about the quality of data and uncertainties";
- that members asked "strong questions" and "insightful questions" during discussions of epidemiology;
- most members had a good understanding of uncertainty and power by the end and members made recommendations about the usefulness of an epidemiology study based on their understanding of the concept of power – "that there can be an effect, but little chance of finding it exists";
- members learned about the relative costs and benefits of doing an epidemiology study, including the amount of money that a study would cost;
- they had formed strong relationships with FHES members, with one stating that "I enjoyed working with them"; and
- a cohesiveness developed among the members.

On the other hand, members and other public participants did not give the same kinds of positive characterization of the committee. We learned from FHES members in our interviews that they felt that that

> the Health Effect Subcommittee meetings I attended were not very well focused in terms of agenda, they were just a series of often unrelated informational presentations by various scientists. And there wasn't a lot of agenda setting done.

> There was little discussion within the FHES about the feasibility of an epi study, about power. Most people in the FHES did not know enough to ask questions
>
> They had one [presenter to the FHES] who got up there and went on and on and on for 45 minutes and none of us could have even told you what this woman said…when she got done, one of us got up and said 'what the hell did you just say?' Its like you are talking way over people's heads and this is not a good use of…time.
>
> Now there are times when it seemed like they may have a concern that they want to address at the next subcommittee that wasn't addressed-- I mean you are talking about a three months' time lapse [between meetings], where things got missed--- and I think that was a concern sometimes.
>
> There were a couple of people on the committee that just seemed to be disagreeable about everything so I didn't really care for that. No matter what was being presented, they questioned it and I don't know, ridicule and jump all over it.

Also, according to the evaluation report, many of those participating in the evaluation did not feel that the FHES had an atmosphere conducive to constructive deliberations. The COSMOS evaluation reports:

> Many agency staff, especially scientists, express reluctance to make presentations to the subcommittee because of the sometimes hostile reactions they get from members. An agency upper management staff person states that staff have been subjected to verbal attacks, and some scientists, especially, do not what to go to meetings because of these confrontations. Agency staff member reports that a member of the Fernald Health Effects Subcommittee made threats at a June 2000 public meeting on the findings of the Fernald public health assessment, resulting in security concerns for staff at the next meeting. However, one scientist commented that of the four Health Effects Subcommittees [then in existence], he would be willing to make future presentation only before the Fernald Health Effects Subcommittee. This scientist believes members of the Fernald subcommittee are not as disrespectful as members of the other committees" (2000b, pg. 2-8).

The type of learning within the FHES may have been affected by its role as a point of convergence of multiple nodal networks. Members did not, initially, share a group identity. For example, members represented different constituencies, had different concerns, and different perceptions about risks and risk management. As work progressed in the FHES, however, the group perceived that its own identity formed. However, the tensions over the purpose of the committee discussed above reveal that the sense of group identify may have been shallow. According to one agency staff member, the Fernald Health Effects Subcommittee relied heavily on "informal communications" (pg. 2-16).

Interactions between the FHES and other networks

The FHES had significant interactions with Township Trustees and FRESH because their members were members of the FHES. During the period our study focused on, the FCAB was

not involved with health risk communication. (However, initial FCAB recommendations were influenced by concerns about human health risks – Task Force 1994, pg. 35).

FHES and Township Trustees

The Township Trustees had little direct interaction with the FHES in their capacities as local officials. Most of the concerns they expressed in their official capacities as Trustees were about clean-up and future use of the site. Some did attend the meetings, however, because of their broad concern about the health of their community and a few became members of the FHES. Trustees had experiences with the FHES that were similar to those of other participants. For example, A Trustee said that

> The FHES meetings were always held two days and it was difficult for me to take two days off work so I either attended the first day or the second day.

FHES and FRESH

On the other hand, FRESH felt that the FHES was an important source of information for the community. A core FRESH member said that

> Most of the health information [for the community] came from the agencies, the health effects subcommittee, and FRESH.

It was also a network in which core FRESH members could participate and learn. However, their relationship with the subcommittee was often ambivalent. As noted above, CDC staff discussed the role of the FRESH health map in furthering understanding of the health risks in the community and they sponsored one core member in a distance learning course about epidemiology. Core FRESH members felt that they gained important knowledge from their participation in the subcommittee.

On the other hand, they never felt that the CDC was fully committed to unearthing the full story about health effects from Fernald, and by extension the FHES did not fully address the concerns of the community or listen to FRESH members, as these quotes from FRESH members illustrate:

> They never really did what we envisioned and thought that they would do. They just plodded along and there was a lot of resentment. There wasn't clear leadership and I think that the CDC was pushing their own agenda through this group of people.

> What were perceived as really big issues for the community, weren't big issues for some of the folks on this board. And while I know we needed the docs and some of the expertise there, we didn't really feel like they were really looking out for our best interest.

> [FRESH member] felt that she was always discounted and I think we were too. They saw us as those hysterical FERSH women, they come and they raise hell all the time and no matter what we do it doesn't make them happy. We didn't get the working relationship [we wanted] and the 'lets all work together and lets go down the road and make these parts fit together.' What we got was this other thing, that they are hysterical folks and no matter what we do its not going to be good enough for them anyway.

> All of a sudden the commitments seemed to disappear until after two or three years, I'm trying to think just how long, about three years, when they changed directors the commitment was not there to work with the people and learn to understand the people, and what those people were really wanting. And then too I believe the advisory board was wanting more from the CDC then they wanted to give.

The relationship between the FHES and FRESH was further strained because of the way that the FHES operated. FRESH did not have input into how the Subcommittee was formed and who would serve as members – unlike their experience with the FCAB (see below). They felt that some of the individuals appointed to the FHES had conflicts of interest and that too few members of the community were selected. They took this as a sign of disrespect from the health agencies.

The feeling that the FHES was not really "for the people" was exacerbated by the reluctance of agency staff, the chair, and some members to meet more frequently (e.g., once a month like the FCAB) and to hold meetings at times during which people would not have to miss work. In particular, a core FRESH member was appointed to the FHES but was never able to attend the meetings because they were held during working hours. The evening portions of the meetings were not felt to be enough or to focus on the important, relevant topics.

> We would go in the evenings and they would always schedule the stupid shit in the evenings, like the internal stuff and you know really cool things that we wanted to hear were happening during the day. We would argue with them about their agenda and why can't you do this in the evening and why can't you meet on a Saturday? They would not listen.

Such feelings had the effect of raising questions about the credibility of findings and the significance of other potential risks that remained unstudied. Although they accept the findings from the completed studies that suggest low risk from cancers (e.g., Phase 1 and 2 risk assessments), FRESH members remain unconvinced that the set of studies conducted were adequate to show that fears of significant health effects from the full range of historical releases were unfounded. More recent findings from ATSDR and studies using the Fernald Medical Monitoring Program data reinforce this belief (Pinney personal communication). In summary, FRESH never felt that the FHES – and by extension the federal health agencies – provided full information about the broad range of health risks in the community or created an inclusive, accountable process. These feelings affected how they responded to and interpreted findings from the health studies.

Fernald Citizens Advisory Board

The Department of Energy Environmental Management Program, US EPA, and Ohio EPA established the *Fernald Citizens Task Force* (FTF) in 1993. Regular monthly meetings have been held since August 1993, in addition to periodic special public meetings and workshops. The FTF was originally chartered, under FACA, to advise the DOE about four specific issues:

1) What should be the future use of the Fernald site?
2) What residual risk and remediation levels should remain following remediation?
3) Where should the waste be disposed? and
4) What should be the priorities among remedial actions?

As a FACA committee, members were selected to represent diverse stakeholder groups in the Fernald community, including Township Trustees, local residents, workers, scientific researchers, and business. Ex-Officio members were from the federal agencies DOE, ATSDR, and EPA. An ex-officio member also represented the Ohio EPA. Members were selected by a well-respected professor from University of Cincinnati, Eula Bingham. She talked with many of the key stakeholders in the community and with agency staff to determine a broadly representative and respected group of individuals to serve as members. She also tapped John Applegate to be the first chair of the committee. According to a staffperson for the Task Force, one of her goals was to establish a committee of "individuals participating as individuals, not just with institutional perspectives."

To accomplish their initial goals, the Task Force set itself an ambitious schedule of meetings and decision points that were coupled with extensive discussion of values and education of members about technical issues. The chair recognized that the committee had to be very focused on specific upcoming actions of the DOE and Flour-Daniel if it was to have any effect. Many members initially felt overwhelmed by the need to provide recommendations within a relatively short period. The chair and consultant evaluated what intermediate decision points would be most crucial to the determination of final remediation and use of the site. The recommendations are described in detail in a report released July 1995, and all recommendations save for one represented full consensus of the board (Fernald Citizens Task Force 1995).

The recommendations of the Task Force were to:

- protect the Great Miami Aquifer and to provide consistent protection across all land uses and environmental media;
- ship highly contaminated wastes off-site;
- dispose of wastes meeting criteria of low level contamination in an on-site disposal facility;
- accelerate remediation in response to reduced annual budgets and priorities for rapid protection of health and the environment, and;
- define future use of the site at a later time, but that decisions should avoid agricultural and residential uses and that a buffer zone be established around the on-site disposal cells.

The only recommendation for which unanimity was not achieved concerned waste disposition; this is the recommendation that concerned the on-site disposal facility for wastes that were to meet specific acceptance criteria. A local resident from Morgan Township opposed the recommendation because he preferred that "all contaminated material be removed from Fernald and disposed off-site" (Fernald Citizens Task Force 1995, pg. 36). According to our interviews,

Ross Township was unable to muster additional opposition to the decision, in part based on the lack of scientific controversy about the recommendation and in part based on the broad based support the recommendation had from other representatives in the community.

In 1995 the group was renamed the *Fernald Citizens Advisory Board* and was given a new charter to advise the DOE EM program about clean-up implementation priorities; the Task Force had been established prior to the Site-Specific Advisory Board process of the EM Program. It continues to meet once a month. More recently its focus has been on developing recommendations on the future use of the site.

On-Site Disposal Facility Project

The on-site disposal facility (OSDF) is an engineered waste disposal facility located on the northeast section of the site that reflects "the 'balanced approach' to waste management at Fernald" (FEMP 2001). It is designed to hold up to 2.5 million cubic yards of waste in seven separate waste cells. 85% of the wastes are estimated to be contaminated soils and 15% from building and other infrastructure debris. Waste acceptance criteria were established with the US EPA in the Operable Unit 2, 3, and 5 Records of Decision, with a goal of protecting the Great Miami Aquifer that is located underneath the site. Numerous physical protection barriers have been designed, including a leachate collection and conveyance system, that transports leachate to an Advanced Wastewater Treatment Facility and a cap and liner, constructed of clay, gravel, and plastic.

Waste disposal operations began in the first cell in 1997, which was completely filled in 2000. Cell 2 was about 2/3rds filled and cell 3 was about 1/3rd filled by the end of 2001 (FEMP 2001). When all the cells are filled the OSDF will be approximately 800 feet wide, 3700 feet high, and 65 feet high.

Future Use

The FCAB was cognizant that the decision to dispose of wastes onsite would have implications for the future use of the site. With onsite disposal of radioactive wastes would come longterm, although low, exposure risks. This lead the FCAB to also consider recommendations to guide the future use of the site. The FCAB touched on these guidelines in its set of recommendations in 1995. Specifically,

> The Fernald Task Force focused its future use recommendations on creating a broad understanding of how the Fernald site could best be used following remediation, rather than identifying specific land use plans for the property. The Task Force believes that specific uses of the land should be determined close to the time of reuse by the people most impacted by that use, within the general guidelines established by the Task Force. As part of these general guidelines, the Task Force recommended that residential and agricultural uses be avoided on the property. However, it was also important to the Task Force that the land be used productively. Accordingly, remediation levels recommended by the Task Force allow for all other use, including recreation and industry. The Task Force also recommended that a substantial buffer area separate the on-site disposal cell and any other uses of the property (Fernald Citizens Task Force 1995, pg. V).

It began to address this issue with more effort in 1999, as part of its Stewardship Subcommittee activities. Ultimately, the FCAB sponsored a series of workshops in the community, and made several recommendations, as shown in Table 3.

Table 3.

Results of the Third Workshop – September 26, 2000

VISION STATEMENT

Fernald Stakeholders envision a Future for the Fernald property that creates a federally-owned regional destination for educating this and future generations about the rich and varied history of Fernald. We envision a community resource that serves the ongoing information needs of area residents, education needs of local academic institutions, and reinterment of Native American remains. We envision a safe, secure, and partially accessible site, integrated with the surrounding community that effectively protects human health and the environment from all residual contamination and fully maintains all aspects of the ecological restoration.

ACHIEVING THE VISION

We believe that this vision can only be achieved through cooperation among all stakeholders and by recognizing the need to identify the funding and incorporate planning and implementation of future uses with on-site remediation. To achieve this vision, we would like to see the following elements implemented on the Fernald Site:

- Adequate property to provide reinterment of Native American remains in a protected park-like setting that recognizes the spiritual nature of this activity.
- Regulated access to the ecologically restored areas of the site through a series of marked and annotated trails that can be used for hands-on learning and discovery of indigenous plants and animals.
- Development of an on-property educational center that provides for the following:
- A complete history of the Fernald area beginning with the first Native American residents continuing through the Cold War years when the Fernald site produced feed materials for America's nuclear weapons arsenal, and culminating with the current efforts of site remediation and ecological restoration.
- Museum-quality displays and related educational programming on the role of Fernald in the Cold War and the many impacts of the production of feed materials for nuclear weapons on the lives of area residents and Fernald site workers, as well as the broader social and cultural impacts on the surrounding community.
- Museum-quality displays and related educational programming on the history of Native Americans in the Fernald region.
- Permanent housing of the public reading room containing copies of the public record of Fernald production and remediation activities and Fernald Living History materials.
- Classrooms and auditorium space.
- Environmental research and groundwater education facilities.
- Expedient access to environmental monitoring results.
- Detailed descriptions and displays on the Fernald environmental remediation process and results.

[Source: FCAB Future of Fernald webpage, http://www.fernaldcab.org/FutureFernald/FOF3rdWorkshop.html]

Risk perceptions

Risk perceptions related to the OSDF varied among members of the FCAB. They also evolved during the FCABs deliberations. A variety of factors influenced the formation of perceptions among the members of this network about the risks from the contaminated materials themselves and about the longterm integrity of the waste disposal cells. They included perceived access to information and independent technical experts, understandings of scientific information, familiarity with radiation, information obtained through presentations and reports, summary materials prepared by the board's facilitator, participation in simulation games, buy-in to the board's process, perceived quality of the decision making processes, trust in the DOE and FEMP contractors, and personal experiences and observations.

The following quotes illustrate how FCAB members perceived the risks:

> Well, there are risks and I think they are probably with low level of contamination in the disposal cell. I don't feel like the risks are high.
>
> A lot of these plastics have not been tested over a long time period. Plastic, if you look back in the history books, hasn't really been around that long. That disposal cell is going to be there hundreds of years. The durability and longevity of plastic we don't know.
>
> My concern there would be, well, the standards we have today for the lining of that disposal cell right now we feel that is adequate. Is it going to be adequate a hundred years from now? Is that line going to stand up, is it still going to be as good as we say it is now? Is it going to protect the ground water?

Risk perceptions also arise over the future use of the site. In our interviews, FCAB members explicitly expressed views about risks or they alluded to them through their preferences for future uses. For example, statements made within our interviews revealed concerns about the risks to human health and the environment as well as local economic growth from residual contamination.

> [We] are highly opposed to having walking trails and bike trails. Who is going to ride their bike around the waste cell?! Once a year I do the tour, but I don't want to go there anymore than that. There needs to be some signage saying this is what this used to be. There are risks. A real risk. Because we are not cleaning it up to background. There is not enough money. We're only taking it to a certain level. In my mind, there is a risk – it may not be a huge one, but there is a risk.
>
> I guess I'm just hesitant enough about the cleanup, that they know what they're doing, that I'd like to see 25 to 50 years go by before they use it in case something else pops up that they didn't realize and they got back and make tests something can go 'Oh no! We've got to go back and clean something up.' The community wants to see it used, and the EPA really wants to see it used.
>
> I think the controversy [about future use] is just a matter of opinion on what people want to see it become. …It's not about risk to me. I think the risk is at a minimum.

For many, underlying the FCAB's discussion of the site's future was a concern for remaining risks in the longterm:

> We have a lot of details yet to work out. How do you maintain safety there? How do you make sure that there's security, that none of the areas are in any way compromised? How do you maintain this for the long haul? And for the long-haul we're talking ten-thousand years, maybe. Short-term, a hundred years, so you know we have something here that's going to last for a long time.

Finally, concerns about the future use of the site are not about risk levels per se. They are about making the area a positive element in the community.

> Obviously, the disposal cells will stay there, and they will be monitored, supposedly, forever, the rest of it is woods and natural habitats, and there's a big push to leave it remain a park, and you know, use it for a nature preserve and whatever, which I don't have a problem with that. But I'd like to see them extend that and involve a bike trail in there that would tie into the one that is presently over in Crosby Township. That would be something that the residents could use on a daily basis, and it's something that we need in this area.

Risk communication

In the context of public health the FCAB has played each of the three roles in risk communication. The FCAB:

1. facilitated learning, or receiving, of information that played a role in formation of risk perceptions among FCAB members and between the FCAB and others in the community.
2. mediated the transfer or information between FCAB members and others (e.g., within the community, federal agencies);
3. created or generated information that plays a role in the formation of risk perceptions among committee members and among others that are non-members;

FCAB as learners of risk information

The chair and facilitator of the FCAB intentionally established a forum for learning within the FCAB. FCAB did not only learn about technical facts. The chair and consultant also developed procedures for helping FCAB members to learn about each other's values and to learn about making trade-offs among alternatives on multiple dimensions (e.g., costs, health risk, environmental damage). They felt that members had to overcome their narrow self-interests:

> [Initially] there were people in the CAB who wanted to clean it up…Originally it started 'get rid of it all.' Well, there are other issues. But if you are one of these very narrow minded person that says: 'I don't give a rat's butt about somebody in Nevada, I don't care about Georgia, I don't care about South Carolina, I don't care about Cleveland, I only care about Ross, I only care about my backyard. I want it gone.' Well, it doesn't exactly work out that way.

Thus, during the first six months, meeting monthly, they created an "intensive learning period"

because FCAB members needed to be very well versed in the characteristics of the site and the clean-up alternatives being considered. The chair and consultant felt that major challenges were to maintain members' interest during the education process and to avoid overwhelming the members with technical information (as discussed above in the section on Township Trustees, they were not always successful in this regard).

The Board chair and staff used a variety of methods to provide useful information to the members and to help them think about different options. For example,

- they created a "tool box" consisting of factsheets, technical summaries, and other information. They updated the information periodically.
- The designed an exercise, "Cleanopoply," to help people understand the DOE budget process.
- They designed a game simulation "Futuresite" to help members (and non-members) learn complex information about environmental contamination, health hazards, and potential future uses and to promote dialogue about options and their trade-offs (see Applegate and Sarno 1997 for more detailed discussion of its use). As part of the simulation, participants were required to use chose between on-site and off-site uranium waste disposal options while considering residual risk, budget constraints, environmental damage from soil removal, and public opposition to on-site disposal.

Furthermore, according to the Task Force:

> Early in the process there was a great deal of mistrust in information provided by the DOE. However, the role of the consultant and the openness of DOE, FERMCO, USEPA, and OEPA throughout the process alleviated this mistrust over time. The unprecedented access given to the Task Force sometimes resulted in newly generated information being made available to the Task Force. In a few cases, key pieces of information changed over the course of the Task Force deliberations. Rather than create further mistrust, however, they changes were promptly identified, the reasons for the changes explained, and the revised information incorporated into the decision process. As a result, the level of trust in this information remained high. (Fernald Citizens Task Force 1995, pg 22-23)

Many of our interviews, supported this view:

> They need to get some technical understanding. Fortunately, that was understood by a lot of the leadership and a lot the people. And so, some of the process is first of all getting comfortable with each other; second of all is getting some education, some real education. You know, what is the risk? What is the science of risk? What is that all about? And that was a big thing with us. And I am saying 'us,' the CAB.
>
> What really helped us I think is that we went very slowly and we walked through everything. We met every month. It was a process that worked for us. We had a [toolbox] notebook and we would add to it every month, which is really helpful because then you can go back and review.

The Futuresite simulation was of particular importance for FCAB members and non-members (e.g., DOE HQ, contractors, regulators). The simulation was "run" in multiple meetings, including one that combined stakeholders, DOE HQ, DOE site, regulators, and contractors in

organization specific and mixed groups. According to the FCAB consultant, the exercise led to "epiphanies for some members. They realized that ideological viewpoints did not make sense." People who had different opinions had to engage each other, and encounter different perspectives. For example, the FCAB consultant observed that "stakeholders cleaned the site from the outside in, and technical people cleaned the site from the inside out." They also encountered the difficulties of making choices. This is how the game worked, according to one of our interviews:

> People sat with each other who didn't want to sit with each other because we have these cliquey little groups. And then you had to spend so much money and what would you do with it this way, would you ship it here…All of a sudden we didn't have any money at our table, we were broke, but we had all this waste kind of sitting here. And other tables were in the same boat that we were. It became glaringly obvious to all of us that there is not enough money to [clean-up the site to background levels]. So we started to badger and say we'll just go back to Congress and we want this much money, we were trying to borrow money from others' tables. And someone said this is not how we do it and we are always trying to change the rules. But I think that was probably the time the light dawned. [Clean-up to background levels] is not going to work.

As representatives of the broader community, some FCAB members, as well as the chair and consultant, were sensitive to the way that the committee could become isolated from the community: "After learning a lot, they could have become removed from the community." They might be viewed as being co-opted.

In an effort to minimize the perception – or reality – that FCAB members would become "co-opted," a series of community workshops were held. A set of workshops were held during the 18 months leading up to the first set of Task Force recommendations in 1995. Later, whenever a "big" issue was before the committee, additional community meetings were held. One example of such meetings was the series of workshops on future use of the site, as described below (also see Table 3 above). All of these meetings provided opportunities for FCAB members to learn from people outside of the committee. In some cases, however, tensions were revealed between the perceptions of those who were members of the committee and those who were not. While FCAB members may not have been "co-opted," they did begin to form collective views about risks and appropriate future uses. This is illustrated by one FCAB member who stated that the meetings:

> Were very hard. People showed up that had never been to anything else, saying 'Well, what about horse trails [as a future use]?' and we were all in the room just cringing.
>
> Interviewer: People in the CAB or just FRESH people?
>
> FCAB member: Everybody who had been through this stuff. You're sitting there bickering with all these people you had never seen before, and they're going 'what about a wading pool?' And we are going 'Oh my god!' They don't understand. They live in the Township, so they have a right to do this, people who really haven't lived around here as long as we have. And I also think people came in with a lot of self-interest.

FCAB as mediators of risk information

The community meetings/workshops also provided an opportunity for the FCAB to provide information about risks to the broader community. The FCAB played an important role as a source of information for non-members. Aside from the periodic community workshops, the FCAB used a variety of other mechanisms to provide information to the general public:

- a webpage was created, providing minutes of meetings, etc.;
- a newsletter and press releases;
- non-members were invited to participate in some activities, such as the Futuresite simulation.
- FCAB meetings were open to the public.

Within the FCAB, information was transferred to members as well. To address the challenge of making recommendations rapidly on technically complex issues the board's chairperson and facilitator attempted to foster an atmosphere where individual members and the whole group could come to their own conclusions. The consultant was tasked with:

- summarizing and "translating" technical information for CAB members and
- validating all information presented to the CAB (e.g., by DOE and contractors).

Thus, for example as mentioned above, they created a "tool box" consisting of factsheets, technical summaries, and other information. They updated the information periodically.

FCAB as generators of risk information

As suggested above in the description of community workshops, the FCAB generated information that played a role in how risk perceptions have been formed within the FCAB itself. The committee was sensitive to moving beyond the larger community by virtue of their learning and group identity. For example, during the last few years the FCAB has endeavored to develop recommendations about the future use of the site. As part of this process the FCAB held a series of public workshops. One FCAB member estimated that 75-100 people came to each workshop. According to the FCAB webpage

> To ensure that the surrounding community plays a significant role in determining the future use of the Fernald site, the Fernald Citizens Advisory Board developed a process that allows the community to provide direct and detailed recommendations to the DOE regarding issues of future use…The Future of Fernald Workshops were designed to provide citizens a direct voice in determining what kind of public facilities should be developed, as well as the types of activities that will be permitted on the Fernald site following the remediation.

The idea for the workshops emerged because some people in the community asked DOE to consider how a "positive legacy" could be left in the community. FCAB members wanted to learn what was the diversity and depth of opinions within the community, and thus they embarked on a process to collect information:

> In late 1998 there was an environmental assessment document that DOE had to prepare in terms of final land use, and they had a hearing and a comment period, and during that hearing, some people in the community stood up, including some people from the Crosby

> Township Historical Society -- folks that hadn't been that active in the site to that point. They said, we want to have a positive legacy out here, we want to use this in a positive way for the community down the road and why don't we start thinking about a cultural/educational center. The DOE did note that the public was interested in finding public uses for the site. From there, the [FCAB] stewardship committee picked it up and said we need to see in more depth is this really a community consensus or is this just 50 people that wrote letters to DOE. Because you never know who is writing these comment cards, it could be 50 crackpots that want something.

Three workshops were held (April 20, 1999, May 24, 2000, September 26, 2000). During the first workshop participants discussed the potential future activities at Fernald, including:

1) Native American history and remains;
2) public use of the land;
3) environmental education; and
4) local and Cold War history

The second workshop (which was also broadcast on the internet to allow participation of people that could not physically attend) asked the 100+ participants to consider potential future uses in terms of:

- What are the things you would most like to see as possible community assets at the site?
- What are the things you would definitely not want to see at the site?
- How would you like to see these assets managed within the community? Where should long-term support come from and who should be involved?

The third workshop was held to give the community a chance to discuss and reach consensus on a vision statement that was developed by the FCAB Stewardship Committee. The vision statement is provided in Table 3, above. The FCAB continued to generate its own information for informing discussions of the future use of the site by a feasibility study of the design and construction of an education facility (sponsored by the FCAB under a grant from the DOE; it is open to Ohio colleges and universities).

The "results" of the workshops were important, according to FCAB members we interviewed, in the formation of their recommendations about future use and their need to work more closely with the community to ensure acceptance of specific uses. In particular, a number of residents were alarmed at the thought of public access to the site, particularly close to the on-site disposal facility. Although such access would have minimal risks, the FCAB realized that the community was not yet ready to envision the site as a safe, accessible property and that the FCAB would need to do more education and dialogue before such activities could be discussed.

Interactions with other networks

FCAB and Township Trustees

Trustees from different townships were members of the FCAB at various times, including the period when the recommendations were developed about retaining radioactive wastes onsite in the disposal cells and during public discussions of the future use of the site.

Three Trustees we interviewed thought that the decision for on-site disposal cells was actually made by DOE in advance of the FCAB deliberations – a belief that reflected a deep distrust of the process and DOE:

> I don't know, a lot of it seems to me like they already had a plan and it didn't matter what I said or anybody else said. That's the impression I got. They already knew what they were going to do. So all of this stuff was just good PR brought on by them-- that's my personal feeling, they already knew what they were doing.

> Early on in the CAB's existence, when I was serving on the board…They showed us numerous slides of disposal cells around the world, and I thought: 'why are they showing this?'…And everybody was confused running around, why in the world are we going to do this type of thing. There were probably 10 or 15 sites, something like that, some were mounds, some were underground, some were, you know, different types. And to me, the decision had already been reached. They were just going to get people in place, committees in place to make it look like the committees came up with this idea. Well, this idea initially, and probably very few people even realized this, was presented to us that way. Sort of like the illegal thing they do with commercials where they take one frame and show a frame of popcorn and then later in the movie, it works on your self-conscious, and I wonder if, by seeing those disposal cells that that was supposed to lead us toward that as a final resolution to this whole problem…Pushed is probably too strong of a word. I felt like it was being suggested and guided toward that final outcome without our knowing it. Very subtlely.

The following quote from a Trustee echoes the distrust of DOE, but it also suggests (at the end) that trust is being regained (*emphasis added*):

> If you lie to me, from that point on, I will think that everything you tell me is a lie, because I have nothing else to gauge it by. So, in my opinion they lied to us from the beginning, and they being some of the people that were in management or mismanagement. At that point, I didn't know who to believe and who not to believe. When you have a guy look you right in the eye and tell you, we're doing core samples in this area to satisfy the people in Nevada where we're taking this stuff, to prove to them that we can't keep it on-site, and then you have a guy come behind this, a construction guy, and say, they've had plans drawn up for two years on a disposal site, and you're on the site, one of em's lying. I tend to believe the guy that told me that they had the plans, because they came up with a disposal site. So I kinda think the lied to us, and *then it took a long time for me to start to believe them again.*

Distrust of the advisory board process was also reflected in the comments of a Trustee who was never a member:

> I am sure people are well meaning people but I think it is probably just a waste of time. Citizen advisory boards generally are just political puppets. I have been on one myself and generally they are looking for some citizens to endorse what they want to do and make it sound good. That is my opinion of that.

During the development of the recommendation for the OSDF, and subsequent to its planning and construction, many Township Trustees' opposition mellowed. Those we interviewed have now turned their attention to the future use of the site and the longterm reliability of the cells. The Trustees concerns about the OSDF and future use of the site are primarily related to stigma associated with contaminants being left onsite. Concerns about stigma were often about the potential economic costs associated with the area being perceived in a negative light, as suggested by this Living History interviewee:

> I think a lot of people seemed to feel like, I'm glad it isn't us living by it. And I actually felt like some of them thought, oh, they're all radioactive…I still find when I got to government conventions or something and mention that Crosby Township is the home of Fernald, they all kind of laugh and say well I'm glad it's you and not us. So it's got a stigma with it. (Harper, pg. 14)

The stigma associated with economic loss is not just an abstract possibility. Community members reported experiencing real economic impacts:

> The farm was an inheritance, we were all proud of that because no matter what else we had, we had that farm. After it came push to shove, you found out that farm wasn't worth squat [because of contamination from Fernald].

> It's kind of a black-eye for our community. I mean it's not a building block, it's not something that we want to go around and say, hey come to Ross Township, and you can live next to the Fernald nuclear plant. I mean it's not something that I feel has been beneficial to this community. But I think it has provided a lot of jobs over the years. It still provides a source of economic income, because of the jobs, and the impact on the rest of the businesses in the community. And when they finally walk away from it, it definitely will have some impact on our community, because there'll be a loss of the jobs and the income.

For another, one way to deal with the stigma is to help people forget. This desire ties in directly with preferences for the future use of the site:

> Residential [use] would be nice, so people could get by the stigma of what's there.

> I don't know why anybody would want to go out there and take any kind of a risk. I don't think I want to go there, I mean, I don't care what people would say. I just wouldn't want to take that kind of a chance, really. I think the best thing to do is just let it go. I know they are trying to be creative and thinking of uses for the site but, again, my high opinion is 'put a fence around it, let nature take over and forget.'

FCAB and FRESH

The Fernald Citizens Advisory Board provided a place for FRESH to learn, to gain a *fresh perspective*:

> I think when you do this work for as long as we've done it, you begin to get some blinders on your eyes and you only see what you want to see. And I think when the idea of the FCAB got floated out there, we were very overwhelmed and thinking 'boy, you know we need some help here.' And you know, 'how clean is clean? And 'we only have so many resources to go to.' And they seated the CAB and it was a very good thing for us because it brought in some people who hadn't been involved. (Crawford, pg. 18)

Initially, FRESH was worried that the FCAB was "a way to get around the community." FRESH core members were "adamant that the CAB be balanced and that it have people on it that we could trust." They gained a high degree of trust in the CAB process when the convenor, Eula Bingham from the University of Cincinnati, consulted FRESH about possible members, and even allowed them to choose community representatives.

> It's good, its effective, they have got a good variety of people on it, which partly occurred because we helped to formulate the types of people that we wanted on it. When they formed that board, Lisa and several of us were interviewed by the lady who put the board together. She picked the actual people, but she talked with us so she knew the things that were important, so that she wouldn't create a board that had some flaws in it so it would be doomed from the start. So, its working real well. Some of the things that it's heading toward I don't necessarily agree with, but it is a democracy.

They also gained trust in the process based on the actions of the first chair, John Applegate, who was perceived to be very fair.

> It has been a long road trying to get them to sit down and listen to the stakeholders and view the stakeholders not as an enemy but as an ally. But when that switch in their thinking occurred, then we could get together and really look at the problems and to try to see the solutions, and make the compromises that might have to be made as far as clean up level. So, it helped when we were all on the same page. It almost has become the site people with the community against the federal government saying 'we need the money, you owe us a cleanup' -- and so it is definitely a different situation.

The FCAB and FRESH have continued to work together on key topics, including the future use of the site. In particular, the FCAB invited FRESH, as an organization rather than through membership of specific individuals, to co-sponsor the Future of Fernald Workshops with the Stewardship Committee (FCAB also invited the CRO and the Living History Project to work with the FCAB Stewardship Committee).

Through their participation in the FCAB, FRESH members developed important relationships with others. For example, the FCAB was a point of convergence for multiple networks, including FRESH, workers, and Trustees.

> And she's been a big salvation to the worker as far as safety and jobs, whether they know it or not. Well, you wouldn't have had that insight if you didn't have an opportunity to work with [FRESH members on the FCAB], and if you didn't have an opportunity to understand her personality. [We] are good friends…It takes you a while to develop that friendship…If I have to talk to her about something confidentially or if I say: 'listen I want you to be aware of these things, is there something we should do together here?'…It takes a while to develop this comradery.

FRESH members' points of view were significantly changed by their participation on the FCAB in some instances. In particular, FRESH moved from a position of advocating that the site be completely cleaned-up to background levels of contamination to accepting on-site disposal of wastes and residual risks to be managed through longterm stewardship activities. For core FRESH advocates the decision to accept and advocate for on-site disposal of waste was an "epiphany" based on learning and social interaction.

Furthermore, FRESH "took quite a bit of heat" from people in the community for their reconsideration of their opposition to leaving any contamination onsite. Their change of view was based on informed consideration of what they had learned from participation in the FCAB and from independent experts.

> Interviewee: We came to the realization that there is not enough money in the entire federal treasury to pay for [clean-up to background levels]. We also looked at if you took it to background, we would have had to go way off site – we would have a moonscape, and gone through a whole bunch of people's property. The regulators have assured us that [the agreed upon levels of residual contamination] are safe.
>
> Interviewer: 'This is safe' sounds like a scientific determination. It sounds from what you just said that it wasn't really that, it was economic.
>
> Interviewee: We looked at it in dollar signs but we also had to look at it from the scientific side too. [Independent expert advising FRESH] had to assure us that this was an OK level. We found that across the country, these were OK levels. They're not perfect. Tolerable. We always know there is going to be a risk, it is small but there is a risk. This is our burden. People will hopefully learn from the mistakes that were made here. It's a legacy. A lot of people have died. There are heroes in a lot of different ways.

At the same time, FRESH core members we interviewed were very concerned about the quality of recommendations, clean-up activities, and health studies. As one interviewee who is a peripheral member of FRESH stated:

> In time, as [the FCAB] starts talking about future use of the site, I do think you will have a bit larger group of people, and frankly, that is viewed as a mixed blessing by the core [FRESH] group. Because let's say for example, someone from Ross who is a realtor comes in and starts stirring up trouble – what is all this stuff about this on-site disposal facility, and they haven't been involved in the debates up to this point and they really

> could throw a monkey wrench at this. I don't know how I feel about that. You are sort of liberal democratic idealism would say, more participation is always better. But I don't know. In this case, with this sort of discussion, I don't know what that would lead to in terms of discussion about some of the more technical aspects of clean up. For example how much of a discussion could you have with folks that have not ever come to a Fernald meeting before about this re-base line [of the budget]?

Although this observation could have important implications for who is viewed as a legitimate participant in discussions of clean-up, we found no evidence that the FCAB or its members explicitly grappled with this problem.

Chapter 5: Discussion of Findings

We have conducted an exploratory case study on the roles of social networks in risk communication about low dose radiation risks. Our case study focused on the Fernald Environmental Management Project (FEMP), a former nuclear production facility located in a rural, residential area 18 miles northwest of Cincinnati, Ohio. The site operated from 1951 until production was suspended in 1988. The main activity of the facility was to produce highly purified uranium metal products ("feed materials") for US defense programs. We studied the risk communication experiences of people in the community about two types of risks: a) the assessment of historical releases of radiological contaminants and b) the disposal of wastes on-site. In the case of historical releases risk communication we focused on the public health risks. In the case of the on-site disposal cells the risk communication efforts centered on future risks to the community from residual contamination. These two issues, within a much larger set of issues dealt with in the community, provide a rich source of data about how the risk communication efforts were experienced and how social networks played key roles in shaping opinions about the risks.

Our approach to understanding the dynamics of risk communications about these risk sources was to enquire into how social networks generated, mediated the communication, and facilitated learning of risk-related information. Specifically, within each nodal network we focused on the following:

- the ways that networks were formed and emerged, and
- the way that information flowed inside the nodal network and between networks,
- the kind of interactions that happened among individuals within the nodal networks that helped people shape their risk perceptions,
- the ways that nodal networks generated their own information,
- the ways that nodal networks mediated the transfer of risk-related information among members and between networks,
- the ways that nodal networks facilitated or prevented learning among members about risks,
- non "risk" factors that were important to the formation of beliefs about the risk, such as trust and stigma.

Two pairs of social networks were discussed. The first pair were existing social networks within the community that concerned themselves with risks arising from Fernald: local government officials in the three townships affected by Fernald and the citizens watchdog group Fernald Residents for Environment, Safety, and Health (FRESH). The second type of networks were two advisory boards established by acts of federal agencies, the Fernald Health Effects Subcommittee established by federal public health agencies and the Fernald Citizens Advisory Board (formerly the Fernald Citizens task Force) established by agencies focused on clean-up and future use of the site. These boards were points of convergence for members of other social networks. Yet, through sustained periods of meetings and deliberations they emerged as new, formal social networks in their own right.

We found that for each social network there were important factors that helped people shape their risk perceptions. They included technical understandings of radiation (or the lack thereof), familiarity with radiation, evaluations of the scientific understanding of risks, the availability and

use of technical reports and presentations, quality of experiences with agency and contractor management, trust in the DOE, CDC, ATSDR, and FEMP contractors, perceptions about the degree to which agency staff cared about the community and its needs, concerns about stigma (e.g., economic impacts), perceived access to information and independent technical experts, perceived quality of the decision making processes, participation in group activities (e.g., FUTURESITE simulation), and personal experiences and observations. Many of the factors were similar for each network, although the ways that they affected members of each network or their relative importance varied.

In the following sections we discuss six key themes that arise from our analysis of how the networks generated, mediated the communication, and facilitated learning of risk-related information. These themes are the role of personal relationships, trust, technical competence, ebbs and flows of attention and resources, struggles over voice, and networks as generators of risk information.

Personal relationships

Our definition of nodal networks is based on the flow of information. Nodal networks are groups of individuals connected by channels of information flow about a central identifying theme or purpose that is shared. The links between members can arise from direct personal interactions, sharing of written materials, and other forms of communication. They are not defined, necessarily, by ideologies, membership or employment, or even shared risk perceptions.

We found in our analysis of this case study that the character of personal relationships was a critical underlying factor in the sharing of risk-related information and formation of risk perceptions. Personal relationships were formed – and broken – among individuals within networks (e.g., members of FRESH) and between networks (e.g., Township Trustees and FRESH members). They affected the flow of information and the shaping of risk perceptions in several ways.

First, personal relationships provided access to information about risk-related issues. The quality and substance of information have been important elements in the shaping of risk perceptions about low dose radiation risks from Fernald. For example, core FRESH members were able to pick up the telephone and call managers at any time – and get a response to their questions. The stability of staff at Flour-Daniel facilitated the development of such access by helping them develop personal relationships with people in the community. The Fernald Envoy Program is another example of how access to information from the site contractor was created. As described above (section on Township Trustees) personal relationships with liaisons from the site were important to the credibility attributed to information. Similarly, personal relationships of FRESH members with others in the community allowed them to gather sensitive and private information for the health map (see below).

But, not all information was accessed through formal channels. Several people we interviewed from FRESH and the group of Trustees discussed the importance of informal communications for risk-related information. They also relied on informal relationships. For example, a Trustee felt he received more information from informal interactions in this small rural community than from other “official” sources like DOE or the site contractors. The evaluation of the Fernald

Health Effects Subcommittee also found that informal communications were important between CDC staff and members of the FHES. Finally, informal channels of communication were important to FRESH, whose members learned "insider" information about risk related issues from workers on the site.

Second, relationships were important to the perceived trust of others. Such beliefs had implications for the shaping of risk perceptions within the nodal networks. For example, trust was important to whether individuals in each of the nodal networks believed the information provided to them by the DOE or site contractor was credible and believed that DOE and the contractor were committed and honest risk managers. In the early years of this risk controversy, deep feelings of distrust emerged among Trustees and FRESH members toward the DOE and FEMP contractors. People felt lied to and betrayed. Later, FEMP Flour-Daniel had to work hard to regain trust by Trustees and FRESH so that risk studies and information they provided members of these networks was believed. We learned that one factor contributing to such feelings was that turnover of site management and staff before 1992 hampered the formation of trust because *personal* relationships were not well-formed, for example, with Township Trustees and members of FRESH. In this sense, access helped to foster trust.

At the same time, personal relationships were not always enough to overcome institutional distrust and barriers to the sharing of risk information. For example, FRESH members and Township Trustees could express trust in individual managers with the site contractor or staff with the DOE, but they held continued, deep distrust of DOE as an organization because of the legacy of lies that were revealed since the 1980's. A similar dynamic occurred in the relationships between FHES members and the CDC. FHES appear to trust the staff from CDC who managed the FHES.

Personal trust was also an important factor in the shaping of perceptions toward FRESH and, consequently, the shaping of risk perceptions among Township Trustees and members of the FHES and FCAB. They learned that sensitive discussions could take place with core FRESH members in confidence. In addition, while core FRESH members had strong opinions, others felt that they were not unreasonable or unwilling to shift views based on new information (e.g., change in support for epidemiology study and on-site disposal of wastes). In turn, they became more willing to listen to and consider risk-related information from FRESH, including information they brought to discussions from outside, independent experts. Again, a factor that played a role in the development of personal trust among these networks was longterm stability of key individuals. Core FRESH members were, often, longterm residents in the community. By repeated interaction members of these networks were able to feel confident that FRESH members were informed and committed. In this sense, trust helped to foster access.

This dynamic highlights a third role for relationships in the sharing of risk-related information and the formation of risk perceptions. Social interaction in deliberative settings was a critical mode of learning and important in the formation of risk perceptions. Learning was not just based on individual efforts or information per se. Relationships were critical. Personal relationships affected learning within and between networks about both technical information and the values of others. In particular, the advisory boards, FHES and FCAB, created important venues for the development of new relationships and learning. Core FRESH members spoke of their support

for the FCAB, in part, because it would provide a place for people with different opinions to engage each other in dialogue and encounter different perspectives. The FCAB was a point of convergence for multiple networks, including FRESH, workers, and Trustees. In addition, as core FRESH members developed personal relationships with independent experts they were able to learn important technical information about clean-up technologies and dose reconstruction.

We found additional examples of personal relationships supporting learning, and strong suggestion that they helped to form of risk perceptions. For example, personal relationships between an Envoy Program Liaison and the Township Trustees played a key role in how risk information was understood – how well learning took place. New information and a renewed faith and trust in FEMP management and regulators played roles in the evolution of Trustee's risk perceptions. As another example, FRESH members developed relationships with community activists concerned about other DOE nuclear weapons facilities (i.e., once called the Military Production Network, now the Alliance for Nuclear Accountability). In fact, these relationships were critical to FRESH's developing understanding that they should not demand that the Fernald site be cleaned-up to "background levels." From people from other DOE-affected communities they learned that wastes from Fernald would impose risks on others – and they would not do this.

Fifth, personal relationships facilitated dialogue and reaching agreements. The ability of core FRESH members to debate and reach agreement on controversial issues, such as onsite disposal of wastes, depended in large extent on the quality of their relationships. Similarly, the FCAB chair and facilitator worked hard to establish respectful relationships that supported listening and constructive dialogue among members of this network. The quality of these relationships, we learned, supported members' ability to discuss controversial subjects and to reach agreements (and make recommendations) about controversial issues.

Sixth, the ability of a network to generate information was based, in part, on personal relationships. The way that relationships can support the gathering of new data is exemplified by FRESH's efforts to create a "health map." FRESH core members were able to gather potentially sensitive private information from people in the community because of the personal relationships established within this stable, rural area. As discussed previously, the health map was important to the shaping of risk perceptions. In addition, people in the community learned they could trust core FRESH members, which enabled FRESH to continue to collect data for the health map. Core members were adamant about refusing to provide contact information to the CDC about who specific pins on the map represented. FRESH promised confidentiality to its informants and strictly maintained that confidentiality.

Finally, personal relationships allowed deference to other network's positions about risk. For example, a Township Trustee expressed to us in an interview that he accepted, grudgingly, longterm onsite disposal of wastes at Fernald because he deferred to FRESH's stance on this issue. Similarly, we observed that peripheral members of FRESH would defer to the stances of core members about risk management controversies. Unlike the findings from the sister case study on the tritium release controversy at Brookhaven National Laboratory (Webler 2002), we did not find evidence here that interpretations of risk-related information were settled by ideological forces or that members of a networks conformed to established beliefs about risk.

Rather personal relationships supported such deference. It is unlikely that such deference would have been extended if close social ties did not exist.

Trust

Trust was a salient dimension of risk perceptions among members of the four nodal networks. In this section we describe how trust toward two risk management institutions, DOE and CDC, evolved and helped to shape perceptions about risks and those institutions. In addition, our case study suggests that "openness to sharing information" and "respect" are two underlying dimensions of trust, in addition to competence, predictability, caring, and commitment that have been proposed previously (Kasperson et al. 1992).

Early risk perceptions were formed in a context of strong distrust of the DOE and site contractors (National Lead of Ohio and Westinghouse). Members of the larger community, including Township Trustees and members of FRESH, felt lied to and betrayed. They received inconsistent risk messages. They felt they lacked critical information. Similarly, within the FCAB initially there was a great deal of mistrust in information provided by the DOE.

The DOE, as well as Flour-Daniel, USEPA, and Ohio EPA, worked hard to regain the trust of the Fernald community. Inspite of the oft-stated belief that trust, once lost, is hard to regain, we found that DOE-Fernald and FEMP were able to regain trust with FRESH, Township Trustees, and the FCAB (as opposed to DOE Headquarters). The renewed trust, however, was conditional and not unanimously shared among members of these networks.

As described above, feelings of trust were related, in part, to the emergence and stability of personal relationships among members of the nodal networks and DOE staff onsite (as well as Flour-Daniel managers): "when you get to know people and been in enough meetings and you started working on projects with them, hopefully you can tell whether they're telling you the truth." We found that trust was also based on:

- perceived technical competence;
- willingness to share new information, even if it was "negative";
- perceived willingness to listen and consider alternative points of view;
- consistency of information, including consistent statements that knowledge was uncertain;
- belief that input mattered to risk management decisions; and
- ability to verify, independently, claims about risk.

These factors are related to those that have been proposed as critical to perceptions of trust in risk controversies: competence, care, commitment, and predictability (Kasperson et al. 1992). However, they also reflect something more. The perceived openness of the risk management institutions was also important to the re-emergence of trust by FRESH and Township Trustees. We found that its re-emerge after a period of deep distrust and feelings of betrayal was associated with people's ability to verify information and the basis for decisions and explore hidden agendas, whether real or perceived.

Another issue associated with the re-emergence of trust was respect. For example, as an advisory board established by the DOE, the FCAB (then the task Force) was initially met with

some distrust by members of FRESH. Initially, FRESH was worried that the FCAB was "a way to get around the community." However, they found that their opinions about the make-up of the committee was respected. Such feelings of respect helped to gain the trust of FRESH in the process, where they ultimately learned and shaped risk perceptions. Similarly, members of FCAB received clear feedback from the site and DOE that their input mattered; this was a sign of respect for their time, effort, and preferences.

In addition, we found that trust worked at different levels. As described above, members of the FCAB, FRESH and Township Trustees expressed feelings of trust toward individuals who worked for DOE and the site contractor Flour-Daniel. On the other hand, they did not express the same degree of trust toward the institutions themselves:
"the level of trust toward the agency as a whole hasn't probably changed."

We also found that feelings of trust could vary among individuals within a nodal network, while the network as an entity as a whole could extend trust toward another (group or organization). For example, some Township Trustees expressed to us continued distrust of DOE-Fernald. However, as a network we found that, overall, the DOE-Fernald was a trusted source of risk information and risk manager.

The history of relations among the nodal networks and the risk management institutions responsible for clean-up of the site suggest that trust can be regained. The experience of the CDC in this case provide another example of how easily trust can be lost. Unlike the DOE and Flour-Daniel, the CDC initially held the trust of the community when they arrived to work on public health impacts. When the CDC dissolved the FHES in 2001 they left under a cloud of distrust and resentment. Trust was lost when the CDC was perceived as uncaring, uncommitted, and disrespectful, even while it was simultaneously viewed as a competent and open source of risk-related information.

In particular, risk-related views of FHES members were affected by growing perceptions that the CDC was not willing to study the full range of potential health effects from Fernald and that the CDC was not able to address the community's "real" needs. Although CDC staff disagreed with this characterization of what happened, the point is that these were the salient beliefs of FHES members we interviewed. This had an important effect on the risk perceptions of those we interviewed: even if the risks of the diseases that were studied were viewed as low, other, unassessed risks were viewed as potentially being significant and the "real" needs of the community remained unmet. CDC as a risk management institution was viewed as wanting.

In addition, the relationship between the FHES and FRESH was strained because of the way that the FHES operated. FRESH did not have input into how the Subcommittee was formed and who would serve as members – unlike their experience with the FCAB. They felt that some of the individuals appointed to the FHES had conflicts of interest and that too few members of the community were selected. There was resistance within the FHES to accommodating the wishes of FRESH members to hold meetings at different times and more frequently. FRESH took these as signs of disrespect from the health agencies. A feeling of disrespect exacerbated the view that the CDC was not committed and did not care deeply about the risks faced in the community. It

influenced the creation of distrust and the shaping (e.g., strength) of risk perceptions among the FRESH network and some non-FRESH members of the FHES.

Technical competence

As described earlier one factor in the shaping of risk perceptions was the formation and quality of personal relationships. A second factor was technical competence. Like personal relationships, technical competence was mediated by social interaction within and among networks.

Gaining technical competence was a primary goal within the nodal networks studied. For example, FRESH members worked hard to become educated about the issues. Core members felt that they had to be well-informed in order to be credible participants in decision-making processes about site clean-up and health studies of risks from historical exposures. In the end, FRESH was viewed as a credible source of information; sometimes they were viewed as *the* source of information. Within other networks, some individual's perceptions of risks and risk management were influenced by the views of FRESH. Similarly, the FHES help meetings that allowed members to discuss the details of strengths and weaknesses of epidemiological studies for assessing the risks from FEMP historical exposures. These opportunities went beyond seeing network members as passive recipients of information. Rather, the networks established interactions that enabled the members to be actively engaged in learning and interpreting risk communication messages.

FRESH members gained competence about complex risk topics in a variety of ways. While, for example, the read on their own, social interaction was critical. FRESH members learned from regulators, independent experts, and contractors at workshops and meetings. Through their interactions with others from outside of community (MPN/ANA), FRESH members learned about the risks faced by other communities and the impacts that would result from transfer of wastes. Within the networks created by the advisory boards, FRESH members – as well as Township Trustees -- learned about, for example, dose reconstruction and health risk assessment methods, the concept of statistical power, budgetary issues, and clean-up and waste isolation technologies. The FCAB used an innovative approach to learning with a simulation game to help its members understand tradeoffs related to resources (e.g., budgets) and clean-up levels. Its members, too, understood the need to be well-informed if they were to play a useful role in decision-making about Fernald risks.

The technical competence gained was important to the formation of risk perceptions. As discussed, Township Trustees, FRESH, and FCAB members were for the most part in strong support of a complete clean-up of the site after closure. As they learned more –together -- about the technical feasibility of such a goal, the economic costs, ecological impacts, and consequences to other communities that would receive removed wastes, these networks began to consider the option of onsite disposal of some wastes. They grappled with the question: what was an acceptable future risk to the community from waste cells onsite? And, most members of these networks agreed to their use. As we have observed in much of this case study, however, there was rarely complete agreement. For example, some members of the FCAB and Township Trustees felt that the onsite waste disposal cells were not a good solution to the management of contaminated wastes from the site.

A similar effect of learning was observed within the FHES. Like FRESH, FHES members for the most part were advocates of having CDC conduct an epidemiology study in the community. However, after learning about epidemiology methods and limitations within the FHES and other venues, this view changed. They began to understand that the utility of an epidemiology study in the community would be limited because of low power and they supported CDC's decision to not do an epidemiology study.

The ebbs and flows of attention and resources

The nodal networks concerned with risk issues around Fernald where not just involved or uninvolved. Their attention and participation in processes related to risk management ebbed and flowed. The degree to which networks involve themselves in particular risk-related processes, including formal deliberation and informal community organizing and risk communication, has implications for the ways they help to shape risk perceptions. Similarly, how they structure *who* pays attention and is involved can also have important implications for how risk perceptions are shaped within and among networks.

First, the involvement of networks can change. For example, during the development of the recommendation for the OSDF, and subsequent to its planning and construction, many Township Trustees were actively engaged in seeking risk-related information and discussing risk management options. Those we interviewed have now turned their attention to the future use of the site and the longterm reliability of the cells. The Trustees concerns about the OSDF and future use of the site are primarily related to stigma associated with contaminants being left onsite. Moreover, instead of actively seeking out information themselves, they more frequently turn to other networks for information, including FRESH. As discussed above, FRESH is viewed as a trusted and technically competent source of information. They also turn to the FCAB for guidance. Such dynamics suggest a topic for further research: how does the timing and degree of involvement of different networks in risk-related communications affect the formation of risk perceptions?

Second, members of the nodal networks often found themselves overwhelmed by information. Sometimes it was the complexity of information that was overwhelming. In other cases it was the sheer volume. The nodal networks adapted to this situation by distributing labor and resources within the network. The two advisory boards created subcommittees and working groups. The FCAB relied on a facilitator that received high marks for his abilities as a "science translator." On the other hand, the Township Trustees and FRESH formally assigned specific individuals to focus on particular topics. Within a Township the Trustees selected one member to attend to Fernald clean-up and/or health effects. The distribution of attention was achieved in two ways within FRESH: a) assigning particular core members to focus on specific subjects (e.g., health, clean-up technologies, clean-up budget, political organizing and networking) and b) by people self-selecting as core or peripheral members. These kinds of structural arrangements suggest two topics for further research: a) how is critical information shared within a network? and b) how important are "key individuals" at defining the risk perceptions of others within a network?

Struggles over voice

The ability of social networks to influence risk perception within a larger community is related to the power of their voice. "Voice" is related to credibility and the social legitimacy of leadership and it can help to shape risk perceptions in two ways. First, as a group gains voice their views may be more widely shared and perceived as credible. Their views can gain persuasiveness. Second, as a group gains voice they can gain the power to speak *for* others. They can claim to represent the views of a larger community of people, including those that are not formally part of the nodal network (whether as core or peripheral members). The dynamics by which such effects on risk perception can occur is an important topic for further research.

Within this case study we found several examples of struggle over who best represented the risk perceptions and spoke for the views of "the community." One example is the way FRESH struggled to gain a voice within the community, and to be perceived as credible stakeholders. This was in part a struggle over how they were characterized or framed. FRESH attempted to portray themselves not as activists or "hysterical" housewives. They made a clear choice to not be "anti-nuclear" but rather to focus on health of the community. According to a core FRESH member we interviewed, DOE, site contractors, and Trustees all attempted at one time to paint a different picture of FRESH, and influence the community's attitudes toward the group. DOE, for example, tried to characterize FRESH members as "activists," a rhetorical move resisted by FRESH because of the way that term was reacted to by residents in this rural community.

The interactions between the Township Trustees and FRESH is a second example of a struggle over voice. Some Trustees raised the question about who legitimately speaks for "the community." Trustees spoke of their discomfort with not being perceived as fully informed spokespeople and representatives of the community -- even while FRESH was viewed as *the* source of information, because it has access to information that was not available to others and even while simultaneously respected and supported the critical role played by FRESH in the ongoing controversy.

Networks as generators of risk information

Nodal networks can analyze existing data in a new way or conduct their own research to gather new data. In either case, the network provides new information to people that can inform risk perceptions. Usually the information is generated and shared in a social context.

For example, FRESH core members began to gather information from other community residents about the incidence of cancers and other diseases. This resulted in the creation of a "health map," that, in turn, played an important role in communicating about risks with non-FRESH members in the community as well as politicians (e.g., Senator Glenn's staff, who later supported legislation calling for an epidemiological study in the Fernald community). It played a critical role in shaping risk perceptions among FRESH members who observed clear patterns among instances of diseases and fatalities in the community. In addition, the generation of risk-information through interactions with community members had secondary effects. In particular, the health map may have helped to influence perceptions of FRESH as a credible and trustworthy watchdog group (e.g., by Township Trustees, FHES). Core FRESH members were adamant about refusing to provide contact information to the CDC about who specific pins on

the map represented. FRESH promised confidentiality to its informants and strictly maintained that confidentiality.

The FCAB also generated its own information. It gathered, through a series of public meetings it sponsored, data about the diversity and strength of views in the community for the future use of the Fernald site. This information helped to shape the perceptions of FCAB members. This does not mean that FCAB members necessarily agreed with what they heard. Rather, in some cases it reinforced their opinions that more education with the general public was needed as to why residual contamination should preclude certain uses (e.g., bike riding). As in the case of FRESH, the FCABs efforts to gather input from non-members may have played an important role in how it was perceived within the community.

The generation of risk-related information was not a role played by all of the nodal networks studied. FRESH and the FCAB generated their own information, while the Township Trustees and the FHES did not. The reasons for this difference appear to be complex, but included considerations about:

- availability of resources. For example, Township Trustees did not have the resources to start their own data gathering efforts in the community;
- roles and responsibilities. For example, CDC viewed it as their responsibility to conduct (or have contractors conduct) the the studies;
- expertise. For example, CDC did not view the FHES members as having the appropriate expertise to design and conduct studies, even though they were viewed as important for providing recommendations about them. On the other hand, some Township Trustees held implicit assumptions that, as elected representatives, they knew the concerns of the community.

Summary

Underlying our analysis of the four nodal networks studied in this case study is the idea that discourse can generate new understandings about issues, perceptions about risks, and preferences for alternatives. Social interaction is used as a means to allow for the emergence of new meanings. This conceptual understanding is borrowed from a framework that describes how a communication functions to generate new meanings as listeners and speakers use utterances as "thinking devices" (Tuler 2000).

Risk communication research often rests, implicitly or explicitly, on a transmission model of communication (Renn 1992). We found that the four nodal networks acted as channels for conveying existing information from one group to another, as suggested by this model. Information is sent from a source, through a channel, to a receiver of that information. For example, the FCAB placed much emphasis on creating an atmosphere where individual members and the whole group could come to their own conclusions. Each member was provided with a “tool box” consisting of factsheets, technical summaries, and other information; this “tool box’ of documents was updated periodically as new information, reports, etc. were made available. In this sense, the networks played the role of a channel of risk communication messages.

The sender-receiver model also characterizes "errors" of interpretation between senders and receivers of risk messages as arising because the "true" meanings are not correctly preserved by

message recipients. However, semiotic theory can offer another possibility: that the message is used as a "thinking device" as part of a creative, dialogic function of communication. The recipients of risk messages may be playing a different "semiotic game" than the risk manager/communicator. Similarly, recent research has highlighted the ways that risk controversies are "amplified" or "attenuated," in part as a result of the ways that "risk signals" are interpreted and the ways that symbols (semantic images) play a role in the generation of social meanings (Kasperson et al 1988, Kasperson 1992, Renn et al. 1992). In other words, generative meaning making activities are "rational" (Wertsch 1990). Our findings support the claim that the transfer of risk information does not imply that no reinterpretation or reframing occurs. Rather, it is to be expected that meanings are *not* preserved completely as information is provided to others. For example, FRESH publishes newsletters summarizing new reports from the DOE, but it also provides commentary about the strengths and weaknesses of that report. Similarly, The FCAB's tool box was based on summarizing and "translating" technical information for CAB members.

This conceptualization of risk communication has important implications for how the activities and participation of agencies, researchers, local officials, and community members are understood and judged. In addition, it has implications for future research, as discussed in the following chapter.

Chapter 6: Conclusion and suggestions for future research

The Fernald Environmental Management Project's efforts to understand and manage 1) public health risks from historical releases during site operation and 2) residual contamination from onsite disposal of wastes and the future use of the site provides a rich case study for those interested in the dynamics of risk communication. The exploratory research reported here illustrates the importance of social interaction in the formation of risk perceptions among members of groups and of the ways that risk information flows within and among social networks in a community facing a hazard. This is an underdeveloped area of social science research on risk issues. In the previous chapter several key themes emerging from the analysis of the case study were discussed, and their implications for future research highlighted. In this chapter we suggest additional questions that were raised by this research and can usefully be explored. In conclusion, we offer suggestions for areas of further research (in no particular order of importance).

First, in prior research trust has been conceptualized as arising from four factors: predictability, consistency, competence, and care (Kasperson, Golding, and Tuler 1992). Our findings suggest that these were important factors in establishing and undermining trust among individuals, groups, and organizations in the Fernald community. However, another factor also played a role in feelings of trust toward the agencies in this case. It has to do with the ability to verify, independently, the claims of the agencies, the contractors, and experts conducting studies and analyses on behalf of the agencies and site contractor. The importance of "openness in the sharing of information" and the way it interacts with the other four factors is be an interesting topic for further research. We also found evidence of a concern about respect in attributions of trust/distrust. While respect may be related to the dimension of caring, it may be an additional dimension in its own right.

Second, we found that technical competence was an important goal within the nodal networks. While there is much concern over the need for technical competence within risk communication literature (e.g., NRC 1996), there is a paucity of research about how social interaction facilitates or limits learning within risk controversies (Depoe 1997). With increased attention to the need for "analytic-deliberative" processes (NRC 1996) and forums for public involvement, greater attention to group learning processes would be helpful for scholars and practitioners.

Third, risk communication research often rests on an assumption that the sender-receiver model is valid. However, this research provides additional evidence that perceptions, interpretations, and attributions about risks are constructed dialogically, in social interaction. A useful avenue of future research would be to apply alternative theories of communication and semiotics to risk communication, to deepen our understandings of how information flows and is interpreted.

Fourth, we found that some social networks generated risk-related information, and that such information could be important in the formation of risk perceptions both within and outside of the network. What are the important factors that support the generation of new knowledge by local organizations? What factors make such information play a role in the formation of risk perceptions? Why is the information trusted or not? These are some of the important on this topic that can be helpful for risk managers to understand as they interact with local groups in risk controversies.

Fifth, we discussed two networks in this report that emerged through the actions of the agencies. These advisory boards, the FHES and FCAB, were points of convergence for individuals in the community who were not initially part of the same social networks. As points of convergence they became emergent networks, and are one form of capacity building within a community. A reflection of how the FHES, as a point of convergence for multiple nodal networks led to the emergence of a new nodal network is found in the creation of a new non-profit group that will continue to promote health studies and risk communication in the community. The new group was established by former members of the FHES, as well as others in the community, including a member of the FCAB, former Township Trustee, and peripheral and core members of FRESH. Future research can elucidate the ways that networks can be created and sustained.

Finally, we found that many individuals were members of multiple networks or received risk-related information from more than one network. Yet, those we interviewed also clearly privileged some information sources over others. In our discussion of findings we identified some of the factors that make certain sources more salient, such as familiarity with and credibility of the source. Similarly, we found that individuals tended to privilege specific ways of characterizing risks from low dose radiation associated with Fernald, while they also appeared able to understand and utilize other ways of framing the risks. Such phenomena have been observed in prior studies (e.g., Wertsch 1987, Tuler 2000). It would be interesting to study in more depth the reasons that certain sources and frames are privileged, and the ways that the privileging arises through interactions among individuals and subgroups of networks.

Final conclusions

The case study of the legacy of radiological releases from the Fernald nuclear weapons facility and efforts to clean-up and understand their effects explored the ways in which people's participation within social networks helped shape their perceptions of low dose radiation risks. The findings from this case study strongly support the hypothesis that social networks affect the ways individuals form risk perceptions. Such networks provide means for information to be distributed and interpreted for the members of the network. They also provide opportunities for people to learn and play more informed roles in risk-related decision-making and management.

Acknowledgments and Disclaimer

The research reported here benefited from the help of two graduate students, Jasmine Tanguay (doctoral student, Department of Geography, Clark University, Worcester, MA) and Jennifer Wilhoit (doctoral student, Department of Environmental Studies, Antioch New England Graduate School, Keene, NH). They collected and summarized background information and conducted interviews.

I also received much support and encouragement and benefited from frequent discussions with Thomas Webler about my understandings and analysis of data in this case study and comparisons with the "sister" case study he was writing on Brookhaven National Laboratory. Our frequent meetings and discussions helped clarify many of ideas and insights that are discussed in this report.

This report was prepared by the Social and Environmental Research Institute for Decision Research, Inc. (Eugene, OR) under subcontract. Decision Research was supported by funding from the US Department of Energy's Low Dose Radiation Research Program, Office of Biological and Environmental Research, Office of Science under Cooperative Agreement Number DE-FC07-99ER63879 with Decision Science Research Institute. Any opinions, findings, and conclusions expressed in this report are those of the authors and do not necessarily reflect the views of the Department of Energy or Decision Research.

References

Applegate, J. and Sarno, D. 1997. FUTURESITE: An environmental remediation game, *Simulation and Gaming* 28(1):13-27.

ATSDR 1999. Demographic analysis for populations residing within 1 mile, 5 kilometers, and 10 kilometers of the Fernald site. Atlanta, GA; Division of Health Assessment and Consultation, ATSDR.

ATSDR 2000. Feed Materials Production Center (USDOE) Public Health Assessment. CERCLIS NO. OH6890008976. Draft Report. Atlanta, GA; Division of Health Assessment and Consultation, ATSDR.

CDC 1998. *Estimation of the Impact of the Former Feed Material Production Center (FMPC) in Lung Cancer Mortality in the Surrounding the Community*. Atlanta, GA: Radiation Studies Branch, NCEH, CDC.

CDC 2000. *Screening Level estimates of the Lifetime Risk of Developing Kidney Cancer, Female Breast Cancer, Bone Cancer, and Leukemia Resulting from the Maximum Estimated Exposure to Radioactive Materials Released from the Former Feed Materials Production Center (FMPC)*. Atlanta, GA: Radiation Studies Branch, NCEH, CDC.

COSMOS 2001a. Evaluation of the Health Effects Subcommittee Advisory Process. Executive Summary. Task Order #9, Contract No. 282-98-0027. Bethesda, MD: COSMOS Corporation.

COSMOS 2001b. Evaluation of the Health Effects Subcommittee Advisory Process. Volume 1, Final Report. Task Order #9, Contract No. 282-98-0027. Bethesda, MD: COSMOS Corporation.

COSMOS 2001c. Evaluation of the Health Effects Subcommittee Advisory Process. Volume 2, Final Report. Task Order #9, Contract No. 282-98-0027. Bethesda, MD: COSMOS Corporation.

Depoe, S. 1997. Public involvement, civic discovery, and the formation of environmental policy: A comparative analysis of the Fernald Citizens Task Force and the Fernald Health Effects Subcommittee. In S. L. Senach (ed.) *Proceedings of the 4th Biennial Conference on Communication and Environment*, pg. 244-253. Syracuse, NY: SUNY College of Environmental Science and Forestry.

FEMP 2001. Factsheet on on-site disposal facility (OSDF). Available online: www.fernald.gov.

Fernald Citizens Task Force 1995. Recommendations on remediation levels, waste disposition, priorities, and future use. Ross, OH: The Fernald Citizens Task Force.

Kasperson, R. E. 1992. The social amplification of risk: Progress in developing an integrative framework. In S. Krimsky and D. Golding (eds.) Social Theories of Risk Westport, CT: Praeger.

Kasperson, R. E., O. Renn, P. Slovic, H. S. Brown, J. Emel, R. Goble, J. X. Kasperson, and S. Ratick 1988. The Social Amplification of Risk: A Conceptual Framework, *Risk Analysis* 8(2):177-187.

Kasperson, Roger, Dominic Golding, and Seth Tuler. 1992. Siting hazardous facilities and communicating risks under conditions of high social mistrust. *Journal of Social Issues* 48(4): 161-187.

Ohio EPA 2000. Fernald Chronology. Available online: www.offo2.epa.state.oh.us/fernald/finfo/chronology.htm. Columbus, OH: Office of Federal Facilities Oversight, Ohio, EPA.

Radiological Assessments Corporation (RAC) 1998. Task 6: radiation doses and risk to residents from FMPC operations from 1951-1988. Volumes 1 and 2 (Final Report). Neeses, SC: RAC.

Renn, O. 1992. Risk communication: Towards a rational discourse with the public, *Journal of Hazardous Materials* 29:465-519.

Renn, O., Burns, W., Kasperson, R. E., Kasperson, J. X., and Slovic, P. 1992. The social amplification of risk: theoretical foundations and empirical application. *Journal of Social Issues* 48(4):137-160.

Tuler, S. 2000. Forms of talk in policy dialogue: Distinguishing between adversarial and collaborative discourse. *Journal of Risk Research, 3*(1), 1-17.

Webler 2002. Low Dose Risk Perception and Communication: A Case Study of the Tritium Controversy at Brookhaven National Laboratory. Report prepared under subcontract with Decision Research, Inc. for the US Department of Energy's Low Dose Radiation Research Program, Office of Biological and Environmental Research, Office of Science.

Wertsch, J. 1987. "Modes of discourse in the nuclear arms debate," in R. J. Parmentier and G. Urban (eds.), *Current Research on Peace and Violence*. Tampere, Finland: Tampere Research Institute.

Wertsch, J. 1990. The voice of rationality in a sociocultural approach to mind. In L. C. Moll (ed.) Vygotsky and education. NY: Cambridge University Press.

Appendix A: Interview guide

In this interview, we will be asking you about a series of events or issues that occurred during the clean-up and public health assessments at Fernald.

Iterate through questions 1-3, asking about each issue.

NOTE to interviewer: be careful about whether to use present tense or past tense. This may depend on the issue (e.g., future use is a current issue, setting of soil clean-up standards is a past issue).

1. Tell us, briefly, **what happened** during
    a) the planning and development of the onsite-waste-disposal facility?
    b) setting of soil clean up standards?
    c) CDC's efforts to characterize community health effects from Fernald?
    d) efforts to define the future use of the site (e.g., Future of Fernald workshops)?

- Can you highlight some of what were for you the key points in the history of this issue (a-d)? *The purpose here is to bring the person's mindset back to the issue. We are not necessarily seeking information at this stage, but we won't ignore new information, obviously. Keep this discussion short!*

2. As far as you are concerned, **what was this issue about (a-d)**?

Probes

- *Risk and danger?*
- *Trust and mistrust?*
- *Community and economic development?*
- *Accounting for past harms?*

3. Talk a little bit about **your take on this issue (a-d)**.

Probes

- *What do you think about the health risks? (their risk perceptions)*
- *What kind of images do you have of the facility?*
- *How do you view the officials at the Facility (past and present)?*
- *What is your solution to the problem?*
- *What outcomes would you like to see?*
- *What do you think of the process?*
- *Do you think there is anything the officials can do about anything at all or are their hands tied?*
- *What information and events were important in shaping your views?*

If they mention trust:

- *Is trust an issue because there is:*

no satisfactory way to discuss the risks?
Control or eliminate the risks during the near term?

4. What **other issues** do you care about? Where do these four fall in terms of its importance to you given all the things you care about?

For the following questions, focus on the most important issue(s) to the interviewee (a-d in Question 1)

5. What opportunities did you have to discuss these issues with other people? **Can you tell us about the kinds of places or venues where you had interaction with other people about this issue?**
   The goal here is to get a list of the discourse spaces.

   Probes:
   - Were you a member of an advisory board (FCAB, CRO, FHES)? If not, did you attend any of the advisory board meetings?
   - Do you belong to any citizens groups (e.g., FRESH) where this was discussed? Did you attend any meetings of local citizens groups?
   - Do you belong to any civic organizations where this was discussed?
   - Did you talk about it with neighbors?
   - Did you talk about it with close friends? If so, in what settings?
   - Did you attend any meetings or presentations where Facility/state agency employees talked about the issue?
   - Did you read about it in the newspaper? On television or radio?
   - Were there key networks that you tapped into for information and/or support?
   - What other places or venues did you go to that provided information?

     Where any meetings or events particularly important to you (e.g., particular workshops, advisory board meetings)?

6. Now we would like to talk about **what the quality of the discussion was like in these different venues**. What were these different venues for discussion like?

Ask about each one individually

- Describe the kinds of people you might talk face-to-face with about these issues.
- How did conversation unfold in these settings?
- Did you have a chance to talk?
- Did you have the sense that people listened?
- How would you characterize the conversation (dialogue, interaction, discussion) there?
- Was your point of view respected?
- Were you able to get a sense of what other people in the community are feeling?
- How do you get a sense for how people at the Facility/state agency are feeling?
- Did you think that the discussions were well informed technically?
- Were people able to talk about non-technical issues and concerns?

7. Now we want to discuss **the way that information was brought into these settings**. What are the different sources you draw upon to gain knowledge about the risk, safety, and health issues related to these issues?
   - What sources did you rely on for factual information?

- Are there particularly important sources of information that you relied on (people, reports, etc.)? How would you rate these various sources? (good, bad?; some sources better for some issues and not so good on other issues?)
- What happens for you when there is an overt conflict in opinions between one source and another, or between one group and another (e.g., local environmentalists and the facility managers)?

8. Do you know of any **standards** that are relevant to the allowable levels of risk (contamination, exposure) for these issues?
   - Do you think that the standards are too high? Too low? For an adequate level of protection?
   - How well do the experts and scientists at the facility understand the risks to the community? How do you view science as a source for making management decisions about these issues?
   - How do other people in the community view science as a source for making management decisions about these issues?
   - If science is not enough, what other standards and values ought to apply?

9. Is there anything **unique about this region** that we need to know about in order to understand why these issues unfolded in the manner that they did?
   - History of previous controversies
   - Culture of behavior
   - Personal animosities among people
   - What has been the role of the facility in the community? (e.g., primary employer, "good neighbor", a mystery)
   - Multiple townships, agencies, etc.

10. Now we'd like you to reflect on how your **opinions about these issues changed over time**.
    This needs to link back to question 2 (what is this controversy about) and should iterate from one issue to the next (a-d)
    - What is your opinion right now about this issue?
      Probes:
      Do you feel it was a serious danger to human health?
      Do you feel that the Facility was honest about the dangers associated with the issue?
      Do you feel that people were concerned about health risks or something else?

    - What were some of the more important things that shaped the way you feel about this risk?
    - What are the key factors that have influenced your opinions about what is good and bad, acceptable and unacceptable with regard to the issue?
    - Can you point to any significant changes in your opinion?
    - How would you describe how other people in the community – not Facility employees – generally interpret this issue?
    - Does this differ from how Facility employees interpret the danger associated with this the issue?
    - How have views, opinions regarding the issue in the community changed over time?
    - Why do other people in the community care about this? Or not?

FERNALD CITIZENS ADVISORY BOARD

Draft Minutes from the November 15, 1997 Meeting

The Fernald Citizens Advisory Board met from 8:37 a.m. until 11:50 p.m. on Saturday, November 15, 1997, at the Alpha Building, 10967 Hamilton-Cleves Highway, Harrison, Ohio. The meeting was advertised in local papers and was open to the public.

Members Present:	John Applegate French Bell Marvin Clawson Lisa Crawford Jack Craig Pam Dunn Darryl Huff Gene Jablonowski Graham Mitchell Gene Willeke
Members Absent:	Jim Bierer Constance Fox Dan McElroy Warren Strunk Robert Tabor Thomas Wagner
Federal Official Present:	Mike Jacobs
Staff Present:	Tereza Marks Crystal Sarno Douglas Sarno

About 10 spectators also attended the meeting, including members of the public and representatives from DOE and Fluor Daniel Fernald.

Post Office Box 544 Ross, Ohio 45061 513.648.6478

1. Call to Order

Chair John Applegate called the meeting to order at 8:37 a.m.

2. Announcements and New Business

The Board approved the minutes from the September meeting without changes.

John Applegate announced that Warren Strunk has resigned from the Citizen's Advisory Board due to work commitments. Applegate reminded the Board that over the years, Strunk has had to use work time to attend these meetings. Applegate made a motion that the Board formally thank Strunk for his service. Lisa Crawford seconded the motion. The Board will send a letter of thanks to Strunk.

Applegate suggested that the Board discuss membership issues after the meeting. With Strunk's resignation, the Board has four available positions. Applegate proposed that the Board develop a list of possible replacement members.

Applegate announced that Al Alm has resigned as Assistant Secretary of the Department of Energy. Because of this change in administration, the Board will have to educate the new Assistant Secretary about Fernald and the work occurring at the site. The Board feels that it is important that the new administration be aware of Fernald's ability and desire to move forward aggressively.

Applegate announced that the chairs of the SSABs held a meeting in Dallas in October. Fernald is much further along, chronologically, than any of the other sites, and the Fernald CAB is now dealing with implementation issues. At the meeting of the SSABs, there was also an update on the status of the national dialogue.

Applegate presented copies of the Complex Wide Contractor Integration Report to the Board. This document introduces a new style of "map," to describe the creation and disposition of different waste forms, that is to be included in the Accelerated Cleanup Plan.

The Nevada Community Advisory Board is hoping to sponsor a workshop on low level waste and Applegate has suggested that the Fernald CAB work with them. The relationship between Fernald and Nevada has become a model for cooperation between other SSABs.

Applegate learned at the meeting of the SSABs in Dallas that the Savannah River site asks the ex-officio members of their board to provide them with an annual list of areas on which the Board should provide comments. The Board and the Agencies work on the list together, and then formalize those comments. Applegate suggested that this might be something of interest for Fernald.

Since the last meeting of the CAB, the funding for Fernald has been moved from the general Environmental Management fund to a Defense Facilities Closure Project.

Finally, Applegate announced that the Fernald CAB web site is now linked to Rocky Flats and Oak Ridge. To provide better inter-SSAB communication, the Fernald site will be kept updated.

3. Review of Site Tour

Lisa Crawford presented a brief overview of the site tour that occurred as part of the October Fernald Monthly Progress Briefing. Crawford reported that the tour was well attended by the public – there were some new faces, which is a good thing. She stated that the tour allowed people to see that there is a lot of activity on the site, (i.e. a lot of soil is being moved). Crawford's impression is that the site is changing weekly.

4. Prioritization

Doug Sarno presented the background of the Fernald CAB and its recommendations on prioritization issues. In July 1995, the Fernald Citizens Task Force recommended an accelerated remediation schedule, removal of special nuclear materials from Fernald and the shipment of legacy wastes as soon as possible, the elimination of the costs of maintaining and providing security to buildings which are scheduled for demolition, the discontinuation of ongoing repair and maintenance to on-site buildings and infrastructure, the streamlining of DOE regulatory requirements, and an overall culture shift within DOE from operations to remediation. In March 1997, the 2006 Plan (Ten-Year Draft Plan) was released. This plan called for DOE to projectize, increase efficiency requirements, develop new technologies, and reduce mortgages. The Efficiency Committee of the Fernald CAB was formed in May 1997 to provide recommendations on budget and efficiency issues, review site priorities and review scheduling issues. The CAB sent a letter on site priorities to Bob Folker, Acting Field Office Manager in September 1997 stating that the priorities and funding given to non-remediation activities is too high and restating the 1995 recommendations, calling once again for a fundamental change in the approach of DOE to remedial operations. Finally in October 1997, FEMP was designated as a Defense Facilities Closure Project by Congress.

Jack Craig announced that the Ohio Field Office now has a new manager, Leah Dever. Dever will attend the next CAB meeting. Dever has many connections in Nevada and has worked at DOE-Headquarters.

Sarno explained that as a Defense Facilities Closure Project, Fernald is still part of the EM budget, but the money in the closure fund cannot be moved to other DOE sites. The purpose of the Defense Facilities Closure Project is to focus resources on the goal of closing the site. Under this classification, however, Fernald received less money than requested. Fernald had requested $268 million, but only received $258 million. Rocky Flats is also classified as a Defense Facilities Closure Project. Jack Craig stated that the Mound Project may eventually also be included in this account.

The Defense Facilities Closure Project classification is a result of Congress being unhappy with the way DOE-HQ is organized. Congress wants to see a fundamental change in the way Environmental Management Division operates. However, the Congressional report is not directly recommending many of these changes. Since DOE-HQ is looking at a reorganization, Congress has requested a detailed schedule for the two sites. The Fernald section of the plan is expected to provide a large amount of detail about the site. Rocky Flats, however, is not as advanced as Fernald and the Rocky Flats plan is a contractor generated-plan which has not yet been reviewed and approved by DOE.

Jack Craig felt that due to this reclassification, many of the issues mentioned in the September 1997 letter to Bob Folker have been addressed and resolved.

The CAB was informed that Al Alm has asked each site to submit any big issues to him that he can work towards resolving before he resigns. DOE-FEMP has submitted two issues, one of which is the OU1 ROD limits on the ability to use commercial rail. Due to this

problem, DOE-FEMP has postponed procurement of rail cars until Spring. This delay will not affect the current schedule. By January or February, however, DOE will need to resolve these issues, so that IT can complete its rail plan. If this is not resolved by January or February, the cleanup goal for OU1 will be missed.

5. DOE Prioritization Slide Presentation

Terry Hagen and Johnny Reising presented slides showing the schedule and progress of activities occurring at the DOE site.

OU1:
Terry Hagen announced that there will be no change to the schedule for the Waste Pits as a result of the reduced funding. As stated earlier, IT and Flour Daniel will be developing rail plans between now and March. The first enforceable milestone for this project is March 1999. Johnny Reising showed an aerial photo of the Waste Pits taken in 1985 and compared it to a photo taken April 1, 1997. Reising stated that DOE is hoping to take a new photo as soon as the weather clears. Reising and Hagen also discussed the Land Use Master Plan. Reising stated that the rail trestle for OU1 has recently been completed.

OU2:
Hagen stated that the schedule for this project is on track and in some cases is actually a little ahead of schedule. Members of the Waste Management Committee noted that they would like to have a tour of the OSDF as part of their December 1st meeting. Reising stated this would be possible. The tour was scheduled for 5:30 p.m. Reising continued the presentation by outlining the lining layers used in the OSDF. He stated that wastes would begin to be placed in the OSDF in early December.

OU3:
Hagen stated that under the revised schedule the completion date for safe shutdown will still remain at the end of 1999. However, the actual D&D of buildings will be delayed.

OU4:
Hagen announced that the estimated date of completion of the Silos Project is 2008. Reising discussed the recent concerns regarding the erosion of part of the bank of Paddys Run in this area. Some old wells casing were exposed. The well casings were fine, but FDF had to reroute the flow of the stream to avoid possible future problems.

OU5 :
Hagen announced that some soil work has been delayed as a result of the reduced budget.

Overall, there are three areas in which delays are expected: non-south field soil excavation, the D&D Project, and the pace of the cell project. In all other areas, tasks are running on or slightly ahead of schedule.

Waste Management:
Over the past several years, the amount of non waste nuclear materials has stabilized at about 63 million tons. About one third of the enriched uranium left is being sold to British Nuclear Fuels. An RFP is out to try to sell the remaining enriched uranium. FDF has tried to find a buyer for the depleted uranium, but has been unsuccessful. This material will be declared waste in 1998. Gene Willeke suggested that this might be an issue for the Waste Management Committee to discuss. The CAB should have this material declared waste and disposed of off-site. Sarno asked for details on this waste so that the Committee could prepare a letter about this issue.

Crawford asked that the CAB view a 1962 film showing the work that had occurred at the site. Sue Walpole said she had a copy. The Board decided to show the movie at the next CAB meeting.

6. Costs

Terry Hagen began the discussion by pointing out there are basically two kinds of cost associated with non-remediation activities: administrative support and technical oversight and integration. He pointed out three things that FDF is doing to reduce costs: 1) implementing the Rad Control Optimization Study (i.e. reduction of restrictions in controlled areas, cross training of technicians); 2) producing a long range plan for phasing out support and oversight services (i.e. consolidation, prioritizing, and further projectization); and 3) streamlining project control functions (i.e., reducing the number of activities in the base line schedule).

Doug Sarno proposed that the Waste Management Committee send a letter to DOE asking for quick removal of low level waste to be ultimately disposed off off-site. Jack Craig suggested that the injunction issue which has resulted in the lack of commercial disposal be added to the letter. The Board decided that two separate letters would be more effective. The Board noted that the issue of commercial disposal was previously addressed in the September letter to Bob Folker. Now the Board would be responding to their response. In the case of the injunction, the CAB wants to make it clear that DOE should continue with external regulation. Craig also proposed that the DOE-Ohio Office general counsel meet with the Waste Management Committee at the December 1st meeting to discuss the injunction.

In regards to the future role of the Efficiency Committee, Graham Mitchell suggested that the committee talk to FDF about the inefficiencies of which they are aware and where FDF can make improvements. Willeke suggested that there be more consequences to FDF as a result of an action or a decision that increases inefficiencies. Applegate then asked the full Board for comments on the priorities DOE had outlined in their presentation.

A letter on the reaction to Fernald's becoming a Defense Facilities Closure Project has been drafted. Applegate distributed the draft to the Board members. The Board agreed to change the last line of the document to read "accelerated cleanup at Fernald". The Board also suggested the addition of another paragraph to outline what steps DOE needs to make to improve conditions at the site.

Sarno announced that information will be provided to the Board on a more regular basis. This information will consist of committee summaries, committee notebooks, and report summaries.

Applegate opened the floor for public comment. Tricia Thompson, Head of FDF Public Affairs, said she felt that the site tour was good. She noted that there are four pages of interest in the Fernald Report, and that a cleanup book is available for stakeholders every three months. Photos of the site can also be found on the web.

Pam Dunn wanted feedback on the recent lawsuit which resulted in the judge telling DOE to do what it was told to do in 1990. Jack Craig was unsure of the status of the lawsuit, but promised to find out more information.

7. Adjournment

Applegate adjourned the meeting at 11:50 a.m.

I certify that these minutes are an accurate account of the November 15, 1997, meeting of the Fernald Citizens Advisory Board.

John S. Applegate, Chair Date
Fernald Citizens Advisory Board

Mike Jacobs Date
Federal Official

A Stakeholder Vision for the Future of Fernald

Fernald Stakeholders envision a Future for the Fernald property that creates a federally-owned regional destination for educating this and future generations about the rich and varied history of Fernald. We envision a community resource that serves the ongoing information needs of area residents, education needs of local academic institutions, and reinterment of Native American remains. We envision a safe, secure, and partially accessible site, integrated with the surrounding community that effectively protects human health and the environment from all residual contamination and fully maintains all aspects of the ecological restoration.

Adopted by Fernald Stakeholders at the Third Future of Fernald Workshop, 9/26/00

Achieving the Vision

We believe that this vision can only be achieved through cooperation among all stakeholders and by recognizing the need to identify the funding and incorporate planning and implementation of future uses with on-site remediation. To achieve this vision, we would like to see the following elements implemented on the Fernald Site:

■ Adequate property to provide reinterment of Native American remains in a protected park-like setting that recognizes the spiritual nature of this activity.

■ Regulated access to the ecologically restored areas of the site through a series of marked and annotated trails that can be used for hands-on learning and discovery of indigenous plants and animals.

■ Development of an on-property educational center that provides for the following:

— A complete history of the Fernald area beginning with the first Native American residents continuing through the Cold War years when the Fernald site produced feed materials for America's nuclear weapons arsenal, and culminating with the current efforts of site remediation and ecological restoration.

— Museum-quality displays and related educational programming on the role of Fernald in the Cold War and the many impacts of the production of feed materials for nuclear weapons on the lives of area residents and Fernald site workers, as well as the broader social and cultural impacts on the surrounding community.

— Museum-quality displays and related educational programming on the history of Native Americans in the Fernald region.

— Permanent housing of the public reading room containing copies of the public record of Fernald production and remediation activities and Fernald Living History materials.

— Classrooms and auditorium space.

— Environmental research and groundwater education facilities.

— Expedient access to environmental monitoring results.

— Detailed descriptions and displays on the Fernald environmental remediation process and results.

Criteria for the Design and Future Use of an Education Center

Recommended by the FCAB April 19, 2001

In keeping with the Stakeholder Vision for the Future of Fernald, the Fernald Citizens Advisory Board is strongly supportive of an on-site educational center to enhance the environmental, educational, and Native American elements on the Fernald site following remediation. The Fernald Citizens Advisory Board recommends that the following criteria for the proposed Education Center be incorporated into all DOE planning activities for Fernald site restoration and that a conceptual design and issues for implementation of the Education Center be incorporated into the Public Use Master Plan. The Fernald CAB recommends that this center be designed as an energy-efficient building that reflects the environmental nature of the future Fernald site and provides for the following:

■ adequate spaces for both large and small group learning
■ auditorium type space for lectures, videos, and other programs
■ environmental research and groundwater education facilities
■ housing and access to environmental monitoring results
■ facilities to house and allow viewing of Fernald Living History tapes
■ adequate space to house Fernald historical and remediation records including all of the records currently housed at the PEIC
■ exhibits, displays, and/or videos on Native American history in the region and the likely historical uses at Fernald
■ exhibits, displays, and/or videos on Native American burials on site
■ exhibits, displays, and/or videos on Fernald before the Cold War
■ exhibits, displays, and/or videos on Fernald's role in the Cold War and technical processes at Fernald
■ space for examples of equipment/tools/other items used at Fernald
■ space for photo and video documentation of the site process
■ exhibits, displays, and/or videos on the remediation of Fernald
■ exhibits, displays, and/or videos on the ecological habitats at Fernald
■ exhibits, displays, and/or videos on impacts of Fernald operations on area residents and Fernald site workers
■ space for the final location of the Cold War Garden and other future memorials
■ office space and facilities for site stewardship staff and operations.

In consideration of the above future needs, the Fernald CAB requests that DOE begin the design and construction of this facility as soon as is feasible so that it may serve the many needs of the ongoing site operations and be transitioned to an education center following site remediation. Furthermore, the Fernald CAB requests that DOE begin now to prepare the many collections and exhibits that will be housed in the education center and use currently available spaces to begin making these available for public access.

Criteria for the Design and Future Use of Trails

Recommended by the FCAB April 19, 2001

Recognizing the need to incorporate the funding and planning of future uses with current remediation, the Fernald Citizens Advisory Board recommends that the following criteria for trails on the restored site be incorporated into all DOE planning and remediation activities at the Fernald site. Work should begin now to design the complete trail system so that proper grading and other work can be incorporated into remediation and restoration activities, and strongly encourage that all site decisions be made in light of the future of Fernald to ensure the efficient integration of future use activities with the remediation process. The criteria are in keeping with the ecological and educational emphasis envisioned for the restored site.

- Trails should provide access to key ecological areas and enhance the educational experience.
- Trails should provide access to areas used for environmental monitoring.
- Areas of the site identified for research should not be readily accessible to the public.
- Trails should be designed to encourage and support learning and field study activities. Trails should be designed to discourage recreational activities such as biking, rollerblading, and jogging. As such, trails should not "loop" through sensitive areas.
- In the more environmentally sensitive areas, trails should be made of materials that have the least negative impact on the environment while maximizing educational access.
- Trails should provide access to overlooks of environmentally sensitive areas.
- Trails should provide access to both the Native American burial site and connect that site with the envisioned on-site Education Center.
- Trails should provide some level of handicap accessibility. The FCAB recognizes that some environmentally sensitive areas of the restored site will not be handicap accessible.
- Historical, environmental, and educational markers should be placed along the trails. These markers should be tastefully designed in keeping with the environment and durable so as to minimize maintenance.
- The design of the trails should facilitate educational field trips.
- The design of the trails should limit the number of points of public access to site.

FERNALD CITIZENS ADVISORY BOARD

Fernald Residents for Environment, Safety, and Health

Fernald Living History, Inc.

For more information, please visit the FCAB website at www.fernaldcab.org, or contact Patti Kidd at 513-648-6478 or pkidd@theperspectivesgroup.com