Exploring Public Participation Decision-making at Superfund Sites: A Mental Models Approach

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EXPLORING PUBLIC PARTICIPATION DECISION-MAKING AT SUPERFUND SITES: A MENTAL MODELS APPROACH

By

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ABSTRACT

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Exploring Public Participation Decision-making at Superfund Sites: A Mental Models Approach

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While public policies and programs in the United States encourage public participation in agency decisions on environmental issues, how best to engage the public remains controversial. Public participation is more challenging when complex and uncertain scientific or technical issues are involved. This research applies a mental model methodology to explore what people engaged in Superfund site cleanup decisions think about when making public participation decisions. The intent is to find better ways of engaging people in constructive processes that achieve mutual understanding and lead to better decisions.

An initial expert-informed mental model of public participation decision-making is developed based on a literature review, expert interviews, and professional workshop discussions. The model provides an illustrative framework of interconnected variables that is coherent to public participation professionals and consistent with current public participation theory. The “expert” model is used to guide semi-structured interviews of participants engaged in public participation at two Superfund sites. Transcribed interviews are analyzed using an iterative coding process to develop a participant mental model of public participation decision-making. Coding patterns are used to distinguish three characteristic ways of thinking - experiential, analytical, and strategic - which are associated with ad hoc, informing, and intentional types of public participation decision-making, respectively. Also, differences in expert and participant models indicate that experts are generally more attentive to broad-reaching, long-term societal objectives than participants.

While established in risk communication research, this is the first known application of the Mental Models methodology for public participation research. The mental models that emerge from this research identify the diverse range of variables and the relationships among variables that should be considered during public participation planning and decision-making. The identified different ways of thinking about public participation reveal communication barriers that can lead to different decisions about how best to conduct public participation and frustrate efforts to work together. The implications of these findings to public participation theory, research, policy, and practice are discussed.
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**TABLE OF CONTENTS**

Abstract ......................................................................................................................... iii

Acknowledgements .......................................................................................................... iv

List of Figures .................................................................................................................. xii

List of Tables ................................................................................................................... xiii

Chapter 1: Introduction .................................................................................................. 1

  Public Participation Challenges in an Age of Scientific Complexity .................. 3

  Research Objectives and Approach ................................................................. 9

  A Superfund Focus .............................................................................................. 11

  Summary and Conclusions .............................................................................. 23

  Document Organization .................................................................................... 25

Chapter 2: Literature Review ...................................................................................... 28

  Current Knowledge on Science as a Source of Controversy .................... 30

    *A Historical Account of Science-based Decision-making* ..................... 30

    *Disparate Expertise and Resources* ............................................................ 35

    *Dueling Experts and Implications to Trust* ................................................ 36

    *Scientific Uncertainty and Burdens of Proof* ............................................ 37
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Assessment as a Paradigm for Managing Uncertainty</td>
<td>39</td>
</tr>
<tr>
<td>Psychological and Cultural Influences on Risk Perception</td>
<td>43</td>
</tr>
<tr>
<td>Current Conceptual Frameworks for Understanding the Practice of Public Participation</td>
<td>49</td>
</tr>
<tr>
<td>Major Strands of Public Participation Research</td>
<td>56</td>
</tr>
<tr>
<td>Management Theory</td>
<td>59</td>
</tr>
<tr>
<td>Collaborative Learning</td>
<td>60</td>
</tr>
<tr>
<td>Decision Analysis</td>
<td>63</td>
</tr>
<tr>
<td>Procedural Justice</td>
<td>64</td>
</tr>
<tr>
<td>Theories of Democracy</td>
<td>67</td>
</tr>
<tr>
<td>Evaluation</td>
<td>69</td>
</tr>
<tr>
<td>Communicative Theory</td>
<td>72</td>
</tr>
<tr>
<td>Summary and Conclusions</td>
<td>75</td>
</tr>
</tbody>
</table>

Chapter 3: Methodology ........................................................................... 78

Methodology Selection ........................................................................... 78

Historical Development and Current Applications of Mental Models

Methodology .......................................................................................... 79

Mental Models Applicability to Understanding Public Participation

Decision-Making .................................................................................. 80
Needs and Interests ........................................................................................................... 129
Individual Ways of Thinking ..................................................................................... 134
Individual Public Participation Knowledge and Preferences .................................. 136
Inter- and Intra-Group Interaction and Process Decision-Making ................... 138
Chapter Summary ........................................................................................................ 140

Chapter 5: Participant Mental Models ................................................................. 141

Analysis by Project Site ............................................................................................. 145

  Residential Soil Quality Site .............................................................................. 149

  Drinking Water Quality Site .......................................................................... 157

Analysis by Way of Thinking .................................................................................. 164

Interpretation ............................................................................................................ 171

  Experiential ......................................................................................................... 173

  Analytical ........................................................................................................... 176

  Strategic .............................................................................................................. 178

Chapter Summary and Conclusions .......................................................................... 180

Chapter 6: Expert Versus Participant Differences .............................................. 182

Experts May Under Emphasize Substantive Aspects of the Problem .......... 183

Experts May Over-Emphasize Broader Social Benefits of Using Good Process ................................................................................................................. 188
Existing Context versus Needs and Interests ........................................ 188

Process Norms and Values versus Needs and Interests .................... 191

Understanding of Different Approaches to Public Participation .......... 194

Minor and Insignificant Differences ................................................. 195

Additional Emotions ........................................................................ 195

Inter- and Intra- Group Interaction and Individual Learning ............ 196

Needs and Interests of Others ....................................................... 196

Media and Effect Outcomes .......................................................... 197

Summary and Conclusions ............................................................. 197

Chapter 7: Implications and Advice .................................................. 201

Implications for Public Participation Theory of Science-intensive

Controversy ..................................................................................... 201

A Unique Model for Understanding Public Participation Decision

Making ............................................................................................ 201

Advancing a Three-Way Characterization of Participants ............. 203

Substantive versus Societal Objectives of Participants and Experts .. 206

Applications to a Communicative Theory of Public Participation ...... 208

Implications for Mental Models Research ...................................... 212

A New Methodology for Public Participation Research ................. 212
Methodological Lessons: Aligning the Interview Protocol with the Analysis................................................................. 214

Advice for Public Participation Practitioners................................. 217

Applying Mental Models as a Public Participation Planning Tool...... 217

Overcoming the Analytical-Experiential Communication Barrier ..... 219

Responding to Participant’s Perceived Needs and Interests .......... 222

Advice for Participants................................................................. 223

Anticipating Controversy ............................................................. 223

Elements of a Thoughtful Public Participation Decision.................. 224

Seeking Leadership and Expertise ................................................. 224

Advice for Policy Makers and Program Administrators.................. 226

Bridging the Analytical-Experiential Barrier................................. 226

Evaluating Project Manager Effectiveness..................................... 229

Defining a “Good” Public Participation Process .............................. 230

Addressing Broader Social and Process Oriented Benefits of Public Participation................................................................. 234

Strengths, Limitations and Future Research Needs........................ 238

Credibility..................................................................................... 241

Dependability................................................................................ 244
**List of Figures**

Figure 1. Predictive Model of Risk Perception .......................................................... 47

Figure 2. Analytic-Deliberative Framework Proposed by U.S. National Research Council .................................................................................................................. 51

Figure 3. The Presidential/Congressional Commission Risk Management Framework ............................................................. 53

Figure 4. The Acceptability Diamond ........................................................................ 70

Figure 5. Iterative Connection of Public Participation Process with Preconditions and Outcomes ........................................................................................................... 74

Figure 6. Expert Mental Model of Stakeholder Public Participation Decision-Making . 115

Figure 7. Existing Context for the Expert Mental Model ........................................... 116

Figure 8. Needs and Interests for the Expert Mental Model ........................................ 117

Figure 9. Participant Mental Model of Public Participation Decision-Making .......... 142

Figure 10. Existing Context for the Participant Mental Model ................................... 143

Figure 11. Existing Context for the Participant Mental Model ................................... 144

Figure 12. Comparison of Expert vs. Participant Mental Models of Public Participation Decision-Making ........................................................................................................ 184

Figure 13. Existing Context of the Comparative Mental Model ................................. 185

Figure 14. Needs and Interests of the Comparative Mental Model ............................. 186

Figure C-1. Key Steps in the Joint Fact Finding Process ............................................ 292
List of Tables

Table 1. Number of Responses by Node and Interviewee, Organized by Site ........... 146

Table 2. Number of Responses by Node and Interviewee, Organized by Way of Thinking ........................................................................................................................................................................... 166

Table 3. Dominant Nodes for Different Ways of Thinking........................................... 172
CHAPTER 1: INTRODUCTION

Public participation in the affairs of government is at the normative core of
American democracy – a government of, by, and for the people. Numerous and wide
ranging mechanisms exist for the public to participate in government. Some of these
require little direct engagement between a citizen and government representatives or
personnel, like voting or providing financial support to candidates for public office.
Others allow for direct engagement of citizens with government representatives or
personnel, like attending a public meeting on a specific proposed project or policy
decision. However, the term “public participation” is increasingly recognized to focus on
more direct forms of engagement, whereby citizens are brought together with
government decision-makers in an organized process (National Academy of Sciences,
2008).

In accordance with its recognized importance to democratic government, public
participation has become infused into statutes and practiced at all levels of government
in the United States today. Guidance on the proper role for public participation exists to
guide agency decisions in policy formulation (Presidential/Congressional Commission on
Risk Assessment and Risk Management, 1997; National Research Council, 1996), as a
mandate from the President (The White House, 2004; Bolten and Connaughton, 2005),
and is established in agency guidance that direct project level processes (e.g. Council on Environmental Quality, 2007; Environmental Protection Agency [EPA], 1999).

Despite broad support for the idea of public participation and copious guidance on how to conduct public participation, how best to design and conduct public participation is often contentious and challenging (National Academy of Sciences, 2008). As described throughout Chapters 1 and 2, numerous different ideas exist about what public participation is or should be, and how best to conduct public participation. These differences can lead to controversy, make implementation of public participation efforts more challenging, and limit the effectiveness of public participation efforts (Wells & Margand, 2006). These challenges can lead some agency managers to question the efficaciousness of public participation efforts, which can lead to minimizing public participation to the bare minimum prescribed by regulation (Johnson & Chess, 2006; EPA Office of Inspector General, 1996).

This research responds to the contemporary challenge facing public participation in this age of scientific complexity; namely, the challenge of engaging technical experts, agency decision-makers and the general public in problem solving processes that can overcome sources of controversy and otherwise enable high quality decisions to emerge within a socially constructive process. Over time, failure by the agencies to achieve effective public participation on technically complex issues can compromise effectiveness in applying their technical expertise to knowledgeably achieve their missions and mandates because the public will fail to understand and approve of their decisions. Similarly, failure by the public to actively seek public participation
opportunities and effectively participate in government decisions can compromise the notion of democratic government as one that meets the needs and interests of, by, and for the people.

**Public Participation Challenges in an Age of Scientific Complexity**

How to involve the public is more challenging where the issues involve complex and uncertain scientific or technical information (Nakamura & Church, 2003; Folk, 1991). The different ways by which experts and lay citizens think about the nature of the problems to be addressed can lead to frustration with the public participation processes (Fisher 2000; Tesh, 2000; Edelstein, 2004; O’Brien, 2000). Moreover, experts and lay stakeholders can craft opposing rhetorical appeals in their efforts to describe their perspectives and concerns that can further frustrate communication and exacerbate a sense of conflict (Hamilton, 2003).

Technical experts tend to seek efficiency of their work through the use of established procedures and standards. These procedures and standards rely upon technical terms and concepts, and complex and lengthy assessments are often produced. These technical assessments are conducted to meet the applicable regulatory requirements and communicate with other technically-minded experts and agency decision-makers.

Conversely, lay stakeholders can be critical of the use of technical assessments as a primary means of informing decisions (Tesh, 2000; Steingraber, 1998). Lay stakeholders can have a difficult time communicating with agency officials when the problems, analyses and solutions are addressed only in technical terms. Such technical
assessments rely upon technical terms and concepts that are not widely understood. More than that however, the technical assessments do not necessarily address the perspectives and concerns that lay stakeholders have about the problem, the methods of analysis, or the possible solutions. Lay stakeholders may seek to address concerns that extend beyond existing regulations. Such challenges to the status quo are a needed component to continually assessing, improving, or adapting existing regulations to meet evolving needs. Lay stakeholders may also be mistrusting of designated experts or critical of existing norms by which experts conduct their assessments and make decisions in conditions of uncertainty or incomplete knowledge. Differences of opinion between experts on assessment methods or interpretations of facts amidst uncertainty can increase lay stakeholders’ sense of uncertainty and erode their trust in experts.

With the rise of technical knowledge and expertise throughout the 20th century, there has been a trend toward the transfer of public policy development and decision-making from political deliberation processes to expert assessment processes (Fisher, 2000). Increasingly larger and more complex technical assessments are dominating the decision-making process such that it increasingly difficult for non-technical stakeholders to participate in the deliberations and politics that may also be pertinent to the decision-making process. Associated with this trend toward expert dominated assessment is a decline of confidence in professionals and technology. Portions of the public have become dissatisfied with the pace of progress on environmental issues and the increasingly privileged role of experts in the decision-making process. Some have come to perceive experts to be more interested in increasing their own authority, power
and wealth (Beck, 1992). Contemporary public participation embodies the ongoing challenge of integrating the diverse perspectives and concerns of citizens and technical experts into mutually agreeable decision-making processes with sound outcomes (Webler & Tuler, 2002; McKinney and Harmon, 2002; Carpenter & Kennedy, 2001).

Public participation scholars have offered competing notions of the purposes and ideals of public participation. Moynihan (2003) identifies an “instrumentalist” view dominant among agency personnel who generally seek to optimize costs versus benefits in public participation processes. The benefits from the expert/agency perspective derive from using directly applicable regulatory criteria, which must be addressed to legally justify their decisions. For agency personnel holding an instrumentalist view, public participation can be perceived as inefficient by adding cost and sometimes having uncertain benefits (Thomas, 1995). Hence, the minimum required effort may be expended toward public participation. With such instrumental decision making, agency personnel needs may be met, but the needs of other stakeholders may not be. When such differences are left unresolved, the perceived ability of the agency to effectively respond to the will of the public is diminished. The normative core of democracy - a government of, by, and for the people - is not achieved.

The notion of robust and meaningful public participation stands in contrast to the instrumentalist view. Moynihan (2003) refers to the notion of robust and meaningful public participation as the “normative” perspective. Under this view, meaningful public participation requires enhanced citizen participation in agency decisions. Public participation, principally through direct interaction and discourse is
seen as essential to achieving mutual understanding necessary to have constructive civic engagement and a health civic community (Habermas, 1984; Habermas, 1987). The notion of meaningful public participation assumes that the related processes will meet the needs and interests of diverse stakeholders, result in more widely accepted decisions being made, and thereby support agency legitimacy. Agency guidance is provided that encourages public participation in all aspects of environmental decision-making and that involves stakeholders in defining how they participate, even if such ideals are not always realized in practice (e.g. EPA, 2000; EPA, 1999; Council on Environmental Quality, 2007). This normative perspective elevates the need for achieving democratic ideals over the long-term instead of emphasizing more immediate agency needs that constitutes the instrumentalist perspective.

The various existing approaches to public participation research provide a broad base for understanding why controversy arises when the issues being decided involve scientific complexity and uncertain risks, but they may also contribute to ongoing competing notions of the purposes and ideals of public participation. For example, evaluation oriented research has focused on describing commonly recognized metrics for assessing the quality of public participation outcomes through observation of applied practice, while research within the communicative theory tradition has sought to provide a normative theory for understanding public participation that is grounded in theories pertaining to effective communication that seek to achieve mutual understanding. Additional strands of public participation research are presented in Chapter 2. While past research has advanced many ideals of what constitutes “good”
public participation and ways of characterizing and describing it, there remains limited common understanding of how to best conduct public participation in practice (Marcus et al., 1999; Teske, 2000; Webler and Tuler, 2002; Gray, 2004; Fischer, 2000).

Taken as a whole, this research seeks to provide insights that can help people develop a common understanding about how to engage more constructively in working through their differences and otherwise arrive at high quality decisions that are broadly supported. Much is at stake if public participation processes fail to meet the needs of a democratic society.

From the agency perspective, if the agencies fail to engage the public in ways that communicate the basis for their decisions, they risk undermining public support for their mission. For example, if the EPA consistently fails to make decisions about environmental clean-up that are coherent to those living in or around the contaminated sites, over time and with repeated failure they may lose legitimacy. If sufficiently widespread, such public disillusion could lead to legislative program changes. Such an outcome would tend to devalue the important informing role that technically expert agencies like the U.S. EPA currently provide.

Conversely, if the public fails to engage the agencies, they risk delegating all decision authority to experts and fostering the development of technical elite who make decisions in an increasingly hierarchal and authoritarian method of governance. In other words, if the public becomes disinterested or despondent about public participation, the agency’s perspective, including the beliefs, values and problem-solving frames that accompany that perspective, becomes unchallenged. This outcome
obviously devalues the role of the citizen in the development of robust and legitimate decisions. Furthermore, it disregards the scientific uncertainty and the subjectively-based tradeoffs inherent in the decisions. Where technically expert agencies are given autonomous decision-making authority, decision-making becomes conflated to a naive perspective of complete objectivity.

A number of different strands of research have been advanced to inform an understanding of what public participation should achieve, how it should be implemented, and how well it is implemented. As described in Chapter 2, Webler & Tuler (2002) delineate these various strands of research, each of which respond to a particular focus or perspective, such as the needs of management (Management Theory), a desire to improve learning during public participation (Collaborative Learning), concern for procedural justice (Procedural Justice) or democratic principles (Theories of Democracy), and others. Among these established areas of research and development, this research seeks to build upon and contribute to the Communicative Theory approach. This approach establishes fairness and competence as two central components of a normative definition of what is “good” public participation (Webler & Tuler, 2000). However, limited empirical studies have been undertaken to evaluate the theory in practice (Webler & Tuler, 2002; Webler, Tuler & Kruger, 2001; Webler & Tuler, 2001). These studies have begun to identify differences that groups of people have about what public participation should accomplish. Whereas some people may seek popular acceptance of outcomes that legitimizes the decision-making process, others may be focused on the technical competence of decision-making process. Other
perspectives may focus on the educational value or civic building capacity of the process used to support a decision, or on the fairness of the process as perceived by all the parties. Accordingly, this research responds to the need for additional empirical studies that assess how different groups of people engaged in controversy actually think about public participation and make decisions on how to engage with each other, with a focus on situations involving scientific complexity.

**Research Objectives and Approach**

In response to the challenges facing public participation in an age of scientific complexity, this research seeks to better understand the diverse ways that different types of participants engaged in scientifically complex controversy conceptualize their public participation decisions. Key similarities and differences in ways of thinking about public participation are sought. In particular, this research seeks to define differences among public participation experts in academia, public agency managers who are responsible for managing a scientifically complex project, and other participants such as the general public or other agencies that have a responsibility or interest in the project.

Accordingly, this research explores three fundamental questions:

1. **What do different types of participants engaged in scientifically-intensive controversy think about when making public participation decisions?**

   Existing communicative theory suggests that different groups of people focus on different issues; however, this phenomenon has not been explored specifically within a technically complex context like a Superfund project.
2. What characteristically different ways of thinking about public participation decision-making can be identified among participants engaged in science-intensive controversy, and are these differences associated with different public participation decisions? Existing communicative theory characterizes how people think about public participation within the context of the process used to achieve outcomes (Webler and Tuler, 2002). With this research, I seek to characterize different ways of thinking by considering both what people are thinking about and the decisions they make about how best to engage in public participation.

3. What differences in ways of thinking about public participation exist between public participation experts and participants, and can these differences create barriers to effective development and promotion of public participation programs and project level processes? Existing communicative theory suggests that different notions exist about what is an appropriate or best approach for conducting public participation (Webler, et al., 2001). This research seeks to more fully understand these differences in order to elucidate strategies for designing and implementing public participation processes that achieve effective communication. Within the Communicative Theory research tradition, effective communication is recognized to mean that public participation processes allow the needs and interests of the parties to be identified and responded to in ways that achieve mutual understanding (Renn, et al., 1995).
A Mental Models methodology is used to explore how individuals’ ways of thinking about public participation differ and to explore any associations between individual’s ways of thinking and their public participation decisions. A mental model is a theoretical and conceptual framework and set of assumptions conveying the thought processes people use to make a decision. The Mental Models methodology is an established methodology in the field of risk communication that provides a structured process for defining an expert depiction of a phenomenon and then testing the expert depiction in other cohorts (Morgan, et al, 2002; Fischhoff and Bruin, 2006).

Identified similarities and differences in ways of thinking about public participation are applied to elucidate communication barriers that can lead to different ideas about how best to conduct public participation and otherwise frustrate efforts to work together. These findings are further applied to consider implications to public participation theory, research, policy, and practice.

A Superfund Focus

This subsection establishes the U.S. Superfund program as an appropriate venue for the study of science-intensive controversy. Technical complexity and social controversy are common at Superfund sites (Nakamura and Church, 2003). The nature of the technical complexity, the nature of the controversies, and the types of programs established to respond to the controversy are described. The subsection concludes by characterizing the ongoing challenges to the current practice of public participation at the EPA. These real-world challenges establish a need for and orientation toward the specific research questions presented in Chapter 2.
Superfund is a common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) originally passed by Congress in 1980 and reauthorized and revised by the Superfund Amendments and Reauthorization Action (SARA) passed by Congress in 1986. The legislation provides a federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through CERCLA, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

Cleanup of Superfund sites requires the application of extensive specialized expertise to assess the nature of the contamination problem and to develop a remedy. The application of this technical expertise is applied within a highly structured process that is simply and briefly summarized to contain the following steps¹:

1. **Preliminary Assessment and Site Investigation (PA/SI):** gathering of preliminary information to determine if further investigation is necessary because of threats to human health or the environment. For warranted sites, these early investigations will culminate in a Hazard Ranking System (HRS) score that is used to determine eligibility for NPL listing.

2. **National Priority List (NPL) Listing:** formally recognizing the site as one that qualifies to be addressed by the Superfund program.

3. **Remedial Investigation and Feasibility Study (RI/FS):** determining the nature and extent of contamination at the site, testing whether certain technologies

¹ See: [http://www.epa.gov/superfund/community/process.htm](http://www.epa.gov/superfund/community/process.htm)
are capable of treating the contamination, and evaluating the cost and performance of technologies that could be used to clean up the site.

4. **Record of Decision (ROD):** explaining which cleanup alternatives the agency has selected to clean up the site. The ROD is first described in a Proposed Plan that is subject to public review as described below. To comply with federal policy (U.S. EPA, 1990), the cleanup decision must consider two Threshold Criteria (overall protection of human health and the environment, and compliance with other applicable regulations and requirements), five Balancing Criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of contaminants through treatment; short-term effectiveness; implementability; and cost), and two Modifying Criteria (state acceptance; and community acceptance).

5. **Remedial Design and Remedial Action (RD/RA):** preparing final design plans and specifications and implementing the remedy. Construction Completion is designated when all physical construction tasks are completed.

6. **Post Construction:** providing for the long-term operation and maintenance of engineered systems or other types of institutional controls that are intended to prevent exposure to contamination that remains after construction.

7. **Deletion from the NPL:** Removal from the NPL list once all cleanup goals have been achieved.
Numerous methodologies and options for implementing this generalized process are available to accommodate projects of various size and complexity, and the process may not always be linear if new information is discovered that requires a return to early steps in the process.

The initial stages of a Superfund site investigation typically involve multidisciplinary teams of earth scientists, physical scientists, biological scientists and other health scientists. These scientists must characterize the nature of the problem that is generally not observable to the naked eye. Extensive testing is required to identify chemical contaminants in the environment and to determine what existing or future potential risks these contaminants pose to human health and the environment. Ascertaining how contaminants released into the air, soil or water might move through the environment and come into contact with people or ecological resources often involves the application of sophisticated models. Examples of such models include dust dispersion models that describe how contaminants in soil dust might be transported through air and deposited elsewhere, hydrogeological models that describe how contaminants in soil might migrate into groundwater and then be carried down gradient to areas of existing or future potential groundwater use, ecological models that describe how contaminants might accumulate in the food chain, and so on. Ultimately, a potential for exposure to the contaminants is determined, and this exposure is related to the potential for harm or risk using risk assessment models. All of these assessments and models must grapple with the natural variability that complicates a simple assessment, limitations of complete knowledge that leads to uncertainty, and a finite
amount of money and time to conduct the assessments. That said, assessment costs of hundreds of thousands of dollars to millions of dollars are spent in a process that generally takes several years at best but can go on for decades. Numerous technical reports are generated that can be difficult and time consuming for people who do not have the relevant technical expertise to understand. To provide some sense of the expert knowledge required to be conversant in the procedures used, the risk assessment process alone is described in six core guidance documents and supported by dozens of additional documents that define the EPA’s preferred methods for conducting risk assessments.²

Later stages of remedy design and construction typically involve civil, chemical, geotechnical and environmental engineers. The engineers conduct their own investigations to inform the design process. These designs can involve soil removal and replacement, the design of hazardous waste repositories, groundwater capture systems, and water treatment plants. Moreover, various types of agency and political appointees may get involved in arranging the financing, ordinances, and long-term government procedures for managing aspects of the remedy, such as maintaining repositories or operation water treatment plants, long into the future. The burden for such long-term management is often borne by local governments or responsible parties.

The technical assessments and remedy design plans that are conducted to assess the nature of the contamination problem and to develop a remedy are generally prepared by the responsible party or parties, which are typically an industry or business,

or the EPA. Where no responsible party can be identified, the EPA may use the “Superfund” to pay for the work which is generally conducted by consultants and contractors who work directly for the agency.

Concerned residents and other citizens are provided the opportunity to review and comment on the technical reports and design plans. They may also be extended the opportunity to review and comment on the work plans or scopes of work that describe the process to be used to generate the technical reports and design plan. There is a fair degree of latitude extended to the project manager about which documents will be provided for public review and how extensive the process for conducting the review will be. However, there are certain minimum requirements for public participation that are defined by regulation. EPA’s Community Involvement Handbook (EPA, 2005) provides a summary of these requirements which is briefly summarized as follows:

1. A public spokesperson must be assigned to each Superfund removal action.
2. An administrative record must be established in a location available to the public near the site.
3. The agency must provide at least a 30 day comment period for any proposed removal action that involves a planning period of less than six months, i.e. an emergency type action.
4. For removal actions expected to take more than 120 days, the agency must prepare a formal Community Involvement Plan (CIP) and conduct interviews with interested parties to inform this plan, as described in greater detail below. This plan is to be updated, if necessary, at the completion of the
investigation phase and prior to entering the engineering design phase of a project.

5. The agency must provide at least a 30 day review period for Engineering Evaluation and Cost Analysis (EE/CA) reports. This is an expedited type report format used for projects that are expected to take six months or more to plan.

6. Sites that are added to the National Priority List (NPL) must first be published as a proposed rule in the Federal Register, the agency must respond to comments received, and then publish the final rule.

7. When undertaking a Remedial Action, the most extensive type of investigation that most Superfund sites undergo, the agency must inform the public of the availability of a Technical Assistance Grant (TAG) and provide the application materials at the local repository.

8. Upon completion of a Feasibility Study and a Proposed Plan for how the site will be remediated, the agency must publish a notice in a major local newspaper that announces a comment period and provides a brief summary of the plan. The minimum required public comment period is 30 days, but the review period must be extended by at least another 30 days upon timely request. The opportunity for a public meeting must also be provided, and a court recorder must prepare a meeting transcript that is available to the public.
9. Prior to completing a Record of Decision (ROD) that describes the kinds of remedy the agency will require, the agency must prepare a response to public comments and attach this response to the ROD. If the public comment resulted in any changes in the agency’s decision, this must be explained in the response to public comments.

10. If the ROD is revised at a later date, the agency must prepare an Explanation of Significant Differences (ESD) document, and provide a public a notice in a major local paper that summarizes the changes. The ROD must also undergo a similar public notification process and provide for the same kind of public review that is required for a Feasibility Study and Proposed Plan.

11. Upon completing the final engineering design, the agency must issue a fact sheet and provide a public briefing, if appropriate, prior to beginning the Remedial Action.

12. Upon completion of the Remedial Action, the agency must publish notice of intent to delete the site from the NPL in the Federal Register and a major local newspaper. The notice is subject to a minimum 30 day review period, and the agency must respond to the comments received prior to publishing final notice in the Federal Register.

As can be discerned from a review of the above listed minimum requirements, the public review process in its minimal form requires citizens to review numerous technical documents. Often there are disparate levels of technical knowledge among the various stakeholder groups who participate in the review process. Moreover,
diverse opinions emerge about the types of cleanups that are warranted that stem from the uncertainties and inherent limitations to the technical reports. After all, the final decision about what to do, if anything, involves a measure of subjective judgment that weighs costs against benefits. Controversy between the EPA, affected citizens, companies that may be responsible for cleanup costs, and other stakeholders is common.

A key component within this laborious and lengthy process is the risk assessment. The substantiation of the need for a Superfund action is contingent upon a demonstration that chemical contamination poses a significant risk to human health or the environment. Accordingly, the EPA has developed a highly technical risk assessment process to systematically and consistently measure the degree of potential risk posed by the contamination. The agency's perceived role and central importance of technical assessment in addressing Superfund problems is revealed by former EPA Administrator William Ruckelshaus (1991, p. 54):

“We are now in a troubled and emotional period for pollution control; many communities are gripped by something approaching panic, and the public discussion is dominated by personalities rather than substance... We will not recover our equilibrium without a concerted effort to more effectively engage the scientific community.... I need the help of scientists.”

In addition, Edelstein (2004) describes how residents living within a Superfund site or otherwise directly affected can frequently experience dramatic negative consequences that can invoke a more experiential way of assessing risk and framing concerns. Superfund sites post significant threats to health and property and additional psychosocial impact to residents’ sense of safety and well-being. As described in greater
detail in Chapter 2, much empirical study and assessment has been conducted to
understand the various ways in which factors such as trust, risk perception and a host of
other factors can shape controversies like those at Superfund sites and adversely affect
those involved (Adler & Kranowitz, 2005; Earle, 2004; Slovic et al., 2004; Peters et al.,

In recognition of the technical complexity and social controversy involved in the
Superfund process, the EPA Superfund program has established several community
involvement programs that are designed to enhance the ability of citizens to participate
in Superfund cleanup decisions (EPA, 1999; EPA, 2006a). A Community Involvement
Plan (CIP) is required when a new site is listed on the National Priorities List (NPL); i.e.
becomes a priority Superfund site, and again later in the design phase of the project.
The Community Involvement Coordinator (Coordinators) is a staff position within the
EPA that is typically responsible for managing the public involvement process, including
the preparation of the CIPs. Coordinators are provided broad discretion about how to
prepare the CIPs.

Informal conversations were undertaken in 2007 by the author with five
Coordinators in different EPA administrative regions across the country to gain some
first-hand insight on CIPs and about how and when programmatic public participation
resources are applied to projects. The Coordinators indicated that they use interviews
with affected citizen representatives, generally 20 or more, to seek feedback on the
types of community involvement desired. At the Coordinators discretion, information
about EPA’s public participation resources and programs may be provided to the
interviewee. The information received by the Coordinator is used to prepare a CIP, which is available to the public for public review and comment prior to being finalized. The CIP provides a starting point for a community involvement process that is constantly changing and reacting. Thus a CIP may become quickly outdated.

The CIP may specify the use of one or more of EPA’s community involvement programs, including Technical Assistance Grants (TAGs), Community Advisory Groups (CAGs), Superfund Job Training Initiative (SuperJTI), and Technical Outreach Services for Communities (TOSC). These programs provide money or services to aid communities in their involvement. The TAG program provides money, typically in $50,000 allotments, to qualified community groups so they can hire technical expertise to help understand project related information. The CAG establishes a public forum and focal point for sharing information among stakeholders. The SuperJTI provides money to support job training in the community in areas related to cleanup. The TOSC provides independent technical information to communities near Superfund sites.

The Coordinators indicated that programmatic public participation programs like TAG or CAG are initiated in response to community demand, although in some cases the programs are recommended by the Coordinators where they believe it will be a benefit. It was unanimously believed that TAG and CAG programs are not applied at most Superfund sites, despite the overall positive attitude expressed by the Coordinators for the programs. The Coordinators indicated that TAGs were turned down for “eligibility” issues – the community proposal did not encompass a sufficiently wide variety of

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3 Program descriptions are provided at: [http://www.epa.gov/superfund/community/index.htm](http://www.epa.gov/superfund/community/index.htm).
interests. Also, many communities are insufficiently organized or otherwise not interested in managing a TAG contract. CAG utilization was generally recognized by Coordinators as a community driven need.

The effectiveness of EPAs public participation programs has been criticized. An assessment of the TAG program by the EPA Office of Inspector General (1996) concluded that the TAG program was not being fully utilized because the program’s needs were not defined from a participant’s perspective, information about the TAG program was not consistently getting to community groups, and the TAG program was implemented inconsistently across EPA regions.

Since the 1996 Inspector General report, several administrative improvements to the TAG program and other community involvement programs have been implemented in an effort to improve utilization (Englebert, 2006). However, current EPA Administrators within the Superfund Community Involvement and Outreach Branch (Wells & Margand, 2006) indicate that challenges to wide-spread utilization of community involvement programs remain. They suggest from experience that an understandably technocratic orientation of the agency creates obstacles to expanded utilization of existing programmatic resources designed to enhance community involvement.

Criticisms remain even where programmatic resources are used. In a comparative case study of TAG use at two project sites, Teske (2000) observed that the TAG program did facilitate public participation in technically complex decisions, but the degree of influence on the decision-making process was dependent upon the degree of
trust between the agency and the interested parties and the officials’ willingness to integrate citizens concerns into the process. Similarly, in a broad review of public participation actions at numerous Superfund sites Lowry (1998) observed that the effective use of Citizen Advisory Boards (such as CAGs) can be limited by regulators’ lack of commitment to meaningful public participation and inclusion of diverse participant groups, and that the CAG program appears to have done little to address inequities in participation.

**Summary and Conclusions**

Indications are that available resources and state-of-the-art public participation methods are not utilized as often or effectively as they could within the EPA. Moreover, it appears that the existing programs may not always be responding to the community’s needs from the community’s perspective, some communities may not be aware of TAG, CAG and other similar programmatic resources and programs, and such programs may be inconsistently administered across EPA regions and even between individual Coordinators within regions. These findings indicate that EPA may not be consistently delivering the programs that participants want, EPA may not be consistently communicating to participants how the existing programs can meet their needs, or both. More fundamentally perhaps, there may be differences between how conflict resolution experts (those who helped craft and promote the use of programs like TAG and CAG) think controversy should be responded to and how many project level personnel and project participants actually respond to controversy.
The different ways people think about their public participation decisions may undermine effective communication. A better understanding of the diverse ways in which public participation experts, agency managers, and general citizens think about their public participation decisions may provide valuable insights for improving communications and otherwise aiding agency personal and citizens alike in making informed and wise public participation decisions. These decisions span a wide range of choices about how involved the public review process should be, what parts of an agency’s processes are of interest to the public and if those processes need to be modified to meet the public’s needs, if or how the public should organize to represent their interests, and the resources or programs needed to support the public participation process. Moreover, there are decisions that may be made by agency managers or upon request by concerned individuals about the nature and objective of the public participation process. Should the objective be to inform the public about the technical assessments, to establish a collaborative process for defining what work gets done, to maximize public influence on agency decisions, or in the most extreme and antagonist cases to prepare for litigation?

The Superfund program provides an ideal focus for this research because it involves technically complex problems, social controversy, and seemingly disparate perspectives among participants about how best to conduct public participation. While EPA does have an active public participation program in place to respond to these challenges, the existing programs are not always utilized or utilized successfully to engage the community or resolve differences. This suggests a difference in
understanding between those who designed the program and those who use the program about what constitutes effective public participation.

Accordingly, this research seeks to better understand these different ways of thinking about public participation in cases where technical complexity is involved. This is achieved by identifying and evaluating the key similarities and differences in ways of thinking about public participation that exist among people involved in Superfund controversy.

**Document Organization**

The nature of the problems associated with public participation on science intensive issues introduced in Chapter 1 are expanded upon in Chapter 2. An expanded review of the current literature on science as source of controversy in public policy and decision-making is provided, with an emphasis on the issues most germane to the EPA’s Superfund program. Chapter 2 continues by identifying and describing the various theoretical, conceptual, and methodological frameworks that have been advanced for addressing science as a source of controversy and otherwise enabling effective public participation. The chapter concludes by elaborating on the gaps in current knowledge that this research seeks to address.

Chapter 3 presents the research methodology. Both the rationale for selecting the research method and a detailed description of the methodology are presented. The methodology consists of three basic parts, each of which is intended to address one of the three specific research questions. The results for each of research question are then presented in Chapters 4 through 6.
To address this first research question, this research identifies the variables that are currently recognized by public participation experts (scholars in academia and professionals working as facilitators or in related fields) as relevant to public participation decisions on science-intensive projects and assembles them into an expert mental model. The expert mental model is developed and presented in Chapter 4. The expert mental model identifies the diverse range of variables, and the relationships among variables, that should be considered during public participation planning and decision-making.

To address the second research question, this research applies the expert-based mental model derived in response to Question 1 to empirically explore how the mental models of different groups of people currently engaged in scientifically complex controversy include some variables over others. Interviews conducted with individuals at two study sites are analyzed in Chapter 5. Three characteristic ways of thinking among participants emerge from the analysis and are associated with unique types of public participation decisions.

To address the third and final research question, the knowledge gained about individuals engaged in controversy is applied to reflect back upon the original expert mental model and elucidate unique expert perspectives on public participation. In response to the third research question, Chapter 6 contrasts experts with participants in order to characterize a ways of thinking about public participation that are unique to experts.
In the discussion provided in Chapter 7, the theoretical implications, methodological implications, and practical advice derived from the research findings are presented. The observed differences in ways of thinking about public participation among various participants and between experts and participants are considered in terms of the communication barriers these differences can create and the ways that they might otherwise exacerbate controversy. This knowledge is applied to advance a unique model for understanding public participation, characterize the different observed Ways of Thinking about public participation, and ultimately propose advancements to a Communicative Theory of public participation. Observed differences in ways of thinking about public participation is also applied to develop practical recommendations that can enable participants engaged in technically-intensive controversy make better public participation decisions. Finally, knowledge gained is applied to advance the design of more broadly embraced public participation policies and project-level processes that are effective at meeting the varied needs of diverse participant perspectives. Chapter 8, Conclusions, provides a concise summary of the most significant findings and recommendations provided in Chapter 7.
CHAPTER 2: LITERATURE REVIEW

This chapter examines the current knowledge, practices and research in public participation. This information is presented to define the research perspective and identify the knowledge gaps addressed by this research. Current knowledge on the sources and causes of controversy surrounding public decisions involving scientifically complex assessments is described. The discussion then describes the leading conceptual frameworks that have been established to integrate scientifically complex assessments into public participation practices. Definitions of what public participation is and frameworks for implementing public participation are presented. The kinds of practical problems that exist in the implementation of the public participation frameworks are identified.

This review reveals that while much commonly recognized and accepted knowledge exists about the causes of controversy surrounding public decisions of scientifically complex assessments, considerable differences persist about how best to conduct public participation. In the context of Superfund, and other public programs involving scientifically complex assessments, these differences in the practice of public participation are, at least in part, due to the different goals and objectives that exist among the managers and among those who participate in public participation processes.

Current research into public participation seeks to develop improved conceptual and theoretical understandings of public participation that lead to the development of
better processes for conducting public participation (Webler & Tuler, 2002). While the body of academic literature on public participation is growing, when viewed holistically, it is recognized as diverse, dynamic, and lacking consensus on key needs and future directions (NAS, 2008). The different goals and objectives observed in the practice of public participation are mirrored in current research. As recently stated in the preface to the National Academy of Sciences’ (2008) report titled, Public Participation in Environmental Assessment and Decision Making,

“A growing literature has offered theory to define and justify public participation, has proposed tools and strategies for participation, and has begun to examine what happens in participation processes. But this literature, while substantial in size and including much work of high quality, has not been cumulative. It provides no overall assessment of whether or not, in general, public participation enhances environmental assessments and decisions; those designing public participation processes have trouble extracting lessons from it; and it does not reflect a consensus about the key questions requiring further research.”

Current major strands of public participation research are reviewed using a typology developed by Webler and Tuler (2002). Moreover, a personal assessment is offered of the theoretical and practical value derived from each strand of research. From this assessment, the communicative research tradition is presented as a particularly effective strand of research for supporting the objectives of this research. Current gaps in knowledge within the communicative research tradition that this research responds to are identified. In particular, this research responds to the need for empirical research that evaluates diverse ways by which people actively engaged in public participation on scientifically complex issues think about their public participation decisions.
Current Knowledge on Science as a Source of Controversy

The literature review begins by situating the current understanding of science as a primary tool for managing our environment within a continuum of prevailing thought through 20th century, and it identifies the critical responses that have emerged in response to this movement. After establishing this larger framework for understanding the evolving role of science in public decisions about the environment, current knowledge on the reasons why science is not only helpful but can also be a source of controversy are identified and described. The list of reasons identified for the conflict range from functional barriers, inherent complexities and limitations of science, psychological theories, and sociological theories. This information is then assembled into an interdisciplinary perspective that recognizes the varying perspectives that people have that lead to tensions and communication challenges.

A Historical Account of Science-based Decision-making

Few would deny that the modern technological era is providing a high quality of life for many, but it is also creating an ever growing list of potential risks that must be managed. Environmental contamination, climate change, genetically engineered foods, and resource-intensive land use are but a few of the many challenges that are being responded to by various public agencies in the U.S. today. As science has given rise to technologies that can make our lives more comfortable, science has also become increasingly important for informing decisions about how best to manage our environment.
Science became embedded in public decision-making processes on issues pertaining to the environment long before hazardous waste issues were recognized in mainstream thought and before Superfund was created. In *The Western Confluence*, McKinney and Harmon (2004) lay out the manner by which contemporary bureaucracy and agency decision-making on environmental issues has become constrained (likely described more as gridlocked by many) by numerous and often competing or overlapping laws, jurisdictions, and ideologies that have become established over the course of history. To begin to understand how science can be a source of controversy, it is important to recognize how notions of science are intertwined within this broader complex framework of agency decision-making.

As the West became settled and the desire to optimize the allocation and use of resources became a necessity, expert management emerged as one of the dominant ideologies for governing (McKinney and Harmon, 2004). Professional resource specialist were called upon to provide rational planning, scientific investigation, and objective analysis to most efficiently meet social needs and maximize economic benefits. The dangers of involving the public in public administration issues were recognized by President Woodrow Wilson (1887, p. 210), who stated, “Directly exercised in the oversight of the daily details and in the choice of the daily means of government, public criticism is, of course, a clumsy nuisance.” Early proponents of this ideology, such as Gifford Pinchot, the first Chief of the U.S. Forest Service beginning in 1905, argued for centralized control of resource management as a mechanism for separating politics from science and thereby ensuring the full benefits of scientific management. President
Theodore Roosevelt was also an ardent believer in the promise of science to bring efficiency and optimization to government administration and decision-making. This efficiency was to be achieved by using the latest scientific expertise to replace marketplace completion with reasoned planning, and to create a central authority to make optimal decisions (Fisher, 2000; Hays, 1959).

In this era, politics was viewed as the proper sphere for public involvement, and administration was to be insulated as much as possible from political interference and left to professionals. This kind of categorical thinking about how government should operate was a hierarchical, top-down model of administration and democratic accountability (Thomas, 1995). These kinds of fundamental ideologies have supported the creation of every land management and environmental agency that has been created since (McKinney and Harmon 2004, p. 67).

Today, government agencies are provided their mandates through myriad laws and regulations. Moreover, states, counties and tribal governments maintain environmental laws and agencies to manage those laws. While each law and agency was created to address an environmental need, the end result today is a complex web of laws and regulations which can have mixed mandates that confuse and complicate issues. Within the ideology of expert management, the assessment of these complex issues is delegated to the expert scientist, engineer, or attorney. Harvey Brooks, an academic pioneer in the merger of science and public policy and a distinguished Harvard professor for more than three decades, stated, “Much of the history of ...progress in the
Twentieth Century can be described in terms of the transfer of wider and wider areas of public policy from politics to expertise” (Fisher, 2000, p. 5).

The notion that resources can be managed best through centralized control and professional experts derives itself from a positivistic worldview that dominated much of 20th century thought. A fundamental element of this worldview as applies to resource management and environmental issues is the hope and belief that through objective scientific inquiry humanity can optimize the management of natural resources. The roots of positivism date back to the eighteenth-century Scottish Enlightenment author David Hume, who is generally regarded as the founder of the positivism, but it was Comte who coined the term ‘positive philosophy’ in the nineteenth century (Delany & Layton, 2004). According to Delany and Layton (2004), Hume’s work initiated the positivist worldview by questioning whether knowledge based on individual facts was possible. However, by the nineteenth century and contrary to Hume’s initial skepticism, proponents of positivism regarded scientific knowledge as the sole form of certain knowledge and even as the solution to collective problems facing humankind. Delaney and Layton (2004) use the term “neo-positivism” to describe this contemporary perception of the positivistic movement.

Unfortunately, after a century of technocratic management, a large number of citizens have become increasingly dissatisfied with the progress made on environmental issues. Pollution lingers despite 40 years of management by the EPA, disputes about forest management continue seemingly unabated while widespread forest die-off and forest fires emerge and are attributed in large measure to historical management
practices, new challenges to address biohazards and nanoparticles emerge as a result of scientific ‘progress’, to name but a few examples. Using the EPA as a specific case in point, despite over three decades of effort, large capital investments by both government and industry, and many environmental improvements, a large part of the public continues to perceive risks posed by chemical contamination as a substantial threat to public health (Brown & Mikkelsen, 1997; Steingraber, 1998; Kroll-Smith, 2000; Edelstein, 2004). How people perceive the risks can be much different than suggested by technical risk assessment (Kraus et al. 1992, Flynn et al. 1994). Controversy can emerge when public perception of risk differs from conclusions derived from technical assessment. As asserted by Fisher (2000, p. 30) for example, public confidence in professionals and technology has declined as they are perceived to be more interested in increasing their own authority, power and wealth. Similarly, Beck (1992) postulates that modern societies are shifting their focus from the types of social structure needed to manage the distribution of goods to a different social structure that can effectively manage the distribution of ‘bads’.

Much of the critical response to use of science as preeminent tool for environmental management can be understood as part of the emergence of a post-positivistic worldview (Fisher, 2000). Post-positivism holds that reality can never be fully understood or explained because of the multiplicity of causes and effects and because of the social construction of meaning that restricts pure objectivity. This perspective challenges the belief in the role of science as a purely objective tool for use in resource management decisions. Rather, science is understood to be shaped by certain
underlying sociocultural practices of scientists. In other words, science is a human endeavor and scientists cannot therefore be expected to be purely objective in the application of science in decision-making processes pertaining to the environment.

The subsections that follow review the current literature on the underlying sources of controversy that exist today on issues of scientific complexity, and areas of sociocultural bias in the application of science are identified.

**Disparate Expertise and Resources**

One of the first experiences that a person likely has as they try to engage in a scientifically complex public controversy, like a Superfund cleanup, is the amount of time and expertise it takes to understand the issues and otherwise participate effectively in advancing their interests. Science-based assessments such as the site investigation studies, risk assessments, and remedy designs described in Chapter 1 are complex (see a Superfund Focus). It takes much time, money and expertise to conduct scientific investigations. The reports and plans generated tend to rely upon specialized terminology that efficiently and effectively communicates to other technical specialists but can be a barrier for communicating to those outside their disciplines (National Academy of Sciences, 2008; Folk, 1991; National Research Council, 1989).

Often times, efforts by the agency to engage interested parties in the scientific investigation process come up short. The public meetings are too infrequent, the information is not adequately understandable to a general audience, and efforts to engage the public often result in failed attempts to substantiate and defend the technical basis for the work and decision. In cases where agency objectives for the
project or the public participation process are inconsistent with the objectives of the interested public, frustration and anger can arise (Kauffman, 1995; Edelstein, 2004). Concerned citizens and other stakeholders generally do not have the training, time, money or resources to participate in science-based assessment on equal terms with those who sponsor or otherwise conduct the studies.

**Dueling Experts and Implications to Trust**

A common and natural response to these inequities of resources is for the various stakeholders engaged on an issue to seek out their own experts to ensure that the science is done correctly or otherwise addresses their concerns. One motive for EPA’s TAG program is to provide money to citizen groups so that they can have the kind of trusted expertise needed to understand the science. However, this response has given rise to the frequently observed problem called ‘adversary science’ (McCreary, et al, 2001) or ‘dueling experts’ (Ehrmann & Stinson, 1999). In some cases, this can be the result of an overt effort by one party to ‘out gun’ another party by applying the expertise of select scientists to achieve an agenda. Adversary science is commonly and clearly “practiced” when decisions are litigated. However, problems can also emerge in more subtle ways.

The process of scientific discovery involves much advocacy and critique as scientists seek to advance the importance of their work, the soundness of their methods, and the robustness of their work (Fischhoff, 2007a). Uncertainties about the scientific findings are made explicit. Moreover, other scientists typically engage in a critically review of the findings. Other scientists may find it necessary to repeat the
experiments or assessments that produced the findings or conduct different types of experiments or assessments. It can take many years to reach broad consensus among scientists on new findings. When scientific processes are applied within a general public setting that involves vested interests in the outcome, the arguments of the engaged scientists or technical experts can appear more like advocacy. The ability to conduct science objectively becomes questioned. Issues about uncertainty (such as those described in the next subsection) can become amplified or misrepresented through communications such as the news media (Scherer & Cho, 2003; Taylor-Gooby, 2004). Repeated experiences by the public with ‘dueling’ scientists (and technical experts more generally) that cannot come to agreement on issues can diminish the public’s trust in scientists (Fisher 2000; Ward, 2008).

**Scientific Uncertainty and Burdens of Proof**

Standards of practice among scientists regarding burdens of proof can also run counter to social values and agendas. The incongruity of scientific norms with public values is clearly articulated by Tesh (2000, p. 77), who states:

“Despite what most laypeople might imagine, environmental epidemiologists do not directly ask whether exposure to pollution has caused disease. Instead, they go about it backwards, always starting with a negative hypothesis: that there is no correlation between exposure and disease. Every study’s aim is to disprove that hypothesis. The disproof demands a high level of certainty. Investigators must show, using a standard mathematical formula, that no more than a 5 percent probability exists that their findings could be the result of chance. In other words, epidemiologists must be 95 percent sure before they will conclude that a correlation exists between exposure and disease...”

Tesh (2000, p. 77) continues by arguing that scientific certainty is fine if the aim is to add to scientific knowledge and you want to be certain of your results, but if your
aim is to protect public health the high standard of certainty “both robs you of a scientific rationale for doing so and justifies those who would expose the public to potentially harmful substances.” This is an unethical standard according to Tesh, who states that, “if Science reflects the culture in which scientists live, then as cultures change so should science” (Tesh, 2000, p. 78). From this cultural perspective, resistance to change in how science addresses uncertainty can be perceived as a form of hegemonic entrenchment of existing social norms and sources of power.

Scientific uncertainty extends into many areas: is cancer prevalence the result of widespread contamination, are the myriad of manmade chemicals that have little or no scientific information toxic, how do we respond to the lack of information about potential synergistic effects of chemicals or effects on understudied and potentially sensitive subpopulations, how accurate are toxicological studies that extrapolate effects observed in animals to humans in order to set exposure limits, and so forth. Scientific uncertainty limits the ability of epidemiologists, toxicologists, and public health officials more generally to provide certainty that the exposed populations may want or expect or think is possible. In Superfund risk assessments for example, default assumptions are commonly applied to fill gaps in complete knowledge. Accordingly, there are limits to how conclusive risk assessments can be about potential impacts to human health and the environment.

At a policy level, a widely applied response to such concerns about scientific uncertainty and burdens of proof has been the Precautionary Principle. One of the most
globally accepted definitions of the precautionary principle is found in Article 15 of Rio Declaration that emerged from the Rio Conference or “Earth Summit” in 1992:

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."4

Similar principles are identified in numerous other international agreements as well as national and local government policies around the world. This principle essentially allows for discretionary decisions by decision-makers in situations where there is evidence of potential harm in the absence of complete scientific proof. This principal is not embeded within the Superfund program. Even if it were, the judgment required in the application of this principal in public decision-making processes still leaves ample room for disagreement and controversy among engaged stakeholders.

**Risk Assessment as a Paradigm for Managing Uncertainty**

As a subset of issues pertaining to science more generally, differing perceptions of risk assessment have become central to many environmental controversies. Risk assessment practices are established in many areas of environment and public health management, such as pesticide registration, food safety, transportation, permitting of industrial facilities, and so on. Most relevant to this research is the formalized set of risk assessment practices that has been established by the EPA.5 As previously described in Chapter 1 (see A Superfund Focus), risk assessments are used to identify that a chemical

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5 See [http://www.epa.gov/oswer/riskassessment/risk_supersfund.htm](http://www.epa.gov/oswer/riskassessment/risk_supersfund.htm)
contamination problem exists and to determine a numerical set of cleanup goals for remediating contamination where it is identified at concentrations of potential concern to human health or the environment.

For example, a risk assessment may conclude that all portions of a residential yard that contain lead, arsenic or other contaminants above a determined threshold concentration should be remediated. The remediation is expected to reduce future exposure to any remaining contamination to levels below which adverse health effects will not occur. For carcinogenic chemicals, like arsenic, the regulatory default assumption is that there is no threshold level below which there is no potential for causing cancer. Accordingly, policy has been established that seeks to reduce risk of cancer as a result of exposure to chemicals to levels in the range of 1 in 10,000 to 1 in 1,000,000 (U.S. EPA, 1990). Not surprisingly, people respond differently to the idea of having residual contamination remaining in their yard, or wherever the exposure may be coming from in a specific situation. As will be shown for the sites studied in this research, some people do not see the need for cleanup while others do not accept the idea of exposure to contamination no matter how small.

EPA style risk assessments can provide valuable information to government experts. The assessments provide a consistent basis for assessing risk across multiple sites. This is helpful to decision-makers who must justify regulatory decisions, set priorities, and allocate resources in accordance with prescribed guidelines. For

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6 The cancer risk values presented are the incremental increased risk from exposure to hazardous chemicals. As a point of reference, the lifetime background risk of getting cancer in the United States is 1 in 3 (U.S. Department of Health and Human Services, 1990). Background causes of cancer include both inherited genetic and environmental (both anthropogenic and natural) origins.
Superfund, many of the prescribed guidelines such as prescribed levels of acceptable risk (see above) and criteria for selecting a remedy (see Chapter 1, A Superfund Focus) are contained in the National Contingency Plan (U.S. EPA, 1990). To simplify the process of justifying regulatory decisions, it is natural to expect decision-makers to seek a risk assessment that presents risk in an objective as possible manner and to have the risk assessment focus on the issues that pertain to the prescribed criteria.

When held accountable before a diverse public however, EPA style risk assessment cannot by itself serve as an effective risk policy and management tool if the risk assessment process does not address the factors that influence peoples’ perception of risk and if the reasons for a particular decision are not well communicated to the public. In a 1997 report prepared by a Presidential/Congressional Commission on Risk Assessment and Risk Management (Omenn, et. al. 1997, p. 39), the panel of nationally recognized risk assessment experts state,

“Technical risk assessments seldom set the regulatory agenda, however, because of the different regulatory goals specified in the various environmental statutes and the different ways in which the public perceives risk... Effective risk communication is critical to successful implementation of the Risk Management Framework”

Concurrently, the methodologies for assessing and managing risk are becoming more complex as more scientific information becomes available. This added complexity creates additional communication challenges for those tasked with explaining the risk assessments to the public. As Löfstedt and Frewer (1998, p. 13) observe, “…there is the notion that the role of globalization has made society more complex and more difficult to understand, forcing individuals to rely more on policy makers, industrial officials and
other authorities. The public of today are forced to trust various types of experts in order to cope.” By having to rely on experts to assess the risks associated with modern technology, a greater need for trust in this expertise by the public is created. Achieving such trust is often confounded, however, by the challenges of risk communication that in turn are rooted in the diverse ways in which people perceive, communicate and respond to risk.

This is point in the unfolding of the sources of controversy in scientific investigations that can become truly confounding to the typical concerned citizen who decided to engage in something like public participation around a Superfund cleanup. Upon recognizing the resource challenges inherent to participation, it is often the case that a truly committed citizen can overcome the challenge of procuring a federal grant, like a TAG, that allows them to hire a technical expert to track the issues more closely and help them represent their interests within the technically oriented framework used by the agency. Citizens with the courage to speak out are also generally able to express their interests about acceptable levels of scientific uncertainty and risk, at least in general terms. However, where issues of risk are involved and where the citizens’ requests are not acted upon, it is hard to image that citizens, or the agency decision-makers for that matter, can understand why it is that they perceive the nature of the problem and needed solutions so differently. A high degree of self awareness and awareness of the perspectives of others is required to recognize the influences on risk perception. The explanation for these challenges is rooted in the psychological and cultural influences on risk perception.
Psychological and Cultural Influences on Risk Perception

On an individual, psychological level, the perception of risk is affected by emotional factors relating to dread: fear of unknowns (e.g. few understand toxicology), fear of catastrophic events (e.g. the world will be poisoned or they will be harmed), and fear derived from lack of personal control (e.g. decisions made by little trusted government agents) (Slovic, 1987). Numerous other psychometric factors such as degree of personal control, perceived fairness, trust, personal benefits, and general emotional state have been identified throughout the literature. Further discussion on these factors is provided in Chapter 4, wherein further literature review is provided to support the development of the mental model that emerges from this research.

For the current purpose of generally understanding psychological influences on risk perception, consider the “white male” effect observed by Flynn et al. (1994). In a national survey in which perceptions of environmental health risks were measured for 1275 white and 214 nonwhite persons, the authors observed that 30% of the white males surveyed judged risks to be extremely low when compared to females and non-white males. This subgroup of white males was better educated, wealthier, politically more conservative, and characterized by trust in institutions and authority. In a later review of this study, Paul Slovic (1997, p. 402) postulates that, “Perhaps white males see less risk in the world because they create, manage, control and benefit from many of the major technologies and activities.” Stated differently, the extent to which a person trusts those in power strongly affects a person’s attitude and perception of risk. Slovic (1997, p. 402) goes on to conclude,
“To the extent these sociopolitical factors shape public perception of risks, we can see why traditional attempts to make people see the world as white males do, by showing them statistics and risk assessments, are often unsuccessful. The problem of risk conflict and controversy goes beyond science. It is deeply rooted in the social and political fabric of our society”.

As people perceive issues such as trust and power being enmeshed with technical assessment, ways of thinking about the problem at hand become more complex than simply trying to understand the science. A long history of empirically supported research dating back to the 1970s indicates that individuals can use some combination of two modes of thinking: an analytic system and an experiential system (Slovic et al., 2004; Slovic, 2000). The experiential system tends to be favored by people when decisions must be made quickly, decisions require understanding complex information, or decisions involve a substantial amount of uncertainty. In such situations, factors such as trust in the decision-maker, fairness of the process, degree of personal control of the outcome, the amount of personal benefit, and other such factors are applied within the experiential system to aid in making decisions. Conversely, the analytical system tends to be favored when a person has the time to logically assess the information, has the ability to work with numbers and abstract symbols if necessary, and has the interest to derive a logically justified decision.

Using this experiential/analytical distinction, one can surmise that individuals from the general public, who have limited time, resources and specialized expertise to evaluate a risk assessment may rely upon an experiential decision-making process. Conversely, agency and industry personnel that are provided with the necessary
resources to conduct detailed assessments and who are required or otherwise motivated to logically justify their decisions would favor the analytical system.

Care must be exercised however in perceiving that people, be they scientists or lay citizens, rely purely on the analytical system or the experiential system when evaluating information and making decisions. Slovic et al. (2004, p. 321) express this point very elegantly:

“It is sobering to contemplate how elusive meaning is, due to its dependence upon affect. Thus the forms of meaning that we take for granted and upon which we justify immense effort and expense toward gathering and disseminating “meaningful” information may be illusory. We cannot assume that an intelligent person can understand the meaning of and properly act upon even the simplest of numbers such as amount of money or numbers of lives at risk, not to mention more esoteric measures or statistics pertaining to risk, unless these numbers are infused with affect. ... [Affective] feelings form the neural and psychological substrate of utility. In this sense, the affect heuristic enables us to be rational actors in many important situations, but not in all situations. It works beautifully when our experiences enable us to anticipate accurately how we will like the consequences of our decisions. It fails miserably when the consequences turn out to be much different in character than we anticipated.”

While psychology provides one framework for understanding how different individuals might perceive risks differently, sociology provides another framework for understanding risk perception. Several studies have examined the distinct types of worldviews that are believed to influence individuals’ perception of risk (Peters et al., 2004; Adams, 1995; Thompson et al. 1990). Peters et al. (2004) applied an experimental study design to evaluate the effect of worldviews and other emotions on risk perception. Their worldview definitions drew out of prior research on worldviews associated with nuclear power (Peters & Slovic, 1996), and are is summarized here as follows:
• **Individualists** favor personal judgment and self regulation. They tend to believe that people will produce the abundance that would make up for any hazards that are created in the process.

• **Hierarchists** are group oriented, favor social organization and the maintenance of authority. They tend to foster the view that nature is robust and ascribe to sustainable development type doctrines.

• **Egalitarians** tend to be more group oriented, believe in low levels of stratified rules, frame risk-related issues in more ethical terms, and not trust government experts. They are more likely to display emotional responses to risk-related issues.

• **Fatalists** are more isolated and tend to focus on individuals rather than groups. They are resigned to stringent controls on their behavior and have a “why bother” attitude toward risks.

Based on self-reporting scores of 198 participants about perceived risks from various sources of radiation, the authors found that participants high on hierarchical, fatalist and individualist scales perceived lower risks, less negative emotional affect, and less stigma. They proposed a model to explain how affective reactivity interacts with worldview to shape an individual’s overall emotional appraisal of risk (Figure 1). These emotional appraisals were observed to result in negative emotions that in turn shape risk perception. When the negative emotion is repeatedly generated, a deeply rooted stigmatizing of the issue occurs.
Overall, individual differences in affective reactivity and worldviews were associated with the strength of emotional appraisals that were in turn associated with negative emotion toward risks from more stigmatized sources of radiation. Accordingly, the authors conclude that “two persons can witness the same series of events but appraise them quite differently due to individual or cultural differences” (Peters et al., 2004, p. 1362). This assessment of different ways in which people relate to each other predicts that risk perception is not so much a deliberate thought process, but rather an expression of underlying assumptions about the relationship of the individual to society.

Cultural influences on trust and perceptions of scientific validity were also observed in an assessment of the stakeholder interactions in the cleanup of a U.S. Department of Energy site by Hamilton (2003). Tensions at the DOE site between technocrats and the general public were found to involve competing definitions of public involvement. The technocrats preferred to work within established processes that “legitimate scientific decisions” (Hamilton, 2003, p. 298). Hamilton observed that,
in contrast to the technocrats, the general public viewed established processes with distrust and sought more ‘open’ forums for public participation and decision-making.

The psychological and sociological perspectives on risk and science more generally suggest that multiple experiential and analytical processes are used to interpret the situation and access risk. In complex situations where the concerned public is forced to rely upon the expertise of others, the way in which people assess the situation tends to invoke these more psychological and sociological perspectives on risk. A further review of the literature and identification of those factors thought to pertinent to making public participation decisions at Superfund sites is provided in Chapter 4.

In summary, there are many sources of controversy involved in the application of science to address the complex environmental problems we face today. This review began by addressing fairly easy to recognize sources of controversy such as barriers to obtain adequate information on a timely basis and having the appropriate expertise to understand the issues. Moreover, there are numerous problems inherent to the application of scientific processes within a public setting where vested interests are at stake that can lead to the condition of adversary science. This tends to diminish public trust in the scientists and contribute to controversy. Science has certain limitations as a practical decision-making tool that derives from the lack of complete knowledge, the need to address uncertainty, and established scientific norms for burdens of proof that may not align with some individuals’ cultural perspectives. In addition, there are numerous psychological and sociological perspectives that people can use to differentially interpret risk.
Current Conceptual Frameworks for Understanding the Practice of Public Participation

While much of the 20th Century involved the creation and expansion of a technocratically-grounded government that was to objectively employ the scientific method to make optimal and effective decisions about environmental issues, the governmental decision-making process has become mired in controversy. Based on what we currently know about science-intensive controversy, public decision-making processes must address more than just the scientific and technical challenges. Public decision-making on issues of concern to the public must be able to integrate people’s diverse perspectives about the issues and how public participation should be conducted. Better processes are sought for bringing citizens, experts and decision-makers together in a manner that allows the important technical and social issues to be expressed, evaluated and made relevant to decision-making. Also, to effectively bring parties together, the process must be recognized as fair and mutually beneficial (Paterson, 1995). Methods of decision-making are sought that better meets the diverse needs and perspectives of those affected by the decisions in a diverse and democratic society (Fischer, 2000; Slovic 2000; Leighninger, 2006; Brown & Mikkelsen, 1997; Carpenter & Kennedy, 2001).

There are many ways whereby citizens may interact with government. These may include participating in special interest groups, taking legal actions against government, holding demonstrations, producing media messages or politically motivated art, and many other related actions (Cox, 2006; Carpenter and Kennedy,
However, the term public participation has become recognized as a specialized form of government interaction, although specific definitions vary. A recent publication by the National Academy of Sciences (NAS, 2008, p. 11) defines public participation as:

“organized processes adopted by elected officials, government agencies, or other public- or private-sector organizations to engage the public in environmental assessment, planning, decision making, management, monitoring, and evaluation…any of a variety of mechanisms and processes used to involve and draw on members of the public or their representatives in the activities of public or private-sector organizations that are engaged in informing or making environmental assessments or decisions.

The International Association for Public Participation (IAP2, 2006, p. 3) has adopted a similar definition of public participation as:

“Any process that involves the public in problem solving or decision making and uses the public input to make decisions. While there is an element of dispute resolution in all public participation, the essence of public participation is to begin a participatory process before disputes arise. Public participation includes all aspects of identifying problems, developing alternatives, and making decisions.”

Current EPA policy for public participation in Superfund is found on their website:

“The goal of Superfund community involvement is to advocate and strengthen early and meaningful community participation during Superfund cleanups. Superfund community involvement staffs at Headquarters and in the Regions strive to:

- Encourage and enable community members to get involved.
- Listen carefully to what the community is saying.
- Take the time needed to deal with community concerns.
- Change planned actions where community comments or concerns have merit.
- Keep the community well informed of ongoing and planned activities.
- Explain to the community what EPA has done and why.”

See http://epa.gov/superfund/community/.
Common themes to these definitions of public participation is the focus on processes that seek to involve the public in agency decisions, yet stopping short of conceding any direct control or authority for the decisions. Various general conceptualizations for how this should be done have been advanced.

The analytical-deliberative model established by the National Research Council (1996, Figure 2) is an often referenced general framework for representing how public officials, scientists, and the affected public should work together.

**Figure 2. Analytic-Deliberative Framework Proposed by U.S. National Research Council**

![Diagram of Analytic-Deliberative Framework](source.png)

Source: National Research Council, 1996

Figure 2 illustrates how various participants are to engage jointly in a structured process that leads to a decision and also carries forward through implementation and evaluation of the decision. The steps in the structured process leading up to a decision are:

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8 This is the most readable version available in documents retrievable electronically through the internet.
• problem formulation,
• process design,
• selecting option and outcomes,
• information gathering, and
• synthesis.

Importantly, as the participants move through the process, they jointly engage in analysis and deliberation. Analysis is used to organize and evaluate the data in a scientifically rigorous way, while deliberation enables scientists, public officials and affected parties to interact, learn, and provide feedback throughout the stages of project.

Another conceptual framework for understanding how participants should work together to conduct risk assessments was prepared by a Presidential/Congressional Commission on Risk Assessment and Risk Management (Omenn et al., 1997). This framework, shown in Figure 3, shows all stakeholders centrally engaged in all steps of risk assessment and risk management.
Of course, it is one thing to establish such generalized conceptions of how participants should work together, and quite another thing to find ways to make it work in practice. The challenge involved was effectively captured by the Presidential/Congressional Commission (1997, p. 39):

“Risk assessment can provide valuable information to those who set environmental, health, and safety regulatory priorities, allocate resources within regulatory agencies, and make regulatory decisions. ... After a decade of research at leading universities and experiences at all levels of government, much has been learned about how to enhance effective risk communication to gain the confidence of stakeholders, incorporate their views of knowledge, and influence favorably the acceptability of risk assessments and risk management decisions. That knowledge is not reflected commonly in practice, however.”

Not only are these conceptual frameworks for conducting public participation uncommonly practiced, criticisms remain that these frameworks are fundamentally flawed. While recognizing value in having public officials, scientists, and other affected
parties engage jointly in a structured process leading to a decision, Fisher (2000, p. 250) argues that this approach continues to characterize science as purely objective, and that the process of applying scientific principles on projects is still only in the domain of scientists. Deliberative participation, he argues, remains outside of science. Rather, what is needed is a conceptual framework for public participation that perceives science and multi-stakeholder deliberation as a continuation of the same activity – namely that of creating mutual understanding.

While there is reasonable agreement on what public participation is and to some degree at least agreement about how it should work, differences are more problematic concerning the purpose for conducting public participation. IAP2 (2006, p. 5) identifies four reasons why managers may want to involve the public:

- “It is required.
- You are frustrated or even desperate.
- You believe there is some value.
- You will get some advantage from doing so.”

However, the regulatory requirements to conduct public participation are often more limited in scope. Similar to what was described in Chapter 1 in terms of the minimum public involvement requirements for the EPA, public participation can often be limited to intermittent opportunities for the public to comment on agency documents or to express themselves at public hearings. These minimums may be appropriate in circumstances were little demand for public involvement exists. However, the application of such minimalistic approaches in the face of higher levels of
public interest can lead to legal or political quagmires for agency managers that can frustrate efforts to move forward.

Where increased levels of public interest in a decision exist, managers may recognize certain value or advantage in applying more involved and appropriate forms of public participation. Such value or advantage is commonly recognized to involve improved decision quality, increased legitimacy of the decision-making organization, or improved decision-making capacity of the engaged public (NAS, 2006). Within these rather broad and general categories lay a host of more specific benefits for public participation such as:

- Embracing democratic principles and philosophies,
- Improved integration of diverse perspectives into decisions,
- Improved sharing and distribution of key information,
- Increased mutual understanding of and transparency in the basis for a decision, and
- Improved relationships between people that carry into future work.

Considerable discretion exists within agencies about when and how public participation is implemented that allows agency managers to respond to the varying degrees of complexity and public interest that may exist on any specific issue. However, that discretion can also extend to and draw from the different goals managers may have for public participation. Agency officials may not be explicit about the purpose for public participation, and the real intent or perspective of any individual manager in any specific situation can vary considerably from the broadly stated policy objectives of the
agency and the public participation objectives of the affected public. As indicated by the NAS (2008, p. 43), “this situation leaves considerable room for ambiguity, misunderstanding, and contestation over who should participate, how, when, and with what kind and degree of influence.” In short, opportunities exist to improve the knowledge and practice of public participation.

**Major Strands of Public Participation Research**

Currently, a number of different strands of research exist for integrating science into public participation. These were recently compiled by Webler and Tuler (2002) into the following typology, which is delineated in further detail below:

- **Management Theory** seeks improved understanding of effective decision-making from the manager’s perspective and is concerned with strategies for balancing the need for quality against the need for public acceptance.
- **Collaborative Learning** is a method of practice based on learning theory as applied to collaborative contexts; it also is attentive to the broader societal and human development benefits of public participation that go beyond the issue or decision at hand.
- **Decision Analysis** is supported by decision theory and responds to a technical persons’ desire for quantitative clarity and optimal outcomes in the decision making process.
- **Procedural Justice** seeks to provide an ethical foundation for the practice and evaluation of public participation and somewhat assumes fair process will result in fair outcomes.
Democratic Theory provides a political philosophy and political science foundation for public participation.

Evaluation seeks to induce some commonly recognized and useful metrics for assessing the quality of public participation outcomes in different contexts.

Communication Theory seeks to provide a normative foundation for public participation that is grounded in theories pertaining to effective communication and that emphasize fairness and competence as key variables of effective communication that achieves mutual understanding.

As proposed by Webler & Tuler (2002), the different strands of public participation research involve a range of conceptual, theoretical and methodological bases that suggest the possibility for further debate and refinement. For example, where the communicative approach seeks to establish a normative theory of what constitutes effective communication, procedural justice provides a conceptual framework for understanding concerns for fairness, and decision analysis seeks to establish criteria for evaluating complex decisions. Accordingly, the typology is perhaps reflective of the multiple ways by which public participation is understood, studied, and practiced. Moreover, much public participation research has been descriptive in nature, seeking to observe and distill best practices, rather than theoretical. As stated by Webler and Tuler (2002, p. 179), “the need for better conceptual and theoretical understandings of public participation has become clear.” As the first known effort to establish a typology of public participation research, the current typology reflects the diverse and sometimes overlapping perspectives of public participation research. A
typology has yet to be proposed that establishes a clear or thorough history of
descriptive, normative, and explanatory research on public participation.

Regardless of any present shortcomings, the typology of public participation first
identified by Webler and Tuler (2002) is adequately organized to support a review of the
major literature on the topic, and it is well suited to identifying the reasons for selecting
the communicative approach for use in this research. Accordingly, this typology, which
was only briefly described by Webler and Tuler, is described in greater detail and applies
additional references. Moreover, each framework is concluded with a personal critique
which supports the rationale for selecting the communicative approach as an
appropriate framework for approaching this research.

The communicative approach, which seeks to provide a normative basis for what
constitutes effective communication in a public participation process, is selected as an
appropriate framework for approaching this research because it provides a logical and
more politically neutral foundation for advancing a theoretical framework for public
participation than the other theories and concepts of Webler and Tuler’s typology. As
will be demonstrated throughout this subsection, the current state of research suggests
the need for research that can help to establish a more consistent and broadly
recognized basis for understanding why public participation is important and how best
to do it. While “theories of public participation have traditionally not received great
attention, and few theories have been proposed and tested”, theory is “key for
unlocking the puzzle of public participation” (Webler and Tuler, 2002, p. 180). As
summarized by Webler and Tuler (2002, p. 181), theory can inform practice by:
• “Generalizing knowledge beyond each practitioner’s experience.
• Highlighting preconditions that can influence the process.
• Focusing attention on intermediate indicators of desired outcomes.
• Helping match method with purpose.
• Helping predict outcomes of interventions.”

This subsection concludes with an explanation of the theoretical foundation that supports this research. I argue that, among the various strands of public participation research, the communicative research approach is the most appropriate basis for conceptualizing my research. Moreover, I explain how this research contributes to the communicative research tradition by providing much needed additional empirical assessment. In particular, this research evaluates the different perspectives people have of the important technical and social issues surrounding their public participation decisions within a Superfund context.

Management Theory

Management theory is based on observations on how managers make effective decisions (Vroom & Jago, 1978; Vroom & Yetton, 1973). Most notable as applies to the environmental realm, John Thomas (1990, 1995) developed a decision process flow chart that allows the choice of a public participation process to be selected based on seven needs of the agency official (quality requirements, information needs, availability of solution options, need for public acceptance, the potential for public acceptance to be achieved, the alignment of agency versus public goals, and the potential for conflict
to emerge). The theoretical framework upon which the flow chart is premised is identified by Thomas (1995, p. 36) as follows:

“Where the needs for quality are greater, there is less need to involve the public. Where on the other hand, the needs for acceptability are greater, the need to involve the public and share decision-making authority will be greater.”

As my own critical reflection, this approach presupposes that the agency manager’s needs supersede those of other stakeholders and that the agency manager has the best perspective from which a public participation decisions should be based. It is difficult for me to imagine that all of the questions deemed relevant to the decision-making process can be answered in a complete way without first seeking some preliminary involvement from those affected by the decision. While the framework for decision-making that Thomas proposes may aid an agency manager, the systematized process that has been derived from management theory seems to fall short of the broader principles relating to democratic theory. Citizens are not afforded an adequate opportunity to participate in the scoping of the decision-making process.

**Collaborative Learning**

Developed by Daniels and Walker (2001), this method of practice for conducting public participation emphasizes the importance of learning through collaborative processes and emphasizes the goal of improving the situation. Although some methods of public participation practice do not have a strong theoretical underpinning, collaborative learning is notable herein for the degree to which practice is informed by theory. As noted below, it is also noteworthy for utilizing a mental models methodology
that is closely related to the mental models methodology used in this research. It draws upon the following principles, theory and techniques:

1. **Conflict management principles**: Collaborative learning emphasizes a deliberative process that is integrative rather than distributive in its orientation to negotiation, and that strives for consensus outcomes (Daniels and Walker, 2001).

2. **Collaborative learning theory**: Collaborative learning theory sees learning as an active process of creating meaning whereby the learner tries to make sense of something on their own and the teacher serves as a resource or guide to help the learner. This is in contrast to having someone tell you how to do something (Atherton, 2009; Brooks and Brooks, 1993). In applying this theory, the Collaborative Learning focuses most on adult learning and experiential learning. According to Daniels and Walker (2001, p. 79), adults bring more experience, less patience, and little tolerance for being “taught”; they want to learn actively while they are working on the issues important to them.”

3. **Soft systems methodology**: “Soft Systems Methodology” was originally developed in the late 1960’s by Peter Checkland as a modeling tool, but has become increasingly recognized as a learning and meaning development tool. The technique has application to situations where there are divergent views about the definition of the problem (Adrien et al., undated). A seven step process is used to conceptualize the problem, develop a model of the
problem (which are very similar in nature to the mental models presented in this research), and ultimately arrive at solutions to the problem. As described by Williams (2005):

“although soft systems methodology develops models, the models are not supposed to represent the ‘real world’, but by using systems rules and principles allow you to structure your thinking about the real world. The models are neither descriptive nor normative, though they may carry elements of both.”

Daniels and Walker (2001) integrated conflict management principles, collaborative learning theory, and soft systems methodology to develop a five step process that defines the Collaborative Learning methodology:

1. **Assessment**: understanding the nature of the situation and the stakeholders.

2. **Training**: formal instruction on the principles, processes, and outcomes of Collaborative Learning.

3. **Design**: developing a situation-specific strategy for meaningfully involving stakeholders.

4. **Implementation/Facilitation**: use of a third-party neutral to engage the stakeholders in various workshops, meetings, field trips, etc. as defined by the design.

5. **Evaluation**: Data gathering from participants to generate lessons learned.

As a critical reflection, the goal of establishing an environment within which collaborative learning occurs is certainly worthwhile. This kind of learning objective has applicability to the “human development” aspect prevalent in democratic theory as previously discussed (NAS, 2006; see Public Participation as a Response to Controversy).
However, in my opinion the Collaborative Learning methodology may undervalue the real reasons people seek to become involved in government decisions – they seek to affect outcomes! While learning may be a frequent benefit of public participation, by itself, the collaborative learning approach does not appear to adequately encompass the reasons why public participation is necessary.

**Decision Analysis**

Decision analysis provides a method of practice for evaluating complex decisions and determining an optimal solution. Commonly called Multi-Criteria Decision Analysis (MCDA, Kiker et al., 2005) or Multi-Attribute Decision Making (Harvey et al., 2004), the methodology generally requires the quantification of value judgments by assigning scores to various criteria of interest to a particular decision. Decision analysis is based on decision theory, which is concerned with identifying the values, uncertainties and other issues relevant in a given decision, its rationality, and the resulting optimal decision (Peterson, 2009). The notion that value judgments can be systematically structured makes this method of practice worthy of mention within the typology.

As described by Linkov et al. (2004), “The common purpose of MCDA methods is to evaluate and choose among alternatives based on multiple criteria using systematic analysis that overcomes the limitations of unstructured individual or group decision-making.” The process can be as simple as assigning weighting scores to various criteria. This most simplified approach is typically performed during the Feasibility Stage of the Superfund process (see A Superfund Focus in Chapter 1). Often times each proposed remedy will be scored against the various required criteria such as cost or long-term
protectiveness, and the scores are added up for each alternative to determine the overall best option. In a more complex form, weighting mechanisms can be used to favor some criteria more than others. Advanced mathematical methods may be applied within available software applications to support more complex assessments (Linkov et al., 2004).

In my own assessment, MCDA has been developed into a practical tool that can be used to break a large problem down into its component parts, and it can be used to make the basis for a decision quite transparent. It also provides an engineering-oriented efficiency to establishing values and supporting the decision-making process. However, such efficiency can circumvent the kinds of deliberative processes that are necessary to get people to work through their differences in a true spirit of collaborative problem solving.

**Procedural Justice**

Procedural justice provides a conceptual framework that focuses the practice and evaluation of public participation on concerns for fairness in the processes used to achieve outcomes. Political philosopher John Rawls (1999) defines a “perfect procedural justice” to consist of an independent criterion for what constitutes a fair or just outcome of the procedure, and a procedure that can help assure that the fair outcome will be achieved. This contrasts with a “pure procedural justice” system in which there is no criterion for what constitutes a just outcome other than the procedure itself.
While not specifically mentioned by Webler and Tuler (2002), Environmental Justice is an important expression of the procedural justice approach as applies specifically to hazardous waste issues that are regulated by the EPA and in part by Superfund legislation. Environmental justice concerns grew out of awareness that hazardous waste treatment and storage sites are often located in low-income and minority communities, likely because of cheap land prices and less political opposition (Saha and Mohai, 2005). The response to these social injustices seeks to more fairly distribute the “goods” and “bads” of the industrial processes that caused the contamination, seek fair procedures that provide greater voice to all members of the community including the politically powerless, and otherwise reduce or eliminate the exposure to pollution (Bryner et al., 2001).

In 1991, delegates to the First National People of Color Environmental Leadership Summit drafted and adopted 17 principles of Environmental Justice that has served to define many of the aspirations of the environmental justice movement9. In summary, the 17 principles address:

- ecological integrity and sustainability,
- environmental quality,
- social discrimination,
- cultural self-determination,
- access to decision-making processes,

9 See http://www.ejnet.org/ej/principles.html.
• compensation and access to health care when human health or ecological integrity are compromised,

• enforcement of informed consent procedures and a halt to the testing of experimental reproductive and medical procedures and vaccinations on people of color,

• destructive operations of multi-national corporations generally,

• opposition to military occupation, repression and exploitation of lands, peoples and cultures, and other life forms,

• education that appreciates diverse cultural perspectives, and

• wise consumer choices that conserve resources and minimize waste.

Also seeking to provide greater awareness of what the term environmental justice means to adversely impacted people of color and lower income communities, Kuhn (2000) proposed a four-part categorization of environmental justice issues. While Kuhn goes to great length to capture the rich heritage of ideas behind each of these four issues, for the purposes herein they are briefly and simply defined as follows:

1. Distributive justice: the equitable distribution of social goods and bads.

2. Procedural justice: how procedures are implement to help achieve fair outcomes.

3. Corrective justice: processes that restore victimized persons.

4. Social justice: addressing the underlying racial, economic, and political factors in ways that hold privileged classes accountable.
Kuhn concludes his paper by stating: “Compliance with the law, while perhaps sufficient to gain necessary government approvals or avoid the imposition of legal liability, is no longer sufficient if one wishes to achieve environmental justice.” Accordingly, greater discernment in agency decision making processes is called for in order to achieve the aspirations of the environmental justice movement.

Procedural justice is ethically grounded within the ideals of political equality. As Webler (2002) notes, a variety of criteria have been proposed for measuring adherence to procedural justice ideals, such as accurate information, representativeness, participation in decision-making, and the suppression of bias. In my own view, these are practical and necessary standards to consider in a legal or political setting. However, the implementation of this approach in its ‘perfect’ sense does not by itself consider the hidden biases, prejudices, and other difficult to recognize differences between people (such as the psychological and cultural influences on risk perception previously described) that can make it difficult to establish a commonly recognized norm for what constitutes a fair and ethical process or outcome. Processes such as those described under Collaborative Learning above are needed to help elucidate hidden biases where they exist.

**Theories of Democracy**

Democratic theory is normative in nature, and most often consists of a political philosophy that expresses the values believed to be inherent to democratic governance. While public participation in governance is intrinsic to democratic principles, there is no single theory of democracy from which a normative theory of public participation can be
based (NAS, 2006). In evaluating the many theories that have been posited over the years, the National Academies of Science in their report titled *Public Participation in Environmental Assessment and Decision Making* concludes that there are three “broad headings” by which various theories of democracy tend to converge: “political equality, popular sovereignty, and human development” (NAS, 2006, p. 46). Political equality refers to the inalienable right of citizens to participate in making public policies. Popular sovereignty refers to the principle of self government and the notion that government authority derives from the governed. Human development refers to the perhaps less well recognized idea that through democratic involvement people not only advance their interests but come to understand their interests and how those interests relate to others. Through democratic involvement, people learn about each other and become socialized. This learning process is thought to be important in developing private individuals into public citizens (NAS, 2006).

Collaborative governance is an emerging conceptual framework for leadership intended to achieve democratic ideals that has received much recent attention (Ehrmann and Birkhoff, 2005; Leighninger, 2006; Susskind et al., 1999). Collaborative governance is intended “to build the capacity of citizens and officials to engage people with diverse viewpoints in constructive forums with good information” (McKinney and Harmon 2004, p. 232). This statement embodies three of the most basic principles of alternative dispute resolution today; that it is informed, inclusive and deliberative. The underlying ideals of collaborative governance are integral to notions of democracy, and
are not new. Thomas Jefferson is quoted as saying, “...whenever the people are well informed, they can be trusted with their own government...”

Today, collaborative governance is seen to have emerged as a practical and constructive response to the gridlock and public dissatisfaction with prior and present forms of governance of environmental resources (Bolten and Connaughton 2005). It embodies the ongoing challenge facing many public officials today, namely that of assimilating the conflicting values and interests of citizens within science-intensive environmental decisions (McKinney and Harmon 2002). This approach, which has received widespread recent interest, is firmly grounded in the common American values inherent to our democratic form of government – a government that is of, by and for the people.

To summarize the democratic theory in my own terms, it is similar to procedural justice in that it is grounded in political philosophy. As such, it is subject to similar kinds of contested notions and norms, in this case concerning what constitutes an appropriate or right form of democracy. Again, Collaborative Learning type methodologies are needed to elucidate the contested notions and norms in an effective learning forum.

**Evaluation**

Public participation research is also supported by efforts that seek to inductively derive criteria or processes by which the effectiveness of public participation can and should be evaluated. For example, Bradbury and Branch (2006) evaluated the effectiveness of public participation at a U.S. Department of Energy and U.S. Department of Defense hazardous waste cleanup sites to derive an “acceptability
diamond” framework for evaluation. The acceptability diamond (Figure 4) involves four main points:

- **Informative**: addressing the substantive issues.
- **Inclusive**: meaningfully involving all stakeholders.
- **Deliberative**: addressing relationship needs among the stakeholders.
- **Accountable**: being clear on the decision criteria.

At the center of the four points of the acceptability diamond is the need to transparency or information disclosure.

Figure 4. The Acceptability Diamond

This evaluative structure proposed by Bradbury and Branch is similar to the “informed, inclusive, and deliberative” framework previously discussed for Collaborative
Governance in the Democratic Theory section above, and can thereby be readily recognized as drawing from democratic philosophy.

Part of the evaluative literature is also focused on relating certain public participation techniques to certain process or outcome objectives that can be measured. Chess and Purcell (1999) provide a widely referenced review of the evaluative literature that reveals the challenges inherent in trying to establish static and objective norms for evaluating public participation. These authors concluded that the form of public participation does not necessarily determine either process or outcome success, but rather how the agency uses a particular process may have as much or more influence on the effectiveness. The authors point to the need for additional research to better understand the association between process and outcomes.

Any decision-maker benefits from having clearly established criteria by which success can be measured. In the Superfund program for example, the EPA must ultimately be accountable by some measure of performance for having involved the public in their decision-making. However, any form of evaluation must align itself with some philosophical or ideological foundation. The Acceptability Diamond for example, draws much support from the previously described Democratic Theory of public participation. Therefore, while the evaluative research tradition can provide insights that utilize theoretical principles, evaluative research is not in itself a theoretical foundation for understanding public participation.
**Communicative Theory**

Communicative theory seeks to provide a normative foundation for public participation that derives from a recognized ideal of what constitutes effective communication. This approach is presented last in the series to allow it to be compared and contrasted to the other strands of public participation research. Communicative theory seems best suited to transcend political orientations and philosophical orientations that are intertwined with the Procedural Justice and Democratic Theory perspectives on public participation. It does not seek to apply a particular technique, like Decision Analysis, nor does it presuppose needs for certain selected outcomes like Collaborative Learning (i.e. improved shared understanding) or Management Theory (i.e. management efficiency). It does seek to establish certain norms for evaluating effective public participation that are rooted in the essence of the constitutive elements of effective communication.

The prevailing line of research in the Communicative Theory tradition posits that fairness and competence are the most relevant core variables for achieving effective communication within a public participation process (Webler & Tuler, 2000). This line of research applies concepts advanced by Jürgen Habermas (1973, 1979, 1984, 1987, 1991, and 1992) who sought to define the “ideal speech situation” necessary to effectively achieve mutual understanding. Thus, effective communication is understood to be that which achieves mutual understanding. Habermas believed that it was only through communicative actions that commonly recognized standards for reason develop that are needed to achieve mutual understanding. Habermas asserted that the ideal speech
situation involves four validity claims that comprise these commonly recognized standards. As simplified and refined by Webler & Tuler (2000), a valid statement must:

1. make sense,
2. be factually correct,
3. be morally right, and
4. be sincere.

Statements that parties recognize as achieving these four validity claims support effective communication. Free and un-coerced rational discourse between interested parties is recognized by Habermas to provide the conditions necessary for creating mutual understanding and reaching consensus. They must have the right to assert, defend or question any factual or normative claim. This interaction also must not be constrained by activated role or status differences. In short, the interested parties must perceive to have a fair opportunity to contribute to the discourse. Habermas’s theories are thereby understood to advance two meta-principles of effective communication: fairness and competence. Habermas asserted that given enough time, fair and competent communication will always produce agreement (Renn et al., 1995; Jaeger et al., 2001).

While Communicative Theory provides a logical and politically neutral foundation for establishing a theoretical framework for public participation, limited research has evaluated the soundness of the theory in practice. Webler and Tuler have conducted two empirical studies of participatory decision-making process that began to explore the strengths and weaknesses of fairness and competence as a theoretical
framework (Webler & Tuler, 2002). In the case of a forestry planning process in New England, the authors came to recognize that a focus on good process as an adequate predictor of good outcomes was not enough for participants. Participants wanted good process and good outcomes to be considered in parallel. In the case of a watershed planning process in Massachusetts, the authors came to recognize that a normative theory of public participation cannot rely only on fundamental principles, but must also accommodate the contextual features of the specific project. In short, the authors recognize that more research is needed that links fundamental principles with “the complexity of people’s motives and behavior” and “the historical context” within which the public participation process is embedded (Webler & Tuler, 2002, p. 186). In support of their ideas, the authors proposed a simplified schematic depicting how different elements of public participation are iteratively connected (Figure 5).

**Figure 5. Iterative Connection of Public Participation Process with Preconditions and Outcomes**

Source: Webler & Tuler, 2002
Summary and Conclusions

Controversy seems to be inextricably intertwined with science-intensive public decision-making. As described throughout this chapter, existing research indicates that different people may apply different perspectives to understanding science and different people have different ideas about what public participation is, how it should be conducted, and what its goals should be. As people with such differences come together to solve problems, these differences can lead to communication barriers and otherwise frustrate efforts to work together.

There are many competing and sometimes overlapping or interdependent conceptual frameworks, theoretical frameworks, philosophies, and methodologies that can be applied by public agency managers, legislative overseers, and affected citizens to making decisions about how to conduct or engage in public participation. Each has applicability within a particular perspective: Accordingly, the variables deemed relevant to defining a ‘good’ public participation process appear to be at least somewhat contingent upon the perspective one takes toward public participation. Webler and Tuler (2002, p. 179) similarly recognized the need for theory to “acknowledge that different people have different beliefs about what public participation should accomplish.” Notions of what constitutes good public participation are evolving and commonly recognized and measurable norms for evaluating public participation effectiveness have not been established in practice (Webler et al., 2001; Chess, 1999).

This research responds to the previously identified call by Webler & Tuler (2002, p. 186) for more research that links fundamental principles with “the complexity of
people’s motives and behavior” and “the historical context” within which the public participation process is embedded. Moreover, Webler and Tuler (2002, p. 186) identify a need for additional research that addresses “a broad landscape of variables, from preconditions and moderating variables, to variables that depict the deliberative process itself, to processes that capture the significance of the outcomes of the process.”

Accordingly, the primary goal of this research is to empirically identify how different people who are actively engaged in controversy think about their public participation decisions. More specifically, this research expands upon the basic conceptual framework presented in Figure 5 by adding significant specificity and detail to the contextual preconditions, process (i.e. methods of interaction and communication), and outcomes that comprise our understanding of the public participation process. This increased understanding is applied in Chapter 7 to advance communicative theory of public participation and offer practical advice to researchers, policy makers, and those engaged in the public participation practices.

This research takes the position that much of the controversy involved in science-intensive public decision-making originates from the diverse perspectives of those engaged. The communicative research tradition provides an effective and theoretically-grounded perspective from which these differences can be understood and responded to. The essential objective of the communicative research tradition is to find ways that better enable people to meaningfully and effectively communicate and
otherwise constructively work through shared problems and make well-informed decisions.

The Superfund program is selected as an ideal research context for contributing empirically derived knowledge to the communicative research tradition. As described in Chapter 1, Superfund projects are often highly complex and involve considerable controversy. Accordingly, they involve a large number of preconditions that must be considered in a public participation process. Moreover, the Superfund program evokes disparate perspectives among participants about how best to conduct a public participation, and about what outcomes should be achieved both in term of the environmental improvements and the expected benefits from public participation. Projects within the Superfund program invoke considerable complexity across all elements of Figure 5, thereby providing an ideal source of empirical knowledge by which each element of Figure 5 can be assessed in detail.

Consistent with the objectives of the communicative research tradition, this research seeks to explore how people engaged in controversy on Superfund projects think about their public participation decisions. Consistent with Figure 5, this thinking is generally understood to involve contextual preconditions, process alternatives, and outcome objectives. To achieve this objective, this research seeks to apply a novel application of an established and effective methodology for understanding the thought processes people use to make public participation decisions.
CHAPTER 3: METHODOLOGY

This chapter begins by identifying and describing the mental models research methodology that is selected for this research. The reasons why this method is ideally suited for addressing the research questions are provided. Moreover, the epistemological perspective underlying the methodology is described and discussed in terms of relevance for addressing the research questions and the kinds of research outcomes that this research methodology and perspective support. The remainder of Chapter 3 provides a detailed description of the mental model methodology as adapted for application in this research.

**Methodology Selection**

This research applies a Mental Models methodology because it is well suited to the initial exploration of the numerous variables and relationships among variables that describe how people make decisions (Morgan et al., 2002; Fischhoff and Bruin, 2006). As it relates more specifically to the research questions for this research, the Mental Models research design is applied to identify the various components of how people think about their public participation decisions and the inter-relationships among those components.

**Historical Development and Current Applications of Mental Models**

**Methodology**

Kenneth Craik (1943) first proposed that the mind constructs “small-scale models” of reality to anticipate events, to reason, and to underlie explanations. These
small-scale models are constructed from perceptions, imaginations, and interpretations of discourse.

Craik’s work was significantly advanced by Phillip Johnson-Laird, who proposed a mental model theory to explain the basic structure of cognition. He asserted that individuals hold working models in their minds that “play a central and unifying role in representing objects, states of affairs, sequences of events, the way the world is, and the social and psychological actions of daily life” (Johnson-Laird, 1983, p. 397). Mental model theory rests upon the existence of a direct correspondence between entities and the relationships between entities as understood by people (i.e. their mental model) and entities and relationships between entities in the real world. However, all models depict only that which is useful or interesting to achieve some desired outcome, and as such are not complete or necessarily optimized representations of reality (Bara et al., 2001).

John-Laird’s mental model theory challenged prevailing psychological theories that relied upon prepositional logic and logical rules of reasoning to explain how people solved problems and made decisions. In particular, mental modeling theory was shown to have several advantages in explaining why people can make incorrect (i.e. seemingly illogical) and suboptimal decisions (Johnson-Laird et al. 1998). According to mental model theory, individuals focus on information gathering that is consistent with their needs as understood by their existing mental models and are seemingly reticent to seek information that would expand or falsify their mental models.
Mental model theory has been successfully applied to understand thinking and learning in many areas, such as: probabilistic reasoning, temporal reasoning, causal reasoning, modal reasoning, counterfactual thinking, pragmatics, and decision-making (Bara et al., 2001). The breadth of interest in both basic and applied research that relies upon mental model theory is rapidly increasing. A search for “mental model” as a key word term in the Science Direct database conducted on September 15, 2010, identified between one and four articles published per year between 1998 and 1997, followed by a generally steady year-after-year increase to twenty publications thus far in 2010. Article titles identify many applications in understanding how people learn, communicate, and make decisions. For example, mental model theory underlies a study on how children learn about the earth (Hannust & Kikas, 2010), sources of disagreement about workplace safety between managers and employees (Prussia et al., 2003), and the use of information in business decisions (Calantone et al., 2010).

**Mental Models Applicability to Understanding Public Participation**

**Decision-Making**

The practical objectives for all mental models research is to better understand how people learn, communicate, and make decisions. Similarly, the objective of this research on public participation is to better understand how individuals make decisions to engage in technically intensive controversy, specifically at Superfund sites. To do so, this research seeks to identify what information people utilize to understand the issues and how they utilize this information to make decisions about how to participate in the Superfund process. Decisions that lead to forms of participation that can enhance
learning and communication are expected to improve the quality of public participation generally.

As the first known application of the mental models method to public participation, this research takes a first step toward the development of a mental model of the variables involved in the public participation decision-making process. Accordingly, the outcome expectation is more descriptive than predictive in the sense that this mental models research seeks to describe the variables and relationships among variables that people use to make a public participation decision, rather than seeking to predict what kind of decision an individual would make with computational accuracy.

This research draws principally upon the Mental Models methodology advanced by Morgan et al. (2002), which has focused on the practical application of mental model theory to issues involving risks, such as health, safety, and environmental risks. One objective of their approach is to help risk managers and communicators understand public risk perception and communicate more effectively with the public to reduce risk. The object of the communication is to enable better informed decisions. Another objective is to help the public better understand how risks are created and controlled, and how science is applied to understanding risk.

**General Approach for Applying the Mental Models Methodology**

Mental models research involves a systematic process of inquiry that enables differences in risk perception between laypeople and experts to be understood such that more effective strategies for experts to communicate to lay persons can be
developed. Examples of research conducted within this tradition include Niewöhner et al. (2004), who sought to effectively communicate chemical risk protection needs to workers in order to improve workplace safety, and Bostrom et al. (2004), who sought to improve public understanding of climate change in order to design communications that would lead people to take actions to reduce adverse effects from climate change.

These kinds of applications tend to involve phenomena that are well characterized by experts, and the objective is to identify what key information needs to be communicated to enrich the mental models of the target audience and thereby improve their decision-making capability. While the methodology may identify information important to target audience decision-making that experts did not identify, the overall intent is often to develop a one-way communication strategy that is derived by experts for application to a target audience.

However, applications involving two-way communication also exist. For example, Zaksek and Arvai (2004) sought to improve public communication about wildland fire as a necessary component for achieving improved natural resource management. In this case, the risk and benefits of wildland fire varied spatially and temporally across multiple stakeholder groups. The objective was to facilitate a two-way exchange of information between various expert and non-expert stakeholders such that the relevant technical and value-laden information was exchanged. In this kind of application, the mental model method can be used to characterize different mental models that preclude effective communication between stakeholders as well as to
identify misinformation and knowledge gaps that are important to more informed decision-making.

Utilizing the Mental Model methodology developed by Morgan et al. (2002), a mental model is depicted as an influence diagram. An influence diagram is a simple visual representation of a problem you are trying to resolve.\(^\text{10}\) It offers an intuitive way to identify and display the variables and the relationships among the variables that are important to a decision, and in theory, it represents an understanding of the decision problem that is congruent with the mental models that people hold in their minds. The model may illustrate one person’s mental model or it may be inclusive of variables deemed relevant across groups of people. The model is constructed using “nodes” to represent the variables of interest and “arrows” to identify cognitive connections people have among the variables and the ways they relate to or interact with each other. Collectively, the mental model defines the set of variables and relationship among the variables, as understood by individuals or groups of individuals, which pertain to the outcome of interest – in this case public participation decision-making.

The process used in this research to construct the mental model is generally consistent with the methodology developed by Morgan et al. (2002). To address research question 1, the cognitive processes used by individuals and groups to make public participation decisions are identified and expressed in a mental model format. A literature review, interviews with public participation experts in academia, and two workshop discussions among public participation practitioners and academic experts is

\(^{10}\) See [http://www.lumina.com/software/influencediagrams.html](http://www.lumina.com/software/influencediagrams.html) for a brief introduction to influence diagrams.
used to construct an initial expert mental model of public participation decision-making. The proposed mental model takes a first step toward integrating a broad body of knowledge into a single unified framework.

To address research question 2, an empirically-grounded participant mental model is derived. The initial expert model is used to guide the development of an interview protocol that enables data collection for all nodes in the model. The protocol is used to gather data on residents and regulators engaged in public participation at two Superfund project sites. The recorded interview data is then transcribed, and the text is coding and analyzed. For this research, regulators are defined as one type of participant that influences public participation decisions at the project level. Once established, the nodes (i.e., variables) identified in the participant mental model are used to conduct a final coding of the interviews. The coded data is then systematically analyzed to identify similarities and differences in the mental models for groups of participants.

To address research question 3, the participant mental model is compared to the initial expert mental model to elucidate ways in which experts think differently than participants. Variables overlooked or under-recognized by experts are identified by recognizing the new nodes added to the participant mental model. Variables overlooked or under-recognized by participants are identified by recognizing nodes included in the expert model but not used by one or more participants.

**Research Perspective**

An important aspect of social science is to be critically self aware of the perspective or standpoint(s) from which the research is conducted and to reflexively
accommodate that understanding into the methodology used to collect, analyze, and interpret the data. Such ideals for social science research have emerged from the growth of post-positivist thinking described in Chapter 2.

Mental models research that uses experts to construct the initial expert model can reveal understandings that can be viewed as lacking and as beneficial to target audiences. For example, applied mental models research to facilitate public education campaigns to reduce teen smoking may involve the transmission of experts’ knowledge and may be devoted to “correcting” lay misconceptions. However, even in this type of case, it is important to keep in mind that the target audience may have needs and interests that are previously unknown to experts and that are critically important to understand in the development of communications to achieve some desired outcome, such as fewer teen smokers. As Morgan et al. (2002, p. 20) state, “the term ‘expert’ refers to the individuals creating it [i.e. the expert model], without implying that their beliefs are perfect or even superior to lay beliefs in all respects.”

Within applications where differing values and beliefs among stakeholders and between stakeholder and experts exist, the Mental Models methodology can be adapted and applied in ways that seek to define and clarify different perspectives without seeking to assign preferential status to any particular way of thinking. Of course, one must start somewhere to begin building a mental model, and the natural inclination is to start with those who profess to know most about the phenomenon of interest so as to quicken the process of identifying nodes and their dependencies. However, as “non-experts” are interviewed, modifications to the model frequently are
needed to accommodate the different perspectives. Critical assessment of the similarities and differences in the nodes and nodal relationships identified in the original expert model and the non-expert model may be used to re-examine the original “expert” perspective.

The focus of understanding different perspectives tends to locate Mental Models methodology as a more post-positivist approach to conducting research. When applied as a practical problem solving tool, the initiation of the research is not solely reliant or contingent upon existing theory about the phenomenon being investigated. Mental models research can be conducted in the absence of existing theory on the topic of investigation. Also, the initial development of an expert model is not restricted to portraying only those independent and dependent variables that are generally regarded as objective statements of fact. As the research progresses, mental model methodology is more concerned with elucidating people’s understandings and perspectives and less concerned with representing the world in a singularly definable and objective reality. The objective is to understand those variables that are important for communications that affect decision-making and behavior.

Because it is not dependent on the prior existence of theory regarding the subject of the investigation, Mental Models methodology has certain commonalities with and may be seen to tend more toward a grounded-theory approach in comparison to the four other main qualitative research traditions: biography, phenomenology, ethnography, and case study (Creswell, 1998). The grounded-theory research tradition begins by setting aside preconceived theoretical notions, and then seeks to develop or
discover a theory that describes how people act and react to the situation or phenomenon being investigated. The Mental Models research method is similar in that it begins with the researcher identifying a large number of variables potentially applicable to a decision-making situation as understood by subject matter experts on the topic of interest. As applied in this research, there are a large number of variables related to the controversial situation, which can be recognized as the independent variables, and set of public participation options, which constitute the dependent variables. Beyond this generalized framework of the inputs and outputs to decision-making, mental models research does not pre-empt any particular theory or set of theories about the variables of greatest influence and how these variables truly relate to each other in the minds of participants when they make public participation decisions. The general objective of the Mental Models methodology is to distill from this complexity some comprehensible and generalizable explanations about the different perspectives people have and how these different perspectives create communication challenges and affect decision-making. The research findings are used to inform development of a communication strategy that better enables people to make well-informed decisions that can lead to behavioral change.

Understood in this way, the mental models that emerge from the research represent the perspectives of the research subjects rather than establish objective models in the positivistic sense. As stated by Morgan et al. (2002, p. 21), mental models are “not a model in the formal sense. It does not involve a strict mapping between things in the real world and elements in the model…” What it does is provide some
structure and coherence about complex systems of thought of individuals, which can be used to identify those elements within the system that are of interest to the researchers and others.

More specifically within the field of public participation research, the Mental Models methodology is situated most fundamentally within the communicative research tradition in comparison to the six components of the conceptual framework developed in Chapter 2: management theory, collaborative learning, decision analysis, procedural justice, theories of democracy, and evaluation (see Chapter 2). As characterized by Webler and Tuler (2002), the communicative approach considers process fairness and competence as central components to a normative theory of what contemporary public participation should entail. In a similar fashion, the research questions and Mental Models methodology presented herein seeks to improve public participation policies, programs, and practices by identifying key variables supporting well-informed public participation decisions.

This research employs empirical methods to advance theory based on the way things are understood by both experts in the field of public participation and people engaged in public participation decisions at the project level. The Mental Models methodology is an empirically-based methodology for understanding individual’s cognitive processes, and the findings are used to inform strategies for overcoming communication barriers that inhibit more fully informed public participation decisions. According to mental model theory, different people may rely upon different mental models to support public participation decisions that are internally rational and
justifiable to each individual but seemingly ineffective or suboptimal to others. These differences can lead to communication barriers between individuals. As stated by Webler and Tuler (2002, p. 186), “Different people expect different things of a participatory process, and a good theory explains the logic of different perspectives” and “Any useful theory must explain the complexity of people’s motives...” The communication barriers that this research seeks to overcome involve expert-to-participant barriers that inhibit the development and promotion of public participation programs that meet participants’ needs and interests (see Chapter 6), and the participant-to-participant barriers that inhibit effective group problem solving at the project level (see Chapter 5).

Overall, the epistemology inherent to the Mental Models methodology and described above is well suited for evaluating complex phenomena involving cognitive decision-making processes. Moreover, it is particularly well-suited as an exploratory research tool for achieving a holistic explanation for how numerous dependent variables interact in the absence of pre-existing adequately broad and encompassing theories. Because the mental models developed by this methodology not only identifies variables affecting a decision but seeks to identify causal relationships between the independent variables, it provides a more explicit and detailed format for exploring the perspectives involved in making public participation decisions. As a first application of the mental models method in public participation research, it is expected to provide a unique perspective within existing research regarding public participation.


**Research Scope**

A mental model research design is generally defined to comprise three parts, though all three parts need not be used (Morgan et al., 2002). First, an Expert Mental Model is developed based on interviews with topic experts. The expert model is then used to develop an interview protocol, and interviews are conducted with a target population to initially uncover the different ideas that people hold about a topic. In the optional third stage, the prevalence or generalizeability of the identified ideas may then be confirmed in a more efficient and focused manner using questionnaires. Effective use of questionnaires presupposes that the breadth of variables relating to the phenomenon of interest is adequately known. The scope of this research utilizes the first two steps, as explained in the subsections that follow.

**Expert Mental Model Development**

For this research, the expert mental model was developed through a three stage process. First, a literature review was conducted of empirical research on public participation with a focus on Superfund related literature. Key variables identified through this review were included in the mental model.

In the second stage, purposely selected public participation experts in academia were presented the model and asked to comment on the structure and the adequacy of the elements included.\(^{11}\) The interviews were unstructured and relied heavily upon open-ended questions. The interview duration was typically one hour. The interviews

\(^{11}\) Discussions and interviews were conducted with Dr. Matthew McKinney (University of Montana), Dr. Robin Saha (University of Montana), Dr. Caron Chess (Rutgers University), Dr. Baruch Fischhoff (Carnegie Mellon University), Dr. Thomas Webler (formerly Antioch University), Dr. Lawrence Susskind (Massachusetts Institute of Technology), and Dr. Steven Schwarze (University of Montana).
were recorded and notes were taken during the interviews. With each successive interview the model was modified to account for the comments. Overall, the model evolved from a complex assortment of interconnected nodes presented on a single page to the more structured, nested and readily coherent model design that is presented in Chapter 4. Nodes representing similar concepts were combined. Importantly, Individual Ways of Thinking emerged to encompass nodes for Existing Context, Emotions, Process Norms and Values, and Needs and Interests. This structural development in the mental model allowed all of the nodes pertaining to the project related issues to be characterized as a whole and related to the process preferences in a readily apparent manner. These developments and others are described with the presentation of the mental model in Chapter 4.

In the third stage, the mental model was presented at two workshops. The first workshop involved four invited public participation experts at the University of Montana. The second workshop involved about twenty public participation practitioners and experts who self-selected to attend a presentation titled “Exploring Public Participation Choice: Development of an Expert Model” that was delivered at the U.S. Institute of Environmental Conflict Resolution 2008 conference in Tucson, Arizona. At both workshops, a 30-minute presentation of the research and the mental model was provided, followed by approximately 30 minutes of roundtable discussion. The model as presented in Chapter 4 was revised to incorporate ideas expressed through these consultations. Perhaps the most broadly significant change was to add the Emotions box to the mental model. Its significance derives from being included as one of three
general nodes that are used to characterize Ways of Thinking. The general nodes are then defined by other more specific nodes within the nested model design. This and other model developments are identified by reference to conference participants with the presentation of the model in Chapter 4.

The construction of the mental model applied the guidelines provided by Fischhoff and Bruin (2006, Table 2). These guidelines provide questions about the nodes, links, and overall model construction that are helpful for achieving model clarity. The mental models that emerged from this research are presented in Chapters 4 through 7.

In broad terms, the model’s general structure emerged from the literature search as a relatively unstructured collection of variables and gained a nested structure design of increased detail and organization upon each successive review and comment. Contributions made by experts to model refinements are identified as personal communication references in the text below. Importantly, the model development process was not consensual. Most experts were not extended the opportunity to review how their interviews informed the model, and so the final model that emerged is the author’s interpretation of the information provided.

**Participant Mental Model Development**

Development of the empirically-based participant mental model required the selection of study sites, selection of interviewees, interview protocol development, iterative coding leading to the development of the participant mental model, and analysis and interpretation of the coded data.
Institutional Review Board Compliance

The University of Montana's (UM) Institutional Review Board (IRB) Policy requires that all research projects involving human subjects be approved by the UM IRB. In accordance with UM requirements, the author completed the on-line self-study program. An IRB Summary, IRB Checklist, and Participant Information and Request forms were submitted to the UM IRB office on February 4, 2008 (IRB proposal #34-08) and approved on February 5, 2008. The IRB Summary form concluded with the following commitment:

“Stakeholders’ wishes regarding confidentiality will be determined prior to the interview, and if desired by the interviewee, their identity will be kept confidential at all times and will not be used during the analysis of the data or in the written report. Interviewees will be given the option of:

- being identified,
- being identified by a pseudonym, or
- not being identified in any way.

Interviewee’s verbal responses will be noted by the researcher (see the Participant Information and Consent Form). Interviewees will be able to request a change to their confidentiality at any time during the interview and until the findings are reported. Interviewees will be made aware that their participation is voluntary and their information they provide can be removed from the study at any time until the findings are reported. Audio recordings will not be shared with anyone else without written consent of the subjects on the recordings. If there is any question about an interviewee’s wishes about identifying information, he or she will be identified in the transcribed notes with a pseudonym. I will keep one master list of corresponding names and pseudonyms in a locked cabinet in my home office in Helena, Montana. Within three years from the completion of the research (i.e. graduation), confidential data will be destroyed by the researcher (audio tapes will be erased, computer field notes will be deleted, and paper copies will be shredded).

No written consent form is proposed. A verbal study description and confidentiality offer will be provided [as described in the Participant Information and Consent Request form].”
Interviews were conducted in the summer and fall of 2008. Data analysis continued through fall of 2009. A Continuation Report was submitted to the UM IRB in March, 2009.

**Site Selection**

There are approximately 1,275 Superfund sites nationwide. Therefore, selection criteria were required to identify site(s) that would meet the needs of this research. The expert mental model identified a large number of variables thought to influence public participation decisions. Site selection criteria were developed to aid in selecting sites that would invoke as many variables identified in the expert mental model as possible, while keeping the overall effort to a manageable size. Several conceptual criteria were identified that encompassed the site characteristics needed to invoke as many variables as possible. It was also necessary to identify several practical criteria for site selection to ensure a feasible research project.

**Conceptual Criteria:** Study site selection sought a large range of participant groups, including concerned and engaged citizens involving a range of socio-economic considerations (e.g. financial status, education level, types of employment) and multiple participant groups. These differences were expected to invoke many of the variables identified in the expert model as important to people’s public participation preferences, such as available time or money to contribute to the effort, characteristics of group identify, degree of trust in government institutions, or levels of technical knowledge, to name just a few.

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12 For a current listing and count on the number of sites, see: [http://www.epa.gov/superfund/sites/npl/index.htm](http://www.epa.gov/superfund/sites/npl/index.htm).
Site selection also considered how long the Superfund site investigation had been going on and the degree to which important decisions had already been made by the agency. The expert mental model anticipates that those engaged in Superfund controversy may learn about the site and about public participation in ways that would affect their public participation preferences. Since sites can be active for decades, considerable opportunity for learning exists. Participants in the latter stages of a Superfund site (e.g. post ROD, after remedy design, or after remedy implementation; see Chapter 1 for a description of the Superfund process) may have entirely different needs and understandings about the project and their public participation preferences than those in the earlier stages of a project. During early stages of the project, the full scope of the problem, potential risks, and potential remedies are unknown, and the evolution of project participants toward forms of public participation that are more effective may yet to have occurred (without presuming that such evolution ever occurs on many projects – worthy research unto itself). Since this research is motivated to support more effective decision-making in selecting the right kind of public participation process at the early stages of (potential) controversy, site selection were favored sites that have yet to establish a ROD. The ROD is a large and important decision that generally marks the division between the site investigation and remedy design phases of the project. It defines in somewhat general terms what remediation is to be done. It is a milestone that is tracked in EPA database systems, and therefore served as a convenient criterion by which potential sites could be initially sorted for consideration.
This research responds to the need to address the types of technically intensive controversy that commonly occur at Superfund sites. Accordingly, site selection also sought moderate to high levels of ongoing controversy. Levels of controversy were judged based on the degree to which stakeholders were sufficiently motivated to be actively engaged in influencing decisions made or to be made by the EPA, and where there were differences in opinion about the impending decisions. This assessment was made by reviewing news articles that were discovered using internet searches using Google, and through phone discussions with EPA personnel in regional offices that are familiar with a broad range of topics. As site selection narrowed, brief phone conversations with EPA Project Managers and Community Involvement Coordinators were used to confirm prior sources and ascertain that controversy persisted. Where controversy existed it was readily identifiable and consistently expressed across the various sources of information used in the site selection process.

The level of controversy was also considered in terms of the kinds of public participation procedures that were being applied to respond to or manage the controversy. The expert model identified a range of public participation preferences. Accordingly, sites were selected that seemed to reflect different kinds of public participation preferences among the participants. This was judged by selecting different sites that had settled into using different public participation methods, as described later in this subsection. The application of this criterion meant it was necessary to study multiple sites.
Some consideration was given to selecting a site that did not involve controversy in order to elucidate the kinds of variables and public participation preferences that may contribute to reducing controversy. While arguable worthwhile, the addition of this condition to site selection was determined to add considerably to the work load for this research and was therefore omitted.

Site selection also considered selecting cases from multiple EPA regions because the Inspector General’s (1996) report identified regional attitudinal differences that seemed to effect how EPA public participation programs were considered and implemented (see Chapter 1). However, the Inspector General’s report did not identify specific regions as supportive or non-supportive, and a thorough assessment of this condition was considered to be a separate research effort. Accordingly, site selection considered sites in multiple EPA regions; however, this consideration was subordinate to other considerations and it was ultimately not utilized.

**Practical Criteria:** It was initially estimated that approximately five expert interviews and twenty participant interviews would provide meaningful results. Prior experience indicates that most ideas ‘out there’ on a topic can be identified with twenty to thirty interviews (Morgan et al. 2002, Thorne 2005).

While a large range of participant groups were sought, extremely large Superfund projects that would more easily attract many different participant groups were avoided in favor of sites that participants could discuss in reasonable fullness in a one-hour interview to minimize rejection from volunteer interviewees. No remuneration was to be offered to the interviewees. Superfund sites can often involve
many issues, such that a considerable amount of time can be necessary for anyone to provide even a cursory description of “the problem.” To ensure that stakeholder’s concerns could be discussed in depth in about an hour, sites involving one or two general areas of stakeholder concern were sought. Options considered involved a focus on asbestos contamination of residential and commercial properties, groundwater contamination, residential soil contamination, and contamination of the source for municipal drinking water.

**Site Investigation Methodology:** To employ the selected criteria, a search of eligible sites was initially conducted using information made publically available on EPA’s web site. EPA’s web site does provide a database of all Superfund sites nationwide; however, the national database does not contain most of the information needed to assess sites according to the above criteria. Fortunately, each of the ten regions within EPA does contain a web page that lists each Superfund site within the region. Links to each listed site lead to summary descriptions of the site. Generally, these web pages contained the information necessary to apply the site selection criteria. However, information on some sites could be several years old. Also, it was a laborious process to review the descriptions, thereby making a comprehensive review of all 1,275 Superfund sites to identify the very best site(s) unmanageable.

The search for candidate sites began close to home (Montana), where conducting the research would be easier. It was originally hoped that interviews could be done in person. However, good candidate sites close to home where excessive travel costs would be incurred were not identified. Accordingly, the search moved out
geographically until good candidate site(s) were identified. As candidate sites were identified, web site reviews of Superfund information was supplemented with casual discussions with EPA personnel to ensure that up-to-date information was being obtained. Web site surveys and discussions with EPA personnel were conducted first in Montana, and were ultimately extended to EPA Regions 8, 9 and 10. While Montana is located in Region 8, Montana is located close to the border with Region 10. Region 9 was reviewed for “good measure” because it contained many sites, particularly in California. As it turned out, finding sites that matched the criteria was somewhat difficult. In conducting the search it seemed that few, if any, new Superfund sites had been added to the Superfund program during the five to ten year period preceding this research. Those sites involving controversy and that had not advanced well into the remediation stage were frequently larger and more complex. Many sites had evolved past the point of ROD.

Six to eight potential candidate sites were identified. To inform final selection, additional information was gleaned from news articles, federal and state project reports, and web sites maintained by stakeholders that were identified through internet searches using Google. Additionally, phone calls were made to EPA project managers and Community Involvement Coordinators to confirm current project status and characteristics.

**Descriptions of the Select Sites**

In the final selection, two Superfund sites were selected from this list of possible sites. To capture a range of socioeconomic conditions and a range of public
participation being applied, it was necessary to involve at least two sites. Using two sites also increased the possibility for involving a greater variety of other site-related variables identified in the expert mental model to become part of the research. Because the controversy at the selected sites focused on just one general issue, the sites were smaller in geographical extent and in terms of the numbers of actively involved participants. Preliminary research of the two selected sites indicated that all key participant groups could be fairly represented with approximately ten interviews per site.

Both of the selected sites are located in the western United States, are within EPA Region 8, and involve historic hardrock mining legacies. However, the characteristics of contaminant exposure and risk, the characteristics of the communities involved, and the public participation approaches used are quite different. In comparison to many Superfund sites, both projects are relatively young and both projects are relatively small. Site names and interviewee names are kept confidential in accordance with the expressed desire of many interviewees. The sites are therefore referred to as the Residential Soil Cleanup site and the Drinking Water Cleanup site.

Controversy at the Residential Soil Cleanup site focused largely on remediation of contaminated residential yards and other soil in a small, rural town. Previously founded upon the discovery of precious metals, economic conditions were poor. Several mining companies were implicated as Potentially Responsible Parties (PRPs). EPA completed a Record of Decision (ROD) outlining the overall remedy several years ago, which was not considered to be ideal because it meant that come important
decisions had already been made and that the community may have advanced considerably through the learning cycle identified as a node on the mental model. However, yard remediation design and implementation were still underway that required many decisions be made about how the remedy to remediate residential soil was to be done. Considerable controversy remained about work to be done and it seemed as through little progress had been made to constructively resolve differences or achieve mutual understanding. Residents interviewed largely oppose the remediation project and the Superfund program generally, and controversy about the project was considerable. However, at the time of the interviews, no residents had yet to reject EPA’s requests to allow yard remediation. No programmatic public participation resources such as a Technical Assistance Grant (TAG) or Community Advisory Group (CAG) were being applied to manage public participation at this site. Communication by EPA at this site evolved from open public meetings toward more directed interaction with elected local town officials on broader project planning issues while contractors communicate with individuals about individual residential property remediation needs.

Controversy at the Drinking Water Cleanup site focused largely on mine-impacted surface water quality in a drainage that supplied the town’s drinking water. Historic mining exists on both private and public land, engaging a wide range of state and federal agencies and mining companies. A ROD had not been completed at the time of the research. The town is a wealthy resort town with an educated population that was generally supportive of the EPA action. Residents’ objectives, as represented
by community leaders, were to achieve pristine water quality in the drainage through non-engineered solutions (e.g. minimizing the potential to create contamination by removing waste pile rather than build and continuously operate a water treatment plant) wherever possible and to prevent further mining. Conversely, EPA sought to ensure that future water quality did not exceed drinking water standards and to achieve additional water quality improvements for an acceptable, but undetermined, reasonable cost. Engaged citizens and local agency leaders had formed a watershed group and a CAG, and they utilize the TAG program.

**Interviewee Selection and Description**

Interviewee selection used the stratified judgmental\(^\text{13}\) approach consistent with the Mental Models method (Morgan et al. 2002). Potential interviewees were initially identified from EPA web sites and internet searches for news articles, citizen group web sites, and related reports using Google. Agency project managers and community involvement specialists were included in the interviews and agreed to participate. Other interviewees were selected based on availability and willingness, and to represent diverse points of view. All prospective interviewees were provided with an informed consent. No remuneration was offered. Many expressed desire for confidentiality. Interviewees were asked for suggestions of others to interview and interviews continued until the list of interviewees were inclusive of all points of view on the project.

\(^\text{13}\) Stratified judgmental refers to a method of selection that begins by dividing the target population into multiple sub-populations of interest in order to ensure broad representation, and then using judgment in sampling with each sub-population.
Two candidate citizen interviewees declined to participate, one at each site. In both cases, the individuals expressed strong opposition to the Superfund project and concern that participating would not serve their needs. Minority voices may have been missed as informants may not be motivated to identify people with different views and news information may not have thoroughly identified all points of view. Community residents that may have a stake or interest in the project but that were not actively involved were not sought to keep the scope of the research to a manageable size. Identifying non-engaged residents would have required use of a different interviewee selection methodology. Accordingly, some perspectives may have been missed.

Nine interviews were conducted for the Residential Soil Cleanup site, consisting of five residents, the EPA project manager, the EPA Community Involvement Coordinator (hereafter referred to as the Coordinator) and their counterparts at the state level. Three of the five residents had recently held local government offices in a volunteer capacity. Three of the residents and one resident who was an employee of a PRP were against the Superfund project and dissatisfied with the substantive and process aspects of the project. A fourth resident was supportive of the Superfund action generally but was dissatisfied with particular elements of the work. A fifth resident was supportive of the project generally and was appreciative of the quality of the work conducted. The two EPA personnel and two state personnel were supportive of their agency’s missions, but open about the challenges they perceived in working with residents.
By chance, nine interviews were also conducted for the Drinking Water Cleanup site, consisting of four residents and five agency personnel. Fewer residents were included, which reflects this site’s more representational form of public participation and larger number of agency participants. Moreover, two of these residents received financial support to participate under the TAG program and other sources received through non-profit organizations to which they belonged. A third resident was a paid local government official. These individuals indicated they represented broadly supported residents’ needs. A fourth resident was employed as a manager for a mining company active in the watershed. Agency personnel included the EPA project manager, the EPA Coordinator, a federal public land agency manager, the state’s project manager, and a technical specialist with the state. Three residents were supportive of EPA’s work to date. The fourth resident, who was employed by a mining company, was supportive of the Superfund action but was only mildly interested in the details and did not regularly attend meetings. All agency personnel were generally supportive of EPA’s work. The state’s project manager was most critical of the work that had been done. All interviewees were uncertain about if or how they might come to agreement over long-term water quality objectives.

**Interview Protocol Development and Application**

A semi-structured interview protocol (see Appendix A) was developed consistent with the Mental Model methodology (Morgan et al., 2002). The questions were developed to elicit responses in each general area of the expert mental model. This semi-structured method permits the elucidation of issues “on the mind” of the
interviewee with a minimal degree of prompting and control of the interview, and it thereby allows the major areas of concern to be identified. Interviews generally lasted 40 to 60 minutes. The author conducted the interviews by telephone from May to September, 2008. All interviews were recorded and transcribed verbatim.

**Coding and Participant Mental Model Development**

A participant mental model was developed to define the nodes (i.e. variables) to use in coding the text. The participant mental model is a revision of the expert mental model that is developed to allow consistent coding of all interviewee text. The participant mental model provides a framework that is specific to the perspectives expressed by people engaged in and talking about a specific project. The participant mental model is presented in Chapter 5.

Interview transcripts were initially coded by the author by assigning nodes (i.e. variables) of the expert mental model to the text. The interview text and assigned codes were entered into a Microsoft Excel spreadsheet that allowed ease of searching and sorting of codes and related text. A separate spreadsheet file was created for each site. Within each file a separate spreadsheet tab contained each transcript. The transcript was divided into segments of text consisting of one or more sentences expressed by the interviewee pertaining to one or more codes in the participant mental model. The text was divided into a new segment when the topic being expressed changed. If the interview returned to a previously mentioned topic, the same codes were assigned as appropriate. If a substantive topic expressed by the interviewee was provided in response to a notably leading prompt, this prompt was captured in the
assigned code. Such prompted responses were excluded from analysis. This is an important methodological procedure for ensuring that the data reflected interviewees’ thoughts and minimized the interjection of bias from the researcher. Leading questions would compromise the credibility of the research, as discussed in Chapter 7 under the Strengths, Limitations and Future Research Needs subsection.

Multiple levels of codes were assigned to each segment of the text. Level 1 coded to the most general level of the model (see Figure 9 presented in Chapter 5) and Level 2 coded to more detailed levels of the mental model (see Figures 10 and 11 presented in Chapter 5). These codes were kept in separate columns of the spreadsheet to allow for sorting text segments by these different levels of detail within the mental model. Key phrases were copied from the text segment and placed in their own column. The three columns of coded data (Figure 9 for level 1, Figure 10 for level 2, and Figure 11 for level 3) for each interviewee were copied into new spreadsheet tab so that all coded data was in one spreadsheet table. For each interviewee, the data in this table was sorted alphabetically by Level 1 and then by Level 2 and 3. This allowed for ease of comparison across interviewees, and it simplified the process of counting codes in the production of summary tables used to conduct the analyses as described below.

Upon initial assessment of the data, it became apparent that new nodes needed to be developed and closely related nodes needed to be clarified or in some cases condensed into a single node to enable consistent coding of all text. A participant mental model was developed through multiple coding iterations that identified new nodes and combined nodes representing closely related topics. This coding
methodology achieved the exploratory objectives of this research in its present stage. It
does not support a rigorous quantitative inter-interviewee comparison of the frequency
of expressed responses.

**Analysis and Interpretation of Coded Data**

At the outset of this research, it seemed natural to categorize Superfund
participants as either regulators or residents. However, prior work by Johnson and
Chess (2006), who observed that the attitudes of agency personnel about public
participation may be characterized as either “enthused” or “constrained,” suggested
that there may be other valid ways to group participants other than as regulator or
resident in a public participation context. With this in mind and keeping within the
more grounded-theory research tradition supported by the mental models method (as
previously described in this chapter), the analysis and interpretation of the coded data
sought to let any characterizations and categorizations of interviewees emerge from the
data.

Consistent with the Research Objectives and Approach subsection of Chapter 1,
my analysis and interpretation of the coded data sought to identify the diverse ways
that different types of participants engaged in scientifically complex controversy
conceptualize their public participation decisions. What emerged from the analysis and
interpretation process were shared texts among three groups of participants that reflect
three distinct ways of thinking about their public participation decisions. The
methodology used to conduct the analysis and interpretation is summarized here and
presented in greater detail with the data in Chapter 5.
Step 1, Organizing Coded Data by Interviewee Type: To initially explore coded data, a table was constructed that contained all of the coded results. Interviewees were categorized in the table as either residents or regulators, and further organized by site. The interviewees were also identified as either supportive or not supportive of EPA’s actions at the project site. The table identified the number of times a node was coded for each interviewee. The table also identified if the interviewee expressed a positive and negative judgment or orientation. For example, when coding for trust if the interviewee expressed a lack of trust, this negative orientation was recorded as a -1 in the table. If the same interviewee mentioned a lack of trust in two different segments of text, the table would indicate a -2 for the trust node for that interviewee. If a third segment of text expressed trust in a supportive or positive way, the table would indicate -2/1 to indicate two negative and one positive orientation to the trust node.

Step 2, Pattern Recognition and Re-organizing Data: The table of coded data was reviewed to identify patterns of responses among the interviewees. This assessment sought to define how different people emphasized different parts of the mental model. My analysis of the patterns of coded responses among participants in this first table suggested an alternative organization of interviewees into new groupings. For example, frequent negative responses for emotions, one of the nodes in the model, were observed for some interviewees, while consistently positive emotions were observed for other interviewees. Similarly, patterns were observed within and between different interviewees for other nodes in the model like technical complexity, commitment and other nodes as described more fully with the presentation of the data
in Chapter 5. I therefore constructed a second table to group interviewees according to these observed patterns.

**Step 3, Elucidation of Ways of Thinking:** Further examination of the re-organized data in the second table revealed three distinct “Ways of Thinking” among participants. These Ways of Thinking are revealed by areas in the mental model that were emphasized in the text for the various interviewees. By examining the frequency and qualitative emphasis of responses corresponding to various nodes of the mental model, I was able to identify a subset of nodes that characterized each way of thinking. The elucidation of these key distinctions, in turn, allowed me to discern different shared texts that characterized different ways of thinking about public participation.

Given the qualitative nature of the study and the potential for error and uncertainty in discerning nodes of the model that involve small differences between individuals, the characterization of the three ways of thinking emphasized those nodes of the model for which large differences between the groups of individuals could be identified. Those nodes that clearly stand out as characteristic of a way of thinking are called “dominant” nodes. The following criteria were established to identify dominant nodes:

1. Qualitative emphasis provided in one or more segments of text that is particularly revealing and compelling but not reflected in the quantitative analysis of coding frequency and magnitude, or

2. Within a Way of Thinking: consistent coding across individuals (i.e. node coded at least once for 75% or more of interviewees) or large reoccurrence
of coding for at least one individual (i.e. coded at least five times for any one interviewee) within a way of thinking, and

3. Among Ways of Thinking: large differences in the percentage of individuals receiving a code for a node (i.e. a frequency difference of at least 75%) or a large difference in the reoccurrence of coding (i.e. a difference of at least six between maximum and minimum counts between each Way of Thinking), and

4. No readily discernible site related effects as evidenced by similar frequency (i.e. the percentage of interviewees that were coded for a node) and magnitude (i.e. the number of times any one interviewee was coded for a node) of responses across interviewees within a site.

The application of these criteria is provided with a presentation of the results in Chapter 5. Specific examples are provided that demonstrate how the criteria are used in the analysis. Chapter 5 also presents the shared texts for each way of thinking. The presentation is supported by original quotes from the interviews.

Assessment of Expert vs. Participant Differences

A different method of assessment was necessary to evaluate expert/participant differences due to the methodological differences used to develop the expert and participant mental models. The initial expert mental model was created through the researcher’s interpretations of literature reviews, interviews with experts, and workshop discussions. The participant mental model emerged through a systematic, empirical, and iterative process of coding and revising the model. New nodes were
added as needed to accurately code the text, and closely related nodes were clarified or in some cases condensed into a single node to minimize coding complexity. The iterative process ended when all text for all interviewees could be consistently coded using the participant mental model.

The two models are compared to identify what is unique to the expert model – i.e. a fourth way of thinking that is distinct from and not already revealed in the prior defined three ways of thinking for participants. A comparison of the expert model to each way of thinking revealed for participants was not conducted. The large degree of similarity between the initial expert model and the general participant model would cause such an analysis to closely resemble the assessment performed to elucidate the three ways of thinking from the general participant model. Accordingly, independent comparison of the expert mental model with each participant-based way of thinking would be expected to provide the same kinds of insights identified by the expert mental model presented in Chapter 4.

The criterion for each objective was derived after data inspection to effectively parse out the biggest differences, yet retain a systematic method that minimizes parsing bias. The following objectives and assessment criteria were employed:

1. Variables overlooked or under recognized by experts were identified by recognizing the new nodes added to the participant mental model.
2. Variables overlooked or under recognized by participants were identified by recognizing nodes included in the expert model but not used by one or more participants.
Terminology and Writing Conventions

This dissertation uses the terms experts, practitioners, and participants in specific ways in order to distinguish between the different ways that different groups of people informed this research. Experts are principally those in academia to reflect the backgrounds of those who most informed the development of the expert mental model. The term participants is inclusive of all stakeholders engaged at the project level in group problem solving, constructive or not, such as agency personnel (including practitioners), technical experts, and citizen stakeholders. As one type of participant, the term practitioner is used in this research to refer to trained public participation professionals working at the project level to aid lay participants and other stakeholders in constructive group problem solving.

The mental models developed from this research incorporate a large number of nodes within the mental model literature. Beginning with Chapter 4, The Expert Mental Model, the names of specific nodes in the mental model are treated as proper nouns and therefore use first letter capitalization. The intent is to alert the reader that a specific component of the mental model is being addressed without constant need of parenthetical reference or superfluous text.
CHAPTER 4: THE EXPERT MENTAL MODEL

This chapter addresses research question 1: What do different types of participants engaged in technically-intensive controversy think about when making public participation decisions? This is achieved by identifying the variables recognized in current research that people use to make public participation decisions. The relationships among variables are illustrated using a mental model format that is described in detail herein. This part of the research uses a literature review, interviews with public participation experts, and workshop discussions attended by public participation experts to inform model development.  

The literature review presented here builds upon and is distinguished from the literature review presented in Chapter 2 in several ways. In Chapter 2, the literature review involved a more thematic approach to identify current knowledge, practices, and major strands of research in public participation, with the goals of identifying the perspective and knowledge gaps to be addressed by the research. The literature supporting the development of the mental model here in Chapter 4 has a more focused objective and is more detailed within this objective. Notwithstanding some overlap in referenced literature, the literature review herein identifies a more comprehensive list of variables, and relationships between variables, that may influence people’s public participation decisions. In contrast to the more narrative style used in Chapter 2, herein the literature is presented within the structured and more analytically oriented manner.

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14 The same reference convention is used in this dissertation to credit literature sources, interviews, and workshop discussions. References dated 2007 or 2008 and involving McKinney, Saha, Schwarze, Penny, Chess, Fischhoff, Susskind, or Webler are personal communications applied to meet the objectives of this chapter. As dissertation committee members, McKinney, Saha, Schwarze were able to validate their input.
needed to support the development of the mental model. Importantly, the expert mental model derived from the literature review is modified through iterative interviews and workshop discussions with public participation experts to derive a model that is coherent to public participation.

The expert mental model derived here in Chapter 4 supports the evaluation of different ways of thinking for participants in Chapter 5, and the evaluation of expert ways of thinking in Chapter 6.

**Overview of the Expert Mental Model**

The mental model that emerged from my interpretation of the expert interviews and workshops is presented in Figures 6 through 8. Relationships among the variables are identified by arrows that connect related nodes. The node at an arrow’s tail is recognized to exert some influence on the node at the arrow’s head. The model uses a nested diagram structure. To accommodate space requirements in printing, Figure 7 and Figure present the details for two parts of the model shown in Figure 6.

Figure 6 presents the most generalized model structure. This part of the model was most influenced by the expert interviews and workshops as opposed to the literature review. The structure that emerged reflects existing negotiation theory (as previously stated in Chapter 2, subsection titled Public Participation Theory): namely, that people engage in public participation in ways they think will best meet their needs and interests (National Academy of Sciences, 2008; Susskind, 2008, McKinney & Saha, 2008, Susskind et al., 1999). This theory presumes that individuals are ‘rational’ actors, they understand what their needs and interests are, and they choose from among the
Figure 6. Expert Mental Model of Stakeholder Public Participation Decision-Making

Individual/Social Learning

Existing Context:
- desire for information or engagement
- recognition of stakeholder differences

(a) seek process fairness
(b) attend to power struggles
(c) facilitating ideological discussion
(d) achieve popular legitimacy
(e) leadership and compromise

Emotions:
- hopes, fears, frustrations, attitudes, likes/dislikes, opinions, trust, stigmas

Process Norms and Values:
- substantive process
- social

Needs and Interests:
- no engagement
- inform
- seek advice
- build agreement (proactive)
- resolve disputes (reactive)
- advocacy/public relations

Revealing of Individual “Ways of Thinking”

Convener restricts options

Inter- and Intra-Group Interaction

Process Decision-making
Figure 7. Existing Context for the Expert Mental Model

- Technical Knowledge
- Technical Complexity

Substantive Variables

- Need/Desire for Information or Engagement
- Personal Resources
- Available Time
- Vulnerability
- Concern
- Health and Safety
- Security and Control
- Trust of Institutions

Interpretive Variables

- Knowledge of Stakeholder Differences
- Social Group Identity
- Stereotypes of Others
- Public Participation Preferences of Others
- Nature Vulnerability vs. Regenerativity

Social Complexity

- Relationship History
- Multiple Authorities
- High Stakes
- Cultural Heterogeneity
- Geographic Scale
- Organizational Culture and Leadership

Social Variables

- Experience
- Institutional Resources
- Supervisory Structure
Figure 8. Needs and Interests for the Expert Mental Model
public participation options known to them the approach(es) that they think best meet their needs and interests. Of course, deviations from these assumptions may occur. Emotions may interact with more analytical forms of rationality to influence perceived needs and interests (Penny, 2008). Also, individuals may have very limited prior knowledge of public participation methods that can constrain strategic thinking about how best to meet their needs and interests (Schwarze, 2008). As individuals interact in groups, individuals are not necessarily free to act upon their own will, but must generally coordinate their preferences and actions within a social and institutional context (Susskind, 2008).

The dotted grey box\textsuperscript{15} in Figure 6 labeled Revealing of Individual Ways of Thinking captures the notion of individuals as rational actors. Nested within this box, the Needs and Interest box represents the outcome expectations for an individual as a result of public engagement. Their needs and interests are derived from their understanding of the existing context of the problem. Their understanding of the context creates a desire for information or engagement and a recognition of stakeholder differences. This context and call to action is interpreted through personalized normative notions and values about process as well as their emotions. This collective Way of Thinking is applied by an individual to assess process preferences based on their knowledge of process options. Individuals bring these initial conceptions about process preference into group interactions, through organized meetings and

\textsuperscript{15} The term box is used in this research to refer to a feature of the mental model that encompasses multiple nodes, such as Individual Ways of Thinking, Emotions, and Process Norms and Values in \textbf{Error! Reference source not found.} and Substantive Variable in Figures 8 and 9.
spontaneous interactions with individuals and groups. These interactions can affect learning, which can in-turn affect Ways of Thinking. For the convener, the learning process may be used to restrict the range of process options available for further consideration. These feedback loops are ongoing as process selection occurs and reoccurs over the life of a project.

The subsections that follow provide a detailed description of the model and the information used to inform model development.

**Existing Context**

It is widely recognized that all controversies emerge from an existing historical, situational context that influences one’s needs and interests (Webler & Tuler, 2002; Susskind & Cuikshank, 1987; Fischer & Ury, 1981; Carpenter & Kennedy, 2001). This Existing Context can be disaggregated into substantive, interpretive, and social variables, as shown in Figure 7. Substantive variables are the tangible elements of the problem that are being responded to or that relate directly to the problem, such as technical or regulatory complexity of the problem and an individual's level of knowledge for understanding the complexity. Social variables are those that identify the various social groups involved and describe the nature or quality of the interrelationships among those groups. Interpretive variables identify perceptions and judgments. The empirical evidence from existing literature that supports the nodes and relationships in Figure 7 is provided in the text that follows. The expert interviews and workshops contributed relatively little at this level of detail in the overall mental model.
The perceived need by individuals for information seems a natural starting point for projects involving technical complexity. In response to the Government Performance and Results Act of 1993, the U.S. Forest Service and the EPA evaluated the effectiveness of EPA’s Superfund community involvement program for promoting community involvement in hazardous waste cleanup decisions (Charnley & Engelbert, 2005). One prominent conclusion drawn from this study was that “community members who were most informed about and involved in the cleanup process at Superfund sites generally were also the most satisfied with the community involvement process, and the job that EPA was doing cleaning up the site” (Charnley & Engelbert, 2005, p. 165). This research reflects an overall positive attitude among program administrators about the usefulness of existing community involvement programs at EPA, and it suggests that forms of public involvement that increase knowledge about the Superfund process can lead to mutually satisfactory outcomes. These ideas are captured in Figure 7 as Need/Desire for Information or Engagement, and the arrows connecting it to Technical Knowledge and Technical Complexity.

A perceived need by individuals for information in response to technical complexity was also identified by Teske (2000). Teske explored the potential for TAGs to encourage citizen participation and democratic processes generally. Based on an evaluation of two Superfund sites, Teske suggests that TAGs can facilitate citizen participation in technically complex decisions, and that amount of citizen participation may be greater at large, technically-complex Superfund sites. These findings further reinforce the Technical Knowledge and Technical Complexity nodes in Figure 7.
Other variables are also known to affect individual’s perceived need and desire for information. McComas et al. (2006) examined why citizens choose to attend or not attend public meetings related to local cancer cluster investigations in six communities. The authors generally characterized those who attended the meetings as “the curious, the fearful, and the available,” while those who did not attend were described as “the uniformed, the indifferent, the occupied, and the disaffected” (McComas et al., 2006, p. 671). The desire for information and engagement surfaces in this research as a dominant factor motivating citizen attendance at public meetings, and it re-enforces the relationships of Technical Knowledge and Technical Complexity with a Need/Desire for Information or Engagement. The research also identifies Available Time, having adequate Personal Resources to attend meetings or otherwise participate, perceived “vulnerability” of the fearful (identified by the Vulnerability node), and one’s overall level of concern (identified simply as Concern) about the issue as important nodes relating to the Need/Desire for Information or Engagement.

Work by Edelstein further illuminates variables that contribute to Concern. Edelstein (2004) describes how the challenges of living within a community that is designated as a Superfund site can lead to dramatic changes in a person’s worldview. Involuntary exposure to uncertain risks that were previously unknown and invisible can lead to broad “lifescape” changes as individuals try to cope with the stress of living within a Superfund site. These lifescape changes involve reconsideration of certain “normal life assumptions” or perceptions about one’s health, ability to control one’s immediate surroundings, personal security, personal safety, and trust in social
institutions (Edelstein, 2004, p. 28). Lingering exposure to contamination, and the resulting “feelings of unacceptable vulnerability,” can lead to distrust, frustration and outrage (Edelstein, 2004, p. 105). Similarly, Freudenberg (1997) uses the term “recreancy”\textsuperscript{16} to describe a distrust that results when technical experts or expert institutions do not perform in accordance with expectations of affected citizens. These ideas are incorporated into Figure 7 as Concern and the sub-nodes under it: Health and Safety, Security and Control, and Trust of Institutions.

Additional research informs the node Knowledge of Stakeholder Differences in Figure 7, and the sub-nodes beneath it. Research by Gray (2004) on controversy at Voyageurs National Park generally illuminates how knowledge of stakeholder differences is important for understanding how public participation processes evolve and either fail or succeed in meeting participant expectations. As Gray explains, when stakeholders enter into multi-organizational partnerships for the purpose of resolving conflict, finding an acceptable solution requires that “the parties reframe some of their original interpretations about the other parties, about the substantive issues, and/or about the process by which the decision will be reached” (Gray, 2004, p. 166). Gray also identifies four specific frame categories that were important for understanding stakeholders’ interpretations of the Voyageurs conflict: self identity, characterization of others (often using negative stereotypes), preferences for how controversy should be addressed, and beliefs about the vulnerability versus regenerativity of nature. These frames identify how stakeholders think about themselves and others, and are

\textsuperscript{16} The on-line Free Dictionary by Farlex defines recreancy as: \textit{adj. 1.} Unfaithful or disloyal to a belief, duty, or cause. \textit{2.} Craven or cowardly. \textit{n. 1.} A faithless or disloyal person. \textit{2.} A coward.
incorporated into the model under Knowledge of Stakeholder Differences and the four sub-nodes related to it identified on Figure 7. Additional research has similarly evaluated the role of framing in establishing self identity, characterizing stakeholder differences, and developing communication strategies that mobilize support or otherwise construct arguments in support of a position (Hamilton, 2003; DeWulf et al., 2004; Bouwen & Taillieu, 2004; Benford & Snow, 2000). Moreover, Gray states that “interviews revealed few stakeholders who could envision a joint problem solving approach to the conflict and few who could engage in the level of reframing necessary for enabling a successful collaborative solution to emerge” (Gray, 2004, p. 174). Such research reveals possible process knowledge gaps about collaborative strategies that may exist among stakeholders, which is incorporated into Figure 6 as Individual Process Knowledge and Preferences.

Of course, the overall complexity of the social context surrounding a project can be expected to affect the extent to which perceived stakeholder differences become important variables. Scherer and Cho (2003) examined a case of potential chemical contamination of a community water supply at a state led toxic cleanup site. Their study showed how social network contagion theory can be used to explain the existence of like-minded stakeholder groups with similar attitude, knowledge and behavioral structures. This research supports the Social Complexity node in Figure 7, and its relationship to Knowledge of Stakeholder Differences.

Several areas of research are used to derive the sub-nodes that elaborate upon Social Complexity. The Organizational Culture and Leadership node is derived from
Johnson and Chess (2006). They evaluated the public participation attitudes held by personnel within a state environmental agency. Those studied are identified as either “enthused” or “constrained” about public participation. Enthused leaders are expected to bring more diverse or successful past public participation experiences, provide greater institutional resources (time and money) to public participation where possible, and work within management or supervisory structures that better enable public participation programs to be applied successfully.

The sub-nodes to Organizational Culture and Leadership are also informed by Daley and Layton (2004), who reveal some of the challenges and related perceptions that agency personnel experience with community involvement. Daley and Layton conducted a quantitative assessment of factors influencing the pace of remediation at 1,192 Superfund sites. They concluded that “EPA is more likely to tackle ‘easier’ or low-risk sites within the program, community involvement in Superfund is associated with decreased remedial progress, and remedial action is more likely to occur when political oversight is present” (Daley & Layton, 2004, p. 375). When controlling for numerous variables, the study results indicate that the presence of a CAG or TAG significantly decreases the likelihood that a site is at the construction complete phase of the project, and it reveals the competing challenges of project efficiency versus public acceptance that may negatively affect EPA project managers’ attitudes about public participation. While this research by Daley and Layton does not indicate causation (does TAG/CAG presence cause project delays or are they a response to project delay and/or project complexity), it does provide insight into the types of personal experiences and
circumstantially-derived knowledge that EPA personnel and other stakeholders may have about public participation processes. Past Experiences, availability of Institutional Resources, and Supervisory Structure/authority can influence decision-makers’ attitudes about public participation. These considerations are therefore incorporated into Figure 7 as sub-nodes under Organizational Culture and Leadership: Experience, Institutional Resources, and Supervisory Structure. Supervisory Structure considers who is reporting to whom, particularly as it relates to roles and responsibilities for project management versus stakeholder management and the structure’s influence on management priorities, reward and recognition systems.

To further define the term Social Complexity, this paper applies the collective knowledge and experience expressed in a recent effort of The National Academies (2006). EPA sponsored The National Academies to provide guidance to federal agencies and others to assimilate existing knowledge on public participation, improve the practice of public participation, and suggest priorities for future research. The first stage of this study examined the burgeoning case-study, theoretical, and practical literature on community involvement and developed preliminary lists of potentially critical variables, outcome indicators, and causal hypotheses. In a February 2005 conference hosted by The National Academies, a panel of distinguished researchers and practitioners identified a long list of process, outcome and social context factors that are known to influence the design and implementation of public participation programs. This list of process, outcome and social context factors was used to identify the remaining nodes under social complexity not previously identified herein (Relationship
History, Multiple Authorities, Multiple Parties, High Stakes, Cultural Heterogeneity, Moral Issues, and Geographic Scale), and it further confirmed many others that are discussed herein. See Appendix B for a definition of terms.

**Process Norms and Values**

Figure 6 indicates that individuals’ understandings of the existing situational context are shaped by certain normative notions and values about process; in other words about the ways in which information is used to make decisions (Webler, 2007; Chess, 2007). Process Norms and Values can be evaluated using both participant expectations and normative communication theory.

How public participation processes are assessed by participants was investigated by Santos & Chess (2003) in the context of U.S. Army Restoration Advisory Boards (RABs). Santos and Chess concluded that various stakeholder groups had different perceptions of the goals of RABs, which were closely related to stakeholders’ notions of successful outcomes. (Outcome expectations are identified in Figure 6 of the mental model as Needs and Interests.) More broadly, Santos and Chess conclude that it is important to consider both theoretical and participant-driven expectations for evaluating the quality of a participatory effort. Webler and Tuler (2002) provide their own more expansive review of theory and practice than provided here, and conclude similarly that beliefs vary regarding the outcome objectives of public participation, that the beliefs can be influenced by contextual variables involved, and that a general theory of public participation must consider these participant-driven expectations. This

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17 A RAB is the U.S. Department of Defense equivalent to EPA’s CAG.
research supports the inclusion of a Process Norms and Values node as an intermediary between the Existing Context and Needs and Interests nodes.

The degree to which process norms and values are invoked in a particular context may vary. Normative notions and values can play a larger role, for example, for individuals whose identity (note that Social Group Identity is a node in Figure 7, Existing Context) involves a sufficiently large component of social responsibility. When confronted with situations they recognize as unfair, or misuse of power, etcetera, they may desire forms of public participation that provide them with more influence (Webler, 2007).

The contents of the Process Norms and Values box of the mental model (Figure 6) are derived from the work of Webler et al. (2001). Public perspectives about what constitutes a good public participation process were examined within the context of a forest planning process. Forest planning processes also involve a mix of technical complexity and social controversy, much like a Superfund investigation. Five perspectives were identified: (1) popular legitimacy, (2) facilitating ideological discussion, (3) process fairness, (4) attention to power struggles, and (5) leadership and compromise. Each of these is included within the Process Norms and Values box. Terms are defined in Appendix B.

**Emotions**

The Emotions component of the model shown in Figure 6 is intended to capture an individual’s emotional hopes, fears, frustrations, attitudes, trust, stigmas, etcetera, and recognize their subjective likes/dislikes and opinions. This component of the model
was identified during one of the workshops (Penny, 2008). Also, previously cited research such as Edelstein (2004) have described how people living within a Superfund site can become confronted with negative emotional responses such as frustration and distrust. Wide-ranging attitudes toward those in positions of power and authority frequently exist. Moreover, Peters et al. (2004) identify how repeated negative emotional responses can lead to deeply embedded stigmas that affect decision-making.

Trust in particular has been linked to many other variables identified in this model and is therefore recognized as an important variable in decision-making. Trust has obvious connections to previously identified variables such as Relationship History and Social Complexity. Trust of Institutions is previously described as a component of Concern. A close relationship is also recognized between trust and the variables comprising Process Norms and Values such as fairness and legitimacy. Renn and Levine (1991) identified the following normative factors as essential characteristics of trust: competence (technical expertise), objectivity (bias), fairness (acknowledging all points of view), consistency (behavior over time) and faith (perceived good will). Renn subsequently teamed with Webler and Wiedemann to propose fairness and competence as a normative basis for evaluating the quality of environmental discourse (Renn et al., 1995). In turn, Webler and Tuler (2000) considered how fairness and competence might be perceived by participants in a participatory process. Within this context, fairness and competence have become defined as qualities of a public participation process. As defined by Webler and Tuler (2000, p. 5),

“Fairness refers to the opportunity for all interested or affected parties to assume any legitimate role in the decision making process. Competence refers
tot eh ability of the process to reach the best decision possible given what was reasonable knowable under the present conditions.”

The interconnected relationships between Emotions and other boxes contained within the Ways of Thinking part of the mental model is intended to capture the above described connections between emotions such as trust and variables pertaining to Process Norms and Values and variables pertaining to Needs and Interests.

**Needs and Interests**

The Needs and Interests node is shown in Figure 6 as the product of thinking about the Existing Context in light of Normative Notions and Values and Emotions. The Needs and Interests of an individual contemplating public participation are the outcomes they would like to achieve by participating. These aspirational Needs and Interests can include both substantive and process considerations. The variables comprising Needs and Interests are shown in Figure 8.

The substantive variables shown in Figure 8 are arrived at as a result of decisions made by the convener (and those to whom the convener may delegate authority). These decisions establish the Costs and Schedules for the project and the Human Health and Environmental Improvements to be obtained. The Human Health and Environmental Improvements node incorporates the cleanup decisions that precede the actual cleanup action. The National Academy of Sciences (2008) recognizes quality of decisions as one of three primary goals for public participation.

Figure 8 also identifies process and social type variables. The nodes classified as process variables are those most immediately related to implementation of technical
assessment and public participation processes. The nodes classified as social type variables capture the higher level interpretations and judgments derived from the process and substantive variables.

As previously described in Chapter 2 (see Communicative Theory), fairness and competence are recognized as prominent variables for assessing the quality of a public participation process. Technical and Process Competency is proposed in Figure 8 to reflect these objectives as an expected outcome. In other words, the assessments and procedures used to develop a solution to the problem that the project is to solve must be recognized as fundamentally competent. According to Webler and Tuler (2000, p. 183), competency involves “access to information and its interpretations, and use of the best available procedures for knowledge selection.” To be fair, participants must be present, make statements, participate in the shaping discussion, and participate in the decision-making.

Two additional nodes are shown in Figure 8 to support Technical and Process Competency. Drawing from the evaluation literature (see Chapter 2, Evaluation subsection), the notions of Inclusiveness and Transparency are identified as important inputs to Technical and Process Competency. While the Technical and Process Competency node captures the need for informative and deliberative processes, it does not clearly indicate the need for processes to be inclusive of all stakeholders and to be transparent in operation (Bradbury and Branch, 2006; see Figure 4, The Acceptability Diamond). Transparency is used in this context to capture both the need for the information used in a decision to be disclosed and the need to be clear about the
decision criteria; what Bradbury and Branch (2006) term information disclosure and accountability. Inclusiveness is also shown to have a direct influence on perceived Fairness of outcomes.

The remaining nodes presented in Figure 8 are derived in large measure from the list of outcomes (which this paper calls Needs and Interests) provided by The National Academies study. The relationships proposed in Figure 8 consider that Competency is fundamental to accurately informing both the convener and stakeholders about the basis for a decision. The number 1 conclusion presented by the recent expert Panel on Public Participation in Environmental Assessment and Decision Making (National Academy of Science [NAS], 2008, p. 2), states:

“Conclusion 1: When done well, public participation improves the quality and legitimacy of a decision and builds the capacity of all involved to engage in the policy process. It can lead to better results in terms of environmental quality and other social objectives. It also can enhance trust and understanding among parties. Achieving these results depends upon using practices that address difficulties that specific aspects of the context can present.” [emphasis added]

Within the first sentence of this quote we find that “quality” decisions enhance perceived “legitimacy.” Consistent with this statement, Figure 8 shows a direct relationship between Human Health and Environmental Improvement (which is where a quality decision is realized within the mental model framework) and Legitimacy. Again considering Conclusion 1, when done well, we are told, processes that lead to “quality” and “legitimacy” are also expected to build the problem solving “capacity” of those engaged. Applying these concepts to the mental model framework presented in Figure 8, Technical and Process Competency (i.e. when done well) supports Stakeholder and Convener the Problem Solving Capacity which also supports Human Health and
Environmental Improvement (i.e. quality) and Legitimacy. In connecting Stakeholder and Convener the Problem Solving Capacity with Human Health and Environmental Improvements and with Legitimacy, Figure 8 promotes the logical claim that understanding on behalf of both the convener and the stakeholders as a necessary intermediate step.

The degree to which stakeholders understand convener decisions and deem them Legitimate can be mediated by stakeholders’ sense of Trust and Fairness, as previously described (see Emotions). Fairness of the outcome is also recognized to be dependent upon the degree to which stakeholders were fairly and inclusively included in the process.

Further support for the elevation of Legitimacy as the utmost goal is supported by a recent expert-informed handbook promoting collaboration. In this handbook, the Council of Environmental Quality (CEQ, 2007, p. 1) states,

“Collaborative approaches to engaging the public and assessing the impacts of federal action under NEPA [National Environmental Policy Act] can improve the quality of decision-making and increase public trust and confidence.”

This statement recognizes the connection between high-quality decisions that lead to substantive improvements and the public’s confidence in the agency. In comparing this statement to Figure 8, “quality of decision-making” is embodied in the node Human Health and Environmental Improvement as supported by the subservient node of Convener Understanding of Decision Implication to Stakeholders. The term “confidence” implies confidence in agency decisions, which is embodied in the node
Legitimacy as supported by the subservient nodes of Trust, Fairness, Stakeholder Understanding of Convener Decisions, and others.

The CEQ was established within the Executive Office of the President by Congress as part of the National Environmental Policy Act of 1969 (NEPA) and additional responsibilities were provided by the Environmental Quality Improvement Act of 1970. It is a high level body that advances environmental policy objectives. The CEQ coordinates Federal environmental efforts and works closely with agencies and other White House offices in the development of environmental policies and initiatives. However, the astute reader will recognize that the CEQ had no direct authority with Superfund, which is exempt from NEPA requirements. Recent EPA publications that address the agency’s public participation goals are more reserved in defining their public participation goals to that of affecting the decision-making process. For example, the Superfund Community Involvement Handbook states that the purpose of public participation is “to give people the opportunity to become involved in the Agency’s activities and to help shape the decisions that are made” (EPA, 2005, p. 3). Similarly, the Model Plan for Public Participation identifies as their first Core Value and Guiding Principle that, “People should have a say in decisions about actions which affect their lives” (EPA, 2000, p. 13).

The distinction between EPA’s public participation objectives and those identified by the NAS and CEQ suggest different levels of awareness and the ongoing evolution of understanding about the goals for public participation. The EPA’s goals for public participation are supportive of the node Convener Understanding of Decision.
Implication to Stakeholders in Figure 8. This research also incorporate the more recent and expert-informed goals for public participation identified by the NAS and CEQ into the mental model in Figure 8.

**Individual Ways of Thinking**

In summary of the model’s components presented thus far, an individual’s Needs and Interests are derived from their understanding of the Existing Context, which is interpreted and made meaningful by one’s Process Norms and Values and one’s Emotions. Together, these four nodes, as expressed in a given controversial situation, are expected to reveal an individual’s Way of Thinking.

Individual Ways of Thinking must be understood as something more than just the ‘sum of the parts.’ It also captures the relationships among the parts, where the emphasis is placed, and how a meaningful interpretation is ultimately constrained. While thinking was once considered only within the construct of pure rationality, utility maximization, and rules of logic, more recent work in such areas as affective heuristics (Slovic et al., 2004; Kahlor et al., 2003), epistemic risk perceptions (Althaus, 2005; Hamilton, 2003), and cognitive bias (Bazerman and Neale, 1992) identify a much broader spectrum of mental processes used by individuals to make decisions. Through these lines of research, decision-making about public participation processes is recognized as complex and “messy” (Chess, 2007).

Negotiation bias is particularly well characterized for our purposes in the work of Bazerman and Neale (1992), who point out how people can often act in ways that are inconsistent with their self-interests. Overconfidence about winning, keeping
committed to a course of action during escalating conflict, over-reliance on only easily accessible information, and viewing all negotiation as distributive rather than integrative when appropriate are examples of the types of biased thinking known to frequently exist among negotiating parties.

One study has evaluated the conditions under which heuristic forms of thinking are applied to public concern over contamination. Heuristic forms of thinking use mental short-cuts to arrive at conclusions on complex topics. Life experiences may be used to arrive at associations that effectively connect multiple nodes of mental model in affective and self-evident ways. Heuristic forms of thinking contrast with more systematic and analytic forms of thinking; however, both modes of thinking may operate simultaneously (Slovic et al., 2004). Kahlor et al. (2003) evaluated the relationship between perceived amount of information needed to deal with a risk and utilization of heuristic or systematic decision-making processes. Using questionnaire data regarding PCB-contaminated fish risk communication efforts in the Great Lakes, the authors conclude that the larger the gap between one's understanding of a risk and the level of understanding that one needs in order to make a decision about that risk, the more likely one will process information systematically rather than heuristically. If this tendency holds for public participation decision-making, one would expect greater willingness of people to apply more systematic forms of thinking about their public participation decisions at more complex sites where the information needs are likely greater.
Since ways of thinking can vary considerably between individuals and over time for an individual, it is not always expected to be inclusive of all appropriate factors nor necessarily follow established patterns of thought as is suggested by a static model. Modifications to the model may be necessary to accurately reflect an individual’s way of thinking. Moreover, an interpretive assessment of an individual’s expressed mental model is required to discern Ways of Thinking. As previously stated, one objective of this research is to characterize the different Ways of Thinking and associate them with expressed public participation preferences.

**Individual Public Participation Knowledge and Preferences**

The Individual Process Knowledge and Preferences node in Figure 6 represents an individual’s judgment about the public participation approach(es) that will best meet their needs and interests as recognized through their Ways of Thinking. This preference may (or may not) be expressed within a group context wherein the actual decision is represented to occur, as discussed below. Importantly, preference may also be a fleeting judgment within an actively changing project. Regardless, this node represents the idea that each individual who becomes engaged in controversy must eventually make a personal decision about how to proceed. It is important to note here that the mental model makes a distinction between a person’s preference for public participation versus the actual public participation decision, which is presented in the next subsection.

The typology of possible public participation options was initially provided by McKinney and Saha (2008), and has been widely recognized and accepted by those
included in this research with minor revision. No hierarchy of value is intended in the list. Multiple options may be selected, and the choice(s) of options can vary as the project develops. Of course, individuals can only select from options about which they are knowledgeable.

One option available is to not engage for an undefined period of time. Informing is a type of ‘one-way’ public participation whereby the convener (the party responsible for or otherwise funding the work) provides information to other stakeholders to help them understand problems, options, or solutions. Seeking Advice uses ‘two-way’ communication whereby an individual seeks advice or input from one or more stakeholders before making a decision. The Superfund TAG program is a Seek Advice form of public participation. In the TAG program, EPA provides financing to a recognized community group that allows them to hire their own technical experts. The TAG contractor may inform the community group and may also represent the community to inform EPA of their understanding of the issues and its relationship to community Needs and Interests.

Build Agreement is a type of public participation involving multi-party collaborative forms of problem solving. The convener may independently, or through the services of a process manager, share decision-making processes and responsibility with a group of stakeholders without abdicating the convener’s authority. A close corollary to this type of public participation in the Superfund program is the CAG program. As stated on EPA’s web site,\(^\text{18}\) the CAG program “provide a public forum for

\(^{18}\) See [http://www.epa.gov/superfund/community/cag/whatis.htm](http://www.epa.gov/superfund/community/cag/whatis.htm).
community members to present and discuss their needs and concerns related to the Superfund decision-making process” and it “offers EPA a unique opportunity to hear and seriously consider community preferences for site cleanup and remediation” (EPA, 2009). The Superfund CAG program is therefore considered within this typology to be a Build Agreement form of public participation.

Resolve Dispute is also a collaborative type of public participation that involves a process manager. Resolving disputes is distinguished from building agreement in that the process is more typically provided in response to controversy rather than to proactively prevent controversy, and the focus is more on achieving a decision than on building relationships and civic capacity for addressing future conflict. Both mediation and legal processes are considered within this typology to be a resolve disputes form of public participation. Negotiation is another term often considered within the context of resolving disputes. Within this typology however, negotiation is considered to be a more general term. A negotiation can be conducted to resolve disputes, build agreement, or as a component of any other categorization included in this typology.

Advocacy/Public Relations refer to types of public participation that seek to go outside the due process offered by a convener. Appeals to authority above the project level, such as media campaigns and appeals to elected officials, special interest groups, or the public at large are all considered forms of advocacy in this typology.

**Inter- and Intra-Group Interaction and Process Decision-Making**

Individual’s Process Knowledge and Preferences must be expressed and reconciled within Inter-and Intra-Group interactions before a Process Decision can be
recognized and acted upon by the participants engaged in the controversy. These group interactions can occur in diverse ways, such as: interviews supporting development of a community involvement plan; review and comment on written public participation plans; closed door meetings of special interests groups; convening portions of a facilitated process management effort; and many other formal and informal types of interactions between and within like-minded groups. These interactions may continue throughout a project, and process decisions may change.

As information is shared, learning may occur that may affect one’s Way of Thinking. Processes may be used to achieve intermediate project objectives that succeed or fail, as may be assessed differently by different stakeholders. The Inter- and Intra- Group Interaction process must therefore be recognized as potentially highly dynamic, more so than might be immediately recognized from the model in Figure 6 (Susskind, 2008).

Within group processes, issues of power and authority may be clarified. A convener may limit the process options available. As noted by Teske (2000, p. 663) in considering the success of the TAG program, the “degree of democracy present depends greatly on the willingness of the legally empowered decision-making agency to allow citizen groups to influence the process.” In this context, individual process preferences may never be expressed or even fully allowed to develop. Regardless of how constrained a particular interaction may become, the mental model provided in Figure 6 considers that individuals maintain a measure of independent thinking which they apply in order to understand the situation and continually re-evaluate an approach for
participation, from among those known to them, that best meets their Needs and Interests. While the emphasis for this mental model research is the individual cognitive process, the model recognizes that individual’s thinking about public participation as well as their final decisions about how to participate may be mediated by group processes.

**Chapter Summary**

This chapter responds to research question 1 by presenting an expert mental model that describes the thinking and learning processes individuals use to make public participation decisions. Based on a literature review, expert interviews, and workshops, the expert mental model provides an illustrative framework of interconnected variables that describes how individuals think about their public participation decisions. The result is a framework that is coherent to public participation professionals and consistent with current public participation theory. The mental model can aid those developing public participation to recognize the diverse range of variables, and the relationships among variables, that should be considered by those who would engage in a public participation planning process. Similarly, individuals engaged in controversy may apply the model to guide an informed and thoughtful public participation decision. Elaboration on the theoretical implications and practical advice to be derived from the expert mental model is provided in Chapter 7. Moreover, the model is foundational to further research addressing research questions 2 and 3 in Chapters 5 and 6, respectfully. To aid readers as the analysis advances, Appendix B provides summary definitions for each node identified in the mental model.
CHAPTER 5: PARTICIPANT MENTAL MODELS

This chapter addresses research question number 2: What characteristically different Ways of Thinking about public participation decision-making can be identified among participants engaged in science-intensive controversy, and are these differences associated with different public participation decisions? Three characteristic Ways of Thinking are elucidated from participant interviews at the Residential Yard Cleanup Site and at the Water Quality Site. This chapter presents the detailed analysis and interpretative processes used to evaluate participant interviews and identify the three characteristic Ways of Thinking. The outcome of this analysis is a core subset of nodes that characteristically define and distinguish the different Ways of Thinking. The participant mental model that emerged from the coding and analysis is presented in Figures 9 through 11. Because this chapter focuses on participants who are engaged in project related controversy, this chapter analyzes public participation decisions at the project level.

In summary of the detailed methodology presented in Chapter 3, the data analysis used both qualitative and semi-quantitative methods. Segments of interviewee text addressing a succinct topic or collection of topics were coded to nodes of the mental model. Coded interview data were initially organized in a table by project site and further organized as either residents or regulators. The distribution of coded responses in this first table suggested an alternative organization of interviewees according to three different Ways of Thinking. This re-organization of the data was
Figure 9. Participant Mental Model of Public Participation Decision-Making

**Existing Context:**
- desire for information or engagement
- recognition of stakeholder differences (see Figure 10)

**Process Norms and Values:**
- seek process fairness
- attend to power struggles
- promote deliberation
- achieve popular legitimacy
- establish locus for decision authority
- build civic capacity
- role of experts
- due process

**Emotions:**
- hope, fear, frustration, anger, attitudes, curiosity, likes/dislikes, opinions, trust, stigma

**Needs and Interests:**
- substantive
- process
- social (see Figure 11)

**Individual Process Knowledge and Preferences:**
1. no engagement
2. inform
3. seek advice
4. build agreement (proactive)
5. resolve disputes (reactive)
6. public relations/advocacy
7. Individual interaction
8. Legal

**Convener Offers/Restricts Options**

**Individual Learning**

**Inter- and Intra-Group Interaction**

**Process Decision-Making**

Individual “Ways of Thinking”
Figure 10. Existing Context for the Participant Mental Model

**Substantive Variables**
- Unintended Consequences
- Solution Options, Costs and Schedules
- Problem Recognition
  - Knowledge Requirements
  - Regulatory Complexity
  - Technical Complexity
  - Environmental Quality
  - Other Problems

**Desire for Information or Engagement**
- Effect Outcomes
  - Personal Resources
    - Time
    - Money
    - Energy
  - Political Vulnerability
    - Concern

**Interpretive Variables**
- Recognition of Stakeholder Differences
  - Social Group Identity
  - Stereotypes of Others
  - Nature Vulnerability vs. Regenerativity
- Needs and Interests of Others
  - Public Participation Preferences of Others
  - Understanding Others Decisions
  - Other

**Social Complexity**
- Social Variables
  - Morals
  - Multiple Authorities
  - Multiple Lay Parties
  - Cultural Heterogeneity
  - Relationship History
  - Media
  - Organizational Culture and Leadership

**Other Variables**
- Experience
- Institutional Resources
- Supervisory Structure

**Other Problems**
- Technical Competence
- Process Competence
- Transparency
- Inclusiveness
- Commitment
- Security and Control
- Health and Safety
- Trust of Institutions
- Trust of Institutions
- Time
- Money
- Energy
Figure 11. Existing Context for the Participant Mental Model

- **Substantive Variables**
  - Human Health and Environmental Improvement
  - Other Impacts
  - Convener Understanding of Decision Implication to Stakeholders

- **Social Variables**
  - Legitimacy
  - Trust
  - Fairness
  - Stakeholder Understanding of Convener Decisions

- **Process Variables**
  - Cost and Schedule
  - Stakeholder & Convener Problem Solving Capacity
  - Transparency
  - Technical and Process Competency
  - Inclusiveness
necessary to achieve the research objective of associating thought processes with preferences for certain forms of public participation.

A second table was therefore constructed with the same coded data, but interviewees were organized by Experiential, Analytical, and Strategic Ways of Thinking. The frequency, magnitude, and qualitative nature of the coded responses within and between these different Ways of Thinking were systematically evaluated to elucidate those nodes within the mental model that occur more frequently or with greater emphasis within one or more Ways of Thinking. This analysis was used to arrive at a simplified characterization of the distinctive differences between the different Ways of Thinking.

The presentation of the data analysis mirrors this process of discovery by first presenting an analysis of the data as organized by project site. The rational applied to reorganizing the data by Way of Thinking is then presented. The chapter concludes with the identification and description of the three characteristic Ways of Thinking.

**Analysis by Project Site**

The coded data organized by site are presented in Table 1. The table is organized by site and for each site the interviewees are identified as either residents (which includes employees of mining companies and potentially responsible parties to Superfund cleanups as wells as paid citizen group leaders) or regulators (employees of the EPA or other state or federal agencies engaged in the project). Interviewees are further identified as either generally supportive (+) or non-supportive (-) of EPA’s actions.
<table>
<thead>
<tr>
<th>EXISTING CONTEXT</th>
<th>Residential Soil Cleanup Site</th>
<th>Drinking Water Cleanup Site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Desire for Information or Engagement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unintended Solution Effects</td>
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<td>1</td>
</tr>
<tr>
<td>Solution Options, Costs and Schedules</td>
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<td>1 5 2 3 2 1 2</td>
</tr>
<tr>
<td><strong>Problem Recognition</strong></td>
<td></td>
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<td>2 2</td>
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</tr>
<tr>
<td>Other Problems</td>
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<td>3 1 3</td>
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<tr>
<td>Effect Outcomes</td>
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<td>1 1</td>
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Table 1. Number of Responses by Node and Interviewee, Organized by Site (continued)

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Table 1. Number of Responses by Node and Interviewee, Organized by Site (continued)

Notes:
Interviewee signs: (-) not supportive of EPA actions, (+/-) supportive of EPA actions but critical of details, (+) supportive of EPA actions.

Residential Soil Cleanup Site interviewee descriptions:
1. Prior volunteer local official
2. Resident with active project involvement
3. Responsible party employee
4. Prior volunteer local official
5. Prior responsible party employee, civil servant, and local official
6. Project Manager for the state
7. Community Involvement Coordinator for the state
8. Project Manager for the EPA
9. Community Involvement Coordinator for the EPA

Drinking Water Cleanup Site interviewee descriptions:
1. Paid and unpaid leader in non-profit environmental organizations
2. TAG contractor and leader in a local non-profit organization
3. Local official
4. Environmental Manager for a local, active mine
5. Project Manager for the state
6. Technical Specialist for the state
7. Forest Service Ranger
8. Project Manager for the EPA
9. Community Involvement Coordinator for the EPA

Node signs: Negative values indicate a negative orientation. Other: Residential Soil Cleanup Site (historical preservation, aesthetics, long term O&M, daily disruption). Drinking Water Cleanup Site (security and control, cleanup money, safety, promotes new mines).
at the project site. The body of the table presents the number of times a node was
coded for each interviewee. Some nodes of the mental model inherently involve a
positive or negative judgment. Where such differences were discerned from the
interviews, a negative sign is used to identify a negative orientation. Recall that all
segments of interviewee’s text were assigned codes, and all assigned codes are
accounted for on Table 1. Therefore, Table 1 provides a synoptic accounting of every
thought shared in a way the supports identification of similarities and differences
among individuals and groups of individuals.

The coding assessment for the Residential Soil Quality site is presented first. The
similarities and differences to the Residential Soil Quality site are identified in the
subsequent presentation for the Drinking Water Quality site. This approach minimizes
redundant descriptions of coding processes, and hastens the identification of important
differences between the sites. In addition to describing the differences between the
two sites, this presentation of the data by project site also substantiates the manner by
which codes are assigned to segments of text provided by the interviewees. The sub-
headers used in the text below for each site are consistent with the names for nodes in
the mental model (Figures 9 - 11) and the headers used to organize Table 1.

**Residential Soil Quality Site**

**Existing Context: Desire for Information or Engagement.** The top of Table 1
begins by listing nodes that are contained within the “Substantive” box shown on
Figure. Substantive refers to the traditionally recognized, core elements of problem
recognition and “on-the-ground” solutions. Within this category, a heavy emphasis is
noted by most residents and all regulators for Unintended Consequences. The unintended effects included the inability of residents to sell properties or finance loans while labeled as an impacted property under Superfund, the longer than expected timeframe expected by some residents to implement the remediation, certain restrictions on future excavations, and perceived fairness inequities between residents on the amount and nature of the residential cleanups. As yard cleanups progressed, many residents and regulators believed that residents allowed EPA to conduct remediation just to achieve aesthetic improvements to their yards. Some residents disapproved of the use of federal funds to achieve aesthetic objectives.

Notable differences exist between residents and regulators regarding Solution Options, Costs and Schedules. An important consideration that emerged for residents and became recognized by regulators was a desire to preserve sufficient historical features symbolic of the community’s mining heritage. Also, the remedy required the construction and long-term maintenance of waste management facilities. This part of the remedy incurred increased long-term costs to local government and the need to plan for increase taxes to support the cost increases. Such a ramification was not widely expected when the Superfund effort was initiated and it became a source of concern and controversy.

Notable differences also exist between residents and regulators regarding Problem Recognition, which is broken down into Knowledge Requirements, Regulatory Complexity, Technical Complexity, and Other Problems in Figure 10. Regulators spoke more frequently about the need for certain kinds of knowledge, such as risk assessment,
to understand the problems being addressed by the Superfund effort, while some residents tend to discredit such Knowledge Requirements with statements like “I don't believe it [lead] was there [derived from the mine waste at unhealthful levels].” The Regulatory Complexity and Other Problems variables are emphasized largely by regulators. Technical Complexity is unique because both regulators and residents who are supportive of EPA’s actions at the site focused on this variable. This notable difference and the difference in orientation to Knowledge Requirements suggests that those who are opposed to the cleanup effort dismiss the more substantive aspects of Problem Recognition and Solution Options, Costs and Schedules in favor of other more personally meaningful or persuasive aspects of the project. Residents opposed to the project may consider these variables as irrelevant, unimportant, or too difficult to understand or discuss. For residents, being supportive of the EPA action may enhance willingness to consider substantive variables, or willingness and ability to understand substantive variables may enhance one’s ability to recognize and agree with regulators perspectives.

Figure 10 identifies nodes that are collectively described as Interpretive variables. These variables involve higher degrees of personal preference, perspectives, and priorities. In Table 1, certain Interpretive variables stand out as receiving greater focus or inter-individual variation in response. Among the variables affecting Desire for Information or Engagement, the variable Security and Control is unique in the focus given by some regulators and the degree to which it is expressed by all interviewees. Residents opposed to the EPA action expressed concern about their ability to determine
what happens on their properties or to their properties. Those opposed to EPA actions expressed disapproval of EPA’s ability to “blacklist” their property if they choose not to participate in the cleanup by placing notices on file with the county that identify the property as contaminated. Also, residents opposed to EPA actions expressed frustration over what is ultimately done on the properties once access is granted. One resident stated that “EPA is acting like a dictator and we're not going to tolerate it.” The regulators are well informed about these concerns, as revealed by the large focus on Security and Control. Interestingly, residents opposed to the project are also unique in expressing concern about limited Personal Resources (Time, Money and Energy) to achieve effective engagement with the regulators and in expressing concern about their Political Vulnerability. Political Vulnerability concerns expressed the perceived inability of local city and county representatives, state regulators, and U.S. Congressional representatives to affect EPA decision-making. One resident indicated that the “state was scared to say anything” to the EPA that would meaningfully affect the project.

**Existing Context: Recognition of Stakeholder Differences.** Among the Interpretive Variables affecting Recognition of Stakeholder Differences, two variables stand out as receiving heavy focus. Regulators placed heavy focus on describing the Needs and Interests of Others. Text was coded to this variable when the interviewee described a Need and Interest node of the mental model, but from the perspective of another participant. Regulators and to a lesser extent residents supportive of the project placed a heavy focus on expressing their recognition of others’ needs and interests. The most frequent topics mentioned are preservation of historical structures...
and increased burdens on city and county infrastructure. It is readily understandable that regulators would perceive it as their responsibility to know about and respond to the Needs and Interests of Others. Less expected is the difference observed between residents supportive and not supportive of EPA’s cleanup. Residents supportive of EPA’s cleanup expressed a recognition of: EPA’s cost limitations, a change in resident’s attitudes once the soil remediation work was completed and tangible benefits (i.e. aesthetic improvements) were apparent to them, the belief by some residents that there is no health-based need for the cleanup, and concerns by some residents for the details of how certain aspects of the cleanup were implemented. Among residents opposed to the project, one resident expressed a collective concern that residents want to see EPA get the work done and get out.

Consistent with the desire to talk more about the Needs and Interests of Others, text was more frequently coded as Stereotypes of Others for regulators and residents supportive of the EPA actions. This text typically described the community of residents as hard to inform, prideful of their heritage, protective of the mining companies, and resistant to change. A resident supportive of EPA actions characterized the community as expecting too much, griping too much, and not having adequate civic pride about how their properties look and how the town looks. Much less frequent stereotypical descriptions by residents not supportive of the EPA project describe the regulators as not keeping their word and blaming others for their mistakes.

Social Variables, identified on Figure 9, are used to describe the kinds of engaged participants and the characteristics of their interactions. Among the Social Variables, a
consistent and fairly heavy focus is observed for Relationship History. Residents opposed to the project identified a consistent history of negative interactions and disappointments in their interactions with the regulators. Regulators expressed understanding of the importance of relationships to addressing the project, the need to work on improving relationships, and a recognition of past failures. Regulators were unique in expressing the challenges in problem solving across Multiple Authorities and Multiple Lay Parties. Regulators also discussed Institutional Resource constraints and Supervisory Structure constraints much more frequently than did residents. In contrast, perspectives on the Media were overwhelming negative though not with heavy focus for nearly all participants. Media coverage was focused on the local newspaper. Residents and regulators believed that the media mischaracterized the town as hillbillies and mischaracterized the nature of the problem.

The variable comprising Experience is identified in Figure 10 as a more interpretive aspect comprising Social Complexity. Among these variables, Commitment stands out in Table 1 as expressed by all participants, sometimes with heavy focus. In all cases, the focus of commitment was toward the regulators, consisting of a self appraisal by the regulators of their performance or an assessment by the residents of the regulators performance. Interestingly, the expressed perception of Commitment as either positive or negative is correlated with overall support for EPA’s actions. Commitment appears to stand out as a consistent and reliable predictor of an individual’s overall position. The same pattern holds for Technical Competence and Transparency. Statements by regulators reflect that they make every conceivable effort
to be available and respond in a timely manner. Nothing in the interviews indicates that regulators are aware that some residents rate their performance in this area negatively. While cause and effect influences among these variables cannot be ascertained, the observed associations suggest that trying harder to be committed, transparent or competent may not by itself change resident’s negative perceptions. Rather, these perceptions may derive from resident’s perceptions that the overall project is delivering on their needs and interests, or other factors.¹⁹

**Emotions.** Emotions are identified in Figure 9 of the model. The results provided in Table 1 (progressing to the second page) for Emotions are not surprising. Negative emotional responses are commonly expressed by both residents and most regulators, though they are more frequently and consistently expressed by residents opposed to EPA’s actions. However, positive emotions may be underrepresented by methodological bias. Text was only coded for emotions when it was clearly recognized in the transcribed text. Negative emotions are perhaps easier to discern in the text, while more subtle positive emotions may be expressed when relating more analytically oriented thought processes.

**Process Norms and Values.** Process Norms and Values, identified in Figure 9, refers to standards individuals apply to judge the quality of the decision-making process. Among the variables in this category, Locus for Decision-making Authority is unique in being expressed by all interviewees. A consistent correlation is observed between a

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¹⁹ In contemplating this finding and its application to the selection of process alternatives that may serve to break down these seemingly interest-based perspectives, it is perhaps interesting to note that text on Commitment is never directed toward expectations of residents. In contrast, an effectively managed collaborative process generally establishes recognized mutual responsibilities.
negatively expressed perspective on how a Process Norm and Values variable is being implemented on the project and the interviewee’s overall support for EPA’s actions. Also, those opposed to EPA’s actions more frequently expressed other types of Process Norms and Values, notably Attend to Power Struggles.

**Needs and Interests.** Needs and Interests nodes are identified on Figure 11. Not surprisingly, the most frequently expressed Needs and Interests by all interviewees involved whether Human Health and Environmental Improvements were necessary or not and the Cost and Schedule for achieving those improvements. Those supportive of EPA’s actions expressed why remediation was necessary and that the costs and schedules achieved were reasonable, while those opposed expressed counter arguments. Notably, few codes were assigned to Social Variables or Process Variables as categorized in Figure 11. The Social Variables and Process Variables are derived from the Expert Model. Some incongruity may exist between an experts’ recognition of the value and importance of Social Variables and Process Variables and the more focused, pragmatic Needs and Interests of participants (see Chapter 6 for more information on this point).

**Individual Process Knowledge and Preferences.** Individual Process Knowledge and Preferences are identified on Figure 9. Individual Interaction, Inform, and Build Agreement are the three most frequently coded variables in this category. Inform is uniquely coded for all interviewees, but greater focus is identified by regulators. Residents expressed the need to receive information and regulators expressed the need to provide information. Discerning code assignments for Seek Advice, Build Agreement,
and Resolve Disputes was relatively challenging. Interviewees often made general references to “meetings,” and the underlying objective of the meeting as either Informing, Seeking Advice, Building Agreement, or Resolving Disputes had to be interpreted from the broader context of that portion of the interview. Also, all interviewees described a rather ad hoc and experimental approach to determining process preferences. Overall, the project began with public meetings, which were universally recognized as ineffective. Early meetings convened by regulators appeared to have an Informing emphasis. In time, the meetings evolved toward a focus on smaller groups of local government representatives with a focus on proactively (i.e. Build Agreement) addressing unintended project consequences such as increased long-term burdens on the city water system and resident water fees. Those opposed to EPA actions evolved through appeals to Congressional leaders (Advocacy) or attorneys (Legal), before becoming completely frustrated and mad and settling for No Engagement. This ever evolving public participation preference complicates any simple or highly quantitative correlation between thought processes and public participation preference. Also noted is an association between residents not supportive of EPA’s actions, residents who investigated Legal action, and residents that most frequently expressed a negative response for Attend to Power Struggles.

**Drinking Water Quality Site**

This subsection identifies the similarities and differences in the text between the two sites.
**Existing Context: Desire for Information or Engagement.** In comparison to the Residential Soil Cleanup Site, there is much greater similarity in coded responses between residents and regulators for Substantive Variables. This similarity is consistent with the broad support given thus far to EPA’s actions by residents. All residents and regulators were coded under Regulatory Complexity and Technical Complexity, often with high frequency of reoccurrence. The interviews reveal a high level of willingness and ability of the residents to discuss the project in these terms. For example, Resident 1 stated,

“Well, we want to make informed decisions, and we have to educate ourselves. And we’re using the resources available to us – personnel resources. We’re asking a lot of questions of these [EPA] contractors, and we’re paying close attention to scoping all of their performances, and then using our Technical [Assistant Grant] advisers to evaluate their responses.”

In comparing the two sites, it is suspected that Regulatory Complexity and Technical Complexity are expressed more frequently by residents at the Drinking Water Cleanup Site because accepted forms of legal and technical analysis support residents’ objectives. It is also possible that the higher level of education of participants at Drinking Water Cleanup Site enable them to participate more effectively with regulators on technically complex issues. However, it is unknown if this behavioral orientation is widely adopted by all residents, or is disproportionately achieved by leadership from Resident 1.

Residents expressed greater levels of concern about money and time to achieve effective participation than was expressed for the Residential Soil Cleanup Site. Resident 1 for the Drinking Water Cleanup Site worked full time as a paid leader of
multiple non-profit organizations. Finding resources to maintain consistent, long-term and high-quality engagement on this project and other projects was a frequently expressed priority.

**Existing Context: Recognition of Stakeholder Differences.** Residents at the Drinking Water Cleanup Site were consistently coded for text about Public Participation Preferences of Others and Others’ Needs and Interests. These variables provide striking contrasts to coding patterns for the Residential Soil Cleanup Site, and suggest a higher level of effective inter-party communication.

In considering the Social variables (illustrated on Figure 10), striking differences between the two sites also exist for Multiple Authorities and Multiple Lay Parties. Moreover, positive codes are consistently applied to Relationship History for residents and regulators within the Drinking Water Cleanup site. Similarly, Commitment is consistently coded as positive for both residents and regulators, except for Regulator 5. This regulator is opposed to the breadth of the Superfund action and perceives a mission creep since the site’s initial Superfund listing. Negative commitment text described the EPA as trying too hard to appease residents at the expense of doing what is best for the project. A negative orientation for Commitment when opposed to the EPA action is consistent with the association observed for the Residential Soil Cleanup Site.

**Emotions.** Emotions are identified in Figure 9 of the model, and are presented in Table 1, beginning on the second page. Residents and regulators generally expressed positive emotional responses about the Drinking Water Cleanup Site project. The
negative response coded for Resident 1 was directed toward an attorney that had only brief involvement with the project. The negative response coded for Regulator 5 addressed a dislike for the emerging objective of achieving drinking water standards in the stream. Overall, fewer emotional responses were expressed by participants at the Drinking Water Cleanup Site.

More remarkable perhaps is the frequency with which Resident 1 expressed positive emotions. This appears to be part of a strategic effort to use both experiential along with analytical forms of rhetoric to achieve his objective, as supported by statements like, “Well, it’s going to be a battle of winning over the minds and hearts of the community.” However, it should also be noted that a larger number of codes is due in part to the length of the responses provided by this interviewee. The interview lasted about 1.5 hours, which is about 30 minutes longer than then next longest interview.

**Process Norms and Values.** A consistent focus is placed on Locus for Decision Authority, similar to the Residential Soil Cleanup site. Notably different however, is the absence of codes for Attend to Power Struggles for the Drinking Water Cleanup site. These observed differences between the two sites does not necessarily mean that the individuals involved at the two sites have inherently different normative expectations and values about process, but rather it may reflect an interplay between any inherent norms and values and the developments resulting from the Existing Context that give rise to expression.

**Needs and Interests.** Needs and Interests nodes are identified on Figure 11. A focus on Human Health and Environmental Improvement is consistent with that
observed for the Residential Soil Cleanup site. Less focus is given to Cost and Schedule concerns at the Drinking Water Cleanup site. Between the two sites, a modestly larger number of codes are assigned to Social Variables and Process Variables for the Drinking Water Cleanup site. Not surprisingly, Needs and Interests nodes have positive orientations consistent with the broad support by residents and regulators for EPA’s actions at the Drinking Water Cleanup site.

**Individual Process Knowledge and Preferences.** Participants at the Drinking Water Cleanup site placed much less emphasis on the preference for Individual Interaction. This difference likely exists because fewer residents are directly involved with the agency, and because leadership for the residents has been able to work cooperatively in meetings with the regulators.

Consistent with the Residential Soil Cleanup site, the Inform, Seek Advice, and Build Agreement variables are consistently expressed by all interviewees. An exceptionally heavy emphasis on Build Agreement is noted for Resident 1. Interestingly, Resident 1 is unique in expressing an alternative preference for a Legal form of engagement with the agency should the current process prove ineffective in achieving his objectives. The ability to identify and proactively express a broad range of process options further reinforces the broad range of variables that this individual considers in addressing the project.

Resident 4, who did not attend meetings regularly and expressed only mild interest in the Superfund project, expressed much more emphasis on the need to keep informed. This resident is an Environmental Manager for a local mine that repeatedly
expressed the need to use effective science to arrive at a solution. He believed that science was being applied effectively, that he did not need to get more involved to protect his interests, and that the communication systems being used met his needs to keep informed.

**Summary of the Analysis by Project Site and Initial Elucidation of Ways of Thinking**

To summarize the differences between the two sites, the individuals interviewed at the Drinking Water Cleanup site seem to have found a way of working together on issues. There is common support for EPA’s actions. The residents within the community are willing and able to communicate with the EPA on technical issues, and they are able to develop positive working relationships. Concerns about power are much less pronounced. They express positive emotional feelings about the project when talking about it. Individuals at the Drinking Water Cleanup site are effectively applying public participation resources such as the TAG and CAG program to help them meet their objectives. This link between resident support for EPA’s actions and effective use of EPA’s programs is consistent with prior observations that the TAG program (and by logical extension other EPA public participation programs) appears to function well when the interests of the agency and those of the residents are aligned, but fails to live up to its promise when interests are not aligned (Teske, 2000). Where the interests of the citizens and the agency are aligned, as they are for the Drinking Water Cleanup site, EPA’s public participation process can work. For the Residential Soil Cleanup site, where
support for EPA’s actions are absent, the public participation programs are not effectively utilized.

Other readily discernable differences between the two project sites can also be used to explain why public participation is working better at the Drinking Water Cleanup site. Drawing on the community descriptions provided in Chapter 3, the residents at the Drinking Water Cleanup site are more educated and wealthier, and there is the sense that the community is overall more socially-politically similar to agency personal. These similarities likely make it easier for residents and regulators at the Drinking Water Cleanup site to get along and work together.

As described in Chapter 2, this research is interested in pushing beyond the observations of Teske and more casual observations of personality similarities and differences to see if other more subtle communication barriers exist that might further explain why existing public participation programs are not more effective at bridging disparate parties together into constructive problem solving. Further reflection on the observed patterns of the coded data in Table 1 between interviewees across both sites began to suggest an alternative organization of the interviewees into more similar Ways of Thinking that aligned with certain Individual Process Knowledge and Preferences.

Four of the five interviewed residents from the Residential Soil Cleanup Site (that wholly or in part oppose EPA’s actions) provide frequent negative responses for Emotions and for Process Norms and Values. Similarly, these residents provide frequent negative text for Technical Competence, Transparency, and Commitment when describing the Experience of the agency managers.
A second group includes all regulators from both sites and a resident from the Residential Soil Cleanup Site (resident number 5 in Table 1) who was also an employee for a mining company that was partially responsible for cleanup costs and who had served in various local government roles. The text for this group of interviewees consistently addresses Technical Complexity, a subnode to Problem Recognition. Frequent, positively oriented responses addressing Commitment are also provided. Text expressing Emotions are notably absent within this group.

A third group includes residents at the Drinking Water Site, but is strongly influenced by the notably unique pattern of codes observed for the resident who is a paid leader of the local non-profit and citizen-based organization (resident number 1 in Appendix 3). This group shares many characteristics with prior two groups, but also exhibits some apparently unique characteristics. Resident number 1 expresses frequent positive oriented Emotions, and provides a uniquely large number of codes for the Build Agreement type of Process Preference. All members in this group consistently discuss the Needs and Interests of Others.

Importantly, upon regrouping the interviewees in the manner described above, a more consistent pattern of Individual Process Knowledge and Preferences was observed. This allowed the Ways of Thinking exhibited by each group to be more readily associated with their public participation preferences.

**Analysis by Way of Thinking**

This subsection describes the systematic evaluation process used to elucidate those nodes within the mental model that occur more frequently or with greater
emphasis within one or more Ways of Thinking. Table 2 presents the coded data as
organized by Way of Thinking.

Statistical analysis of the coded data was conducted to support a systematic
evaluation of the pattern of coded responses and to identify a core set of nodes that
uniquely characterizes each grouping. Within each Way of Thinking, the frequency by
which individuals are coded for a node is presented. The maximum number of times a
node is coded for any interviewee within a Way of Thinking is also determined along
with the average number of times a node is coded across all interviewees. The average
is presented as an absolute value of the scores, which effectively eliminates the negative
orientation assigned to some codes. These statistics allow the frequency and magnitude
of the coded results to be compared more systematically across the different Ways of
Thinking, particularly considering the larger number of interviewees included in the
Analytical group.

Three columns of numbers on the far right side of the table provide a statistical
assessment of the coding across the different Ways of Thinking. Total Count indentifies
the number of coded responses for all interviewees. The last two columns identify the
amount of difference (i.e. the Spread) between the highest and lowest frequency and
maximum statistics within each Way of Thinking. The “frequency spread” is the
difference between the highest and lowest frequency statistics within each Way of
Thinking, and the “maximum spread” is the difference between the highest and lowest
Maximum statistics within each Way of Thinking. The “total count” and spread statistics
Table 2. Number of Responses by Node and Interviewee, Organized by Way of Thinking

<table>
<thead>
<tr>
<th>Experiential</th>
<th>Analytical</th>
<th>Strategic</th>
<th>Total Count</th>
<th>Spreads*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Desire for Information or Engagement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unintended Solution Effects</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Solution Options, Costs and Schedules</td>
<td>-3</td>
<td>25%-3</td>
<td>0.75</td>
<td>-1</td>
</tr>
<tr>
<td>Problem Recognition</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge Requirements</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Regulatory Complexity</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Technical Complexity</td>
<td>1</td>
<td>5</td>
<td>50%</td>
<td>5</td>
</tr>
<tr>
<td>Environmental Quality</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other Problems</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Effect Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Resources</td>
<td>50%</td>
<td>1</td>
<td>0.33</td>
<td>30%</td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>25%</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>Money</td>
<td>1</td>
<td>25%</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>Energy</td>
<td>1</td>
<td>1</td>
<td>50%</td>
<td>1</td>
</tr>
<tr>
<td>Political Vulnerability</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Concern</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health and Safety</td>
<td>-1</td>
<td>25%</td>
<td>-1</td>
<td>0.25</td>
</tr>
<tr>
<td>Security and Control</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>Trust of Institutions</td>
<td>-1</td>
<td>25%</td>
<td>-1</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Recognition of Stakeholder Differences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Group Identity</td>
<td>2</td>
<td>25%</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Stereotypes of Others</td>
<td>1</td>
<td>1</td>
<td>50%</td>
<td>1</td>
</tr>
<tr>
<td>Nature Vulnerability vs. Regenerativity</td>
<td>1</td>
<td>3</td>
<td>50%</td>
<td>3</td>
</tr>
<tr>
<td>Needs and Interests of Others</td>
<td>75%</td>
<td>-4</td>
<td>0.83</td>
<td>100%</td>
</tr>
<tr>
<td>Public Participation Preferences of Others</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Understanding Others Decisions</td>
<td>-4</td>
<td>2</td>
<td>-1</td>
<td>75%</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>2</td>
<td>50%</td>
<td>2</td>
</tr>
<tr>
<td><strong>Social Complexity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morals</td>
<td>1</td>
<td>25%</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>Multiple Authorities</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Multiple Lay Parties</td>
<td>1</td>
<td>25%</td>
<td>1</td>
<td>0.25</td>
</tr>
<tr>
<td>Cultural Heterogeneity</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Relationship History</td>
<td>-3</td>
<td>-3</td>
<td>50%</td>
<td>-3</td>
</tr>
<tr>
<td>Media</td>
<td>-2</td>
<td>-1</td>
<td>25%</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Organizational Culture and Leadership</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>1/-1</td>
<td>-5</td>
<td>-1/3</td>
<td>75%</td>
</tr>
<tr>
<td>Process Competence</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Transparency</td>
<td>-3</td>
<td>-2</td>
<td>-3</td>
<td>75%</td>
</tr>
<tr>
<td>Inclusiveness</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Spreads* indicate the range of responses (Min, Max) for each category.
Table 2. Number of Responses by Node and Interviewee, Organized by Way of Thinking

<table>
<thead>
<tr>
<th>Experiential</th>
<th>Analytical</th>
<th>Strategic</th>
<th>Total Count</th>
<th>Spreads*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 1 3 4[2]</td>
<td>5 6 7 8 9 5 6 7 8 9</td>
<td>1 2 3 4 5</td>
<td>Freq Max</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Freq Max</th>
<th>Abs Ave</th>
<th>Count</th>
<th>Freq</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% 0 0 0</td>
<td>2 3 1</td>
<td>75% 3 1.5</td>
<td>0% 0 0</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2. Number of Responses by Node and Interviewee, Organized by Way of Thinking

<table>
<thead>
<tr>
<th></th>
<th>Experiential</th>
<th>Analytical</th>
<th>Strategic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4+</td>
<td>5 6 7 8 9</td>
<td>5 6 7 8 9</td>
</tr>
<tr>
<td></td>
<td>Freq Max</td>
<td>Abs Ave</td>
<td>Freq Max</td>
</tr>
<tr>
<td>Individual Interaction</td>
<td>1 5 50% 5 1.5</td>
<td>1 3 5 3 5 2 1 1</td>
<td>80% 5 2.1</td>
</tr>
<tr>
<td>Inform</td>
<td>1 3 1 2 100% 3 1.75</td>
<td>4 8 12 2 6 2 2 2 6 1</td>
<td>100% 12 4.5</td>
</tr>
<tr>
<td>Seek Advice</td>
<td>2 4 1 25% 1 0.25</td>
<td>2 3 2 1 2 1 2</td>
<td>70% 3 1.3</td>
</tr>
<tr>
<td>Build Agreement</td>
<td>2 4 4 2 100% 4 3</td>
<td>9 3 5 6 1 5 5 2 80% 9 3.6</td>
<td>13 1 2 1 100% 13 4.25</td>
</tr>
<tr>
<td>Resolve Disputes</td>
<td>2 1 50% 2 0.75</td>
<td>1 1 1 1 1 1</td>
<td>30% 1 0.3</td>
</tr>
<tr>
<td>Public Relations/Advocacy</td>
<td>2 25% 2 0.5</td>
<td>1 1 1 1</td>
<td>10% 1 0.1</td>
</tr>
<tr>
<td>Legal</td>
<td>1 2 50% 2 0.75</td>
<td>0% 0 0</td>
<td>25% 2 0.5</td>
</tr>
<tr>
<td>Average</td>
<td>36% 0.77</td>
<td>34% 0.81</td>
<td>36% 0.0</td>
</tr>
</tbody>
</table>

Notes:
- Interviewee signs: (-) not supportive of EPA actions, (+/-) supportive of EPA actions but critical of details, (+) supportive of EPA actions.

Residential Soil Cleanup Site interviewee descriptions (identified by bolded numbers):
1. Prior volunteer local official
2. Resident with active project involvement
3. Responsible party employee
4. Prior volunteer local official
5. Prior responsible party employee, civil servant, and local official
6. Project Manager for the state
7. Community Involvement Coordinator for the state
8. Project Manager for the EPA
9. Community Involvement Coordinator for the EPA

Drinking Water Cleanup Site interviewee descriptions (identified by not bolded numbers):
1. Paid and unpaid leader in non-profit environmental organizations
2. TAG contractor and leader in a local non-profit organization
3. Local official
4. Environmental Manager for a local, active mine
5. Project Manager for the state
6. Technical Specialist for the state
7. Forest Service Ranger
8. Project Manager for the EPA
9. Community Involvement Coordinator for the EPA

Node signs: Negative values indicate a negative orientation. Other: Residential Soil Cleanup Site (historical preservation, aesthetics, long term O&M, daily disruption). Drinking Water Cleanup Site (security and control, cleanup money, safety, promotes new mines).

*Spreads = Maximum - Minimum values between different Ways of Thinking. Freq=frequency. Max=maximum value. Abs Ave=Average for absolute value of coded responses. Blue shading = Response frequency for one or more Way of Thinking >=75% or Max >5. Yellow shading = 80% or greater spread for Freq or Max >6.
are further assessed to determine their mean, median, and quartile values across all nodes.

These statistics were visually reviewed to ascertain the best method for elucidating the “dominant” nodes that uniquely identify each Way of Thinking. The criteria used to define the dominant nodes are presented in Chapter 3 and represented here for ease of reference regarding certain interpretations of the criteria:

1. Qualitative emphasis provided in one or more segments of text that is particularly revealing and compelling but not reflected in the quantitative analysis of coding frequency and magnitude; or

2. Within a Way of Thinking: consistent coding across individuals (i.e. node coded at least once for 75% or more of interviewees) or large reoccurrence of coding for at least one individual (i.e. coded at least five times for any one interviewee) within a way of thinking; and

3. Between Ways of Thinking: large differences in the percentage of individuals receiving a code for a node (i.e. a frequency difference of at least 75%) or a large difference in the reoccurrence of coding (i.e. a difference of at least six between maximum and minimum counts between each Way of Thinking); and

4. No readily discernible site-related effects as evidenced by similar frequency and magnitude of response across interviewees within a site.

Criterion 1 was applied in identifying Emotions as a dominant node for the Strategic thinker. The leader for the Drinking Water Cleanup Site expressed frequent
positive emotions, which was a unique attribute in comparison to all other interviewees. This unique attribute warrants inclusion in the description and discussion of dominant nodes in the main text, despite a sample size of one.

The “and” between criteria 2 and 3 ensures that dominant nodes are frequently or heavily expressed across individuals within at least one Way of Thinking, and yet are unique to a particular Way of Thinking. In other words, nodes that are frequently or heavily coded across all Ways of Thinking are generally excluded as dominant nodes. In applying table shading, to be identified as “dominant” a node must have both blue and yellow shaded values.

As it turned out, criterion 4 was applied once to eliminate the node Unintended Consequences as a dominant node for Experiential thinkers. As clearly shown in Table 2, similar high frequency and magnitude of concern was expressed across all interviewees at the Residential Soil Cleanup site, and this node was coded only once for one interviewee at the Drinking Water Cleanup site. A frequently expressed unintended consequence of the remediation effort at the Residential Soil Cleanup site involved the need to increase local taxes to fund long-term maintenance of institutional controls and engineered structures. This need was not anticipated until late in the development of the remedy, and it was an active topic requiring local government cooperation at the time the interviews were conducted.

Note that for the node Needs and Interests of Others and the node Emotions, the criteria are applied to higher level nodes rather than the lowest level nodes identified in the mental model. Blue shading is therefore applied on these higher level
nodes. This is a subjective decision that considers the possibility that these nodes are
too finely disaggregated for the number of interviews conducted to allow meaningful
application of the statistical criteria.

The dominant nodes identified by this assessment are described and evaluated
in the Interpretation section below.

**Interpretation**

The characteristics exhibited by the three interviewee groups that emerged from
the interpretive analysis appear to be consistent with analytical, experiential, and
strategic Ways of Thinking identified in prior research and established in theory. (See
Chapter 2 for a more thorough discussion of theory about Ways of Thinking.) The
analytical and experiential terms are adopted from Slovic (2008)\(^\text{20}\), who defined two
distinctive, but not necessarily exclusive Ways of Thinking used by individuals to
comprehend risk issues. The analytical Way of Thinking is favored in circumstances
when the individual has the time and ability to assess the information consciously and
logically. The experiential Way of Thinking is used when time is short, the issues are
complex, and prior experiences and associations are used to arrive at a judgmental and
holistic conclusion. The strategic term is adopted from Hamilton (2003), who noted how
individuals may selectively (whether intentional or not) use elements of technical and
experiential appeals to achieve rhetorical effectiveness in naming and framing of risk-

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\(^{20}\) Hamilton used the term “cultural” rather than “experiential.” The former has a more sociological
orientation and the latter more psychological orientation. The terms are closely aligned. Hamilton (2003)
defines cultural rationality as a risk orientation that values experiential input, analogy, historical input, and
democratic processes for decision-making. Herein the experiential term is preferred because the focus is on
individuals and because it is more descriptive of the project related experiences that are expressed by the
interviewees.
centered controversy. These three Ways of Thinking, previously identified within risk frameworks, are applied herein to include a broader range of issues expressed by participants as important in describing controversy at Superfund sites.

Table 3 provides a summary of the analysis by presenting the dominant nodes that define and distinguish each Way of Thinking. The remainder of this chapter describes and substantiates the Ways of Thinking presented in Table.

### Table 3. Dominant Nodes for Different Ways of Thinking

<table>
<thead>
<tr>
<th></th>
<th>Experiential</th>
<th>Analytical</th>
<th>Strategic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing Context</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Desire for Information or Engagement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solution Options, Costs and Schedules</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Regulatory Complexity</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Technical Complexity</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Personal Resources</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Political Vulnerability</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recognition of Stakeholder Differences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs and Interests of Others*</td>
<td>✓ (-)</td>
<td>✓ (+)</td>
<td>✓ (+)</td>
</tr>
<tr>
<td>Relationship History</td>
<td>✓ (-)</td>
<td>✓ (+)</td>
<td>✓ (+)</td>
</tr>
<tr>
<td>Technical Competence</td>
<td>✓ (-)</td>
<td>✓ (+)</td>
<td></td>
</tr>
<tr>
<td>Process Competence</td>
<td></td>
<td></td>
<td>✓ (+)</td>
</tr>
<tr>
<td>Commitment</td>
<td>✓ (-)</td>
<td>✓ (+)</td>
<td>✓ (+)</td>
</tr>
<tr>
<td>Emotions*</td>
<td>✓ (-)</td>
<td></td>
<td>✓ (+)</td>
</tr>
<tr>
<td><strong>Process Norms and Values</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attend to Power Struggles</td>
<td>✓ (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locus for Decision Authority</td>
<td>✓ (-)</td>
<td>✓ (+)</td>
<td>✓ (+)</td>
</tr>
<tr>
<td><strong>Process Preferences</strong></td>
<td>Ad hoc - reactive</td>
<td>Informing</td>
<td>Intentional - proactive</td>
</tr>
</tbody>
</table>

Notes: See Appendix B for node definitions. (+) positive orientation, (-) negative orientation.
* The node Needs and Interests of Others and the node Emotions are further defined by subnodes in the mental model. Using these higher level nodes considers the possibility that these nodes are too finely disaggregated for the number of interviews conducted to allow meaningful application of the criteria used to establish dominant node.
**Experiential**

This Way of Thinking was expressed among four of five residents at the Residential Soil Cleanup Site. These residents opposed EPA’s actions, and accordingly, they more frequently expressed negative emotional responses in their texts.

In terms of their Desire for Information or Engagement, the Experiential thinkers typically did not discuss Regulatory Complexity or Technical Complexity using established EPA methods. Rather, they relied heavily upon their personal experiences as long-time residents to assess “the problem” supplemented by analytical thinking using alternative procedures to those used by the EPA. They did not believe that contaminated residential soil was a risk because they had lived in the community all their lives and biological indicators of their exposure were low. For example, one such resident stated:

“I think that they’re putting a Band-Aid on it, on us, and it’s costing us, the taxpayers a lot of money that shouldn’t be spent. I don’t believe that we had that much lead because the older people that lived in town – nobody’s had it. None of the kids has had it. They found a few, but I just don’t believe that they’re doing it right. I just don’t... Because we’re a small mining town, we can’t fight them, so, they blame it on the dumps, and I don’t believe it was there. I think it was the hundred-year-old houses and maybe on the plates we’ve eaten off of, you know. That’s what I think.”

Text for Experiential thinkers frequently identified Political Vulnerabilities. These individuals believed that the political status quo did not represent their interests, that they took personal risks in advocating their position, and that the challenges they

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21 Political Vulnerability is defined in Appendix B as: perceived lack of ability to invoke political power or conditions, perceived or actual, allowing one to be subjugated by existing forms of political power. This may be closely related to the Process Norm and Values node “Attend to Power Struggles.” A statement is coded as an Existing Context type of node when it is presented as a statement of fact.
faced in overcoming opposing views were overwhelmingly large. As one resident put it, “The City Council is scared to death of them [the EPA].” Another resident put it this way in describing the efforts of the state, “But I think that he’s [state official] scared to say anything because he’d lose his job. You know, they're [i.e. the EPA] powerful people.”

In terms of Recognition of Stakeholder Differences, Experiential thinkers expressed more frequently negative feelings about the Needs and Interests of Others, and their Relationship History with other parties. Text provided by residents on Needs and Interests of Others tend to critically question or disbelieve the reasons and motives behind EPA’s actions. Text on Relationship History describes the EPA as being dishonest in their intentions, not keeping their promises, and treating residents poorly. Residents believed they were not listened to, that government officials did not care, that historical preservation needs were unmet, and so forth. As one resident put it, “Never trust the government.” Similarly, and the Technical Competency and Commitment of regulatory personnel is frequently viewed negatively.

All Experiential thinkers expressed frequent negative Emotions coded to multiple subnodes. Frustration, dislikes and negative opinions are among the most frequently coded emotional responses. These negative feelings correlate with their opposition to EPA’s actions.

The Experiential thinkers identified a broad range of Process Norms and Values that were violated, with an emphasis on issues coded for Attending to Power Struggles and Locus for Decision Authority. These expressed power imbalances appear to dominate their assessment of “the problem.” For example, these residents repeatedly
expressed concern about their ability to determine what happens to their properties during cleanup. Specifically, they expressed disapproval of EPA’s ability to “blacklist” their property if they choose not to participate in the cleanup by placing notices on file with the county that identify the property as contaminated. One resident stated that “EPA is acting like a dictator and we're not going to tolerate it.”

Public participation for these individuals was typically ad hoc. It began by following the approach established by the regulators, and then transitioned through multiple alternatives in response to project developments as frustrations grew until finally giving up and opting for No Engagement. This approach to public participation is reflected in the following resident text:

“When they [EPA] first came, we [City Council] held a couple of private meetings, because we didn't know, you know, what was going on at first. And we told them we didn't want them here; we thought we were fine. And so, then they started to hold some public meetings, so then we'd hold our public meetings. And they came to them. I will say that they'd let you say whatever you want. They don't do anything about it, but they let you say it. And then all the meetings since then, like I said, the public meetings, nobody goes to anymore because they don't listen to you anyway.”

Overall, and across all Ways of Thinking, a consistent correlation is observed between opposition or support for EPA’s actions and a negative or positive emotional orientation expressed in the text for those nodes that inherently involve a positive or negative judgment (see Table 2). Relationship History, Commitment, and Locus for Decision Authority are identified as dominant nodes for all Ways of Thinking. While this research cannot ascertain the underlying source of the opposition/support of EPA’s actions or the emotional orientation, the consistent and frequent expression of these topics in this research across all interviewees suggest that these nodes may serve as key
indicator variables for readily assessing the nature and quality of public participation at other sites. The implications of this finding are discussed further in this subsection and in Chapter 7, particularly in the Evaluating Project Manager Effectiveness section.

**Analytical**

This Way of Thinking was expressed by all regulators at both sites and by a resident at the Residential Soil Cleanup Site who supported EPA’s actions. Text for these individuals heavily emphasized technical elements related to Problem Recognition, particularly Regulatory Complexity and Technical Complexity. They frequently discussed the Solution Options, Costs, and Schedules. Briefly stated, these individuals accepted established norms for evaluating risk using EPA risk assessment methodology and regulatory standards, they readily discussed tradeoff for various options, and they were concerned about achieving cost and schedule objectives.

In terms of Recognizing Stakeholder Differences, Analytical thinkers were aware of the challenges created through social complexity. They were generally positive in describing past efforts and interactions that were coded to Relationship History, and they tended to give themselves positive self appraisals for Technical Competence and Commitment in responding to the social complexities of the project - even though many residents provided negative appraisals of the regulators for these nodes. Regulators indicated that they were “proactive” in addressing residents’ needs, they were “consistently available” to residents, and they would “go beyond the minimum” to meet residents’ needs. These characteristics suggest that the regulators achieved an awareness of social complexity because they were forced to confront it, but that this
awareness did not achieve a level of understanding that allowed differences to be resolved. It is not clear from the interviews if the regulators were aware that many residents continue to rate their Commitment negatively despite their efforts to be responsive and committed to residents’ needs. While cause and effect influences among these variables cannot be ascertained, the observed associations suggest that trying harder to be committed, transparent or competent may not by itself change resident’s negative perceptions. Rather, these perceptions may derive from resident’s perceptions that the overall project is delivering on their needs and interests, or other factors. To reinforce statements made previously for Experiential thinkers, Commitment and Relationship History stand out as consistently expressed and potentially important nodes for predicting overall satisfaction with the public participation process from different stakeholder perspectives.

Relatively few emotions are expressed by analytical thinkers, either positive or negative. Regarding Process Norm and Values, Locus for Decision Authority was the most frequent and consistent coded response. The need to work within existing regulatory requirements, established procedures, and existing regulatory channels was frequently expressed by these individuals, sometimes using qualifiers like “obviously.” From this perspective, it is not surprising that informing the residents about EPA procedures and decisions is the dominant public participation preference for analytical thinkers.

22 In contemplating this finding and its application to the selection of process alternatives that may serve to break down these seemingly interest-based perspectives, it is perhaps interesting to note that text on Commitment is never directed toward expectations of residents. An effectively managed collaborative process would establish mutually recognized responsibilities.
Strategic

The strategic thought process is expressed by residents at the Drinking Water Cleanup site, but is seen most dominantly within the paid leader of the citizen group. Like the Analytical thinkers, these individuals are able to apply established agency methods for assessing “the problem;” however, they do not limit themselves to agency methods. For example, Resident 1 stated,

“We don’t want EPA’s lawyers talking to us either. They want to tell us what their legal responsibilities are, and legal limits, and what they’re required to do, and we don’t want to talk in those dimensions. We want to talk [about] what’s the problem; how do we investigate it; how do we fix it. And we don’t want lawyers getting arbitrary with us. So we want to figure out what’s feasible, and see how it works. We don’t want EPA … finding things that don’t work as well the longer they’re in place. We want to find permanent solutions; we want to find non-engineered solutions if we can.”

These individuals uniquely expressed concerns for ongoing Personal Resource limitations (time, money and energy), especially money. Their interviews indicate that they are knowledgeable about fundraising and fiscal management.

Strategic thinkers were highly tuned to Recognizing Stakeholder Differences. Strategic thinkers discussed Relationship History frequently and with a positive orientation. They also expressed recognition of the Needs and Interests of Others in more diverse ways than Analytical or Experiential thinkers. Issues such as the private property rights of others, financial constraints of others, past public participatory experiences of others were discussed with greater discernment and more consistently positive orientation than generally observed for other Ways of Thinking. Not surprisingly, the Experiential thinkers spoke more frequently and with generally positive
orientation about the Process Competence of the regulators, perhaps because they were getting the kind of frequently dialogue processes they wanted.

The leader of the citizen group was unique in describing the project and its challenges using notably positive expressions. For the Emotions nodes, positive responses were coded for hope, attitude, trust and stigma. In the coding for Stigma for example, this resident stated,

“No, there’s no stigma attached to the Superfund designation here...this community wants to get this project or this site cleaned up and restored so that it is no longer an issue. They [i.e. the community residents] aren’t concerned with the long term stigma.”

This positive outlook appears to be part of a strategic effort to appeal for broad community support that enables him to achieve his objective. This strategic approach is also recognized in statements like, “Well, it's going to be a battle of winning over the minds and hearts of the community.” However, these findings, based upon interpretation of text for a single individual, should be considered preliminary until verified in further research.

Like Analytical thinkers, Strategic thinkers placed a focus on Commitment. In contrast to Experiential thinkers, the other resident-dominated Way of Thinking, i.e. the Strategic thinkers, aligned with Analytical thinkers in viewing Commitment positively. As previously explained for Analytical thinkers, this positive orientation may derive as much or more from being successful in achieving their project goals rather than from any objective measure of actions taken to fulfill commitment as might be defined in a job description or job performance review.
Also like Analytical thinkers, Strategic thinkers placed a focus on the Locus for Decision Authority. However, they were much more knowledgeable and intentional than Experiential or Analytical thinkers regarding their process choices. The text below demonstrates how a long-term strategy was conceived to achieve a consensus form of decision-making that leverages available power within the local government, crafts analytical arguments that are persuasive to the EPA, and recognizes divergent values and beliefs systems:

“You know, the fact that the county and the town are both participants in this project has made it very easy for us to have a serious voice that EPA is very respectful of...So, you see much in the way of different personal values and beliefs between the community, the miners, and the EPA on this project in values and beliefs...The reason that we created the coalition ... is that we wanted to prevent apprehensions about the fact that we're an advocacy group, whereas the coalition is an objective, fact-collecting organization. We are out there collecting data and reporting it and are showing a great deal of transparency with the data. We're making our data available to anybody who wants to see it.”

These Strategic thinkers used available agency resources to initiate and maintain a collaborative problem solving effort and an active public relations campaign. As one resident stated, “My goal is to have everyone sitting at the table and talking to each other.” However, legal and political recourse were recognized as alternative process options in the event that collaborative process did not achieved the desired outcomes. Informing and Building Agreement were the most frequently coded process preferences for Strategic thinkers.

**Chapter Summary and Conclusions**

This chapter addresses research question number 2: What characteristically different Ways of Thinking about public participation decision-making can be identified
among participants engaged in science-intensive controversy, and are these differences associated with different public participation decisions? To address this question, this chapter explores what people engaged in technically intensive controversy at two Superfund sites think about when making public participation decisions. Distinctive characteristics in the mental models for groups of participants are identified and associated with certain public participation preferences. Coding analysis of interview data reveals three characteristic ways of thinking - experiential, analytical, and strategic - which are associated with ad hoc, informing, and intentional types of public participation preferences, respectively. Recognition of these distinctive thought processes and the associated public participation preferences is an important and perhaps under-appreciated consideration when making public participation decisions. The implications of these findings are discussed in Chapter 7, with particular emphasis on the observed underserved experiential type of thinker.
CHAPTER 6: EXPERT VERSUS PARTICIPANT DIFFERENCES

This chapter responds to research question number 3: What differences in Ways of Thinking about public participation exist between experts and participants, and can these differences create barriers to effective development and promotion of public participation programs and project level processes? Identifiable differences between the expert mental model presented in Chapter 4 and the participant mental models presented in Chapter 5 are used to characterize how experts may think differently than participants when considering public participation decisions. Having previously characterized three Ways of Thinking for participants in Chapter 5, the emphasis here is on characterizing a Way of Thinking that is unique to experts; therefore, the comparison is made to participants as a monolithic group. The findings are applied to identify communication barriers that may impede broader lay acceptance of public participation programs and policies that are conceived, designed, and communicated by experts.

As a reminder, experts in this research are heavily weighted toward academic experts on public participation process. Development of the expert model relied heavily on peer reviewed literature sources to identify the nodes of the model, but the organization of the model was mostly heavily influenced by the interviews with the academic experts. There are many types of technical and process experts that have the label of participant applied to them in this research. A useful way to think about the expert versus participant difference in this research is that the experts were not engaged in any specific project or controversy when discussing the mental model, while
participants (be they lay or expert in some capacity relating to Superfund) were interviewed about their involvement in a specific controversy.

The differences between the expert and participant models are systematically described and the potentially important differences are identified. The results of the analysis are presented in graphical form in Figures 12 to 14. The text that follows explains the findings presented in the figures. Those differences deemed more significant are presented first, followed by brief explanations of those differences deemed minor and insignificant. These findings are then summarized and applied to identify possible communication barriers between experts and participants and recommend strategies for overcoming those communication barriers.

**Experts May Under Emphasize Substantive Aspects of the Problem**

A comparison of the Substantive Variables differences between the expert and participant mental models suggests that experts may under-emphasize Substantive Variables in comparison to participants. To support detailed, consistent coding of participant’s interviews, the number of nodes used to characterize the Substantive Variables, i.e. the tangible elements of the problem, was expanded in the participant mental model. In building off of the initial expert mental model, the participant mental model was expanded to capture the range of issues expressed (see Figure 13). In final form, Regulatory Complexity, Technical Complexity, and Solution Options, Costs and Schedules were the three dominant nodes used by participants in addressing the substantive issues. The following additional nodes were invoked much less frequently but still represent the greater number of nodes needed to consistently and reliably code
Figure 12. Comparison of Expert vs. Participant Mental Models of Public Participation Decision-Making

Notes: Gray denotes nodes not included in the Expert Mental Model of Public Participation Decision-Making. Underline denotes dominantly nodes used by participants. Dotted underline denotes rarely used nodes by participants.
Figure 13. Existing Context of the Comparative Mental Model

Notes: Gray denotes nodes in the Participant but not the Expert Mental Model. Strikeout denotes nodes included in the Expert but not the Participant mental model. Underline denotes dominantly nodes used by participants. Dotted underline denotes rarely used nodes by participants.
Figure 14. Needs and Interests of the Comparative Mental Model

Notes: Gray denotes nodes in the Participant but not the Expert Mental Model. Underline denotes dominantly nodes used by participants. Dotted underline denotes rarely used nodes by participants.
100 percent of participants’ text: Knowledge Requirements (knowledge believed necessary to understand the substantive aspect of the problem), Environmental Quality (recognizing pollution as a problem needing to be addressed), and Other Problems (other issues that are directly or indirectly invoked while addressing Environmental Quality), and Unintended Consequences (social, economic, legal or physical consequences, positive or negative, that result from a cleanup related decision).

As a first look, the lack of detail in the initial expert model may be recognized as a minor oversight in model construction. Most public participation experts are expected to be familiar with the added level of detail once confronted with it, even if they might tend to initially de-emphasize Substantive Variables in relation to other variables when discussing process outside the context of a specific project or controversy.

However, if we are not too quick to cover the “minor oversight” and we remain true to the pre-planned methodology of this research, the omission of this level of detail in the initial expert model may exemplify how easily process experts might under recognize the details of substantive issues, and conversely, how important a detailed understanding of the Substantive issues is to participants when explaining the issues and the nature of site-specific controversy. Process specialists that are unfamiliar with the technical concepts, regulations, and potential unintended consequences of proposed solutions may be disadvantaged in engaging participants, or may be at risk of putting undue attention on Social and Interpretive variables with which they may be more familiar. In this sense, any pure process solution that is not intimately linked to
the substantive issue might not be recognized by participants as worthy. This finding is consistent with Santos and Chess (2003), who evaluated criteria for measuring success of citizen advisory boards. A key conclusion from this study was that, “Although theory may suggest that process is all that matters, participants are interested in more tangible results” (Santos and Chess, 2003, p. 277). The implications of this finding are discussed further in response to the finding reported in the next subsection, which considers this phenomenon from the opposite perspective and considers additional variables.

**Experts May Over-Emphasize Broader Social Benefits of Using Good Process**

Experts may place more emphasis on a larger set of possible Social and Process oriented Needs and Interests in comparison to participants. This conclusion is derived from certain changes made during the process of constructing the participant mental model that was consistent with the coding of participants’ comments. As was explained in Chapter 5, certain nodes originally contained only within the Needs and Interests box of the expert model were replicated using similar or identical terms to either the Existing Context box or the Process Norms and Values box to establish the participant mental model. The details of the changes and their implications are described in the subsections that follow.

**Existing Context versus Needs and Interests**

A major model change was needed to reconcile the context in which many nodes that originally resided only in the Needs and Interest box of the initial expert mental model were discussed by participants. As originally conceived in the expert model, the nodes in question here were expected to represent outcome expectations of
participants. However, participants often discussed these nodes in a contextual way without placing emphasis on them as an outcome expectation. In some cases these nodes were given different names but have similar meanings. The nodes involved, as listed in the Existing Context or Needs and Interests parts of the model are:

<table>
<thead>
<tr>
<th>Existing Context</th>
<th>Needs and Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Unintended Consequences</td>
<td>Other Impacts</td>
</tr>
<tr>
<td>• Solution Options, Cost and Schedules</td>
<td>Cost and Schedule</td>
</tr>
<tr>
<td>• Understanding Others Decisions</td>
<td>Convener Understanding of Decision Implication to Stakeholders, and Stakeholder Understanding of Convener Decisions nodes</td>
</tr>
<tr>
<td>• Transparency</td>
<td>Transparency</td>
</tr>
<tr>
<td>• Inclusiveness</td>
<td>Inclusiveness</td>
</tr>
</tbody>
</table>

The replication of the nodes Transparency and Inclusiveness within two areas of the participant mental model, and the linking of these nodes to the Experience node, involved a potentially significant shift in understanding how participants relate to these two terms. Participants sometimes used these terms in describing their Needs and Interests for the overall project, which would have been coded in Figure 14, and other times directed their assessment of these terms to characterize specific individuals, which would have been coded to the subnodes pertaining to Experience in Figure 13. The context in which these terms are used is therefore important to those who want to improve participants’ perceptions of Transparency and Inclusiveness. For example,
producing comprehensive technical documents with all the supporting information for an assessment and decisions may be an inadequately transparent response to concerns about “the real reasons” a project manager makes a decision. Similarly, regularly holding large public meetings may not address Inclusiveness if individuals perceive that a project manager is not personally attentive to their point of view. Concerns about transparency and inclusiveness may be directed to the overall process or to a specific leader in the process.

In considering all five of the replicated nodes as a whole, the need to replicate these nodes within the Existing Context box recognized the simple fact that participants are selective about their Needs and Interests. Just because a variable has the potential to be a Needs and Interests node does not mean it will be. This is an important perspective that experts may need to remind themselves of when conducting inquiries of participants’ Needs and Interests. When talking to participants about a controversial situation, many aspects of the project can be described in terms of context, but extra care must be used to distinguish contextual information from an expressly desired outcome, i.e. their real Needs and Interests. While people engaged in controversy may talk a lot, or even complain, about something like Transparency, it is often not nearly so important an outcome as getting the desired substance solution to the problem. Again, this finding is consistent with Santos and Chess (2003, p. 277), who evaluated criteria for measuring success of citizen advisory boards, and state among their conclusions that, “Although theory may suggest that process is all that matters, participants are interested in more tangible results.”
The seemingly obvious nature of this finding, that participants generally have substantively focused Needs and Interests, understates the effort that was required to settle on a final format for the participant model, and by extension, it suggests how subtly perspectives can bias our interpretations of others’ Needs and Interests. In constructing the initial expert model, my perspective was one of a process expert. This perspective subtly led me to consider these nodes only as outcome expectations, i.e. Needs and Interests. Several readings of many transcripts were required before recognizing that participant’s Needs and Interests were being over-stated because I did not have another place in the initial expert mental model to code differently. Other process experts are similarly cautioned against similar misinterpretations of participant’s Needs and Interests. Participants may have a much narrower set of Needs and Interests to be met through public participation than are generally recognized or perhaps thought worthy by experts.

**Process Norms and Values versus Needs and Interests**

The Process Norms and Values nodes labeled “a” through “d” on Figure 12 were included in the expert mental model based on prior research (Webler et al., 2001). Among these, two nodes were most dominantly expressed by participants in this research: Attend to Power Struggles and Establish Locus for Decision Authority. Three additional nodes were added based on coding of participants’ text in this research: Build Civic Capacity, Role of Experts, and Due Process. While these added nodes did not emerge as important to characterizing the three different Ways of Thinking among
participants, the nodes involve ideas that add to previous expert-derived characterizations of Process Norms and Values.

The Role of Experts node was applied to participants’ text that emphasized the need for decision-makers to rely upon specialized technical expertise. The Due Process node was applied to text that emphasized the need to work within established regulatory procedures for problem solving. Both of these nodes identify a measure of technical objectivity that analytical and strategic-minded participants can consider important in defining process. This technical orientation is a significant addition to the more social and process oriented nodes involving power, fairness, deliberation and so forth that are contained in the initial expert model.

In the process of developing the participant model from the initial expert model, the Stakeholder and Convener Problem Solving Capacity node contained in the Needs and Interests box was closely replicated within the Process Norms and Values box as the Build Civic Capacity node. This code was assigned in response to a comment that one “could offer some kind of introductory workshops” to increase technical understanding of the Superfund process. In this context, the interviewee is making reference to a process for building up knowledge rather than expressing a personal and project related need or interest to improve group problem solving skills as a worthwhile outcome. The distinction here is between a process option that might be helpful along the way versus the establishment of a legacy of successful group problem solving capacity.

Conversely, one segment of text was coded to Stakeholder and Convener Problem Solving Capacity (Figure 14, Needs and Interests). This text identified a desired
project outcome that was based on a positive prior project experience. This prior experience, as explained by the interviewee, applied frequent and high-quality stakeholder communications that established transparency and trust. In this context, nodes contained within the Existing Context, Emotions, and Process Norms and Values parts of the participant mental model are brought together to conceptualize an aspirational outcome for the current project of a self-sustaining stakeholder group Problem Solving Capacity. This expressed interest draws upon prior experiences that many participants may not have. It reflects a degree of expertise. In fact, this coding is linked to a paid agency professional assigned a “participant” label in this research, and this person has group problem solving experience that extends across many prior sites.

The somewhat subtle distinction in how these two nodes are coded potentially reflects a subtle difference between expert Ways of Thinking and those of more lay-oriented participants. The findings of this research, while relying upon limited number of coded responses, is supported by the work of Chess and Purcell (1999, p. 2691), who represent an expert perspective when they conclude that, “…organizational or social learning may be one of the most lasting influences of a participatory effort. Exploring only immediately apparent programmatic outcomes may be shortsighted.” Conversely, participants who may lack prior experience or knowledge of effective group problem solving should not be expected to recognize this outcome goal. The presence or absence of knowledge about such seemingly lofty problem solving goals might have a large influence on Ways of Thinking about public participation decision-making.
Accordingly, the Build Agreement or Resolve Disputes process options are expected to be a less frequently recognized process preference by more lay-oriented participants.

**Understanding of Different Approaches to Public Participation**

The challenges experienced in coding text about participation preferences for more lay-oriented participants suggests that experts may have a more nuanced understanding of public participation options that explicitly recognizes multiple possible strategic purposes for meetings in comparison to participants.

Several potential inconsistencies may exist between experts and participants in recognizing a common typology of process options. Participants often expressed a distinction between handling issues on their own versus handling issues in group meetings, or in some cases relying upon legal help. Participants were often not clear, without substantial prompting, about what the underlying objective of a meeting was. The expert typology is largely based on different meeting objectives: receiving or giving information in one-way forms of communication (Inform or Seek Advice nodes), proactively collaborating in two-way forms of communication (Build Agreement), reactively addressing a problem (Resolve Disputes), or working outside of the project’s due process (Public Relations/Advocacy). These expert-oriented objectives of a meeting, or interaction more generally, were often difficult to discern from the participants’ text. Therefore, the participant mental model is inclusive of the options as expressed and understood from the participants’ perspective. Nodes addressing Individual Interaction and outreach for Legal support were added to the Participant Mental Model.
Further considering Individual Process Knowledge and Preferences from a methodological perspective, a limitation of the interview protocol was revealed in coding the data. It is inherently challenging in a real-life situation to clearly identify people’s true preferences from expressed preferences that may be limited by perceived constraints imposed upon them by the convener (as shown by the Convener Offers/Restricts Options node on Figure 12). Moreover, participants may have difficulty in immediately expressing public participation processes to the degree of refinement identified in the mental model. Overcoming such limitations requires substantial prompting that risks biasing the information obtained, and at any rate, such prompting was not a component of the interview protocol.

In summary, the typology of process options of some participants may take the form of Individual Interaction, meetings, Legal, and Public Relations/Advocacy. Some participants may not discern different meeting objectives that experts recognize within the typology of process options provided in the mental models.

**Minor and Insignificant Differences**

*Additional Emotions*

The nodes Anger and Curiosity were added to the Emotions box in Figure 12 to reflect the participants’ text. These nodes were infrequently expressed, as were several others under Emotions. They are a minor extension to the list of emotions identified in the initial expert mental model. Moreover, in assessing participants Ways of Thinking, it was only necessary to discern broadly positive or negative emotional responses.
Therefore, while necessary to code 100 percent of participants’ text, the added emotions are not considered significant to the current analysis.

**Inter- and Intra-Group Interaction and Individual Learning**

The node for Inter and Intra-Group Interaction and the node for Individual Learning shown on Figure 12 were not evaluated in this research. While these are important nodes in the overall model, the focus of this research has been on Individual Ways of Thinking and the relationship of this thinking to process preferences.

**Needs and Interests of Others**

To code participants’ text, the Public Participation Preferences of Others node in the expert mental model was recast in a more general sense as Needs and Interests of Others, under which Public Participation Preferences of Others, Understanding Others Decisions, and Other were added (Figure 13). Other is a “catch all” node applied when interviewees talked about their understanding of others’ needs in areas not addressed by the other two nodes in this category. Nearly every participant is coded multiple times to one of these nodes. While the distinction of terms provided by the subnodes permitted more specific coding, the more general Needs and Interests of Others node emerged as the appropriate level of detail for characterizing participants’ Ways of Thinking. Therefore, this additional level of detail is not deemed significant for characterizing an expert Way of Thinking.
Other nodes were added to the participant mental model that may be best recognized as oversights in the original expert mental model. The Media node refers to the role of the news media in influencing the process or project outcomes. This node was added under Social Complexity because interviewees mention, albeit infrequently, the role of the media on their project. Similarly, the Effect Outcomes node was added under Desire for Information and Engagement because the desire to influence decisions was expressed, also infrequently. As infrequently expressed nodes, these added nodes do not signify any significant differences in Ways of Thinking between experts and participants.

Summary and Conclusions

In reflecting across the four major findings, three general characteristics are discerned about experts when compared to participants:

1. **Experts may under recognize Substantive Variables in comparison to participants.** This conclusion is derived from the assessment of Substantive Variables differences between the expert and participant mental models.

2. **Experts may recognize a larger set of possible Social and Process oriented Needs and Interests and place more emphasis on them in comparison to participants.** This conclusion is derived from the significant changes made by replicating nodes contained within the Needs and Interests box to both the Existing Context box and the Process Norms and Values box to establish the participant mental model.
3. **Experts may have a more nuanced understanding of public participation options that explicitly recognizes multiple possible strategic purposes for meetings in comparison to participants.** This conclusion is derived from the added process options included in the participant mental model and the challenges experienced in coding text about participation preferences for more lay-oriented participants.

These findings can be applied to identify potential communication barriers between experts and participants, and the methods for overcoming those barriers. In response to the finding 1 above, participants may not recognize value in public participation processes that are not clearly linked to their understanding of the more substantive aspects of the Existing Context and their substantively-oriented Needs and Interests. Similarly, in drawing upon finding 2, experts are cautioned against overstating the role of process in achieving the larger set of possible Social and Process oriented Needs and Interests recognized by experts. Lastly, in response to finding 3, experts should apply care in describing the strategic objectives that underlie the purpose for having meetings. Participants are understandably protective of their time. Participants may not respond well to process options requiring more meetings if the participants perceive all meetings as a single form of public participation and where a history of not getting the desired response from meetings has accumulated. In describing a particular process approach that involves more dreaded meetings, experts need to clarify the strategic nature of the meetings and establish clear and acceptable expectations on the possibility for achieving their Needs and Interests.
If process experts are cautioned to be responsive first to participants and to focus on substantive issues, this leaves open a question about the value of and the appropriate place for promoting the broader social and process oriented benefits of public participation. Should experts who work to develop public participation policies and programs, or experts who work to implement public participation processes at the project level, even consider using process options for reasons that they may leave a legacy of Stakeholder and Convener Problem Solving Capacity? Should such experts even consider in their process decisions such outcomes as improving Stakeholder Understanding of Convener Decisions, outcome Fairness, Trust, and ultimately Legitimacy if it is not expressly recognized as a participant-driven Need and Interest?

Let us assume, for the sake of focusing these questions, that experts have thought this through and that the references used to establish the expert mental model in Chapter 4 are sufficient for recognizing these Process and Social variables within the Needs and Interest box as worthy. If participants engaged in controversy are not attentive to the longer-term benefits, and yet there is broader and longer-term social benefits in achieving these benefits, methods for achieving these benefits must generally originate outside of specific controversial situations.

Investment in education is one such option. It would be interesting to determine if these same participants would more freely recognize the benefits of the process and social goals in question here if they were interviewed outside the Superfund project context. Personal experience suggests that people are much more interested, open-minded, and willing to learn about process options when not engaged in controversy.
Might improved civic education influence people, once they become participants in a controversial public decision-making process, to have increased awareness and support for achieving those Process and Social Variables in Figure 14 that have more to do with establishing the Legitimacy of the decision-making process than they do with the Substantive project outcomes?

An alternative to education is to better integrate problem solving approaches that promote achievement of Process and Social Variables into the existing problem solving process. Existing problem solving processes are heavily focused on the Technical Complexity and Regulatory Complexity aspects of the problem. If proactive, Build Agreement forms of public participation were inextricably enmeshed into the science and engineering process, this would obviate the need to ask participants to consider these factors. These issues are considered further in Chapter 7, Implications and Advice.
CHAPTER 7: IMPLICATIONS AND ADVICE

This chapter presents the theoretical implications, methodological implications, and practical advice that are gleaned from the research findings presenting in Chapters 4, 5 and 6. Recall that each of these prior chapters responds to one of three research questions. In the theoretical implication sub-sections of this chapter, the findings for each of these research questions are identified and are discussed in terms of the advancement of existing theory. Then, these component parts are brought together and considered within the context of the proposed mental model to advance ideas pertaining to public participation theory. The discussion then shifts to consider the implications of the Mental Models methodology to public participation research. Herein the strengths and potential weaknesses of the Mental Models methodology within a public participation application are discussed, and suggestions are offered for further methodological improvement. Sections on practical advice are provided to meet the specific needs of public participation practitioners, general public participants engaged in a controversial project, and policy makers and program administrators. This chapter concludes by summarizing the limitations of this research and accordingly, the opportunities for overcoming these limitations through additional research.

Implications for Public Participation Theory of Science-intensive Controversy

A Unique Model for Understanding Public Participation Decision Making

To better understand how individuals make decisions to engage in science-intensive controversy, this research first asked “What do different types of stakeholders engaged in technically-intensive controversy think about when making public
participation decisions?” In response, this research has produced a unique model of the thought processes individuals use to make their public participation decisions.

The theoretically based and empirically supported Participant Mental Model of Public Participation Decision-Making (Figures 9-11) that emerged from this research greatly expands upon previously advanced schematic representations of the general categories of variables involved in the public participation process (Figure 5; Webler and Tuler, 2002). The initial expert mental model synthesizes a large body of literature into a single framework that was refined and clarified through expert interviews and group discussions. This initial expert mental model was then further refined in the development of the participant mental model based on a detailed assessment of interviews with participants at two Superfund sites.

While derived within a focus on Superfund, the model is believed to be sufficiently general to serve as a starting point for assessing technically and socially complex public participation decision-making in applications outside of Superfund. Nodes like Technical Complexity or Regulatory Complexity are not defined so specifically that they are unique to Superfund. Moreover, the process of identifying nodes and nodal relationships were first identified through a literature search that was rarely specific to Superfund.

While public participation in agency decisions has become an accepted norm, the selection of a ‘best’ public participation process can be contentious and challenging. The proposed Expert Mental Model of Stakeholder Public Participation Decision-making reflects this current state of knowledge and is not predictive of a ‘best’ method for a
particular situation. Rather, the model provides an illustrative framework for understanding how individual think about the decision-making process. Individuals determine their Needs and Interests by evaluating the Existing Context of the problem. Their interpretation of the Existing Context is modulated by participant’s Process Norms and Values and by their Emotions. Individuals may employ different Ways of Thinking to arrive at their Needs and Interests. They then must make choices about the process for meeting their Needs and Interests based on their Process Knowledge and Preferences. Individuals’ bring their Ways of Thinking and process preferences into Inter- and Intra-Group Interaction. This interaction can initiate Individual Learning. The interactions may also result in the offering or restriction of process options by the convener (i.e. Convener Restricts Options). These cycles of thinking about the problem, making choices, interacting with groups, and then learning may be ongoing as process decisions are made and re-made. This thought process is captured at this generalized level of detail in Figure 9 in an illustrative format that is coherent to public participation professionals.

**Advancing a Three-Way Characterization of Participants**

To further explore how individuals make decisions to engage in science-intensive controversy, the second research question asked, “What characteristically different Ways of Thinking about public participation decision-making can be identified among participants engaged in science-intensive controversy, and are these differences associated with different public participation decisions?” In response to this question, the assessment and interpretation of the coded participant interviews revealed three
characteristic Ways of Thinking among the participants. A clearly revealed distinction regarding individual’s public participation preferences\textsuperscript{23} was observed within each of the Ways of Thinking:

- Analytical oriented thinkers were observed to follow established procedural norms when responding to anticipated controversy.
- Experiential\textsuperscript{24} oriented thinkers were observed to initially respond to the public participation process put in place by the regulators (who tend to be analytical thinkers) until getting upset and then trying new approaches or eventually giving up.
- Strategic oriented thinkers were observed to extricate themselves from these seemingly innate and dichotomous response patterns.

While this research observes an association between Ways of Thinking and public participation preferences, it does not establish causality. Several site-related variables might also explain this observed relationship. For example, socioeconomic differences between the two sites might make it much easier for Strategic thinkers at the wealthier Drinking Water Cleanup site to become organized and accumulate the resources needed to utilize more varied and more sophisticated forms of public participation. Also, residential yard remediation involves less technical solutions than treatment of acid mine drainage and providing high quality community drinking water.

\textsuperscript{23} The term “preferences” is used here to be consistent with the terminology used to define the Individual Process Knowledge and Preferences node (Figure 7). This node is a subset of the overall mental model addressing public participation decision-making. See Chapter 4 for more information, specifically sections addressing Individual Process Knowledge and Preferences and Inter- and Intra-Group Interaction and Process Decision –Making.

\textsuperscript{24} “Cultural” is another acceptable term as described in Chapter 5.
The more technical demands of the Drinking Water Cleanup site may have increased the perceived need for a TAG to bring more technical expertise to the problem. Finally, contamination in one’s yard is inherently more personal an issue than the supply and maintenance of a public water system. Property owners may therefore respond in more individualistic ways on a private property issue and in more complex and organized group fashion on community-wide issues. Other explanations may also exist. Additional research at more sites is needed to clarify the cause of the relationship observed in this research between Ways of Thinking and public participation preferences.

Not fully understanding potential causality between Ways of Thinking and public participation preferences does not preclude other benefits from advancing a three-way characterization of participants’ Ways of Thinking. Existing literature has promoted dichotomous characterizations of individual behavior when engaged in controversy or facing challenging decisions (Slovic et al., 2004). This approach tends to permanently cast people as either experiential or analytical in their ways of thinking, even if not intended. By using a three-way characterization, this research emphasizes a broad middle ground whereby participants can strategically employ analytical or experiential elements to achieve one’s Needs and Interests. Consistent with the observations made by Hamilton (2003), this research indicates that some individuals can proactively anticipate controversy and discipline themselves to respond in ways that best communicate to diverse groups of people. It is unclear from this research if this strategic Way of Thinking is learned or innate, but it suggests the possibility of learned behavior.
Employing this Ways of Thinking framework may also clarify what might otherwise appear to be purely politically motivated controversy. As previously mentioned in Chapter 4, Teske (2000) evaluated TAGs at two Superfund sites and concluded that that “degree of democracy depends on willingness of EPA to allow citizen groups to influence the process.” In other words, Teske’s assessment of two contrasting sites indicates that when the interests of both the agency and the stakeholders are aligned the TAG program works more effectively, but when interests are not aligned the TAG program seems less effective in achieving mutually desirable outcomes. However, this research suggests there may be more involved than willingness. This research suggests that different Ways of Thinking construct difficult to discern communication barriers to a commonly understood approach for identifying, understanding, and developing a response to problems. In particular, this research identified communication barriers between Experiential and Analytical thinkers. This phenomenon is further discussed later in this chapter under Advice for Public Participation Practitioners, Overcoming the Analytical-Experiential Communication Barrier.

Substantive versus Societal Objectives of Participants and Experts

The third and last research question sought to better understand how individuals make decisions to engage in science-intensive controversy by asking, “What differences in Ways of Thinking about public participation exist between experts and participants, and can these differences create barriers to effective development and promotion of
public participation programs and project level processes?” In comparison to
participants as a general group, this research indicates that experts may:

- Under-emphasize the substantive aspects of the problem,
- Over-emphasize the broader social and long-term societal benefits to be
  obtained from addressing the controversy, and
- Recognize a more nuanced understanding of the different objectives
  inherent in different public participation approaches than participants.

These first two findings are consistent with prior research. In assessing what
works in public participation, Chess and Purcell state among their conclusions the
following expert informed perspective, “…organizational or social learning may be one
of the most lasting influences of a participatory effort. Exploring only immediately
apparent programmatic outcomes may be shortsighted” (Chess and Purcell, 1999, p.
2691). Conversely, project level participants expressed little interest in more broad-
reaching, long-term societal objectives. This observation is also consistent with prior
research. Santos and Chess (2003, p. 277) evaluated criteria for measuring success of
citizen advisory boards and state among their conclusions that, “Although theory may
suggest that process is all that matters, participants are interested in more tangible
results.” This research reaffirms these previously observed differences in how experts
tend to divert emphasis toward procedural aspects of public participation while
participants tend to focus on more substantive aspects of the project.

Regarding the third research finding, this research adds some specific ways in
which experts may recognize a more nuanced typology of public participation process
options. As shown in Figure 12 and described in more detail in Chapter 6 (see Understanding of Different Approaches to Public Participation), Participants do not seem to discern between different meeting objectives, such as Informing versus Build Agreement. This finding highlights the need for clearly defining and communicating about the overarching objective for a meeting and ensuring a common support for the objective among meeting participants. It becomes an important component of Advice for Participants, Elements of a Thoughtful Public Participation Decision, presented later in this chapter.

**Applications to a Communicative Theory of Public Participation**

As described in Chapter 2, this research is most closely aligned with the communicative research tradition. Defined broadly, this tradition seeks to understand and resolve barriers to effective communication and thereby achieve common understanding. Within this tradition, the most diligent effort to advance a theory of public participation has been founded upon a mostly normative extension of Jürgen Habermas’s theories pertaining to the “ideal speech situation”, from which two meta-principles of ‘good’ public discourse - fairness and competence - have been derived (Renn et al., 1995; Webler & Tuler, 2000; also see Chapter 2). Fairness in this context addresses process fairness: the ability to freely participate in discourse and meaningfully influence decisions. Competence in this context also has a heavy process emphasis: the ability to access information, provide information, and use good procedures for interpreting the information.
As described in Chapter 4 in the Needs and Interests subsection, the Technical and Process Competency node is intended to capture the outcome expectations of a fair and competent process. Moreover, the Technical and Process Competency node serves a foundational role in defining Needs and Interests (Figure 14). Inclusiveness and Transparency are identified as important inputs to Technical and Process Competency. Inclusiveness addresses the degree to which all stakeholders can participate, and Transparency address the need to make the information used to support a decision available to all stakeholders and also to be clear and accountable as to the criteria used for evaluating the information and making decisions. Supported by Transparency of information and decision-making processes and Inclusiveness of all stakeholders, Technical and Process Competency is recognized as essential for achieving three additional outcome expectations: Convener Understanding of Decision Implication to Stakeholders, Stakeholder Understanding of Convener Decisions, and improvement in Stakeholder and Convener Problem Solving Capacity. Collectively, these nodes are proposed as encompassing of the breadth of outcome expectations related to people’s Needs and Interest for good public participation process.

The process related nodes shown in Figure 14 are also foundational to achieving good substantive outcomes and promoting positive social values. The substantive outcomes applicable to the sites evaluated in this research are Human Health and Environmental Improvement, project Cost and Schedule, and Other Impacts or unintended consequences of the actions conducted to provide human health and environmental improvement. Trust and Fairness emerge as two key social variables that
are to be achieved by the use of good process. Trust, Fairness, and the Substantive nodes work collectively to influence perceived Legitimacy. Legitimacy is defined as an individual’s perception that a convener’s decision thoroughly and accurately considered the available information to come to a justifiable and acceptable conclusion.

Importantly, the results of this research identify Legitimacy as an overarching objective to be achieved through public participation. A review of the literature and interviews with experts, when interpreted using the highly disciplined and structured mental model framework, produced Legitimacy as a preeminent variable in the mental model. The preeminence of Legitimacy is consistent with the “normative” perspective in that public participation is expected to produce widely accepted decisions (Moynihan, 2003, see Chapter 1). The preeminence of Legitimacy is also consistent with the assessment of public participation conducted by the National Academy of Science whereby they concluded that “public participation improves the quality and legitimacy of a decision and builds the capacity of all involved to engage in the policy process” (NAS 2008, p. 2; see Chapter 4, Needs and Interests section). Among the various Needs and Interests that participants may have, this variable is proposed as the highest possible goal to be derived from a public agency decision.

According to the mental model (Figure 14), Legitimacy is influenced by three categories of variables that can be presented as necessary conditions to any public participation process:
• Quality Process: transparent, inclusive and competent processes are used to develop effective problem solving capacities among the stakeholder, and these stakeholders understand the basis for a decision.

• Quality Decision: the substantive outcomes achieved are derived from a well informed decision maker.

• Quality Social Values: positive social values, specifically Trust and Fairness of outcomes are promoted that ultimately reinforces the Legitimacy of the decision(s) and the process(es).

This framework for identifying the merits of a public participation process and its outcome encompasses both participants’ and experts’ Needs and Interests for what a public participation process should achieve. Fairness and competence continue to have a foundational role within this framework; however, the framework is expanded upon to more fully reflect the call by Webler and Tuler to which this research originally sought a response. As was stated in the conclusion to Chapter 2, Webler and Tuler (2002, p. 179) identify the need for empirical data to identify “a broad landscape of variables, from preconditions and moderating variables, to variables that depict the deliberative process itself, to processes that capture the significance of the outcomes of the process.” and for theory to “acknowledge that different people have different beliefs about what public participation should accomplish.”

This research suggests that participant’s perspectives on the Substantive issues, their Emotions, and a broad range of Process Norms and Values must all be considered to adequately describe how people conceptualize their public participation decisions.
Moreover, how people conceptualize their public participation options must be considered. This research points out that participants are focused on Substantive issues that they want to achieve. Most people would not be expected to recognize the form of rationality they are applying, but rather perceive their Needs and Interests as simply rational and justified. The expert perspective of reconciling different forms of rationality (or Ways of Thinking) through the fair and competent application of process (and all the epistemological perspectives that support this focus such as the socially constructed nature of knowledge; see Chapter 2) is not likely to be understood and well received by the typical participant.

The differences revealed by this research between how experts and participants perceive public participation creates challenging communication problems that prevent more effective and widespread use of existing public participation programs and resources. The importance of Legitimacy as a preeminent feature of the mental model and recommended solutions for responding to the expert versus participant differences are provided in the Advice for Policy Makers and Program Administrators subsection presented later in this chapter.

**Implications for Mental Models Research**

*New Methodology for Public Participation Research*

As previously described in Chapter 3 (see Overview of the Mental Models Approach), this research is the first known application of the Mental Models methodology to the field of public participation. Mental Models is an established methodology for comparing expert and lay conceptualizations of a risk phenomenon.
The intent of the knowledge gained is to inform the development of communication strategies that bridge these differences and achieve some desired behavior modification on behalf of a target audience (Morgan et al., 2002). The general intent of Mental Models research is one of informing a group of managers about how to effectively communicate to a workforce (Niewöhner et al., 2004) or lay publics (Zaksek & Arvai, 2004). Simply stated, one begins with an expert model, this model is compared to a target audience’s perspectives, and messages are created to overcome knowledge gaps and misunderstandings of the target audience. This approach is justified when studying phenomenon that involves clear application of objectively discernable, technically-based considerations, such as is often the case with workplace safety for example.

This research has adapted the Mental Models methodology to evaluate people’s preferences for engaging in technically intensive social controversy. While risk is not always recognized as a foremost issue in this context, risk does pervade many aspects of individuals’ decisions to engage and how to best engage in public participation. These controversial situations may involve risk related to social issues, such as vested interests in personal or working relationships or risks concerning project outcomes and its affect on peoples’ lives, to identify just a couple examples.

However, in applying the Mental Models method to public participation research, it is important to recognize that the phenomenon of interest involves many subjective and technically uncertain considerations. In Superfund cleanups for example, many substantive issues cannot be reduced to statements of objective certainty. Even after site related studies that can go on for decades in some cases, decisions must be
made for sake of expediency despite wide ranging perceptions about how much remediation is necessary and the best method for achieving the remediation. Accordingly, the application of the Mental Models method to public participation research must strive to achieve a two-way form of communication. Rather than privilege the expert perspective, this research endeavors to interpret its findings from multiple perspectives. Hence, this chapter provides sections addressing policy makers (i.e. those ‘experts’ in academia or government who develop new policies and programs), public participation practitioners (i.e. people with training and experience in leading public participation processes), and participants (i.e. volunteers and more lay-oriented persons engaged in project controversy). Moreover, methodological lessons learned are discussed that could support a more balanced research perspective as this line of research continues.

Methodological Lessons: Aligning the Interview Protocol with the Analysis

The Mental Models methodology uses semi-structured interviews. The overall approach is to start with general questions that minimize biasing the interviewee and then proceed to increasingly more detailed questions that address each element of the mental model. This approach allows new ideas to emerge, yet ensures all areas of interest are covered during the interview.

Within this overall framework, there is considerable latitude on how to construct the interview protocol and conduct the interview. The approach selected should match the degree of knowledge about the phenomenon being studied and the type of analysis
to be conducted. Generally speaking, phenomenon that are less well understood
benefit from a less structured interview and a more interpretive form of analysis, while
phenomenon that are understood in greater detail can benefit from a more structured
interview that supports more quantitative forms of analysis. This guideline will be
explained by examining the strengths and weakness of this research.

As a first application of the Mental Models method in public participation
research, this research is characterized as an initial exploration. Prior research did not
employ the kind of holistic approach inherent to the Mental Model methodology. In
developing the expert mental model, a large body of research and expert perspective
was used to assimilate a model that is more inclusive of a broad range of variables than
had been previously reported in the literature.

Accordingly, the interview protocol used open-ended questions of a more
general nature. The interviews were approached in a manner that encouraged highly
conversational dialogue. Hence, the interviews frequently jumped around the sequence
provided by the protocol. Because answers to certain questions came out naturally in
the interviews, they were never asked. As a result, interviews tended to focus on areas
of greatest importance to the interviewee. This approach maximized the opportunity to
identify new variables not previously identified in the mental model, and it explored the
topics on the interviewee’s terms.

Once the interviews were coded, there was a desire to be as systematic and
objective as possible in the interpretation of the results. (See Appendices C and D for
these analyses.) However, the degree to which interpretations of the data could rely
upon statistical measures of the frequency and magnitude of coded responses in various categories had to be balanced against an awareness of the variability involved in the interview process. Accordingly, the criteria established to determine dominant nodes were judgmentally derived after reviewing the results. The goal was to produce a short list of variables that clearly stood out.

In advancing this research, as confidence grows in establishing the range of variables important to public participation decision-making, the interview protocol should become more detailed and specific. Interviews could also become more structured and systematic. This approach would produce data that is more comparable across interviewees. Such a data set would be appropriate for more detailed statistical evaluations that might parse out more subtle differences in participants’ mental models. Consistent with the full sequence of steps presented in Chapter 3 for the mental models methodology, surveys may ultimately be developed to achieve the most structured, systematic, and efficient form of data collection and analysis.

Moreover, quantitative assessment of expert-participant differences in this research was limited by the lack of coding assessment of expert interviews. To better address the two-way objectives of this research (explained in the previous section, A New Methodology for Public Participation Research) future research could interview experts for coding and data analysis. This kind of analysis might lead to the recognition of multiple perspectives within experts, and it would permit an assessment of expert-participant differences that does not tend to privilege the expert perspective.
**Advice for Public Participation Practitioners**

Herein, a public participation practitioner is considered to be a professional with public participation experience who endeavors to improve group problem solving by implementing effective processes at the project level. EPA Coordinators or private practice facilitators are two obvious examples, but project managers employed by industry or government might be other examples.

**Applying Mental Models as a Public Participation Planning Tool**

Practitioners may utilize the mental models provided by this research as aids for recognizing how individuals engaged in technically complex public issues think about their public participation choices. The Mental Models methodology provides an established process for identifying differences in how experts and non-experts think about an issue. The mental models presented in this research have condensed a broad literature search into a relatively concise and coherent set of variables and relationships between variables that people think about when making their public participation decisions. Moreover, for the reasons previously stated in A Unique Model for Understanding Public Participation Decision Making, the mental models presented in this research are believed to be sufficiently general for application to science-intensive controversy outside Superfund.

Practitioners may use the variables identified in the mental model to guide the breadth and depth of interviews or other forms of data collection that may be used to evaluate or plan a public participation process. A Situation Assessment is one example of a well defined public participation planning process that may be used by practitioners.
to inform the selection of a preferred public participation approach (Susskind et al., 1999, Chapter 2). By using the mental model as a guide for conducting semi-structured interviews within a Situation Assessment type process, a practitioner can be aided in broadly exploring the relevant areas of potential concern to the interviewees. Once the interview data is assembled, practitioners may compare their assessment data against the mental model to identify areas that stakeholders are unclear about or under-recognize. This information may be used to develop focused communication or training on specific areas of greatest need to facilitate individuals’ process choices.

Of course, the scope of any such assessment must consider the magnitude and complexity of the controversy and the resources available to support such an assessment. Many aspects of the assessment may be adjusted to meet specific project needs such as, the length of the interviews, the number of interviews, decisions on whether to transcribe and code data and the degree of detail applied in the coding. In support of a more rigorous data collection and coding, as experienced in this research, the coding process does provide a degree of objectivity to the interpretive process. The analytical process of breaking text into small segments that can be labeled with one or more codes forces a considerate evaluation of each part of the text. This process also separates this segment-by-segment assessment from the broad interpretation of the interview. These extra steps of analysis, while time-consuming, can identify items that might have been overlooked, and it minimizes potential bias that may come from focusing on only those portions of the text that appeal, resonate, or otherwise register with the person doing the interpretation.
**Overcoming the Analytical-Experiential Communication Barrier**

Practitioners may also apply recognition of the three different Ways of Thinking observed for participants in planning a public participation process. Many existing public participation processes are recognized according to the nature of the problem without regard for the nature of those engaged in the problem. For example, Joint Fact Finding is a process intended for technically complex problems (Ehrmann and Stinson, 1999; McCreary et al., 2001), while deliberative dialogue is intended for more intractable, value oriented problems (Forester, 1999; Susskind and Field, 1996). Also, EPA’s TAG program is intended to provide a community with a trusted technical advisor to explain technically complex information. Other EPA programs provide technical assistance and technical training. However, an improved understanding of public participation needs may be recognized when the focus shifts from the nature of the problem to include the nature of the individual, i.e. their Ways of Thinking or thought processes.

In this research, the type of individuals under-served by EPA’s public participation program and processes were the Experiential thinkers. These individuals did not get what they desired from the Superfund program. They tended to characterize the problem as one of misuse of power and authority. They characterized their historical interactions and relationships with regulators as poor. They perceived the regulators as incompetent and not committed to their needs, despite a self-described strong sense of Commitment by regulators who feel that do all they can to be responsive to the questions and needs of residents. Experiential thinkers did not
characterize the problem using the same methods as Analytical thinkers. Hence, the analytically oriented regulators were frustrated in their attempts to inform the Experiential thinkers. Perhaps the regulators did not communicate with Experiential thinkers in ways that were meaningful to them because they did not fully understand the needs and interests of the Experiential thinkers. While Experiential thinkers tended to emphasize the Process Norms and Values part of the mental model, Analytical thinkers placed emphasis on the Substantive part of the Existing Context.

EPA’s CAG program provides support for facilitation processes that can be used to share points of view and affect agency decision-making. This program has sufficient flexibility to respond to both technical and value oriented problems. It has been successfully applied thus far in the Drinking Water Cleanup site; although, some concern was expressed by interviewees about the program’s potential to address future upcoming issues, and one regulator opposed to EPA’s actions does not appear to be served by the project. For the Residential Soil Cleanup site, neither the TAG nor CAG program was embraced or used by residents. As previously indicated, Teske (2000) observed that the TAG (and by logical extension CAG) program appears to function well when the interests of the agency and those of the residents are aligned, but fails to live up to its promise when interests are not aligned.

Processes such as Joint Fact Finding and Community-Based Participatory Research have been crafted to specifically address the communication challenges commonly associated with technically complex, multi-participant problem solving (Susskind et al., 1999), as described in Appendix C. Moreover, the CAG program can
serve as an effective vehicle for applying these processes. Importantly, what appears to be missing in underserved situations is the vision and will to initiate such efforts. Residents relying upon more Experiential type thinking may not embrace a TAG program that emphases technical issues as prescribed by the government, nor will they necessarily embrace a CAG that seems to promise more frustrated talk without first addressing real or perceived power imbalances relating to decision authorities.

EPA (2009) advises that “the impetus for establishing a CAG should come from the community.” However, a request for a CAG program is unlikely to be initiated by those who have already been frustrated by meetings involving miscommunication among different kinds of thinkers, are distrusting of the EPA, and are not familiar with deliberative processes. In this situation, the vision and will to initiate an effective methodology for improved communication and problem solving must come from elsewhere. This research suggests that such vision and will is also unlikely to come from analytically oriented regulators who are steeped in technically oriented assessments and are accepting of established decision criteria. Moreover, the opposing positive and negative orientation for Commitment, Relationship History, and Locus for Decision Authority expressed by Analytical and Experiential thinkers in this research, respectfully, suggests that participants (including conveners) in controversy are not always fully cognizant of the nature of their diverse perspectives and the related communication challenges. Where disparate Ways of Thinking and disparate Public Participation Preferences exist, challenges in establishing mutually acceptable forms of public
participation can be expected. When such challenges are not overcome, the perceived quality of the public participation process is likely to be viewed negatively.

Experienced practitioners can provide a much needed response for overcoming the communication barriers between the Experiential and Analytical thinkers. By providing strategically-minded public participation expertise, such as is demonstrated by the citizen leaders in the Drinking Water Cleanup Site in this research, practitioners can be a vital catalyst for effectively initiating the kinds of group problem solving processes that can overcome such communication barriers.

**Responding to Participant’s Perceived Needs and Interests**

Notwithstanding the previously stated advice for overcoming the experiential-analytical communication barrier, other findings of this research recognize certain challenges in implementing more deliberative or collaborative oriented processes like Joint Fact Finding. In consideration of the findings presented in Chapter 6, care must also be exercised in recognizing the possible different Ways of Thinking between the expert and the participant.

Practitioners are advised to initiate public participation processes by first responding to participants’ Needs and Interests as they understand them. Participants cannot be expected to embrace public participation options that are not focused on meeting needs as they understand them. This research suggests caution in promoting public participation strategies based on promising improvements for Capacity Building, Trust, Legitimacy, or other such nodes included in the mental model and identified as rarely used, unless such goals are expressed by the participants. Rather, it is necessary
to begin with the promise of better outcomes, as they perceive them. Then, as
Individual Learning cycles (Figure 12) unfold, an increasingly broader range of variables
can be introduced as they may pertain to helping participants become better aware of a
broader range of possible Needs and Interests and the public participation process
alternatives that can be used to achieve these expanded Needs and Interests.

Advice for Participants

Ultimately, it is the participant engaged in controversy that must make their own
determinations about the extent to which a particular public participation process will
serve their needs and interests. This subsection identifies certain considerations
illuminated by this research that participants may want to include in their decision-
making.

Anticipating Controversy

The potential for controversy is not just dependent upon the degree of Technical
Complexity of the problem. The broad range of Substantive, Process, and Social
variables included in the mental models strongly suggest that there is more to problem
solving than the facts. Individuals’ assessments of what facts are important to know and
how the facts are interpreted are interwoven with and moderated by a complex
integration of numerous considerations. As indicated by the characteristic Ways of
Thinking identified in this research, Ways of Thinking will vary for individuals across a
spectrum of experiential-strategic-analytical orientations. Moreover, learning processes
may allow individuals to shift in these orientations over time. Early recognition of both
the nature of the problem and the nature of the individuals engaged in solving the problem will help to anticipate controversy and plan an appropriate response.

**Elements of a Thoughtful Public Participation Decision**

The nodes and relationships included in the mental models provided by this research collectively identify an inclusive and integrated definition of what experts and participants believe individuals in Superfund cleanup decisions think about, or at least should think about, in order to make informed public participation decisions. In summary, Figure 12 of the mental model identifies the following actions that should be explicitly considered when making a public participation decision:

a. Consider the full range of generally recognized outcome expectations when determining Needs and Interests.

b. Insightfully reflect on how one’s Process Norms and Values and one’s Emotions can affect ways of thinking.

c. Select a public participation process or processes based on knowledge of a range of options and consideration for how these options can best meet one’s Needs and Interests.

d. Recognize the importance of Inter- and Intra-group Interaction in sharing and learning, and the importance of this sharing and learning process for forming public participation preferences.

**Seeking Leadership and Expertise**

Drawing upon the concerns expressed by participants in this research, participants are advised to recognize certain limitations of time, expertise, resources,
political vulnerability, etcetera, which are inherent to effective problem solving and which become more pronounced as the magnitude of the problem increases in size. In considering the need for outside expertise, participants are advised to consider the need for both technical and procedural expertise to address the breadth of substantive, social, and process issues inherent to science-intensive social controversy.

As applies to Superfund specifically, the TAG program has evolved since its inception. The word Technical in the TAG label can be a misnomer. TAG programs routinely address more than technical issues, and the communications that derive from any technical work done by a TAG consultant can perform a much broader type of service than simply reinforcing agency messages that are contained in agency documents to residents. It can be used to help the community organize, help the community proactively determine their needs and interests, advocate for community needs, establish collaborative problem solving, and otherwise help the agency understand resident communications in a manner that is appropriate for each unique situation.

The recently published *EPA’s Environmental Justice Collaborative Problem-Solving Model* (EPA, 2006b) provides a good framework for further considering the merits and methods for implementation of this proposed advice. The stated objective of the Office of Environmental Justice is to “explore the use of collaborative problem-solving to provide a systematic approach for communities to build partnerships with other stakeholders to improve their environmental and/or public health conditions in local areas” (EPA, 2004, p. 1). This objective promotes process solutions that can enable
disadvantaged communities to achieve community-driven and substantively-oriented agendas. This office and the guidance they provide are an example of a progressive program and body of practice that is founded upon principles that are consistent with the mental model framework proposed by this research.

**Advice for Policy Makers and Program Administrators**

In part, this dissertation has thus far established that differing expert and participant mental models of the public participation decision-making process may hinder communication between the two groups. Stated in less technical terms, different Ways of Thinking about public participation exist between and among experts and participants, and these differences can lead to certain communication barriers. The different Ways of Thinking affect the kinds of public participation choices participants make. Participants’ preferences for public participation can be positively influenced if policy makers and program administrators can better conceive programs that participants embrace or can better communicate how existing programs can meet participants’ Needs and Interests, as they understand them. Herein, the results of this research are applied toward advice on the future development and deployment of policies and programs that are broadly embraced by participants.

**Bridging the Analytical-Experiential Barrier**

As previously stated, experiential thinkers were observed in this research as particularly under-served by existing EPA public participation programs and practices. In prior discussion of this problem (see Advancing a Three Way Characterization of Participants and also Overcoming the Analytical-Experiential Communication Barrier
earlier in this chapter), practitioners were advised to intercede with their more strategically-minded Way of Thinking. Such leadership may also come from a variety of sources: private consultants, regulators, or other project participant groups such as a responsible party or citizen participant. The important element is that they bring to the group prior experience, education, and/or training in areas of facilitation, mediation, and group problem solving more generally.

For the policy maker or program administrator, ensuring an adequate supply of appropriately trained practitioners may prove challenging. Not only is it expensive and time consuming to support education and training, but it can also be expensive in implementation. In short, this approach relies upon continuing education and/or proper prior experiences to ensure adequate development and availability of these strategically-minded individuals. While there may be well-deserving benefits of such inputs when it comes to reaching the Needs and Interests of multiple participants, alternative or supplemental actions are conceivable.

The most durable alternative course of action is to reconfigure the existing problem solving process. Existing public participation programs, at least within the EPA, rely upon the voluntary participation of citizen-participants. As previously stated, EPA (2009) advises that “the impetus for establishing a CAG should come from the community.” Yet the communication barriers implicit in the different ways of thinking between Analytical and Experiential oriented thinkers can preclude the rise and development of an effective public participation practices on a given project. The end result of a community-driven public participation policy is the inconsistent and
disproportionate delivery of public participation resources across different projects.
Consistent with the observations of Teske (2000), public participation programs like TAG are more likely to be delivered and applied successfully when the participants and the regulators are like-minded.

Such programmatic shortcomings may be overcome by re-thinking the existing problem solving methods prescribed by current regulations. Current regulations and guidance tend to segregate substantively and technically-oriented problem solving processes from the public participation process. Integrating state-of-the-art process-oriented problem solving methods with the technical process could conceivably minimize the need for process oriented expertise.

Briefly stated, an integrated technical-process approach would require more proactive efforts at achieving stakeholder involvement in the early scoping stages of a project. During project scoping, the effective consideration of Needs and Interests of all participants would be sought. This scoping inquiry would need to be inclusive not only of the technical aspects of the problem, but would also need to consider the other variables affecting participants’ Way of Thinking about the problem (i.e. their Emotions, Process Norms and Values, Desire for Information and Engagement, and Recognition of Stakeholder Differences, as illustrated in Figure 12 of the mental model).

\textsuperscript{25} Subpart E, Hazardous Substance Response, of Superfund regulations provide a prescriptive process that the agency is to use in identifying, evaluating, and remedying a hazardous waste site. Probably the most relevant example of how problem solving methods are prescribed in the regulations is found in 40 CFR 300.430. This section of the Superfund regulations defines the Remedial Investigation/Feasibility Study process. This regulation defines the information to be collected to conduct an investigation, the human health and environmental criteria to be used to assess risk, and the criteria to be used in evaluating and selecting a remedy, among other items. The regulations provide a concise, step-by-step approach that is expanded upon in greater detail in numerous guidance documents prepared by the EPA.
The previously mentioned Joint Fact Finding process is one approach specifically designed for addressing technically intensive social controversy (Susskind et al., 1999, McCreary et al., 2001). Structured processes like Joint Fact Finding aggressively encourage involvement of key parties early in a project and apply shared learning processes to achieve technically rigorous and socially legitimate project outcomes. Less reliance upon facilitation experts and third-party technical expertise may be achieved if an effective group problem solving process like Joint Fact Finding could be enmeshed into a newly conceived remedial investigation, feasibility study, and remedial design process. Additional creative thinking is needed about these kinds of alternative problem solving methodologies that can consistently integrate technically rigorous problem solving methods with effective public participation processes in ways to reduce dependency upon the project-level availability of strategically minded individuals to achieve mutually recognized successful project processes and outcomes.

**Evaluating Project Manager Effectiveness**

Commitment, Relationship History, and Locus for Decision Authority are the most frequently and consistently identified nodes across all Ways of Thinking expressed by participants (see Chapter 5). Commitment was not identified in the initial expert mental model, suggesting it as a variable for greater consideration in future research. In this research, Commitment is defined as an individual’s assessment of a leader’s prior and ongoing attentiveness and responsiveness to the needs of others in meaningful ways. A positive or negative orientation toward Commitment, Relationship History, and Locus for Decision Authority was consistently associated in this research to overall
support for EPA’s actions. Many factors within the mental model, and perhaps others, may be co-factors in this observed association, and this research is not sufficiently focused on this issue to ascertain a direct cause and effect relationship.

Notwithstanding such limitations in fully characterizing this observed association, the findings of this research suggest that participants’ orientations to these variables may derive as much or more from being successful in achieving their project goals rather than any objective measure of actions taken to fulfill commitment as might be defined in a job description or job performance review. Project managers are advised that simply trying harder to be Committed, Transparent, or Competent may not by itself change resident’s negative perceptions. Therefore, personnel performance reviews that consider issues like stakeholders perceptions of a project manager’s level of commitment or responsiveness may be viewed as much or more as indicators of overall stakeholder satisfaction with public participation processes than as objectively measurable indicators of the effectiveness of the day-to-day actions of project management personnel.

**Defining a “Good” Public Participation Process**

Prior research indicates that what constitutes a ‘good’ public participation process is evolving and that generally recognized, measurable norms have not been established in practice (Webler et al., 2001; Chess, 1999). The results of this research suggest that experts and participants can have widely differing perspectives about the kinds of Needs and Interests they seek to achieve through public participation. Participants, who are focused on substantive issues at the project level, lack any real
incentive to achieve those longer-term societal objectives that experts may seek from a public participation effort. How can we pragmatically integrate both long-term civic developmental needs (i.e. building Stakeholder and Convener Problem Solving Capacity and improving the Legitimacy of the agency) with short-term project needs (i.e. achieving Substantive outcomes) to design public participation processes that are broadly embraced by participants? The mental model framework provided in Figures 12 and 14 is applied to this question within the context of current and evolving government mandates and social perspectives.

The highest level of current government leadership concerning such issues as Trust, Fairness, Legitimacy, and civic capacity building are provided in Executive Order 13352, Facilitation of Cooperative Conservation, signed by President Bush on August 26, 2004. The purpose of the order is to “promote cooperative conservation,” which is defined as “actions that relate to use, enhancement, and enjoyment of natural resources, protection of the environment, or both, and that involve collaborative activity...” This definition clearly emphasizes, first and foremost, the substantive outcome focus for the collaborative activity.

An evaluation of the Presidential order within the mental model framework suggests that government policies remain too focused on substantive outcomes at the expense of focus on “higher-level” objectives of Legitimacy and Building Civic Capacity. In short, government policy remains attached to notions that consider the agency to be the knowledgeable and appropriate authority for decision-making rather than the
caretaker of processes and procedures that enable a diverse society to move toward the ideals of democratic self governance.

Certain established theory allows deeper understanding of this issue. As previously explained in Chapter 2, underlying these policy positions are positivistic perspectives that hold reality to be objectively measureable. This perspective holds out for optimal solutions to problems, i.e. a single best and right answer that can be best understood through the application of good science and technology. Therefore, achieving this outcome is the highest attainable good. Conversely, a post-positivistic perspective of reality recognizes the socially constructed aspects of knowledge, is critical of hegemony, recognizes diverse values and beliefs and the role these play in interpreting facts, and does not therefore perceive a single best and right answer to all problems. If we are emerging toward a post-positive world, good process may one-day supersede good outcome as a higher principle of governance. If this shift in perspectives is accurate, it is possible to recognize the emerging need for policies to more explicitly recognize objectives like civic capacity building and of Legitimacy more generally.

Similar propositions are supported elsewhere (Bell, 2004; Adams, 2004; Parsons, 2004). In particular, a critique of Usable Knowledge in Public Policy by Adams (2004, p. 41) concludes by saying:

“Indeed, the fragmentation of modernity has thrown into sharp relief the risks of dependence on centralized expertise as the dominant knowledge frame, and we now need to rethink what usable knowledge is and the capacity of our public administration ideas and instruments to reorientate towards the co-production of knowledge in new spatial and temporal frames.”
The argument for promoting Legitimacy as the highest goal of a public decision-making process is not meant to dispel the importance of high quality decisions that achieve more substantive goals such as Human Health and Environmental Improvements. As shown in Figure 14, such substantive project goals are one of several nodes affecting Legitimacy. However, the proposed mental model presented in this research indicates that when environmental issues engage concerned participants who hold diverse values and beliefs, the highest attainable goal for the agency is improved Legitimacy as perceived by the public that they serve.

A problem with promoting Legitimacy as an ultimate objective is that it is inherently difficult to quantify and measure in any universally accepted or objective way. Moreover, Legitimacy is not the only criterion that should be applied in an evaluation process. The Social and Process variables that feed into Legitimacy are equally difficult to measure, while metrics for Substantive variables like Cost, Schedule, and on-the-ground improvements are much easier to define. The lack of well-recognized and measurable outcome objectives is a recognized impediment to broader use of community involvement processes (Chess & Purcell, 1999; Charnely & Engelbert, 2005).

A generally recognized operational definition of a ‘good’ public participation process is likely to remain elusive because participants’ outcome expectations emerge in part from their divergent perspectives, as exemplified by the four Ways of Thinking identified by this research (i.e. the Expert per Chapter 4 plus the Experiential, Analytical, and Strategic observed for the Participants per Chapter 5). The mental model
framework provided by this research contributes to these ongoing areas of research by providing a coherent framework for how people think about their public participation decisions. This framework can be applied toward continued consideration of a generally recognized operational definition of a ‘good’ public participation process that is inclusive of the diverse perspectives of experts and participants.

The mental model in its current form cannot be applied to prescriptively identify a best public participation method in the manner of a decision tree type construction. However, the mental model can be used as a tool within other public participation planning processes to help inform the selection of a public participation approach that is responsive to the divergent ways people may think about the issues. This research has demonstrated how different Ways of Thinking are associated with different public participation preferences. It was previously discussed how the mental model methodology may be adapted and applied as rigorous tool in applicable circumstances to inform the design of a public participation process for a specific project. The discussion continues below with a focus on applying the mental model framework at the policy and program administration level to address identified differences between experts and participants.

**Addressing Broader Social and Process Oriented Benefits of Public Participation**

The benefits of achieving Legitimacy and other Social and Process oriented outcomes of public participation are supported by such venerable institutions as the National Academy of Science, (2008) and the Council of Environmental Quality (2007),
and others, as described within the context of constructing the expert mental model (Chapter 4). Through the analysis provided in Chapter 6 however, it was observed that participants engaged in controversy are not likely to concern themselves with issues such as Legitimacy of the convening agency while they are struggling to obtain more substantive-oriented project outcomes. If, as suggested in Chapter 6, process experts are cautioned to be responsive first to participants and to focus on their substantive issues, then alternative mechanisms for promoting the broader social and process oriented benefits of public participation must be sought.

Investment in education is one option. It would be interesting to determine if these same participants would more freely recognize the benefits of the process and social goals in question here if they were interviewed outside the Superfund project context. Personal experience suggests that people are much more interested, open-minded, and willing to learn about process options when not engaged in controversy. Appropriately framed civic education might influence the public participation decisions people make once they become participants in a controversial public decision-making processes. Such education would increase awareness and understanding for why civic involvement is important, increase knowledge of more constructive methods for achieving Stakeholder and Convener Problem Solving Capacity and why it’s important to do so, and increase appreciation for how Legitimacy of a democratic government depends upon critical citizen involvement.

In considering such options with a specific program like Superfund, policy makers and program administrators should re-think the drivers that initiate and frame a public
participation effort. Existing public participation programs, at least within the EPA, rely upon the voluntary participation of citizen-participants. Currently, EPA (2009) advises that “the impetus for establishing a CAG should come from the community.” Yet the communication barriers than can exist between Analytical and Experiential oriented thinkers can preclude the implementation of effective public participation practices. As previously mentioned, Experiential thinkers who may have already been frustrated by meetings involving miscommunication among different kinds of thinkers, are distrusting of the EPA, and are not familiar with deliberative processes are as unlikely to seek out Build Agreement forms of public participation as are analytically oriented regulators who are focused on technically oriented assessments. The end result of a “community-driven” public participation policy is the inconsistent and disproportionate delivery of public participation resources across different projects. Consistent with the frequently cited observations of Teske (2000), who provides one of only a few peer reviewed assessments of the TAG program, public participation programs like TAG are more likely to be delivered and applied successfully when the participants and the regulators are like-minded. More routine implementation of TAG and CAG-like programs in ways that do not rely upon citizen initiative would circumvent the Analytical-Experiential communication barrier and create increased opportunities for improved communication and resolution of differences.

Efforts to increase the use of public participation practitioners in the planning and implementation of public participation programs can provide a much needed response for overcoming the communication barriers between the Experiential and
Analytical thinkers. Such practitioners need to be familiar with the application of the full typology public participation options presented in Figure 12, and be familiar with the characteristics of the Experiential-Analytical barrier described above.

Ensuring an adequate and ongoing supply of experienced practitioners may prove challenging. Not only is it expensive and time consuming to support education and training, but it can also be expensive to support such individuals in implementation. In short, this approach relies upon continuing education and/or proper prior experiences to ensure adequate development and availability of strategically-minded public participation professionals. While there may be well-deserving benefits of such inputs when it comes to reaching the Needs and Interests of multiple participants, another alternative exists.

An alternative course of action is to reconfigure the existing problem solving process, i.e. the remedial investigation, feasibility study, and remedial design process incorporated in current regulations and guidance, such that programs like TAG and CAG that require professional public participation are not needed. Current regulations and guidance tend to segregate substantively and technically-oriented problem solving processes from the public participation processes. Integrating state-of-the-art process-oriented problem solving methods with the technical process could conceivably minimize the need for process oriented expertise.

Briefly stated, an integrated technical-process approach would require more proactive efforts at achieving stakeholder involvement in the early scoping stages of a project. During project scoping, the effective consideration of Needs and Interests of all
participants would be sought. This scoping inquiry would need to be inclusive not only of the technical aspects of the problem, but would also need to consider the other variables affecting participants’ Way of Thinking about the problem (i.e. their Emotions, Process Norms and Values, Desire for Information and Engagement, and Recognition of Stakeholder Differences, as illustrated in Figure 12 of the mental model).

Joint Fact Finding process is one approach specifically designed for addressing technically intensive social controversy (Susskind et al., 1999, McCreary et al., 2001). Structured processes like Joint Fact Finding aggressively encourage involvement of key parties early in a project and apply shared learning processes to achieve technically rigorous and socially legitimate project outcomes. Less reliance upon facilitation experts and third-party technical expertise may be achieved if an effective group problem solving process like Joint Fact Finding could be enmeshed into a newly conceived remedial investigation, feasibility study, and remedial design process.

**Strengths, Limitations and Future Research Needs**

This section of the dissertation provides a critical examination of the quality of the research, or what others refer to as the overall soundness or “truth value” (Lincoln and Guba, 1985) of the research. The intent is to highlight key methodological strengths and the usefulness of the findings while recognizing the limitations. Where limitations are identified, additional research that would address the limitations are proposed.

Selecting an appropriate construct for assessing the quality of qualitative research presents its own challenges. Whereas quantitative research has widely recognized and long established norms, numerous strategies have been proposed for
assessing the quality of qualitative research and the merits of these approaches continue to be evaluated. For instance, Marshall and Rossman (1999, p. 192) describe “the essentially contested nature of the criteria of soundness in the current methodological scene.” As a further case in point, Creswell (1998) defines a different set of terms and related procedures for assessing the quality of research for each of five characteristic traditions of qualitative research: biography, phenomenology, grounded theory, ethnography, and case study. However, within both of these texts, considerable attention is given to the prior work of Lincoln and Guba (1985) that is generally applicable to all forms of qualitative research and that is complimentary to prior established norms for quantitative research. The work of Lincoln and Guba appears to have withstood the test of time and is judged to provide a thorough structure for assessing the quality of this research.

Lincoln and Guba (1985, p. 300) identify four canons of quality for qualitative research:

1. Credibility: This canon considers the “trustworthiness and authenticity” of the research (Lincoln and Guba, 1985). The goal is to demonstrate that the research was conducted such that the subject of the research was accurately identified and described. This canon is complementary to the internal validity canon used in quantitative research, which seeks to ensure methodological rigor and soundness. Within the qualitative research tradition, credibility is variously assessed through demonstrated use of rich observation and persuasive weight-
of-evidence, as may be ultimately judged through the consensual opinion of others.

2. Dependability: This canon considers the degree to which the study’s results would be reproduced if repeated with the same participants in the same situational context. It is complementary to the reliability criterion used in quantitative research, with some notable differences. Reliability applies where the object of study is assumed to be static or unchanging. However, when researching people, it must be recognized that the object of study is constantly learning and adapting to evolving conditions. Complete replication in a real world setting is not possible as people are constantly working to improve upon or reconstruct understandings of the world. Accordingly, qualitative studies cannot be entirely replicated. However, the dependability of the findings can be assessed by the degree to which the “complexity of the situational context and interrelations” is recorded and described (Marshall and Rossman, 1999, p. 195).

3. Transferability: This canon considers the degree to which the research findings are useful to other persons or other locations. It is generally consistent with notions of generalizability and external validity used for assessing quantitative research. Marshall and Rossman (1999) recognize that generalization of qualitative research findings from one population or setting to another is often seen as a weakness by traditional canons originating from quantitative research. Qualitative research is often more descriptive in its objective and is specific to a situational context involving humans in the real world that is in a constant state
of change (see Chapter 3). Identifying and controlling for all of the independent and potentially confounding variables, which is necessary to provide the more numerically predicative objectives of quantitative research, often lies beyond the scope of qualitative research. Nevertheless, the transferability of the study results can be assessed by reference to the theoretical framework that orients and shapes the research. A case can then be made for why or how the orienting theoretical framework has applicability to other settings.

4. **Confirmability**: This canon addresses the degree to which the findings reflect the participants’ understanding of the phenomenon or subject of the research and the process of inquiry rather than the researcher’s bias. The object is to assess whether the “findings of the study could be confirmed by another” (Marshall and Rossman, 1999, p. 194). This canon seeks to confirm rather than objectify the value of the data (Creswell, 1998, p. 198), as is generally done in quantitative research. Confirmability is variously demonstrated through examination and transparency of the researcher’s background and perspective, demonstrated understanding of the participant’s perspectives, and the application of quality assurance procedures that employ other researchers to critically examine the analyses to ensure accuracy in data collection and the thoroughness of the interpretations.

**Credibility**

This research applies Mental Models methodology to a new application. The utility of the Mental Models methodology is applied for studying the diverse Ways of
Thinking that are applied in public participation decision-making on scientifically complex public projects. As a first application, this research is exploratory in nature. It does not seek to isolate a set of independent variables that could be applied to consistently predict a person’s public participation preference with quantitative precision. This research does seek a holistic approach to identifying a set of variables and their interrelationships that describe what people think about when making public participation decisions.

Fischhoff et al. (2006) describe how the Mental Models methodology seeks to define a middle path within a continuum ranging from computational models to narrative scenarios. Whereas computational models apply quantitative research methods to predict outcomes using highly structured numeric models, narrative oriented research seeks to identify interdependencies within a particular context and to produce insights from what might otherwise appear to be an array of scattered facts. Narrative research seeks to define a compelling and shared narrative around which the seemingly scattered facts can be made coherent. The Mental Models methodology seeks to serve elements of both approaches by providing a structured model of a complex phenomenon that is coherent, at least to experts on the topic being addressed, and for identifying those elements within the system that are worthy of attention. As a mental model, the model seeks to represent what’s on people’s mind (see Chapter 3), and accordingly, should be explicit enough to be deemed coherent to others. A mental model might be developed into a predictive model should the data requirements to do so ever be achieved. However, the utility of the mental model is not predicated on its
quantitative predictability, but rather on its usefulness in producing insights and providing a structured approach to understanding a complex phenomenon.

The credibility of this research is therefore contingent upon the degree to which the expert and participant mental models were suited to understanding public participation in the two Superfund sites selected. For the Expert Mental Model, the objective was to create an accurate depiction of current knowledge about individuals’ public participation decision-making by constructing a model that was also coherent and convincing to others. In review, the Expert Mental Model (Figures 6 through 8) was derived through a literature review, interviews with five experts in the field, and two workshops involving public participation professionals in academia, government and private practice. Through this process, a mental model that included various nodes (salient constructs or variables) and groups of nodes evolved to a final form, through the repeated interpretive effort of the researcher, which was recognized by the workshop participants as coherent and holistic in its representation of current knowledge.

The Expert Mental Model was then applied in the development of an interview protocol and ultimately the coding and analysis of text from interviews of participants engaged in controversy and making public participation decisions at two Superfund sites. As noted in Chapter 3, care was applied in identifying interviewee text that was provided in response to leading prompts during the interview, and this data was excluded from the analysis of participant’s text. Some modifications were made to the model during the analysis of the participants’ text, and that those changes involved the creation of additional nodes and changes in the grouping and connections among the
nodes (described in Chapter 5 and summarized in Tables 1 and 2). The Participant Mental Model that emerged (Figures 9 through 11) has in this way been demonstrated to be adequately comprehensive in capturing the issues as experienced by participants and expressed during the interviews.

**Dependability**

The application of the mental models developed in this research to characterizing the different Ways of Thinking and associating the Ways of Thinking with characteristic public participation process preferences requires an interpretive assessment of the data. The Mental Model methodology provides a rigorous method for identifying the variables important for this research and a systematic and thorough method for collecting and analyzing empirical data on these important variables. While systematic and thorough, the degree to which similar results would be achieved by another researcher is highly contingent upon the quality of the coding process. It is also dependent upon how the coding analysis is interpreted, which is addressed under Confirmability.

As described in greater detail in Chapter 3, the coding process involved breaking text down into segments consisting of one or more sentences that pertained to one or more codes in the participant mental model. Each node was carefully defined to ensure consistent understanding (see Appendix B). Text was analyzed by the researcher through multiple iterations of coding until all of the text was able to be coded to one or more nodes. All of the text and related codes were contained within an electronic spreadsheet that facilitated sorting of the data and searching for patterns.
This methodological approach achieves a measure of dependability in several ways. Breaking the text down into the smallest coherent segment and relating it to specific part or parts of the mental model reduces the potential for misinterpretation. This approach utilizes all of the text in the analysis, thereby reducing the ability of the researcher to overlook part of text or to bias interpretations toward text that seems more appealing. Moreover, the electronic database can allow researchers to easily relate specific findings to specific segments of text.

Dependability could have been strengthened by involving multiple researchers in the coding and analysis to assure that reliable coding was conducted; however, the financial and human resources to do so were not available. Members of the dissertation committee did engage in reviews of the analyses and requested further verification of certain findings with additional text.

The methodology revealed clear differences in the public participation decision-making of the participants. At the simplest level, the public participation preferences of the Experiential thinkers at the Residential Soil Cleanup site and the Strategic thinkers at the Drinking Water Cleanup site are revealed in the stark differences in the public participation methods actually put into practice. The willingness of the Strategic thinkers to make use of programmatic resources like the TAG program is reflective of more proactive thinking. For the Experiential thinkers, the preference for Informing strategies is evidenced by the higher frequency that this approach is mentioned both within and across Analytical thinkers (see Table 2).
As can be expected in any complex situation, the data analysis also revealed that most participants made reference to a broad range of process options to meet the needs of a range of different situations and issues. Accordingly, the characterizations of process preferences given to the Experiential and Strategic thinkers is not only supported by the frequency by which a particular public participation approach is mentioned, but also upon recognition of how these individuals actually used different forms of public participation in the Superfund project. Therefore, the interpretation is not only contingent upon accurate coding and analysis of coding frequency, but also upon familiarity with the texts provided by the interviewees as a whole and observing how decisions and behavior actually occurred over time on these two projects. The dependability of the interpretations can therefore be confidently recognized as being derived directly from the information obtained about the sites.

While much was done to achieve dependability, the inherent nature of qualitative research makes it unlikely that the application of the same methodology at the same sites but at a different point in time would produce exactly the same results. Some interviewees may no longer be part of the project and new people may have come in. Moreover, the mental models produced from this research identify Individual Learning as feedback loop that influences Individual Ways of Thinking. Therefore, some differences would emerge from interviews of even the same people if the research were repeated today. The Individual Learning node of the mental model was not a focus of this research. However, there are important insights to be gained from understanding if
and how Individual Ways of Thinking can change through learning. Additional research that tracks sites over time would meet this need as follows:

- **Longitudinal Studies.** Mental models research is being increasingly applied to better understand how learning occurs in a wide variety of topic areas. Longitudinal mental model study designs that assess Ways of Thinking at multiple stages in the life of a project might prove particularly revealing of public participation processes that enable more effective participant learning. This research was focused on evaluating Ways of Thinking. However, other elements of the mental model identified in Figure 9 are important to understanding how an individual’s public participation decisions are moderated by group interactions and otherwise evolve over time.

There are additional limitations in understanding the observed relationship between Ways of Thinking and public participation preferences. Several site related variables might explain the observation. As described earlier in this chapter under Advancing a Three-Way Characterization of Participants, socioeconomic differences between the two researched communities, the more technical nature of acid mine drainage and water treatment, and the more community shared interests in water treatment might all contribute to the reasons why the Strategic thinking emerged much more dominantly at the Drinking Water Cleanup site. Other variables might also be involved. Additional research at more sites, as also identified under Transferability, is needed to observe process preferences in a wider range of situations.
**Transferability**

Chapter 7 discusses the implications of this research to theory, future mental models research, and the practice of public participation. The core knowledge and insights deemed most useful to others and for application to other sites are summarized in Chapter 8, Conclusions. Rather than attempt a brief summary of the information provided in Chapters 7 and 8, herein a focus is provided on how the elements of communication theory and mental models generated by this research support the transferability of knowledge to other situations. Remaining knowledge gaps that may limit transferability of knowledge gained in this research are then identified, and additional research that could address the knowledge gaps are proposed.

Chapter 2 describes communication theory as it pertains to public participation, and it explains why this research tradition is deemed most appropriate for advancing a more commonly recognized basis for determining how best to conduct public participation. Briefly restated, communication theory seeks to define the “ideal speech situation” necessary to effectively achieve mutual understanding, and it identifies fairness and competence are the most relevant core variables for achieving effective communication within a public participation process (Webler & Tuler, 2000). Moreover, the literature review provided in Chapter 2 supports the idea that different people use different perspectives to understand and interpret science (Edelstein, 2004; Fisher 2000; Tesh, 2000; Slovic, 1997; Slovic et al., 2004) and they have different ideas about what public participation is and how it should be conducted (Webler & Tuler, 2002; Webler et al., 2001; Chess, 1999). This research sought to respond to the previously identified call
by Webler & Tuler (2002, p. 186) for more research that links fundamental principles with “the complexity of people’s motives and behavior” and “the historical context” within which the public participation process is embedded. Moreover, Webler and Tuler (2002, p. 186) identify a need for additional research that addresses “a broad landscape of variables, from preconditions and moderating variables, to variables that depict the deliberative process itself, to processes that capture the significance of the outcomes of the process.”

In responding to the call by Webler & Tuler (2002), this research has revealed how different Ways of Thinking can exacerbate controversy and constrain public participation decision-making. Moreover, the mental models that emerged from this research add structure and coherence to existing knowledge about these different Ways of Thinking. The illustrative format of the mental models and the supporting interpretive text in Chapters 7 and 8 are intended to aid in applying the knowledge gained from this research to other sites. While the nodes most applicable in a given context may be sites-specific, the nodes and dependencies identified in the mental models developed through this research can be used to help elucidate important variables pertaining to public participation decisions at other technically and socially complex sites.

While recognizing the contributions that this research provides, it remains an exploratory first step in the application of mental models research to public participation. Much can yet be done to improve the transferability of knowledge gained
on different Ways of Thinking to other situations. Additional research that could meet this aim includes:

- **Examine Additional Superfund Sites.** The current participant mental model is based on eighteen interviews conducted at two Superfund sites. Further research at more Superfund sites would allow for incorporation of a larger number of potentially important variables and expand on the number of interviewees upon which conclusions are based. Such research may identify other Ways of Thinking and other types of process preferences.

- **Characterize Ways of Thinking for Other Kinds of Experts.** Engaging a broader spectrum of experts may lead to refinements in the expert mental model that make it more immediately recognizable to a broader audience. In considering the possible policy benefits explored in this paper, extending this research to include senior administrators, program managers (as opposed to project managers), and legislators may provide insights to help public participation experts better communicate future policy and program improvement needs to these policy makers. Just as experts and participants can have different Ways of Thinking that complicates effective communication, policy makers may utilize certain yet unstudied, unknown, and diverse Ways of Thinking that complicates effective communication among themselves and between them and other public participation experts.

- **Use of Questionnaires.** Continuation of the mental models research methodology to include questionnaires administered over a broader
population would enable greater transferability of the findings. As previously described (Chapter 3, Detailed Methodological Description subsection), the Mental Models methodology may evolve to the use of questionnaires as the phenomenon of interest becomes better defined and increasingly more structured forms of inquiry can be performed without undue risk of narrowly constraining the scope of the study or biasing the responses. Questionnaires can be a cost effective method for including larger numbers of people and sites in the research.

- **Examine Sites Managed by Other Agencies.** While this research is focused on Superfund, extending this research methodology to sites managed under other programs and by other agencies would extend the transferability of knowledge to decision-making in other programmatic contexts.

There are certain considerations that can limit the application of Mental Models methodology to other Superfund sites, other kinds of experts, or sites managed by other programs. The interviewees must be in a position where they can freely express what is on their minds. Situations involving active lawsuits or highly visible political contests may constrain the ability of people to speak freely. Confidentiality agreements and delayed publication of the findings, as was used in this study, can reduce these impediments to collecting quality information. However, the potential effects of the research process on the ongoing controversy should be considered.
Confirmability

The analysis and interpretation of this research was performed almost entirely by a single researcher. Members of the dissertation committee did review the data collected and provided comment on the methods of analysis. This support added methodological rigor, which is integral to the presentation on Credibility. Committee review also ensured that my findings were supported by the facts while minimizing any personal bias I may have introduced as the sole researcher. Undeniably however, confirmability could be improved through additional research as follows:

- **Engaging other Researchers.** Engagement of other researchers in interviewing, coding, and interpretation of this research would provide additional perspective and quality control to the interviewing, coding, and data assessment steps of this research. While much methodological rigor was applied to achieve credible, dependable and confirmable results, the conclusions derived are dependent upon the interpretations of the researcher. Engaging other researchers in this research or future similar research would allow other perspectives to contribute to the findings presented herein, leading to increased confirmability. It is hoped that this exploratory research will attract others to conduct similar research.

- **Application of other Research Methods.** The Mental Models methodology is heavily dependent upon information shared by selected interviewees. The interview protocol is designed to thoroughly elicit that which is on interviewee’s mind about a topic. It is well suited to gaining an
understanding of the breadth of variables pertaining to a topic. However, it is less well suited to providing objective proof of causal relationships or for pushing beyond people’s explicit understanding of their needs and interests.

Other research methodologies can provide important alternative perspectives for understanding public participation. For example, experimental study designs that carefully control for potentially confounding variables can be used to provide additional quantitative or qualitative understanding of causal relationships between specific variables. Also, case study designs often utilize a broad range of information sources to support in-depth analysis of a particular case. Such a study design might assess both the thoughts and actions of people engaged in any one Superfund site over time. Insights gained from interview data might be integrated with in-depth assessment of project documents, news reports, on-site observations, and other information sources. Use of alternative research methods can provide added perspectives by which the findings of this research may be confirmed, extended, or challenged.

Absent such additional research, the confirmability of the results can be judged through an understanding of the researcher’s experiences and perspectives, since these provide the context from which interpretive bias is derived. This research is informed by a growing body of literature suggesting that project level personnel and affected citizens may have perspectives about community involvement that differ from upper management and academia (Edelstein, 2004; EPA Office of Inspector General, 1996;
Thus, it is critically important that this research be attuned to the anticipated diversity of perspectives about community involvement that may differ significantly and in fundamental ways from that of the researcher.

The beginning of the critical assessment begins with self-introspection. As a practicing environmental consultant, with a B.S. degree in Environmental Chemistry and an M.S. degree in Toxicology, I have spent over 20 years conducting site assessments, risk assessments, and remedy design assessments that meet the requirements of current regulatory requirements and otherwise conform to the Analytical Way of Thinking that seems to predominate among regulators and permeates regulations. While I spent many years immersed in the Analytical Way of Thinking, it was the repeated experience of failure in communicating to non-regulator stakeholder groups that led to an interest in risk communication and environmental conflict resolution. I have accumulated many different experiences over the past six years that provide me with a broader and truly interdisciplinary perspective. Among these are my academic studies leading to this Ph.D., a Certificate of Achievement in Natural Resources Conflict Resolution, and a private consulting practice that has become increasingly dominated by risk communication rather than risk analysis work. I have represented the needs of citizen groups as a TAG consultant at two Superfund sites, I have provided facilitation services on several projects to help manage conflict between stakeholder groups, and as a consultant I have applied the Mental Models methodology as a practical tool for improved understanding of issue complexity and different perspectives on food safety, climate change, national flood control policy, and national dredging policy.
On a more epistemological level, as researcher I ascribe most closely to the Pragmatist and Hermeneutic traditions of social inquiry. The Pragmatist’s tradition of inquiry focuses on the social situations and conflicts that create and are created by the evolving usage and interpretation of text. It therefore considers that knowledge is social in nature (Delanty and Strydom, 2003). Within the Hermeneutic tradition, “the meaning to be derived from text is negotiated mutually in the act of interpretation; it is not simply discovered” (Schwandt, 2003, p. 302). Furthermore, I ascribe to a middle epistemological stance regarding the objective-subjective nature of knowledge. Reality exists, but because people are finite we are constrained by a bounded rationality. Therefore, any knowledge generating process, such as the gathering of information to make informed decisions about how to engage in public participation, will benefit from multiple forms of learning. Valid data can lead to more accurate understanding, the inclusion of multiple perspectives can provide more holistic understanding, and the act of dialogue can produce a more unified understanding. This perspective therefore favors knowledge generating processes that are informed, inclusive and deliberative. These epistemological orientations to the nature of knowledge bias me as a researcher toward wanting to find ways in which text reveals different perspectives and Ways of Thinking among individuals.

In conclusion, other characterizations of Ways of Thinking, public participation preferences, and learning processes may yet be identified by advancing upon this exploratory research. As a research tool, the Mental Models methodology has enabled the identification of different Ways of Thinking about public participation decisions and
relating them to process preferences. The results of this research may be extended in
numerous above listed ways. Moreover, the methodology can be adapted and applied
as a practical tool for rigorously characterizing the nature of controversy on scientifically
complex projects.
CHAPTER 8: CONCLUSION

Getting diverse groups of people to engage in collaborative and constructive forms of public participation on issues involving complex and uncertain scientific or technical information is challenging. There are many contextual variables of possible relevance to any specific decision about how best to engage in public participation, and there is considerable variability in the ways in which different people think about and respond to these contextual variables when making their public participation decisions.

This research seeks to better understand how individuals make decisions to engage in science-intensive controversy. The intent is to help participants overcome communication barriers that tend to stifle the effective application of public participation processes. To be clear, the intent is not one of finding ways to make people change who they are and otherwise completely eliminate their differences, but rather one of finding ways of overcoming barriers to the use of public participation processes that can best help to achieve effective communication and mutual understanding on commonly shared problems despite these differences.

This is the first known application of the Mental Models methodology to public participation research. This methodology has supported the development of an illustrative framework of interconnected variables that approximates, on modeling terms, what people think about when making their public participation decisions. The mental models of public participation decision-making developed by this research greatly expand upon prior efforts as exemplified by Figure 5. In so doing, the mental models contribute toward the needs expressed in Chapter 2 project (see
Communicative Theory subsection) for a theory of public participation that accommodates the contextual features of the specific application. While ambitious in scope and inherently complex, the framework is consistent with prevailing theories of public participation and coherent to public participation professionals. By assimilating a wide body of existing knowledge into a single, unified diagram, the mental model may serve as a useful aid for recognizing the variables that should be considered within a public participation planning process. The mental model identifies the variables that people may use to make decisions about if they want to participate or how they would like to see public participation conducted.

Application of the mental model to the two Superfund sites evaluated in this research reveals that individuals apply different ways of thinking that can be understood by examining the different parts of the mental model in which they place their focus. To help comprehend these differences and relate the differences to public participation decisions, this research characterized three distinctive ways of thinking among participants actively engaged in controversy—analytical, strategic, experiential—which are associated with informing, intentional, and ad hoc types of public participation preferences, respectively. Recognition of these distinctive ways of thinking and the associated public participation preferences is an important and perhaps under-appreciated consideration when making public participation decisions. Two ramifications are proposed.

First, the three-way characterization of differences can alleviate stereotyping about purely rational versus purely emotional responses to controversy. The terms
used to define the three characteristic ways of thinking are adapted from existing risk literature and accordingly, the differences observed by this research have been identified in prior research involving other sites. However, prior research of the observed differences tends to present the distinctions in dichotomous and opposing terms. Even where authors may have no initial intent on stereotyping, a dichotomous characterization of people’s differences runs the risk of becoming interpreted within the broader, collective wisdom of society in stereotypical terms. The recognition of a three-way characterization scheme allows greater recognition of a broad middle ground wherein individuals can strategically employ both experiential and analytical oriented ways of thinking to effectively communicate and otherwise achieve their needs and interests when working with diverse groups of people.

Secondly, recognizing differences in ways of thinking people bring to public participation decisions can stimulate different ways of thinking about an appropriate choice of a public participation technique. While existing typologies of public participation and public participation theory are based on the nature of the conflict, this research suggests that the type of individuals engaged in the project should also be considered in the design of a public participation program for a given project-specific application. While prevailing norms for conducting scientific investigations, such as subjecting the resulting reports prepared in relative isolation to peer review, may be appropriate among a group of like-minded scientists, alternate processes are likely more appropriate when people with more diverse perspectives and interests become involved. In this
document, the use of Joint Fact Finding and Community-Based Participatory Research have been presented as existing and often effective alternative techniques for allowing diverse groups of people to work constructively to address issues of technical complexity.

Unfortunately though, more structured responses to controversy like Joint Fact Finding and Community-Based Participatory Research are rarely utilized. This research points toward a communication barrier that may prevent people from coming together to agree upon the use of more sophisticated forms of public participation.

In this research, a communication barrier was interpreted to exist between those who tend toward analytical ways of thinking and those who tend toward experiential ways of thinking. The analytical thinkers tended to have an implicit faith in established norms for technical assessments, and they oriented toward informing styles of public participation. That is, they were intent on explaining what they perceive as a preeminent form of logic and insight into truth. Conversely, the experiential thinkers tended to be critical of this perspective. They tended to perceive the application of science as merely a justification for the status quo or an unfair and unwelcomed source of power. These different ways of thinking prevented analytical and experiential types of thinkers from recognizing a commonly understood approach for identifying, understanding, and developing a response to problems. While the analytical thinkers tended to apply informing methods of public participation in an attempt to communicate “facts”, the experiential thinkers may have viewed the interaction as a misuse of power and authority and were not predisposed to accept the message. In
short, people were not hearing the messages of others in ways that achieved mutual understanding. Effective communications were not occurring.

As a specific example, citizens at the soil remediation site did not observe or experience any adverse effects in themselves or their neighbors after having lived a lifetime in the presence of elevated metals concentrations, and they were critical of EPA risk assessment methodology that concluded there was a problem. (Of course, the inverse situation is also a possibility, where EPA risk assessment does not show excessive risk while exposed citizens are greatly concerned or point to cancer clusters.) The process used by the analytical thinkers to scope and assess the risk was too narrow and was therefore not useful to the experiential thinkers. Expressing this problem in terms employed by the mental model, while experiential thinkers tended to emphasize the Process Norms and Values, analytical thinkers placed emphasis on the Substantive part of the Existing Context. Accordingly, a barrier to effective communication appears to have existed whereby both parties failed to get their message across. Frustration, anger and poor working relationships between individuals exhibiting these different ways of thinking resulted.

What was observed at the Soil Remediation Site is too often the norm for how public participation plays out at Superfund sites and other similar types of controversial public decision-making processes. While the EPA attends to its standardized process of holding public meetings and otherwise trying to inform the public about their understanding of the risks and needed responses to those risks, the public becomes increasingly frustrated or mad and eventually stops showing up. This research suggests
that difficult to discern differences in ways of thinking people use to understand the problem and make public participation decisions appear to create difficult to discern barriers to effective communication and mutual understanding. In particular, experiential thinkers may view processes convened by analytically minded regulators as inappropriate and ineffective for meeting their needs.

Overcoming the analytical-experiential communication barrier requires the intersession of strategically-minded leadership, or it requires a re-thinking of existing norms and processes for conducting scientifically complex assessments in a public setting. As observed in this research at the Water Remediation Site, a strategically minded leader that can skillfully communicate with both analytical and experiential thinkers can be effective. The challenge involved should not be underestimated. As observed in this case, much experience and effort is needed to maintain the resources that support such an effort. Grassroots fundraising and grant writing generally requires a sustained level of effort by someone with the experience necessary to be successful. Increased funding to train and sustain leaders that can provide strategically minded leadership would improve the availability of strategically-minded leaders to constructively address these kinds of problems.

However, the structure for how such leaders are interjected into the process should also be considered. The collaborative orientation of the participants engaged in any particular project or issue is dependent upon a sometimes fragile balance of continually meeting various parties’ needs. As observed for the Water Remediation Site, the parties stand ever ready to revert to more combative positions if things do not
go their way. Therefore, a collaborative and constructive approach to public participation will always remain at risk so long as the strategically-minded leadership comes from any one participant group that has a vested interest in the outcome. It therefore seems to make sense to place emphasis on the development and maintenance of a pool of strategically-minded experts that can function as a neutral third-party process manager or facilitator of effective communications.

Even if the call for increased use of third-party process managers was fully embraced, it is difficult to imagine that there would ever be enough of such people to meet every decision-making need. (Perhaps Gifford Pinchot thought the same about the need for technical expertise 100 years ago when technical expertise was increasingly becoming recognized as necessary for the management of natural resources? See Chapter 2.) And at any rate, not every decision involves enough participant interest or magnitude of effort to support someone in the role of a third-party neutral. For such reasons, it makes sense to consider how existing processes used by technically-oriented agencies like the EPA might be reconfigured to more consistently and effectively respond to the needs and interests of those potentially affected by a decision. Re-thinking the technically-oriented processes that are embedded in agency procedures could do much to reduce dependency upon strategically-minded intermediaries. Any such process must be able to allow engaged participants the opportunity to participate directly in the scientific process. Fortunately, state-of-the-art processes like Joint Fact Finding or Community-Based Participatory Research exist that can be applied to meet this need (see Appendix C).
The findings of this research do not inform in any detail how current EPA site investigation or remediation design processes, to select one example application, could be re-worked using the Joint Fact Finding methodology. However, the findings of this research can be applied to identify some of the key drivers and benefits for using a Joint Fact Finding methodology. One of several key tasks in the first step of “Preparing” to conduct a Joint Fact Finding investigation is to “document the interests of all relevant stakeholders” (see Figure C-1). As indicated by the different perspectives characterized in this research, it is important to identify people’s differences and how this relates to their public participation preferences. This information becomes vital to the effective implementation of the “Scoping” step, which allows all participants to have a role in crafting what questions are going to be asked. Without carrying on further, the remaining steps continue to draw participants into a process that is both meaningful and meets their expectations. The key here, and the reason for focusing on just the first couple steps, is to recognize a connection between how peoples’ perceptions of the issue differ and the need to be more flexible in developing the scope of any particular scientific investigation. This scope must respond to the questions people have about an issue on terms and in ways that are meaningful to them.

Boiling it all down to its brute essence, controversy plagues public decisions on issues involving technically complexity. America is a nation founded on principles of democracy. America is also a diverse nation, wherein people hold many different values, beliefs, ideologies, and so forth that affect what our concerns are and how we interpret information. If we are going to continue to accept this diversity or even
embrace it as a source of strength, if we want to build civic capacity to constructively work through shared problems despite our diversity, and if we can recognize how the political landscape has changed such that public officials are increasingly going to have their wisdom and authority to make decisions challenged by those who are affected by their decisions (as described in Chapter 2), then we must develop improved methods for involving the public in the decision-making process and apply them more consistently. Herein, a contribution to this need is provided by:

- Demonstrating how the Mental Models methodology can be used to study public participation,
- Providing a mental model illustrating what people think about when making their public participation decisions, and
- Characterizing differences between various participants and experts in terms of the different areas of emphasis exhibited within the mental model.
- Advancing normative theory on public participation through the communicative strand of research.

These differences affect how people think about the issues, the approach they take to participate with others in decision-making processes, and ultimately their willingness to even want to participate. To ensure the long-term legitimacy of our democratic form of government, we must overcome the communication barriers that can divide people, preclude the use of effective forms of public participation, and otherwise contribute to controversy. Government agencies must therefore proactively
and consistently employ quality public participations processes that promote positive social values as inseparable from a well informed decision.
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APPENDIX A: INTERVIEW PROTOCOL

Mental model relationships and prompts shown in bold-italics

Needs and Interests
1) What are your interests and concerns?
   __ substantive
   __ process
   __ social
   __ beliefs or values

Final Outcomes
2) Are your interests and concerns being addressed?
   __ substantive
   __ process
   __ social

Existing Context
3) What are the interests and concerns of others?
   __ substantive
   __ process
   __ social
   __ beliefs or values

Final Outcomes
4) What aspects of the project have been successful and why?
   __ substantive
   __ process
   __ social

5) What aspects of the project have not been successful and why?
   __ substantive
   __ process
   __ social

Intermediate Outcomes and Existing Context
6) How has your understanding of the project changed over time, giving consideration to the problems being addressed, the way the project is being conducted, and how people are involved?

Existing Context
   a) Has technical complexity been a difficult challenge? Why?
   b) Has leadership or project management been a difficult challenge? Why?
   c) Has diverse social or political conditions been a difficult challenge? Why?
Normative Notions and Values
d) What personal values or beliefs have been a factor for you in this project?
  ___ fairness
  ___ power
  ___ encouraging philosophical discussion
  ___ popular legitimacy
  ___ competence
  ___ locus for decision-making authority

Individual Process Knowledge and Preferences
7) (How have you been involved / What has been the focus of your role) in the project?
  ___ (being informed / informing)
  ___ (providing / seeking) advice
  ___ building agreement/facilitating
  ___ resolving conflict/mediating or legal
  ___ advocacy/public appeal

Group Inter/Intra-action
8) What has influenced (your level of involvement / the way you interact with others outside your organization), and how might you have rather (been involved/interacted)?
   i) What did you do when...(milestone project decision or action)..., and why?

Individual Process Knowledge and Preferences and Individual Rationality
9) How could communication and public participation be made more effective?
   a) More or better information? Why?
      ___ informing
      ___ seeking advice
   b) Other ways to engage different interests in dialogue? Why?
      ___ building agreement/facilitating
      ___ resolving conflict/mediating or legal
      ___ advocacy/public appeal
   c) More influence over the decisions and outcomes? Why?

Closing
10. Have I missed anything important?
11. Who else do you think I should speak to?
APPENDIX B: MENTAL MODEL TERMS

1. **Emotions**: Overtly or indirectly expressed feelings, inclusive of curiosity, hope, fear, frustration, attitude, likes/dislikes, opinion, trust, and stigma.

2. **Existing Context**: The historical and current situational context of the problem, as expressed by an individual.
   
a. **Desire for Information or Engagement**: The degree to which an individual wants to become involved in the problem solving process, as recognized through the underlying nodes.
   
i. **Unintended Consequences**: Other positive or negative consequences that result from a decision or action that is directed toward the initial problem, such as remediating pollution. The unintended effects may be physical, social, economic, legal, etc. in nature.
   
ii. **Solution Options, Costs and Schedules**: The alternative(s) identified for solving the problem, inclusive of the capital and operation/maintenance costs, and inclusive of the time required to implement and monitor the alternative.
   
iii. **Problem Recognition**: An expressed awareness or understanding of the primary problem, such as the need to address pollution, and any secondary problems, such as long-term operation and maintenance costs to others.

1) **Knowledge Requirements**: Recognizing one or more fields of knowledge that should be applied to assess the problem.

2) **Regulatory Complexity**: Recognizing regulations as challenging because of the large number of regulations, overlapping or competing requirements, multiple jurisdictions, uncertain interpretations, etc. The challenges may be personal in nature, or be challenging to address in group problem solving contexts.

3) **Technical Complexity**: Recognizing challenges in understanding or applying technical concepts as a personal challenge or within a group problem solving context.
4) **Environmental Quality**: Recognizing contamination as a potential human health or environmental issue. Often the primary problem that is being addressed. Note that personal concern and recognition of the contamination as a personal concern is addressed as Health and Safety.

5) **Other Problems**: Recognizing problems that are being directly or indirectly invoked or recognized as a result of the environmental quality issue(s).

iv. **Effect Outcome**: Perceived ability to influence future decisions based on personal involvement.

v. **Personal Resources**: Perceived ability to sustain participation.

1) **Time**: Perceived availability of time to participate due to the total amount of time required or scheduling conflicts.

2) **Money**: Perceived adequacy of personal (or affiliated institutional funds if not the convener) to sustain effective participation.

3) **Energy**: Perceived adequacy of personal health, emotional stamina or general vitality to participate.

vi. **Political Vulnerability**: Perceived ability to invoke or be subjugated by existing forms of political power. This may be closely related to the Process Norm and Values node Attend to Power Struggles. A statement is coded as an Existing Context type of node when it is presented as a statement of fact.

vii. **Concern**:

1) **Health and Safety**: Perceiving that the Environmental Quality problem presents a real risk to themselves or others. Individuals may recognize an environmental quality problem as one that is perceived by others, but may not recognize that this problem directly affects them or may not recognize the problem as a true and legitimate problem more generally.

2) **Security and Control**: Perceiving that the Environmental Quality problem or the approach to addressing the problem is causing a loss of personal security and control.
3) **Trust of Institutions**: Positive or negative expressions of faith that an agency or other formal group will perform to an individual’s expectations.

b. **Recognition of Stakeholder Differences**: Recognizing the existence and influence of different groups that are working on the problem or that describe or characterize the perceived similarities or differences between these groups and themselves.

i. **Social Group Identify**: Self association with one or more groups of individuals or institutions.

ii. **Stereotypes of Others**: Explicit or inferred broad generalizations of other groups.

iii. **Nature Vulnerability vs. Regenerativity**: Recognizing or refuting the environment as resilient to pollution or other adverse impacts, or recognizing or refuting the natural environment as something other than common notions of pristine.

iv. **Needs and Interests of Others**: Recognizing what others are hoping to achieve by engaging in the process.

1) **Public Participation Preferences of Others**: Recognizing how others want to participate in the problem solving process.

2) **Understanding Others Decisions**: Recognizing why someone else made a decision.

3) **Other**: A miscellaneous category that generally correlates with one or more nodes in the mental model but in the context of another individual or group of individuals.

v. **Social Complexity**: Statements that capture the character of group interactions.

1) **Morals**: Statements reflecting an individual’s sense of right or wrong.

2) **Multiple Authorities**: Recognizing two or more groups that have decision-making power derived from law or regulation.
3) **Multiple Lay Parties:** Recognizing two or more groups of individuals that are engaged, interested and potentially influential but that do not have legally derived decision-making authority.

4) **Cultural Heterogeneity:** Identifying one or more groups that are generally recognized to distinctive heritage or history.

5) **Relationship History:** Recognizing prior good or bad individual or group interactions as something affecting the quality of ongoing interactions.

6) **Media:** identifying one or more sources of news as influential on the process or outcomes.

7) **Organizational Culture and Leadership:** Recognizing the positive or negative qualities of a lead decision-maker’s organization or one’s own organization.

   a) **Experience:** An individual’s assessment of the quality of their performance as a decision-maker, or their assessment of others in this role. Typically refers to the project manager for the lead agency.

      i) **Technical Competence:** An individual’s assessment of a leader’s ability to understand or implement technically complex issues or procedures.

      ii) **Process Competence:** An individual’s assessment of a leader’s ability to understand or implement appropriate and functional public participation processes.

      iii) **Transparency:** An individual’s assessment of a leader’s past performance in revealing and explaining the basis for a decision. This node is closely related to Understanding Others Decisions. Transparency places emphasis on specific actions taken by a leader that helped to clarify or obscure the basis for a decision.

      iv) **Inclusiveness:** An individual’s assessment of a leader’s past performance in achieving broad involvement in the decision-
making process. Involvement in this context does not imply shared decision-making authority.

v) **Commitment:** An individual’s assessment of a leader’s prior and ongoing attentiveness and responsiveness to the needs of others in meaningful ways.

b) **Institutional Resources:** An individual’s assessment of the adequacy of time and money made available by the leader’s organization to support quality work or quality public participation.

c) **Supervisory Structure:** An individual’s assessment of the effect of organizational relationships of people on the problem solving process. Examples include who reports to whom, is the locus for decision authority clearly recognized, size of the organization if it is perceived to affect quality, etc.

3. **Individual Process Knowledge and Preferences:** Statements that indicate an individual has used or desires to use a particular type of public participation process.

a. **No Engagement:** The individual does not seek information or involvement.

b. **Inform:** The individual recognizes the importance of receiving information (or providing information if the individual is within the convener’s organization).

c. **Seek Advice:** The individual has or desires to respond to the information that is provided (or desires comment and feedback on information given if the individual is within the convener’s organization). EPA’s Technical Assistance Grant (TAG) program is considered a Seek Advice type of public participation, except where the contractor is clearly applied with a facilitation type role. Reference to meetings, when used indiscriminately, are coded as Seek Advice if the broader attitude of the individual is focused on technical information.

d. **Build Agreement:** Statements that indicate a desire to meet in groups to proactively address problems or improve relationships or problem solving capacity. EPA’s Community Advisory Group (CAG) program is considered a Build Agreement type of public participation. Reference to meetings, when used
indiscriminately, are coded as Build Agreement if the broader attitude of the individual is one of cooperation with others.

e. **Resolve Disputes:** Statements that indicate a need to respond to well entrenched and difficult to resolve differences by meeting in groups.

f. **Public Relations/Advocacy:** The individual desires to go outside the due process offered by the convener. Appeals are made to authority above the project level, such as a senior administrator or elected officials, or appeals may be made to other special interest groups or the public at large.

g. **Individual Interaction:** The individual desires to meet privately with an influential person to become informed, provide advice, build agreement or resolve disputes.

h. **Legal:** The individual desires to use an attorney to advocate on their behalf.

4. **Needs and Interests:** The outcomes individuals expect to achieve through public participation if necessary. A statement must clearly indicate an outcome expectation to be coded within this group; otherwise, the statement is coded where the terms below are included as Existing Context, Process Norms and Values, or Emotional and Subjective.

a. **Legitimacy:** An individual’s perception that a convener’s decision thoroughly and accurately considered the available information to come to a justifiable and acceptable conclusion. See also Achieve Popular Legitimacy under Process Norms and Values.

b. **Trust:** An individual’s confidence in the character, ability, strength, or truth of the convener or process used to arrive at a decision. See also Trust under Emotional and Subjective.

c. **Fairness:** An individual’s perception about the impartiality and honesty of the convener or process used to arrive at a decision. See also Seek Process Fairness under Process Norms and Values.

d. **Human Health and Environmental Improvement:** An individual’s perception about the types of action needed to protect human health or environmental
environment. Coded as Environmental Quality if the statement does not reflect a personal interest in improvement as a desired outcome.

e. **Cost and Schedule:** An individual’s perception about the amount of money or time that should or should not be spent to address the primary problem(s) or Other Impacts.

f. **Other Impacts:** See Unintended Consequences as an Existing Context node. Coded as Needs and Interests when individual’s state that Unintended Consequences should or should not be addressed.

g. **Convener Understanding of Decision Implication to Stakeholders:** An individual’s perception that the convener recognizes how a decision affects other parties. See also Understanding Others Decisions as an Existing Context node.

h. **Stakeholder & Convener Problem Solving Capacity:** An individual’s perception that stakeholders should learn group problem solving skills while addressing the more immediate problem(s). See also Build Civic Capacity under Process Norms and Values.

i. **Stakeholder Understanding of Convener Decisions:** An individual’s perception that stakeholders have a right to understand the basis for a decision. See also Understanding Others Decisions as an Existing Context node.

j. **Transparency:** See Transparency as an Existing Context node. Coded as a Need and Interest when it is recognized as an important and desired outcome of the problem-solving process.

k. **Technical and Process Competency:** See either Technical Competence or Process Competence as an Existing Context node. Coded as a Need and Interest when it is recognized as an important and desired outcome of the problem-solving process.

l. **Inclusiveness:** See Inclusiveness as an Existing Context node. Coded as a Need and Interest when it is recognized as an important and desired outcome of the problem-solving process.
5. **Process Norms and Values:** Recognizes that individuals may apply varying standards to judge how information is used in the decision-making process.

   a. **Seek Process Fairness:** Emphasizes inclusiveness and a deliberative nature of the interactions.

   b. **Attend to Power Struggles:** Emphasizes inequities in one or more forms of power and the need for evidence and consensus. The qualities of the interaction process are de-emphasized.

   c. **Promote Deliberation:** Emphasizes value differences and the need for discussion and debate to achieve consensus. Good processes are associated with good outcomes.

   d. **Achieve Popular Legitimacy:** Emphasizes voluntary, consensual and inclusive procedures that are fact based and tied to reasonable schedules for reaching a decision.

   e. **Establish Locus for Decision Authority:** Emphasizes strong leadership, information and evidence, democratic participation (exclusive of consensual decision-making), and deadlines for decisions.

   f. **Build Civic Capacity:** Emphasizes a long-term need to build methods for effective citizen involvement in government decisions.

   g. **Role of Experts:** Emphasizes the need for decision-makers to rely upon specialized technical expertise.

   h. **Due Process:** Emphasizes the need to work within established regulatory procedures for problem solving.
APPENDIX C: PUBLIC PARTICIPATION PROCESSES FOR ADDRESSING SCIENCE-INTENSIVE CONTROVERSY

This appendix provides background information about two public participation processes that can serve as solutions to the kinds of communication challenges that were observed in this research as described in Section 7, Implications and Advice. Essentially, the processes presented herein are specifically designed to allow scientifically complex assessments to be conducted by a diverse group of stakeholders. Other processes do exist that might also be considered, such as the Collaborative Learning process presented briefly in Chapter 2 (Daniels and Walker, 2001), and other processes that promote an analytic-deliberative type approach to public participation (Renn, 1999; Zio, 2003).

**Joint Fact Finding**

Joint Fact Finding (JFF) is one particular process that is elaborated on herein because it has received fairly widespread recent attention and application in the U.S. and the process is broadly applicable to a wide range of potential applications involving science intensive issues. It provides a structure for engaging diverse parties in a decision-making process that is scientifically credible, politically relevant, and fair (McCreary et al. 2001). JFF establishes a structured, yet flexible process for getting experts, decision-makers and key stakeholders from opposing sides to work together, share technical information and local knowledge, and create a single final document that embodies the sum of the joint efforts (Schultz, 2003). As described by McCreary et al. (2001, p 330), JFF rests on a few key ideas:
• “Rather than withholding information for strategic advantage, the interested parties pool relevant information.

• JFF involves face-to-face dialogue between technical experts, decision-makers, and other key stakeholders. Usually, a nonpartisan facilitator or mediator assists in orchestrating this dialogue.

• The process places considerable emphasis on ‘translating’ technical information...into a form that is accessible to all participants in the dialogue.

• Although JFF is geared to building consensus, it tries to clearly ‘map’ areas of scientific agreement and to narrow areas of disagreement and uncertainty.

• It uses a single negotiating text to record the result of the JFF process.”

JFF objectives in any given application may include clarifying technical uncertainty, packaging information in a useful form, developing management options, or securing an agreement. A facilitator may be used to assist stakeholders in such tasks as:

• Identifying key decision-makers and stakeholders

• Clearly framing the problem and objectives

• Preparing the ground rules and developing the project schedule

• Identifying the types of needed expertise

• Identifying and recruiting the necessary specialist (multiple specialists independently prepare and deliver analyses on various topics)
• Facilitating question-and-answer sessions with specialists and summarizing stakeholder findings during each meeting
• Recording stakeholder findings into a single negotiated text (documenting areas of agreement and disagreement).

Figure C-1 provides a brief overview of each of the steps that comprises a JFF investigation.

The fundamental premise behind JFF is that “supervised, direct interaction among scientists, decision makers, and other key stakeholders can bring forth innovative public policies that all interested parties can support” (McCreary et al. 2001, p. 333). Examples of successful application of JFF in environmental contamination or Superfund Clean-ups contexts exist. McCreary et al. (2001) discuss the application of JFF in the New York Bight initiative to determine how to better manage polychlorinated biphenyls in the waters, sediment, and biota of the estuarine and ocean system of the Hudson/Raritan Estuary and the New Your Bight. The project was sponsored by the New Your Academy of Sciences and involved ten agencies and twelve private organizations. According to the authors, the JFF process “produced an unusually high degree of consensus given the complexity of the issues involved and the history of contentious relations among the interest groups and agencies” McCreary et al. (2001, p. 337). The JFF effort culminated in an agreed upon agenda for conducting short-term and long-term research.
Figure C-1. Key Steps in the Joint Fact Finding Process
Similarly, Sher (1999) describes how JFF was successfully applied to resolve public opposition to a groundwater remedy proposed by the Air National Guard at the Massachusetts Military Reservation Superfund site. A Technical Review and Evaluation Team was established that involved all parties – the public, regulatory agencies, the military, and the contractors. There were two ways to participate, in the internal working group meetings or in the open forum whereby the working group kept the broader public informed and insured it was responding to their needs. In an intense two month effort, the sense of crisis surrounding the project gave way to “a publically acceptable Strategic Plan and budding trust in the military’s effort to contain and cleanup [the groundwater] plumes” (Sher, 1999, p. 876).

Despite such successes, there are times when using JFF may not be appropriate. Ehrmann and Stinson (1999) state several reasons when JFF should not be used:

1. Where significant power imbalances and severe disparity in expertise exist among the parties that cannot be equalized. If there is not a compelling reason for parties to truly collaborate, JFF may be misused in ways that reinforce power and technical supremacy. In such cases, JFF cannot be expected to perform any better than other methods.

2. Where the parties do not believe they can construct a fair fact finding process. Some project may be in or lingering under the threat of lawsuits. In other cases, parties may be so opposed in their worldviews that they are unwilling to try and work together. In these cases it may not be possible to develop a process of shared data collection and analysis.
3. Where there are inadequate resources. The degree of conflict that may develop on a project is sometimes difficult to predict. Where conflict is not anticipated, budgets may be inadequate to provide for facilitated methodologies like JFF. While the case may be made that an effective process will save money in the long run, JFF is not an option if appropriate funding is not available in the short-term.

Where adequate resources and a compelling interest to collaborate prevail, JFF provides a structured process for bringing diverse parties together to address questions of scientific complexity.

**Community-Based Participatory Research**

Community-Based Participatory Research (CBPR) is another method for achieving a collaborative working environment between scientists and affected communities. CBPR may be variously referred to as “community-wide research,” “community-based research,” or “community-involved research.” While known by different names, CBPR seeks the participation and influence of nonacademic researchers in the process of creating knowledge (Israel et al., 1998). Israel (1998) reviewed the available literature at the time to identify a collectively recognized set of benefits and principles of CBPR. In terms of benefits, CBPR seeks to:

- improve the quality and validity of research,
- enhance the relevance and usefulness of the research for all partners
- join together partners with diverse skills, knowledge, and expertise,
• strengthen the research and program development capacities of partners,
• increase the possibility of overcoming distrust or research,
• provide additional funds and possible employment opportunities for community partners,
• improve health and well-being of communities.

These benefits are achieved through adherence to the following general principles:

1. Recognizing community is a unit of socially constructed identity.
2. Builds on strengths, resources, and relationships that exist within communities to address their communal concerns.
3. Facilitates collaborative partnerships between community members and non-community members in all phases of the research.
4. Integrates knowledge and action for mutual benefit of all partners.
5. Promotes a co-learning and empowering process that attends to social inequalities. In particular, CBPR researchers involved with community-based research acknowledge the inequalities between themselves and community participants, and the ways that inequalities among community members may shape their participation and influence in collective research and action.
6. Involves a cyclical and iterative process of communication between the involved parties through the research process.
7. Addresses health from both positive and ecological perspectives. This perspective captures the physical, mental, and social well-being aspects of health.

8. Disseminates findings and knowledge gained to all partners in language that is understandable and respectful, and where ownership of knowledge is acknowledged.

The challenges identified for implementing CBPR are similar to those identified for JFF. With CBPR however, there is recognized the added challenge of deciding who represents the community and how the community is defined. Similarly to JFF, successful application of CBPR is contingent upon the skills of a facilitator, in this case one skilled in CBPR. A number of difficult decisions are generally needed to address issues such as:

- How and when does a community participate?
- Who participates and how is it decided?
- How is reasonableness and data validity assessed?
- How are differences over interpretation handled?
- Is additional data needed?