This is to certify that the
thesis entitled

A Tool for Assessing Citizen Deliberative Decisions about Contaminated Sites

presented by

Monica Day

has been accepted towards fulfillment
of the requirements for the

M.S. degree in Resource Development

John Lupi
Major Professor's Signature

July 29, 2008
Date

A TOOL FOR ASSESSING CITIZEN DELIBERATIVE DECISIONS ABOUT CONTAMINATED SITES

By

Monica Day

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Resource Development

2008

ABSTRACT

A TOOL FOR ASSESSING CITIZEN DELIBERATIVE DECISIONS ABOUT CONTAMINATED SITES

By

Monica Day

Despite acceptance of the benefits of public participation for clean up of contaminated sites, agencies often struggle with executing public involvement methods. The literature provides guidance on evaluating methods, but tools for assessing group decisions were difficult to find. This study tested an application of the National Issues Forums (NIF) method for clean-up of dioxins on the Tittabwassee River. The research recruited people to attend a forum in their neighborhood, discuss clean up options, and develop consensus about the preferred solution. This thesis assessed the group decisions according to six dimensions. Forum participants differed in some ways from the neighborhoods at large and the quality of the group decisions varied. The study concludes that while the subjectivity of any assessment method makes evaluation of outcomes difficult, based on the tool developed for this study, the NIF method can produce good decisions in neighborhoods impacted by contaminated sites.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1: INTRODUCTION

Citizen participation began to be institutionalized in the United States during the rise of regulatory rule making in the first half of the twentieth century. Participation was included in rule making to protect individual interests and facilitate public scrutiny of government (Renn, 1995). During the 1950s and 1960s the value of participation to improve public policy to improve policy, plans and projects was starting to be recognized (Renn, 1995). Since then, nearly every federal agency has institutionalized some form of citizen participation in their regulatory decision making procedures (Renn, 1995). Citizen participation has been touted for reducing costs and leading to better projects by reducing the likelihood of litigation and decreasing planning time and changes later in the process (Abel & Stephan, 2000; Woolcock & Narayan, 2000).

In addition to easing policy making, administrators who make a good faith effort to engage the public meaningfully can also increase citizen competence and desire to participate, and engender trust between citizens and government paving the way to work collaboratively to solve public problems. Benefits of quality participation efforts include stronger agency–citizen relationships, improved agency credibility, better policy, and a stronger democracy (Abel & Stephan, 2000).

Despite evidence that citizen participation yields high quality outcomes (Beierle, 2002), citizen participation continues to be a source of frustration for agencies and continues to be underfunded. Making policy about the clean up of contaminated sites has been particularly challenging for public health agencies because of the costs involved in action and the risks involved in inaction. Contaminated sites posing health risks to wildlife and humans exposed to the contaminants, including reproductive problems, birth

defects, cancer, tumors, neurological defects, immune dysfunction, and liver and kidney ailments. Strategies to reduce exposure to the contaminant may require land use changes that impinge further on communities and individuals.

The United States Environmental Protection Agency (EPA), the agency responsible for oversight of the clean up of contaminated sediments, recognizes benefits of early, active, and continuous community involvement in risk management strategies (Council, 1996). In fact, citizen participation programs have become a standard component of decision making processes for contaminated site remediation. Despite these efforts, risks persist, the costs of clean-up may seem overwhelming, or the remediation efforts may seem unacceptably long. Because of the serious health implications, and because clean-up involves disruption of communities, contaminated site remediations are contentious public issues that call for sophisticated citizen participation efforts.

Agencies and other organizations leading and undertaking environmental clean-ups are challenged with how to most productively engage the affected public in clean-up decision making. This study suggests an approach for assessing citizen preferences produced during a deliberative public involvement process known as the National Issues Forums. A contaminated site remediation case in central Michigan provides the context for the research.

Citizen Participation

The present study draws upon literature on citizen participation in public decision making. Institutional barriers to meaningfully engaging affected citizens in public decision-making recognized by this research include representative democracy and a

technocratic approach to risk management. The proposed solution is for public agencies to build social capital with affected citizens by creating new opportunities for citizen involvement, especially deliberative opportunities. The approach seeks to engage affected citizens meaningfully in the ethical decisions inherent in contaminated sediments clean-up decisions by using a structured group decision-making process that emphasizes working-through to resolve tradeoffs in clean-up choice making.

Cleanup of environmental contaminants is often approached by the responsible institutions as largely a technical problem (Council, 1996). While science and mathematics play a critical role in hazard characterization and risk quantification, risk communication, including decision making, requires normative judgments regarding acceptance of risks. The technical experts who are able to quantify the risk provide critical information for making risk management decisions. However, the people who are exposed to the contaminants are in the rightful position to determine what risk is acceptable. Supporting productive communication between these groups, experts and citizens, is the contemporary challenge of risk communication (McComas, 1998). Normative risk decisions that will affect many people cannot be made if people are uninformed or have not thought through the consequences of their decisions. A process of learning about and defining the options, and thinking through the tradeoffs is needed.

Research question

This research seeks to find out whether, when provided with objective technical background information on the problem and potential solutions, affected citizens can attain high quality clean-up decisions using a facilitated, structured decision-making

approach. To answer this question, the research first assesses to what degree forum participants are representative of the area residents.

Setting and approach

To answer this question 378 residents were surveyed of whom 51 (15%) then attended nine structured decision making discussions held in neighborhoods along the Tittabawassee River in the Saginaw River basin in central Michigan. At the time of this study, the Tittabawassee River downstream of Midland was in the risk assessment phase of a clean-up of high levels of dioxin in the river sediments and floodplain. The source of the dioxin was from a chemical production facility that disposed of wastes directly into the Tittabawassee River before environmental regulations were established in the 1970s.

Citizen involvement in cleanup decision making is challenged by scientific uncertainty and low engagement of affected citizens. Scientific uncertainty around the health effects from dioxin exposure at levels that are in the Tittabawassee floodplain has been a vulnerability of the issue that has been exploited by powerful corporate actors. Their rhetoric has been effective at polarizing the views of the citizenry, and interest groups have formed for and against cleanup of the dioxin to try to influence the decision-making. Responsible for leading the cleanup, decision makers such as Michigan DEQ and USEPA are interested in knowing more about the interests of the "silent majority" who are not engaged with the polarized interest groups. However, those not involved in the debate are unlikely to participate in standard public involvement opportunities.

This research was part of an effort to create an institutionally sanctioned opportunity for the "silent majority," the affected but unaffiliated citizens, to discuss

several cleanup scenarios together with others in their neighborhood and come to consensus about their preferred choice.

Organization of the thesis

Following this introduction, chapter 2 presents a survey of relevant literature. Chapter 3 presents the case study and the larger research project of which this thesis is a part. Chapter 4 presents demographic data from the study area and compares forum participants to the larger population. Chapter 5 develops a method for determining the ability of forum participants to reach about how to address the dioxin issue and displays an assessment of the group decisions. Chapter 6 concludes the thesis.

CHAPTER 2: LITERATURE REVIEW

Public participation research is motivated by normative and practical goals. People want a living democracy and effective public policy. Despite decades of research touting the benefits, in practice, public participation activities often flounder. This research is motivated by a real-world problem of making more just and satisfying environmental clean-up decisions. An exploration of some of the scholarship on the topic contextualizes the study.

Problem

Contaminated sites are complex environmental problems that have historically been addressed in the United States with a technocratic approach (Fischer, 2000). The technocratic, synoptic, or rational-comprehensive model is a scientifically based, expert-driven approach that is characterized by a high degree of specialization and is "rule bound," hierarchical, and closed off to feedback (Kelly, 2004; Lachapelle et al., 2003).

Risk assessment is an example of a technocratic approach to addressing uncertain dangers. A typical risk assessment for addressing a contaminated sediments problem includes:

- Hazard identification: characterization of the harm associated with the contaminant;
- Risk measurement or quantification: researching the probability of illness or harm due to exposure to the contaminant;

- Risk communication: examining possible corrective actions including technical aspects of different approaches to conducting a clean-up, deciding which clean-up approach to take; and,
- Risk management: conducting a clean-up, and evaluating the effectiveness (Thompson, 2004).

Science can and should be used to describe and understand the technical aspects of the risk; however, it cannot determine what the target for protection or repair should be or resolve other normative issues (Jasanoff, 1991). Normative problems, or situations requiring discerning what's important and deciding "how things ought to be," require more than facts and information; they require judgment. The individuals exposed to the hazard should be part of deciding what level of risk is acceptable. However, engaging citizens in decision making around risk management situations is challenging for agencies.

The emotionally charged atmosphere of contaminated sites requires excellent public involvement methods. If citizens are from the normative decision making process, agencies risk degrading relationships with the public and their credibility. Furthermore, where special interest groups dominate, as is often the case with contaminated sites, citizens have an increased threat of vulnerability to manipulation. Excluding the public from the decision making process, in the zero-sum atmosphere of representative government is at best going to leave a minority of the public dissatisfied with the solution chosen and at worst satisfy none. Decision makers attempt to limit the influence of special interest groups, falsely assuming that if they "stick to the science" they can maintain a scientific-rational basis for decision making. However, science cannot solve

the normative components of the decision making. What is lost in the technocratic approach to risk analysis is insight into the decision at hand about what is acceptable to the people who are most affected by the problem (Gregory, 2002).

Recognizing the risks of excluding and alienating the public, public institutions have expanded risk analysis to include consideration of public interests and values and a public involvement component (Council, 1996). It is now widely accepted that contaminated site decisions require an understanding of science, engineering issues, regulatory requirements, economic impacts and community values. The U.S. Environmental Protection Agency (EPA), the agency responsible for oversight of the clean-up of contaminated sediments, recognizes benefits of early, active, and continuous community involvement in risk management strategies. Thus, public involvement programs have become a standard component of decision making processes for contaminated site remediation.

Although newer programs offer citizens a range of ways they can become involved, most opportunities are found on the lower rungs of the ladder of public involvement: information and education. Arnstein (1968) developed the "ladder of citizen participation" to delineate the gradations of participation based on degree of influence citizens have over the outcome. The first two rungs: manipulation and therapy, Arnstein (1968) describes as non-participation because they are used primarily to change citizen's views to match the interests of the decision makers. Public involvement activities at the manipulation rung are really public relations tools intended to persuade the public. The middle set of rungs: informing, consultation, and placation involve openly engaging the public, but fall short of ensuring that the public's interests will affect the outcome.

Examples of these middle rung public involvement activities include distributing information by the media, public meetings, and advisory committees. The top three rungs: partnership, delegated power, and citizen control are rungs where citizens have gradations of influence over the decision outcome (Arnstein, 1968). Examples include citizen juries, planning committees, and negotiation.

The lower levels of public involvement are often insufficient for blending expert opinion and citizen interests into satisfying contaminated site clean-up decisions (Gregory, 2000). Traditional avenues for public participation such as public hearings are designed for the purpose of providing citizens with an opportunity to voice their opinions or views of proposed government policies, plans or projects. Such a process includes providing the public access to the proposal; a comment period is offered for public input including a public hearing to listen to public reactions; and decision-makers then usually have discretion in how they use the public input in their decision (McComas, 1998). Where emotions run high and the problem is technically complex, as is usually the case with contaminated sites, these relatively unstructured avenues for input are not likely to yield useful information. There may be too little participation, or the public may be organized into special interest groups where decisions may yield clear winners or losers. In fact, these venues for public input may even exacerbate conflict between citizens and experts leading to "decision paralysis" and public dissatisfaction (Fischer, 2000; Lachapelle et al., 2003).

With inadequate public involvement processes, instead of informing the decision making process, decision makers operating from a technocratic approach may view the public's expectations and desires as unrealistic and ill-informed. Despite believing in

theory in the value of public involvement, in practice, the public is viewed in large part as a problem to be managed. The agency often responds by emphasizing the need for more information (Yankelovich, 1991). It is reasoned that if the public were informed enough, or understood the science better, they would adopt the same or similar solution that the experts select, thus resolving the conflict. However, simply adding to the information base rarely results in great success. While education is important, alone it is most likely inadequate for arriving at solutions that are satisfying to the public and the agency (Arvai & Gregory, 2003). For conflict resolution it is important for experts and the public to have two-way discourse about the technical aspects of the problem, but also about other aspects of concern to the public such as potential economic repercussions, aesthetic implications, tourism effects, health consequences, or impacts on cultural traditions (Arvai & Gregory, 2003; Slovic, 1997). Agencies may dismiss such concerns from the process because they fall outside of their authority. Due to the specialized nature of their responsibilities, agencies are typically constrained to focus their attention on technical solutions within their domain.

By just having an open, non-directed public involvement process such as public hearings or some other open public comment period, the agencies will probably not be able to get the kind of information about public interests that can be useful for making satisfying normative judgments in risk management (Gregory, 2000). With open input many of the affected people may not participate, skewing the kind of information gathered. Also, those who do participate may not have worked through the issues to provide fully developed public opinion (McComas, 1998).

Public Involvement Methods – Deliberation and resolution of tradeoffs

Aware of the need for participatory practices for complex problems, practitioners and scholars have been pursuing alternative public involvement methods since the early 1990s (Abel & Stephan, 2000). Conflict resolution, negotiated rulemaking, mediation, bargaining, citizen juries, citizen panels, citizens' advisory committees, citizen initiatives, study circles, planning cells, and consensus groups are some of the methods that have been tried (Renn, 1995). Many such methods emphasize the role of discourse between citizens and agencies for their effectiveness (Lachapelle et al., 2003; Slovic, 1997).

Using dialog and deliberation is one useful and practical way to engage citizens in decision making. The aim is to facilitate the discussion to help participants to resolve disagreements and differences in a non-adversarial manner, and steer them toward win-win outcomes (Spano, 2001). Facilitation is also important to ensure that power differences are held in check. Deliberative public involvement methods are credited with their legitimizing effects for the agency, increasing sustainability of the decision, improving policy relevance, contributing to citizen empowerment and capacity building, and resolving difficult conflicts (Kelly, 2004; Kothari, 2001; Pellizzoni, 2003).

Contrasting the technocratic approach, Gregory (2002) articulates the importance of wrestling with tradeoffs in risk management decision making:

> With so much attention given to community participation in risk-based deliberation, an obvious question is: Why do there remain so many stalled, unpopular, or otherwise problematic risk-management initiatives? We believe that a primary reason is the inability of most community-based risk initiatives to deal effectively with the difficult value trade-offs that emerge over the course of nearly all risk policy consultations.

Yankelovich (1991) also emphasizes the importance of resolving tradeoffs for reaching public judgment. The term is used for a type of public opinion "that exists once people have engaged an issue, considered it from all sides, understood the choices it leads to, and accepted the full consequences of the choices they make." He describes how public judgment is cultivated and identifies its characteristics. He proposes that "the quality of public opinion be considered good when the public accepts responsibility for the consequences of its views." According to Yankelovich, if the consequences of a particular choice are acceptable and they are willing to be responsible for those consequences, it is a good choice. Two additional characteristics of quality public opinion include the firmness with which an opinion is held and "consistency," the extent to which their thinking is integrated rather than compartmentalized.

Most contaminated sites do not have a clear technical solution. The public may not accept an agency proposal if there are substantial unwanted outcomes or if the public has not worked through the tradeoffs between non-action and potential solutions (Jasanoff, 1991). By not incorporating public values (Smith, 2003), or dealing with tradeoffs of critical concerns (Gregory, 2002), traditional public involvement methods often fail to yield satisfactory outcomes, may undermine the legitimacy of the agency, and may poorly address the problem.

Public involvement theorists emphasize dialogue between decision-makers, agency representatives, other stakeholders and the public (Slovic, 1997) to incorporate values into the decision making process (Gregory, 2002). Giving attention to values in risk management decision making is consistent with the conflict resolution practitioner's recommendation to focus on interests, not positions in order to find mutually beneficial

solutions (Gregory, 2002). However, for as much as discursive methods are recommended, they are not widely used effectively.

Theorists propose various explanations for this shortcoming. One that has already been mentioned is the technocratic approach of many public agencies. According to Yankelovich (1991), this approach makes poor use of values because expert knowledge is culturally revered while public or lay knowledge and feelings are culturally devalued. According to Yankelovich (1991), there is a cultural bias against the emotive in favor of expert knowledge. Similarly, the "objective" conception of risk: the probability of harm based on mathematics and scientific knowledge, is not how the lay public usually views risks in their lives. Instead the lay public's risk perceptions are largely based on personal experiences with risk. The social construction of risk is important to contaminated sites decision making because how individuals conceive of the risk will impact the decision making process. This difference between how the experts and policy makers conceive of risk and the people who are living with the risk creates a communication challenge for engaging the public in dialogue.

A second explanation for why pubic public policy makers do not deal with public values well is for cognitive and psychological reasons: they are unpleasant and difficult issues emotionally to deal with (Gregory, 2002). More specifically, drawing on the decision sciences and behavioral psychology literature, Gregory (2002) identifies six reasons that value tradeoffs are difficult: 1) they are multi-dimensional, for example there may be human health concerns, economic concerns, social impact concerns or moral concerns; 2) there is often outcome uncertainty making it difficult to come to a decision; 3) citizens are usually inexperienced and unfamiliar with making public policy decisions;

4) thinking and feeling carefully is difficult but necessary for disentangling values tradeoffs; 5) incorporating emotional elements into the decision is difficult for the administrators; and 6) such decisions often require learning over time to be made well (2002).

To address these barriers, proponents recommend structured, values-centered decision making (Gregory, 2002; Slovic, 1997; Yankelovich, 1991):

> In contrast to the conventional, science-based process of risk analysis, a values-based approach starts with the interests of citizens and attempts to structure alternatives based on their concerns and expressed trade-offs (Gregory, 2002).

Values are defined as:

> an expression of concerns or interests about what matters to individuals, in terms of both their preferences for different goods or activities and the underlying moral or ethical beliefs that give rise to these choices (Gregory, 2002).

Tradeoffs occur whenever getting more of one thing of value requires giving up something else that is also desirable (Gregory, 2002).

Why do the hard work of sorting through values tradeoffs? Gregory (2002) explains that the resulting benefit is more satisfying decisions:

> Addressing trade-offs is rarely an end in itself: in most cases, a focus on trade-offs is recommended because it leads to a better definition of the risk-management problem a more open discussion and better understanding of the fundamental values of participants, and an improved and more broadly accepted set of recommended risk-management alternatives.

The theory suggests that one path to reaching sustainable risk management decisions is to engage the affected public meaningfully in a deliberative decision making process about the values tradeoffs inherent in each option. A call for this approach is not

new (Council, 1996); however, empirical studies of the feasibility of such an approach are rare.

Scholarship on assessing group decision-making

Although important, collective decision-making about contentious environmental problems is difficult work. Furthermore, how can practitioners know if group decisions satisfy the affected public? Survey of the literature resulted in an abundance of theory about what constitutes a good public involvement process, but little concrete guidance for practitioner for evaluating public involvement outcomes. An assessment tool, which will be described in chapter 5 was developed based on scholarship on evaluating public involvement methods. Public judgment, process fairness, and resolution of tradeoffs are core concepts introduced here.

Reaching "public judgment" is a term made popular by Daniel Yankelovich (1991), to refer to decisions where people have settled on and accept a position. It indicates where struggling has ceased and acceptance can leave people feeling good about taking action. Several factors from Yankelovich's theory were modified for the Tittabawassee River Contaminated sediments Case.

Yankelovich (1991) emphasizes three characteristics of public judgment:

1. Responsibility for the consequences of views.
2. Consistent, dominated by holistic thinking vs. inconsistent or compartmentalized thinking.
3. Stability of views.

The characteristics are compared to public opinion as determined from polls. Yankelovich (1991) provides guidance for how over time on various major national or

international issues, the public incorporates information with their values and accepts or rejects policy choices. Yankelovich (1991) defines public judgment as carefully thought-through opinion.

When making a decision, agencies and policy makers value knowledge about what the public wants and feels about the issues. However decision makers need quality public input about the problem, not simply public opinion. Public judgment, if captured can provide guidance for policy makers about what will and what will not be acceptable to the public. It incorporates people's interests, values, feelings and ethics about an issue. Public judgment, more than public opinion, can help to develop more lasting decisions that serve the interests of more people and are therefore more just.

Deliberative risk communication theory (Beierle 2002; Arvai and Gregory 2003; Habermas 2006) is another literature that provides guidance for how to assess decision making. Much of the deliberative risk communication theory suggests that practitioners apply structure to public involvement processes, rather than just accepting undirected open comment such as may be provided at a public meeting. Process guidance emphasizes issues of fairness (Habermas, 2006), resolution of tradeoffs (Arvai & Gregory, 2003), level of knowledge (Arvai & Gregory, 2003), comfort with decisions (Arvai & Gregory, 2003), how well choices reflect their concerns (Arvai & Gregory, 2003), and achieving consensus (Webler & Tuler, 2000) as indications of quality decisions.

Webler and Tuler et al. (2001) identified five distinct ways that the public decides whether the deliberative process was a good one. These include 1) the process "acquires and maintains popular legitimacy," 2) the process "facilitates an ideological discussion,"

3) the process is fair, 4) the process minimizes power differences, 5) the process results in compromise (Webler, Tuler, & Krueger, 2001). The public decision reached during the process must satisfy the population who is affected by the decision in addition to the regulatory requirements.

Renn, Webler, and Wiedemann (1995) present suggestions for how to evaluate various public involvement methods: citizen advisory committees, citizen panels, citizens juries, citizen initiatives, negotiated rule making, mediation, compensation and benefit sharing, and Dutch study groups. They suggest several factors that should be present if the process is good: "agreement on values," "fairness," "competence," "efficacy," and "applicability."

Process fairness, or procedural justice, is commonly regarded as a basic prerequisite for effective communication. Jurgen Habermas is a leader in the theory. Others such as Suskin & Kruschank have made the theory more accessible for practitioners. Arvai and Gregory have published extensively on the nuances of resolving tradeoffs and balancing values in environmental decision making (2000, 2002, 2003).

Level of knowledge and achieving consensus are two common criteria of quality decisions. However both of these criteria have been critiqued and are not always included in evaluations of decisions or processes. For example, many practitioners emphasize the importance of clarifying values over gains in knowledge. Furthermore, according to many practitioners, quality public deliberations may not result in consensus. Gregory (2000) finds that if public deliberations result in a clarification of what is important to the public and thus provides substantive input for decision makers, then the deliberation was effective.

Consistent (holistic thinking), comfort with decisions, and how well choices reflect participants' concerns were not incorporated into the evaluation framework. Coming together to support a chosen solution requires that some people (those who enter with disparate preferences from the group position) change their perspective.

CHAPTER 3: INTRODUCTION TO THE CASE STUDY

This research examined the prospects for using deliberative methods to help engage a broad spectrum of people and to help them make better decisions about environmental management. For the case of decision-making about cleaning up the Tittabawassee River and floodplain the research asks if participants in the forums reached informed and lasting decisions. This chapter introduces the case and the larger study of which this research is a part, the sources of data used in the research, and the analysis undertaken.

This study is one part of a larger Michigan State University research study sponsored by the United States Environmental Protection Agency. The larger study assessed, from a variety of perspectives, the efficacy of public issue forums as a method for achieving meaningful engagement of unaffiliated citizens in contaminated site communities. The community living in proximity to the dioxin contaminated sediments and floodplain of the Tittabawassee River in central Michigan was chosen as the test case. Case studies allow the researcher to illuminate a particular problem by studying a case in-depth (Patton, 2002).

Case: Tittabawassee River and Floodplain Dioxin Contamination

Higher than normal levels of dioxin have been found in the sediments and floodplain soils of the Tittabawassee River. Dioxins, as a group of more than 210 chlorine-based chemicals, tend to be persistent in the environment and many are toxic even in very small amounts. Testing has revealed dioxins levels in excess of the state's dioxin standard of 90 parts per trillion (ppt) and a number of areas in and around the river (EPA, 2003; Diebel, 2005).

The source of the dioxin has been traced to production practices in the first half of the twentieth century conducted at Dow Chemical Company's Midland facility. In 2003 the Michigan Department of Environmental Quality issued the Dow Midland Plant a 10-year Resource Conservation and Recovery Act Operating License that governs hazardous waste management activities at the Midland facility. It includes requirements for corrective action for dioxin contamination along the Tittabawassee River and floodplain. The Michigan Department of Community Health issued a fish consumption advisory for the Tittabawassee River downstream from Midland.

Like many other contaminated sediments cases, the dioxin issue is contentious within the local community. The main point of the debate is the level of risk posed by the dioxin contaminated sediments and soils. Dow Chemical, the responsible party, has argued that the 90 ppt dioxin standard is unnecessarily low because there is no evidence that people and wildlife are being hurt by the dioxin. The public are aligned on different sides of the debate, some siding with Dow while others supporting the MDEQ. One of the stakeholder groups, the Tittabawassee River Watch, is establishing a class-action lawsuit against Dow to obtain medical monitoring of citizens living on the floodplain. Among stakeholders, the issue has become polarized and the level of distrust amongst the parties is high. There has been extensive media coverage of the issue within the region.

Study design and data used

The National Issues Forums (NIF) designed by the Kettering Foundation provide a deliberative format for decision making about complex and contentious social problems through structured choice-making (Mathews & McAfee, 2000). NIF facilitate decision-making by first naming and framing the issue for participants in a compact and objective

document: the "Issue Guide." The Issue Guide then serves as the basis for a discussion of the tradeoffs between the example solutions to the problem.

Deliberative discourse requires that citizens have knowledge of the basic elements of the public policy problem, the relationships among those elements, and about the consequences and tradeoffs associated with alternative policies. To achieve this, the study team prepared an Issue Guide on the Tittabawassee contaminated sediments issue. The document provided the study participants with a framework for sorting through the contaminated soils and sediments issue and the tradeoffs associated with alternative courses of action.

Prior to writing the issue guide, the study team conducted an intelligence gathering exercise to gain an understanding of the range of perspectives on the Tittabawassee dioxin contamination and potential solutions. Face-to-face, in-depth interviews were conducted with representatives of stakeholders associated with the dioxin issue including representatives of the MDEQ, Dow, local governments, state and local environmental organizations and citizen groups that had formed because of the dioxin issue.

The issue guide was developed based on information learned during the intelligence gathering efforts. The document attempted to set forth in a reader-friendly manner the Tittabawassee contamination problem, how the risk management process is used to make decisions, what possible courses of action might be taken, and what tradeoffs are inherent in each of the choices. Concerns beyond the level of risk from exposure to dioxin were compared for each outcome option including the ability to reduce dioxin exposure, role of government, financial cost, impact on floodplain

residents, impact on property values, and key challenges. Every effort was made to present the information in an unbiased manner so as to not lead the reader to any one of the possible solutions. The reader was encouraged to form his or her own solution to the problem.

Issue forum participants were recruited from selected neighborhoods situated along the 22-mile stretch of the Tittabawassee River affected by contaminated sediments. Half of the selected neighborhoods were lower socio-economic while the remainder were middle class. Local residents who were not members of any recognized stakeholder groups associated with the Tittabawassee case were the target population because one of the goals of the research is to assess the NIF approach for engaging populations who are affected by the decision but who are frequently underrepresented in public decision making. A screen was developed to determine whether an individual met our definition of an "unaffiliated resident."

The target issue forum size was 6-10 to ensure enough people to generate a deliberative conversation but not too many that some individuals would stop engaging. The issue forums were organized by neighborhood with each participant attending one forum. Neighborhoods were determined by a minimum of 50 residences, aerial photographs to identify neighborhoods on or near the floodplain, census units for delineating boundaries, and windshield neighborhood visits to ground truth. The forums were conducted at neighborhood venues such as schools, church halls, and YMCAs. At each forum, a trained neutral moderator facilitated the discussion. The forums lasted approximately two hours.

Recruitment to the forums was done by knocking on doors in the study area. Recruitment by door knock is only practical for problems that are confined to a relatively small area. However, it was conducted both to improve the response rate and accuracy of the survey and also to encourage higher attendance at the forums. This recruitment method, while more intensive than mailed invitations, was employed to have a larger sample size and more representative sample than a mail survey. For these reasons it is a practical method for real world public decision making.

An effort was made to reduce sampling error in canvassing neighborhoods. Every house in a neighborhood was approached. In an effort to reach people at home who may be working different shift schedules, each neighborhood was canvassed twice; doors unanswered during the first visit were knocked again later that day to attempt to reach those who may have been out during the first round of canvassing.

To provide a basis for comparing forum participants to the larger population in the study area, a baseline survey was conducted in the area with as wide a sample as possible. The team of four interviewers canvassed the neighborhoods by knocking on each door and asking adult residents to answer a brief questionnaire. The survey instruments were pre-tested with a group of residents from a community outside of the study area. To increase consistency in data collection, the four interviewers who conducted the door-to-door surveys underwent a training workshop prior to working in the field and daily debriefings were conducted.

To measure the effect of the issue forums on preferences and knowledge, the study participants were surveyed at three points in the study process. First, if respondents to the baseline survey expressed interest in participating in a forum, they were offered a

$25 gift certificate as incentive and as gesture of appreciation for their participation. Those who expressed an interest in participating were given an informed consent document to read and sign and the voluntary terms of their participation were explained verbally.

Individuals who signed the consent document were asked a set of 14 supplementary questions; henceforth this is referred to as the pre-forum survey. After completing the pre-forum survey, each respondent was given a copy of the *Issue Guide* and was asked to read it prior to attending the issue forum.

The second survey came at the end of each issue forum. The participants were given a brief questionnaire to complete before leaving the venue. For comparison purposes, many of the same knowledge and preference questions from the Neighborhood Survey were repeated. The self-administered questionnaire also sought feedback on their experience with the issue guide and forum.

The third and final survey instrument was mailed one month after the respondent attended an issue forum. Once again, many of the same knowledge and preference questions were asked as in the earlier questionnaires. Participants self-administered the questionnaire and mailed it back to the researchers. The purpose of the third survey was to determine the stability of participants' views, i.e. whether their views remained consistent immediately after the forum and a month later.

My role in the larger study involved preparing for data collection, data collection, and data management. I helped to test the research instruments, make modifications to the surveys, provide training to other surveyors, prepare surveys and answer booklets, administer the surveys, mail the follow up surveys, and analyze the data. I assisted with

the issue forums by setting up the rooms, greeting participants, recording and displaying participant comments, and distributing self-administered surveys at the end of issue forum discussions.

To recap, the data used in this thesis includes a baseline survey covering a wider sample within the study area; a three-step survey of the forum participants, and data collected during the forum itself on the process that each group took to arrive at a decision.

Table 3.1 shows the sample sizes and the proportion of canvassed households participated in different stages of the study. Of the doors knocked, 46% did not come to the door, and 21% said "no" when asked if they would like to answer questions. The remaining 33% of the households in the neighborhoods answered the baseline survey. 14% of the doors knocked the resident agreed to participate in the forum and completed a pre-forum survey. This group excludes 3% of total households that were screened from the study because they were affiliated with groups that had vested interests in the clean-up decision. Many of the pre-forum survey respondents dropped out and did not actually attend the forum; a total of 5% of initial doors knocked resulted in a forum participant.

Table 3.1 Recruitment - participation at each stage of inquiry

	N	% of doors knocked	% of doors Answered	% of baseline survey respondents	% of remaining eligible to complete pre forum survey	% of pre forum survey respondents
Doors Knocked	1042	100				
Doors Answered	550	53	100			
Baseline Survey Completed	336	32	61	100		
Screened*	30	3	5	9	100	
Pre forum Survey Completed	142	14	29	42	46	100
Attended a Forum	51	5	9	15	17	36

* *Stakeholder group affiliation screen* Each baseline respondent was asked if they, or anyone in their household is affiliated with a series of nine different stakeholder groups Michigan Department of Environmental Quality, an elected government official, the Lone Tree Council, Michigan Department of Community Health, the Dow Chemical Company (current or retired employee), the Tittabawassee River Watch, a member of a lawsuit against either Dow or the Department of Environmental Quality, Michigan Department of Agriculture, or the Tittabawassee Voice. Of the 378 asked, 19 indicated that they are involved in a lawsuit against Dow or the DEQ, 14 with Dow Chemical Company, and one respondent indicated involvement with Michigan Dept of Community Health. These individuals were not asked to participate in the research ("screened" from participation) because the research was targeting participation from non-affiliated citizens.

The purpose of the research was to examine a different type of engagement of citizens than is typically done. Usually stakeholder groups are assembled and target the most active citizens. However this research sought to understand the average citizen, sometimes referred to as the "silent majority." To target these individuals the screen was developed and those already involved in the issue in some way were excluded.

Neighborhoods surveyed

Nine neighborhoods in the affected area were delineated for canvassing. Freeland Mobile Home (FMH) is the furthest upstream and close to Midland and not in a floodplain. Freeland Town (FLT) is also located in a non-flooding area in Titabawassee Township. Falconview Estates (FVE) is a modular home park with more elderly residents

located outside of the flooded areas. Two neighborhoods, McGliggot Road (MCG) and Gratiot and River Roads (GRR) flood frequently and have confirmed elevated levels of dioxins on their property. During the study many households in these neighborhoods had been contacted by Dow or the DEQ and were involved in a lawsuit against Dow or the DEQ. Four neighborhoods in the City of Saginaw North Saginaw (NSA), East Saginaw (ESA), Maple Street East (MSE), and Maple Street West (MSW), were canvassed. These neighborhoods are located along the Saginaw River, do not regularly flood, and are racially diverse.

The river and floodplain downstream of a manufacturing source in Midland, on the Tittabawassee River is known to be contaminated with dioxins. Although not densely populated, there are residential neighborhoods throughout the floodplain area. Individual homes located along the river that were not clustered were not sampled because many of them were known to be involved in a lawsuit against the manufacturer or against the DEQ (stakeholder groups were excluded) and because of difficulty in sampling widely spaced houses.

Nine neighborhoods more densely populated and in proximity to the contaminated site were chosen for the study. Each residence was canvassed and if they were not in a "stakeholder group" they were asked to participate in the study. The data were grouped by region based on proximity and demographic similarities (see table 4.1). The groups are: "Frequently Flooded" (FF), "Adjacent to Floodplain (AFP)" and "City of Saginaw" (SAG).

Nine forums were held throughout the canvassed neighborhoods, some without any forums, and some with more than one. Two neighborhoods, East Saginaw (ESA) and

Freeland Town (FLT) did not have a forum because no residents showed up to the meetings. One neighborhood, Gratiot and River Roads (GRR) had two forums (GRR1 and GRR2) because so many people from that neighborhood agreed to participate in a forum. The surveyed respondents from the two Maple Street neighborhoods (Maple Street East and Maple Street West) attended one of three Maple Street forums named Maple Street One (MSG1), Maple Street Two (MSG2), and Maple Street Group Three (MSG3). Combined, nine forums were held across seven of the surveyed neighborhoods.

CHAPTER 4: COMPARISON OF NEIGHBORHOODS TO FORUM PARTICIPANTS

This chapter demonstrates how the forum participants are similar or dissimilar to non-participants and the general neighborhood population. Income, education, race, gender, knowledge, interests (reported as "other impacts") and preferred solution are detailed in tables 4.1, 4.2, 4.3, 4.4, 4.6 and 4.7. In addition, tables 4.5 and 4.8 illustrate the key knowledge responses and frequency of blocking statements within forums. Table 4.2 lists the reasons people cited when they declined to participate in a forum. The information is provided to illustrate some differences between participants and non-participants to understand to what degree forum participants were representative of the target population. Demographics of forum participants are compared to census data about the neighborhoods' characteristics in Table 4.1. Income, percent earning a high school diploma, and percent white are listed for the different neighborhoods sampled where a forum was held.

Median household incomes ranged from $13,250 to $65,200. Incomes of forum participants were on average somewhat lower than the median incomes of their respective neighborhoods, according to the census. MCG, GRR1, FVE, MSG2, and NSA forum participants had lower incomes than their respective neighborhoods and GRR2, MSG1, and MSG3 participants had higher incomes than their respective neighborhoods at large. The lower incomes of forum participants may be due to the fact that individual homes on large lots in some census tracts were not canvassed because they were not within the neighborhood. For example, the census tract that included Freeland mobile home park

had homes located along the river on large lots outside of the mobile home park that were not canvassed.

In all of the neighborhoods, the percentage of adults with a high school diploma or higher was at least 77%. Some of the forums appear to have slightly higher graduation rates because no one was in attendance who did not have a high school diploma (MCG, FMH, and MSW). Likewise, according to the census, none of the neighborhoods were 100% white, although some of the forums were 100% white (MCG, FMH). Maple Street East, Maple Street West had the highest percentage of non-white participants.

Table 4.1 Comparison of income, education and racial composition of forum participants to neighborhoods

Neighborhood	Focus Group	Geographic location	Demographic variable	Census figures	Pre-forum survey figures for forum participants only
McGliggot Road (MCG)	McGliggot Road (MCG)	Frequently flooded	median income	$59,896	(n=8) $35,000
			% h.s. diploma	86	100
			% white	96	100
Gratiot and River Roads (GRR)	Gratiot and River Roads 1 (GRR1)	Frequently flooded	median income	$51,111	(n=7) $30,000
			% h.s. diploma	87	86
			% white	96	86
	Gratiot and River Roads 2 (GRR2)		median income	$51,111	(n=4) $62,500
			% h.s. diploma	87	100
			% white	96	100
Falcon View Estates (FVE)	Falcon View Estates (FVE)	Adjacent to floodplain	Median income	$38,929	(n=11) $25,000
			% h.s. diploma	92	82
			% white	95	91
Freeland Mobile Home (FMH)	Freeland Mobile Home (FMH)	Adjacent to floodplain	Median income	$65,200	(n=4) $20,000
			% h.s. diploma	90	100
			% white	99	100
Freeland Town (FLT)	No forum held	Adjacent to floodplain	median income	$53,173	No forum held
			%h.s. diploma	97	
			%white	97	
Maple Streets East and West (MSE) (MSW)	MSG1	City of Saginaw	Median income	$32,400	(n=4) $40,000
			% h.s. diploma	78	100
			% white	64	50
	MSG2	City of Saginaw	Median income	$32,400	(n=3) $15,000
			% h.s. diploma	78	66
			% white	64	67
	MSG3	City of Saginaw	Median income	$32,400	(n=4) $41,250
			% h.s. diploma	78	100
			% white	64	75

Table 4.1 Continued

Neighborhood	Focus Group	Geographic location	Demographic variable	Census figures	Pre-forum survey figures for forum participants only
North Saginaw (NSA)	North Saginaw (NSA)	City of Saginaw	median income	$25,167	(n=6) $15,000
			% h.s. diploma	77	83
			% white	67	83
East Saginaw (ESA)	No forum held	City of Saginaw	median income	$13,250	No forum held
			%h.s. diploma	57	
			%white	8	

Table 3.2 showed participation at each stage of the study. There were 378 people who started a baseline survey. Of those, thirty people were screened from participating because they or someone in their household reported that they were affiliated with one of the stakeholder groups identified on the baseline survey. The remaining reasons volunteered why they could not participate are listed in Table 4.2. The responses were open ended and were not solicited. Thirty people said that they could not attend because of an accessibility issue (they had to stay home because of being someone's primary caregiver, they couldn't physically get to the forum, etc). Twenty-eight people said they didn't have time. Not everyone declining to participate in the study offered a reason, and some respondents offered more than one reason.

Table 4.2 Reasons for not participating in a forum

Reason for not participating	***Total % and (n)***
Screened for Affiliation	23(30)
Caregiver, mobility issue, health, literacy or other disability.	23(30)
Lack of time	22(28)
"I'm not interested" & "moving"	13(17)
Prefer to not get involved in things	9(12)
Work conflict	6(8)
"I don't have anything to offer"	2(3)
*Total**	100(128)

* Total number of responses does not equal the number of respondents because some provided an answer and some did not. The surveyor did not ask for a reason. These were volunteered reasons after being asked if they would like to participate in a forum.

Table 4.3 shows the participation rates of women compared to men. The third column, "Rate of participation in forums within groups" shows what percentage of men and women participated in their respective groups from those who were surveyed. For example, 17% of the men surveyed attended a forum while only 10% of women surveyed attended a forum. Of the 51 people attending a forum 30 of them were men and 21 were women.

Table 4.3 Comparison of rates of forum participation by gender as reported in baseline survey

Demographic variable	(n) Total surveyed	% and (n) of non-forum participants (includes screened)	% and (n) of forum participants	Response rate of forum participants as a percentage of non participant response rate*	Rate % of participation in forum within groups**
Male	(173)	44(143)	59(30)	134	17
Female	(203)	56(182)	41(21)	73	10
TOTAL	(376)***	100(325)	100(51)		

* Figures in the "response rate of forum participants as a percentage of non participant response rate" is calculated by dividing the percent of forum participants by the percent of non forum participants. For example for the male row, 134 % is calculated by dividing 59% by 44%.

** Figures in the "rate of participation in forum within groups" are calculated by dividing the number of forum participants in a category (row) by the number of survey respondents giving that answer. For example, of the 157 (143+30) who were male, 17%, or 30 participated in a forum (30/157=17%). Comparing the participation rates shows if that particular group is over or under represented in the forums. It reads that 17% of the men surveyed attended a forum. On the other hand, 10% of women surveyed attended a forum.

***Gender was unspecified for two respondents.

Table 4.4 compares forum participants and those surveyed who did not attend a forum along three knowledge variables: heard of the issue, source of information, and self assessment of knowledge level. Not surprisingly, people who had not heard of the issue participated at lower rates than people who said they had heard of the issue. The sources of information most frequently reported were from the media, broken up into two groups, one, newspaper (26% of responses), or two, television or radio (37% of responses). The sources of information that yielded the highest participation rates were public meetings (70% of the people who had heard about the issue from a public meeting attended a forum) and direct mail (20% of those who heard about the issue from direct mail). Not very many individuals said that they heard about the issue from a public meeting (ten total) but seven of those ten people attended a forum. The only information about the public meeting was that it was a public meeting, we don't know if it was on the issue or something else. The very high rate of participation within that group shows that people who have attend public meetings are likely to attend another such activity. The table shows different totals because some of the responses were open ended and could have multiple responses (e.g. source of information). Several of the variables had low numbers.

Table 4.4 Comparison of sources of knowledge of the issue between forum participants and non participants as reported in the baseline survey

Knowledge variable	(n) Total surveyed	% of responses and (n) of non-forum participants (includes screened)	% responses and (n) of forum participants	Response rate of forum participants as a percentage of non participant response rate**	Rate% of participation in forum within groups***
Have heard of the issue					
"Yes"	(336)	88(287)	96(49)	109	15
"No"	(42)	12(40)	4(2)	33	1
TOTAL	(378)	100(327)	100(51)		
Source of information (multiple response question)					
Newspaper	(154)	26(128)	29(26)	112	17
Television or radio	(219)	39(194)	28(25)	72	11
Word of mouth	(82)	14(70)	13(12)	93	15
Direct mail	(78)	13(63)	17(15)	131	20
Public meeting	(10)	.6(3)	8(7)	1333	70
Miscellaneous & other sources	(42)	7.5(37)	6(5)	80	12
TOTAL responses	(585)	(495) responses	(90) responses		
Self assessment of knowledge level (survey respondents who answered "never heard of the issue" (above) were not asked about their knowledge level about the issue.					
High	(47)	14(39)	16(8)	114	17
Medium	(143)	42(120)	47(23)	112	16
Low	(145)	44(127)	37(18)	84	12
TOTAL*	(335)	100(286)	100(49)		

*Totals vary because different numbers of people answered different questions and some questions could have more than one response. Individuals who were reported that they hadn't heard of the issue were not asked to assess their level of knowledge. Two people who participated in a forum reported that they had no knowledge of the issue and therefore are not included in the total.

**Figures in the "response rate of forum participants as a percentage of non participant response rate" is calculated by dividing the percent of forum participants by the percent of non forum participants. For example, for the public meeting row, 1333 % is calculated by dividing 8% by .6%.

Table 4.4 cont'd

***Figures in the "rate of participation in forum within groups" are calculated by dividing the number of forum participants in a category (row) by the number of survey respondents giving that answer. For example, of the 42 survey respondents (40+2) who reported that they hadn't heard of the issue, 1%, (2 persons) participated in a forum (2/42=1%). Comparing the participation rates shows if that particular group is over or under represented in the forums. It reads that 1% of the person's surveyed who had never heard of the issue attended a forum. On the other hand, 15% of persons surveyed who said that they had heard of the issue attended a forum. It gives a better measure of comparison than just looking at percentages because the rate within groups is relative.

Table 4.5 Illustration of key knowledge responses across neighborhoods

Neighborhood	Focus Group	% and (n) of survey respondents who answered "no" to "have you heard of the issue?"	% and (n) of survey respondents who answered that they heard about the issue from a public meeting
Saginaw Maple Street East	(MSG1, 2, 3)	27(7)*	(0)
East Saginaw	(ESA)	26(11)*	(0)
Saginaw Maple Street West	(MSG1, 2, 3)	21(9)*	20(2)
North Saginaw	(NSA)	12(5)	10(1)
Freeland Mobile Home Park	(FMH)	7(3)	10(1)
McGliggott Road	(MCG)	7(3)	20(2)
Gratiot and River Roads	(GRR1)	5(2)*	10(1)
Gratiot and River Roads	(GRR2)	(0)	10(1)
Freeland Town	(FLT)	2(1)	(0)
Falconview Estates	(FVE)	2(1)	20(2)
TOTAL		100(42)	100(10)

*Chi square Sig $p<.003$

Table 4.5 shows the breakdown of responses to some key results from table 4.4. Although the most individuals reporting they had never heard of the issue were from the Saginaw Neighborhoods, at least one survey respondent from each of the nine neighborhoods reported that they had never heard of the issue. It is not shown in the table, but the two people who participated in a forum and responded that they had never heard of the issue attended the NSA and MSG2 forums. Similarly, those reporting that they heard about the issue from a public meeting came from several neighborhoods. It is not shown in the table, but the people who responded that they heard of the issue from a public meeting but did not attend a forum were the two individuals from Maple Street West and one person from MCG.

Table 4.6 compares the interests of forum participants to non-forum participants as reported in the baseline survey in response to the question, "Are there other ways that the dioxin contaminated sediments and soils issue could impact your community?" This was an open ended question and so respondents may have given more than one answer. The responses were grouped into the categories listed in table 4.6. The interests that were

expressed at higher rates by forum participants than non forum participants were that the dioxin issue reduces property values; people won't want to move here or will move away; it will hurt the economy; it increases stress; and that they don't think that it causes harm. People with concerns about the impacts on the environment, land use, health, and future generations were not as likely to participate in a forum.

Table 4.6 Comparison of interests of forum participants to non-participants as reported in the baseline survey

Other impacts	(n) Total surveyed	% and (n) of responses from non-forum participants (includes screened)	% and (n) of responses forum participants	Response rate of forum participants as a percentage of non participant response rate**	Rate % of participation in forum within groups***
Multiple response variable					
Reduces property values	(84)	24(67)	31(17)	119	20
Harms the environment	(75)	24(66)	17(9)	71	12
People won't want to move here or will move away, hurt the economy	(59)	18(49)	19(10)	106	17
Land use changes (e.g. can't use parks, can't garden)	(38)	13(36)	4(2)	31	5
Health effects	(22)	7(20)	5(2)	71	1
Increases stress	(21)	5(14)	13(7)	260	33
Don't think it causes harm	(15)	4(10)	9(5)	225	33
May harm future generations	(14)	4(12)	3(2)	75	14
TOTAL responses (open ended question)	(328) *	100(274)	100(54)		

* Total n is not equivalent to the number of survey respondents because some people gave more than one answer. Multiple response question.

**Figures in the "response rate of forum participants as a percentage of non participant response rate" is calculated by dividing the percent of forum participants by the percent of non forum participants. For example, for the public increases stress row, 260 % is calculated by dividing 13% by 5%.

*** Figures in the "rate of participation in forum within groups" are calculated by dividing the number of forum participants in a category (row) by the total number of survey respondents giving that answer. For example, of the 15 survey respondents (10+5) who reported that they don't think dioxin causes harm, 33%, (5 persons) participated in a forum (5/15=33%). Comparing the participation rates shows if that particular group is over or under represented in the forums. It reads that 22% of the person's surveyed who think dioxin doesn't cause harm attended a forum. On the other hand, only 1% of persons surveyed who reported that there are negative health effects from dioxin attended a forum. It gives a better measure of comparison than just looking at percentages because the rate within groups is relative.

Table 4.7 compares the preferred solution of forum participants to non participants as reported in the baseline survey. Because it is an open ended question, some people reported more than one preferred solution. The third column shows the rate of forum participation within groups. For example, 14% of the people who said they don't know participated in a forum. Comparing the percentages in the first two columns shows the relative frequency of the response. For example, 16% of the responses among non-participants were to regulate or litigate. And this group was slightly under represented in the forums because only 9% of people suggesting regulation or litigation attended a forum. Dredging, increased citizen involvement, moving people out of the contaminated areas were among the least popular ideas among participants. The preferred solutions that were most represented were research, monitoring, or further investigation; respondent eliminates a solution (such as not dredging); nothing can be done; high tech solution; I'm not convinced there is a problem; and I trust the experts to take care of it.

Table 4.7 Comparison of preferred solution of forum participants to non participants as reported in the baseline survey

Preferred solution	(n) Total surveyed	% and (n) of responses by non-forum participants (includes screened)	% and (n) of response from forum participants	Response rate of forum participants as a percentage of non participant response rate***	Rate % of participation in forum within groups****
Multiple response variable					
Don't know	(95)	22(82)	17(13)	77	14
Regulate, litigate	(68)	16(61)	9(7)	56	10
"Clean it up"	(60)	14(53)	9(7)	64	12
Research, monitoring, or further investigation into the problem	(51)	10(39)	16(12)	160	24
Prevent them from polluting, reduce or stop sources of the dioxin.	(43)	9(33)	13(10)	144	23
Dredge	(27)	7(25)	3(2)	43	7
Respondent eliminates a solution*	(19)	3(12)	9(7)	300	37
Increased citizen involvement and participation in the issue	(13)	3(12)	1(1)	33	8
Raise awareness, understanding of the issue, provide education to help people reduce exposure	(13)	2.9(11)	2.6(2)	90	15
Move people out of the contaminated area	(12)	2.9(11)	1.3(1)	45	8
"Do something" or other general statement	(11)	2.4(9)	2.6(2)	108	18

Table 4.7 cont'd

Preferred solution	(n) Total surveyed	% and (n) of responses by non-forum participants (includes screened)	% and (n) of response from forum participants	Response rate of forum participants as a percentage of non participant response rate***	Rate % of participation in forum within groups****
There is no solution, nothing can be done	(10)	1.9(7)	4(3)	211	30
Do nothing, don't disturb, let nature take care of it over time	(8)	1.9(7)	1.3(1)	68	13
Employ a technical solution	(6)	1.1(4)	2.7(2)	245	33
Not convinced there is a problem	(5)	.5(2)	4(3)	800	60
"I trust the experts to take care of it," or "Leave it to the experts"	(6)	1.1(4)	2.7(2)	245	33
Cover it	(6)	2(6)	0(0)	0	0
TOTAL responses (open ended, multiple response question)**	(453)**	(378)	(75)		

* For example, a respondent may say "I don't know, except dredging is not the solution."

** Some people gave more than one answer because it was an open ended, multiple response question.

***Figures in the "response rate of forum participants as a percentage of non participant response rate" is calculated by dividing the percent of forum participants by the percent of non forum participants. For example, for the respondent eliminates a solution row, 300 % is calculated by dividing 9% by 3%.

****Figures in the "rate of participation in forum within groups" are calculated by dividing the number of forum participants in a category (row) by the total number of survey respondents giving that answer. For example, of the 13 total survey respondents (12+1) who reported that they think that increased citizen involvement and participation in the issue is needed, 8% (1 person) participated in a forum (1/13=8%). Comparing the participation rates shows if that particular group is over or under represented in the forums. It reads that 8% of the persons' surveyed who think a solution to the problem is increased citizen participation attended a forum. On the other hand, only 33% of persons surveyed who reported that "I trust the experts to take care of it" or "leave it to the experts" attended a forum. It gives a better measure of comparison than just looking at percentages because the rate within groups is relative.

Table 4.8 displays the frequencies of selected variables from tables 4.6 and 4.7 among forum participants. They include 7 variables from the above tables, chosen because they are "blocking" or solution-inhibiting expressions. The people expressing these views participated in disproportionately higher rates than many of the other views expressed in tables 4.6 and 4.7.

Table 4.8 Frequency of blocking statements among forum participants

	MCG	GRR2	MSG3	GRR1	NSA	FVE	MSG1	MSG2	FMH	total
Research, monitoring, further investigation	1	1	-	3	-	3	1	1	1	27(11)
Talking about it increases stress	1	-	-	3	-	2	-	-	1	17.5(7)
I don't think dioxin causes harm	3	-	2	-	-	2	-	-	-	17.5(7)
Respondent eliminates a solution such as dredging	-	1	-	2	1	2	-	-	1	17.5(7)
There is no solution, can't do anything	-	1	-	1	-	1	-	-	-	7.5(3)
Not convinced there is a problem	1	-	-	1	-	1	-	-	-	7.5(3)
Leave it to the experts	-	-	-	1	-	1	-	-	-	5(2)
TOTAL blocking statements	15(6)	7.5(3)	5(2)	27(11)	2.5(1)	30(12)	2.5(1)	2.5(1)	7.5(3)	100(40)

Summary

Forum participants differed from the larger population in some interesting ways. Demographics, knowledge, reasons for participating, and interests were compared. The low number of observations makes it difficult to determine if the differences observed can be attributed to chance. More men participated in a forum than women (59% of forum participants were male, 41% female).

Some participants who declined to participate gave reasons. People frequently said that they didn't have time, couldn't get out, were moving or weren't interested, preferred to not get involved in things. Three people said they don't have anything to offer.

Although few people said they heard about the issue from a public meeting (ten people), 70% of those people attended a forum. The interests that were most frequently citied as concerns from the dioxin issue by participants included "reduces property values" (31% of forum participants stated this concern), "people won't want to move here, will move away, or harms the economy" (19% of forum participants gave this answer), and "harms the environment" (17%). These numbers were roughly similar to those of the general population. Likewise, the leading responses by non-participants were some of the leading responses by forum participants. Two exceptions include "regulate, and litigate") and "dredge." People with these views participated at lower rates than the people who stayed home.

CHAPTER 5: ASSESSING GROUP DECISIONS

This chapter develops and applies a method for assessing group decisions. The first part of the chapter presents the approach for developing the method, after which it is applied to the case. The approach combines theory about deliberative risk communication with public judgment.

Data used in assessing decision quality

Participants were asked a variety of open-ended, scale, and true/false survey questions before and after their participation to observe the effect the issue forums and issue guide had on group decisions. The discussions were recorded and transcribed and process evaluation questions were asked following forum participation. A comparison of responses before and after the survey provides the basis for analysis. In addition, differences between the responses immediately after the forum and a month later provide data about the extent to which participants retained what they had learned at the forum, and about the stability of adherence to the group consensus.

Assessment factors

As introduced in chapter 2, collective decision-making about contentious environmental problems is difficult work, and because of the inherent subjectivity, it is difficult to assess the success of collective decision-making efforts. In accordance with the discussion in chapter 2, this study combines methods from deliberative risk communication theory (Arvai & Gregory, 2003; Beierle, 2002; Habermas, 2006) and public judgment (Yankelovich 1991) to develop a set of aspects of the forum decisions that could be measured with the data collected. The criteria for this research are creatively developed by the author but are based on the literature. The criteria are

referred to as "factors" and they characterize the decisions made. The following factors are the components of the assessment tool:

- Consensus: Participants are in agreement with the group position.
- Decision stability: Preferences of the individual expressed immediately following the deliberation were held over time.
- Preference change: Participant's favored solution before the deliberation changed after the deliberation.
- Resolution of tradeoffs: Mitigation of downsides of a chosen action were incorporated the proposed action.
- Knowledge gain: Participants were able to more accurately articulate the problem and or solution.
- Fairness: The process, facilitator, and information provided were fair.

As discussed in the literature review, many authors have written about what constitutes a good public involvement process; however I was unable to find in the literature a suitable assessment tool for assessing the group outcomes. Therefore, a decision assessment tool was developed based on factors that emerged from the literature cited above. The assessment tool assigns scores for each of the six factors to individuals and groups involved in the decision making. The possible scores for each factor are: 1 = yes, the factor was found (i.e. the criterion was met); 0 = no, the factor was not found (i.e. the criterion was not met); and n.a. = unknown (because relevant information was not available.) For each case, the scores for the six factors are summed and an overall score is assigned to the case. The score is equal to the sum of the individual scores divided by the number of criteria scored (i.e. those with an unknown score are excluded).

The raw overall score is then translated into an assessment of the quality of the decision. The highest overall assessment score is 1 or 100% (e.g. a score of 1 is achieved for each of the six criteria, such that 6 / 6 = 1 or 100%). The minimum possible score is 0 or 0% (e.g. the score for each criterion is 0; 0 / 6 = 0 or 0%). Given that for some criteria the score is unknown, the denominator when calculating the overall score might be less than 6. In other words, the quality assessment is derived from the number of observances of each factor divided by the possible observances for that factor.

Assessments are based on a combination of data collected at the group and individual levels. Focus groups at the forums produced decisions about the preferred action regarding dioxin clean up. The positions reflected in these group decisions were reached through consensus. Sometimes they contained multiple components. The consensus positions were recorded as a visual tool on flip chart paper during the forums.

The scores for each factor are developed from survey responses. A group's score is the aggregate of the scores of individuals within the group. Individual responses to the open-ended survey question, "What is your preferred solution to the Tittabawassee contaminated sediments and soils issue?" answered at three points during the process over time (before the forum, immediately after the forum, and a month after the forum), provided the data used to determine factor assessments. Individual group members received scores for each of the following factors if information is available:

- Consensus: was the individual participant's decision consistent with the group decision?
- Decision stability: Did the participant's preferred solution immediately after the forum remain the same one month later?

- Preference change: Did the participant's favored solution before the forum change following participation in the forum?
- Resolution of tradeoffs: Was there evidence that the participant recognized downsides of a chosen action and incorporated that recognition into their decision?
- Knowledge gain: Did the participant learn about the issue over the course of their participation in the study? The primary indicator of knowledge gain was an observable increase in participant's ability to accurately articulate the problem and/or solution.
- Fairness: Did individuals express that they thought the process, facilitator, and information provided were fair? Ability to participate, incorporation of their views, unbiased information, and unbiased facilitator are components of fairness assessed.

Then, with individual assessments completed, the individual assessments were tallied within each group to come up with a group assessment (1, 0, .5, unknown). The numerical scores were checked for meaning and validity by considering the responses in context (compared to the other participant responses in that group) and they were rescored. Thus the assessments were assigned iteratively: before rules for the factors were firmly developed, during development of the factor rules, and following group assessments.

Several factors were considered for the assessment tool that were not ultimately included. For example, one of the key components of public judgment as defined by Yankelovich (1991) is "consistency," to what degree the person's values conflict with

their decision. This factor was not included in the tool because it was too difficult to measure.

Calculation of the six factor scores

This section shows how each of the six factor scores was calculated.

Process Fairness

The process fairness score reflects the participant's response to the set of survey questions on the post forum survey asking about process fairness. If a participant indicated that the process was not fair on two or more out of 6 process fairness questions, they were assigned a 0 for process fairness. One or fewer responses indicating that the process was not fair resulted in a score of 1 for process fairness observed.

Consensus

The consensus score reflected the degree to which the individual participant's preferred solution was reflected by the group position. A score of 1 (yes) was assigned when the individual preferred solution after the forum, immediately after or in the final questionnaire, was part of the group-identified decision. A score of 0 (no) for consensus was assigned when the individual response did not match the group's preferred solution, and an "n.a." was assigned when there was not enough information.

For example, the group position for Freeland Mobile Home Park (FMH) was "dredge hot spots, impound and treat." Participant #300's individual response, "Put in a wastewater treatment plant by Saginaw Bay and dredge the river," received a 1 because it reflects the group position. Participant #285 of that same group received a 0 for their response, "Just leave it alone."

Often an individual position would not represent the full group position because the group decision included multiple solutions. When the individual position reflected only part of the group decision, a score of 1 was assigned. For example, the group Falcon View Estates (FVE) included a detailed step by step process: "Reduce exposure, flood control, open space, dredge hot spots and wait for bioremediation for the floodplain when available." Case #27 was scored 1 for stating "land management and open space corridor," which captured part of the group decision.

Decision Stability

A decision stability rating of 1 was assigned for participants where their preferred choice following the forum was the same choice one month later. A score of 0 was assigned where the choice changed substantially, and an "n.a." was assigned when the final questionnaire was not returned. For example, in the Maple Street Group 1 group, case #58 demonstrated a stable decision when stating immediately following the discussion "dry dredging or the use of new technology to break down contamination" and one month later "dredging."

Preference Change

The score for preference change is set equal to 1 for an individual 1) whose preferred solution as expressed in first post forum questionnaire or the final questionnaire differs from their preferred solution as expressed in the baseline survey, or 2) if the position was not developed in the baseline survey, the first post forum questionnaire or the final questionnaire response provides evidence that they formed a position. The participant may maintain some of their original views, but their views have been

modified to include the views of other participants or other elements of the group decision.

The preference score is 0 if the individual preferred solution as expressed in the final questionnaire is the same solution expressed in the baseline survey and does not include an addition of a new position or new elements of the group position. The first post forum questionnaire may have indicated a new position that has changed from the baseline survey; however, the final questionnaire does not include the new position. This is an indication of temporary preference change. The position may demonstrate learning new information but the new information appears to fall short of affecting their preferred solution. Zero indicates either no preference change, or no long term preference change such as in cases where positions may have changed at first post forum questionnaire but reverted back to original position on the final questionnaire.

A score of n.a. or unknown indicates that change in views is indeterminate due to missing or incomprehensible information. Either the baseline survey response is left blank or it is incomprehensible, or both the final questionnaire and the first post forum questionnaire were left blank or the responses that were given were incomprehensible.

Preference change was also determined by comparing responses before participation with responses following participation. Preferences are distinguished from knowledge because preferences captured a person's position where knowledge measured the accuracy and detail of the case. The accuracy of positions was not assessed as a part of this study. For example, if they selected "open space corridor" that was not considered more or less correct than "dredging." A score of 1 was assigned for preference change when the preferred solution before participation was substantially different from the

preferred solution following participation. A score of 0 was assigned when consistency in preferences before participation and after participation were observed. "N.a." was assigned when not enough information was provided to make an assessment.

As an example, case #4 of the Falcon View Estates group demonstrated a change in preferences. Before the forum he or she stated, "Studies to see if there is a health problem, until that's done, then act." Following the forum he or she stated, "Identify where they exist and make efforts to avoid exposure to them. Continue to focus technological-biological research methods to negate dioxin contamination." The initial position was to not act until it is determined if dioxin poses a health risk. Following the forum his or her position has changed to avoid exposure and treat the contamination.

Resolution of Tradeoffs

When participants raised concerns about a clean-up approach, and their concerns were incorporated into the group position, "resolution of tradeoffs" is exhibited and the score is set equal to 1. The final questionnaire response includes some mention of concerns and addresses those concerns in the solution. Also, to receive a 1, the outcome must be that the desired solution is the same as the group position.

An individual received a 0 for resolution of tradeoffs when a concern was raised and impeded their ability to agree with the group position. Or, 0 is assigned if the participant expresses that a certain solution is not possible because of a tradeoff. The group position is not acceptable to the participant because of a particular unresolved concern. The participant may reach a decision that incorporates his or her concern into his or her own personal position, but the incorporated solution is not reflected in the group decision.

A score of n.a. or unknown is assigned if the responses given in the first post forum questionnaire and final questionnaire do not include mention of a concern, or there is no response, or the response is incomprehensible.

An example of resolving a tradeoff was demonstrated by participant #335 in the McCliggot Road group (Appendix), "A combination of open space corridor and neutralizing dioxins via chemicals after the technology has been further developed and more is known about the side effects." The tradeoff of neutralizing dioxins with chemical treatment is that the treatment may create harmful side effects. By combining moving people out of the contaminated area, "Open space corridor," with applying the neutralizing treatment after the "technology has been further developed and more is known about the side effects," the participant demonstrates that they were able to incorporate their concerns about the downsides of the solution into the decision.

Knowledge Gain

Participants were given a score of 1 for knowledge gain where there was evidence that they learned from their participation in the forum and it appeared that the learning persisted over time. A 1 is given if the response on the first post forum questionnaire and final questionnaire indicated that the participant gained new information, more clear understanding of the issue, or corrected for previously held false beliefs about the issue when compared to the respondent's baseline survey response.

Participants received a score of 0 if they demonstrated short term learning but appeared to have lost that knowledge in the final questionnaire. The response on the first post forum questionnaire may indicate gaining knowledge (such as new information, more clear understanding of the issue or correction of previously held false beliefs) but

the final questionnaire response demonstrates a loss of that knowledge. A zero is assigned when the participant maintained incorrect information over time. The lack of knowledge gain may have been due to a failure of the method or the facilitator's failure to provide information, such as more definitively establishing the risk of dioxin. A score of 0 was also assigned when at no point in their responses did a participant demonstrate having gained knowledge from participating in the discussion.

A score of n.a. or unknown indicated that responses on one or both of the post-forum questionnaires were too short or incomprehensible to make a determination of whether the participant gained knowledge or not.

As an example, before participation in the forum, #221's preferred solution was, "Stop dumping. Filter water. Clean up trash." This response reflected a common misconception that the pollutants are currently being discharged. The post forum responses, "Dry dredging," immediately following the discussion and, "Dry dredging if the people involved in the dry dredging can be geared up in protective gear," reflected gaining knowledge about the problem and the risks associated with clean-up. Thus, #221 was scored a 1 for knowledge gain.

In contrast, participant #252's response before the forum and after the forum did not change. The misconception that the health risks are not well established and that the best solution is to study the issue was maintained over the course of the treatment. Participant #252's initial response, "The way they are going is alright - - doing the study" is essentially the same as after the forum, "Evaluate the health risks on people first. What level can we live with? Wait and see," and in the final questionnaire, "Need more

answers to how people and wildlife are affected." Thus #252 was assigned a score of 0 for knowledge gain.

Similarly, participant #244's responses, "Flood control and total clean up" and, "Total clean up" did not provide enough information to demonstrate learning when compared with their response before the forum, "Complete clean up. Stop Dow from emitting anything. It doesn't make sense that Dow can still dump." #224 dropped the misinformation portion of the response, "It doesn't make sense that Dow can still dump," but the responses following the discussion were not precise enough to make a determination of whether they learned very much during the forum. Thus #224 received an "n.a." for knowledge gain.

Converting factor scores into an individual decision assessment

Each forum participant received an overall individual decision assessment score based on their six factor scores. Individual decisions were scored according to the following set of rules.

When individual positions were in agreement with the group position over time, the individual was scored 1. A decision is categorized as a quality decision if "consensus decision" and "decision stability" both hold, and at least half of all the remaining factors also hold. The factors "consensus decision" and "decision stability" were determined to be the most important factors; both had to hold for a decision to be considered a quality decision. I determined the other four factors: preference change, resolution of tradeoffs, knowledge gain, and process fairness to be of lesser importance for determining the quality of a decision. To summarize:

- (1) Quality decision was assigned to individuals who received an assessment of 1 for both consensus decision and decision stability and received a score of 1 on at least three (50%) of the six factors.
- (0) Low quality decision was assigned to individuals if they did not receive an assessment for both consensus decision and decision stability, and they did not receive a score of 1 on at least three factors. Alternatively, low quality decisions were reached where not enough information was available (n.a.) on one of the key factors (decision stability or consensus decision) and there was a 0 for more than half of the other factors.
- (0.5) Moderate quality decisions resulted from receiving a 1 for consensus decision or decision stability but not both, and greater than or equal to 50% for the total percentage.
- (n.a.) Unknown was assigned when not enough information was available for consensus decision and/or decision stability.

Although the lesser factors provide insight into the participant's ability to adhere to the group position over time, their absence does not create discordance with the group decision. When an individual decision reflects consensus and maintains that general position over time, the overall group position is stable because it is reflected in the individual positions. If that individual maintains their position but falls short of explicitly resolving tradeoffs, learns in the process, expresses concerns about fairness of the process, or shifts their views in the process, the group position still maintains its integrity. However, the other, "lesser factors" are usually present if the "greater factors" of stability

and consensus are demonstrated. The lesser factors then are indicators of quality decisions, but not requisites.

Assessing quality is inherently subjective. To determine a scale and evaluation criteria, I thought about, "What is the goal of the forum?" and, "What kinds of decisions are needed in this type of scenario?" A more or less rigorous scale could be developed depending on the needed outcomes. This scale was constructed to result in a wide spread for the data so as to be able to discern findings that could illuminate how the forums could be improved to serve this purpose. For example, in this exercise we needed groups to come to a decision within two hours of discussing the topic. In the real world, they may have more time to consider the issues but they may not. Given these time constraints, what kind of decisions did we find? How much change in knowledge was observed? How stable were the decisions over time? The answer to these questions is that there was a range of decisions that were made, some better than others. Quality is a relative term and is contextual. However, this scale could be adapted to many different scenarios.

Examples

Case #313, McGliggot Road, demonstrates a quality individual decision assessment as it received a score of 1 for every factor. The detailed survey responses are shown in the appendix and a summary is in table 5.9 of this chapter. The requirements for the first factor, fair process were met; the consensus position were met: Case 313's individual preferred solution "A combination of neutralizing the soil and river with new technological chemicals and an open space corridor" was consistent with the consensus decision of "open space corridor; neutralize hot spots (bioremediation); test on GM

property before using wide scale." The decision was stable because he or she stated as the preferred solution in the final questionnaire "control future land use to new development (open space corridor) . . . coupled with new chemical treatment of the soil and water which will be available in a few years . . . " The two post-forum questionnaire responses contrast with the baseline survey response of "educate the people about the parts per trillion and the low percentage [of dioxin] we're talking about here . . . " demonstrating learning and preference change. Finally, tradeoffs of the possible negative impacts of new technology were incorporated into the decision, declaring to test it first.

Some participants who were assigned a "good quality decision" only exhibited some of the second tier factors. To receive a quality assessment, they had to have a position that was consistent with the consensus, the decision had to be stable, and 50% of all factors had to be exhibited. Several participants with quality decisions, did not completely maintain preference change over time (0 for preference change), did not exhibit resolution of tradeoffs (n.a. for resolution of tradeoffs), or did not exhibit learning (0 for knowledge gain).

Poor quality individual decision assessments were assigned based on receiving no more than one "yes" assessment for the core factors (consensus decision and decision stability) and less than 50% of "yes" assessments for all factors.

For example, #285 neither agreed with the group position nor was his or her position stable over time (received a "0" in both consensus decision and decision stability.) #285 also demonstrated an unresolved cross pressure "is it even possible to clean up dioxin?" The decision in the final questionnaire to "do nothing" was deemed a

poor quality decision because it did not exhibit any of the factors of quality decisions including learning or preference change.

Decisions that fell in the moderate-quality range were characterized by clean-up preferences that did not perfectly reflect the group position over time, but demonstrated some components of the group position. Moderate quality decisions had 1 for either consensus decision or stable decision and "yes" for greater than or equal to 50% of all factors. Or, moderate quality decisions may have had both consensus decision and stable decision at 1s and less than 50% for total factor percentage. Participants who agreed with the consensus decision immediately following the forum but their agreement was not stable over time were assigned moderate-quality assessments.

Moderate quality decisions are characterized by beginning to form consensus, but were yet unable to reach agreement and demonstrate all of the characteristics of quality positions. Examination of moderate quality decisions is useful for practical application of the issue forum methodology to identify what might aid a group in reaching consensus. The methods applied in this study, in which unaffiliated citizens were asked to come to agreement on a contentious and often emotional environmental health issue within two hours, was purposefully brief. The goal was to determine what quality of group decisions ordinary citizens might reasonably be able to achieve with the fewest resources from the agency in regard to preparation and facilitation. The moderate-quality decisions provide insight into the potential and also the weaknesses of the methodology for achieving quality group decisions on a difficult problem and with few resources.

Not enough information to make a determination (n.a.), was assigned when the factor data were not available. For example, this assessment was assigned if the survey was not returned or if that question was left blank by the respondent.

Constructing a group assessment

Group scores were assigned based on the aggregates of the individual scores in the group and aggregate factor scores. 4 values were possible: (1) yes, quality decision reached, (2) poor quality group decision achieved, (3) moderate-quality decision achieved; and (4) n.a., not enough to determine the quality of the group decision. I assigned these scores as follows:

- Yes, a good quality group decision was reached when at least 80% individual scores "yes" and where the total factor proportion was at least 80%.
- No, poor quality group decision assessment was made when greater than 50% of the individual assessments were "no" or "n.a." and the total factor proportion was less than 50%.
- Moderate quality group decision assessment was made when, of a sample size more than 4, after n.a. values were removed and at least 50% but less than 80% individual assessments were "yes" or "moderate-quality." Also, the total factor proportion fell between 80% and 50%.
- Not enough information to make a determination (n.a.) was assigned when there was a very small sample size (less than four individuals in the group had assessments when n.a. values were removed) and valid cases had mixed individual assessments.

In addition to a score, each group's decision was described, guided by the following questions:

1. Did the group arrive at consensus? What was the group decision? What percent of participants agreed with the group decision?
2. What were the downsides to the position? To what degree were they identified and incorporated into the position? To what degree were they unresolved?
3. How stable was the group position for participants? What percentage maintained the group decision one month later? Of those who did not, did they revert to a previously held position or did they seem to develop a new position, different yet from the group decision? What evidence is there that learning occurred or did not occur? What evidence is there that positions changed or did not change? What connections are there between learning and position change and development of stable group positions?
4. What is the quality of the group decision?

Analysis of the spread in quality of the decisions informed the formation of assessment rules. For example, the four quality levels of individual decision quality (quality, moderate, low, and n.a.) informed the assessments of the group decisions, highlighted the various pathways of individual decisions within groups, and clarified factor meaning. Variation was observed within each of the quality levels, but, an effort was made to develop the most simple assessment scale possible and maintain meaningful differentiation. For example, within the assessment of individual decision score, a 1 was awarded to individuals who maintained their position throughout the levels of inquiry, and to those who were slow to agree with the group position but eventually settled on it. The assessment was made this way because long term adherence was needed for the group decision to be of a high quality, and temporary changes for an individual, so long

as they maintained the group position over time, could be tolerated. Participants could "sleep on it" and develop agreement with the group position over time, and contribute to the quality of the group decision. Conversely, the way the data were analyzed, agreeing with the group position immediately following the forum but then later changing position would contribute to a group decision assessment of poor or moderate quality.

Other data related to factors

This section displays additional data about the decision factors. Residents were asked questions about knowledge and their acceptance of clean-up options, however those questions often did not produce the kinds of results that were useful for assessing the quality of their decisions. The additional results are provided to illustrate what more is known about knowledge, acceptance of clean-up scenarios, and process fairness and to focus in on each of the factors. The results of 5.2, 5.4, and 5.5 were not included in the final version of the assessment tool.

Table 5.1 shows the consensus positions that groups developed during focus groups and were recorded on flip chart paper. For example, the Maple Street East (MSE) focus group decided that the best solution would be to "Dredge the hot spots, and conduct ongoing testing and re-dredging over time." Two neighborhoods are listed, Freeland Town (FLT) and East Saginaw (ESA) but no one showed up to their forums and therefore there was no group decision. As shown in Table 5.1 all of the groups but two incorporated dredging into their group clean-up decision. It is interesting to note that before participating in a forum, only three respondents who attended forums identified dredging as the best solutions (MCG case #331, GRR2 case #275, FVE Case #14) (Appendix) yet 23 individuals, and seven group positions expressed preference with

dredging following the deliberation. Discussing the alternatives together had a dramatic impact on the articulated preferred solution. Responses to questions in the surveys asking respondents to rate their level of acceptance (Table 5.2) (Preforum survey question 4 and the first post forum question 6) did not demonstrate preference change as clearly as responses to the open ended survey questions (Baseline survey question 8) "What actions, if any, should be taken to solve the Tittabawassee dioxin contamination issue," first post forum survey question 7, and final questionnaire survey question 8.

Table 5.1. Consensus positions by forum

Forum	Consensus position
McGliggot Road (MCG)	Open space corridor. Neutralize hot spots with bioremediation. Test on GM property
Gratiot and River Roads Group 1(GRR)	Dredge hot spots in river & floodplain. Flood control. Insure residents against illness. Cap low concentration areas
Gratiot and River Road Group 2 (GRR2)	Voluntary relocation in high contamination areas. Wildlife area. Do nothing elsewhere but with health monitoring
Freeland Town (FLT)	No forum held
Falcon View Estates (FVE)	Reduce exposure, flood control, open space, dredge hot spots and wait for bioremediation for the floodplain when available
Freeland Mobile Home (FMH)	Dredge hot spots. Catch & treat downstream flow with a chemical solvent in a pond
Maple Street Group 1 (MSG1)	Dry dredge and treat. Control flooding. Dow & GM together
Maple Street Group 2 (MSG2)	Heat treat hot spots, buy out people who want to go, dredge after the river is clean
Maple Street Group 3 (MSG3)	Dredge hot spots, ongoing testing and re dredging over time
North Saginaw (NSA)	Control flooding. Dredge – dry. Bioremediation floodplain
East Saginaw (ESA)	No forum held

Table 5.2 shows the change in mean acceptance level of different clean-up scenarios. Dredging had an initial aggregate score of 2.8 (just below 3, "neither

acceptable nor unacceptable" on the five point Likert Scale used to measure level of acceptance of the alternative clean-up solutions). Following participation Table 5.2 shows that the dredging increased by 0.3 overall, just above 3 "neither acceptable nor unacceptable." Asking people to decide in a group results in different decisions than asking people individually in a survey. This is the case even when they had just participated in a discussion in which the group came up with a different solution.

Table 5.2 shows which solutions were overall more or less acceptable before and after participation. The distribution was greater after participation, with leaving contaminated soils and sediments in place the most unacceptable (1.9 mean each) and use of new technologies to neutralize dioxins, dredging, and banning agriculture the most acceptable (3.3, 3.1, and 3.0 respectively).

Table 5.2 Change in mean level of acceptance of clean-up scenarios*

Action	Pre-forum mean	First Post forum mean
Move residents off of properties with dioxin contamination	2.6	2.4
Dredge or dig up and remove the contaminated soils and river sediments	2.8	3.1
Leave the contaminated soils and sediments but cover them with a layer of clean soils and sediments.	2.2	1.9
Ban all agricultural activities on properties with contaminated soils	2.8	3.0
Take no action. Leave the contaminants in place and let nature take care of them over time.	2.2	1.9
Use new technologies such as the use of bacteria or heat to breakdown and neutralize the dioxins.	3.4	3.7

*Scale: 1 very unacceptable, 2 unacceptable, 3 neither acceptable nor unacceptable, 4 acceptable, and 5 very acceptable; n=51

Table 5.3 maps some common thought pathways that led to acceptance of various clean-up options. For example, moving residents was a relatively unpopular solution,

receiving a 2.4 mean acceptance after forum participation (Table 5.2). When discussed in the forum people expressed that it wasn't right to force people to move because they live on property with contaminated soils. People expressed concern that people wouldn't be able to sell for a fair price because who would want to buy their property when it is contaminated? When proposed that moving could be voluntary, some people agreed that moving people would be okay. This is what is meant by resolution of tradeoffs. Other tradeoffs may not be resolved, such as if the expense is too high or if Dow might leave town because of the expense. Where this was the concern, and left unresolved, moving residents did not become a more acceptable solution. Table 3.9 is not an exhaustive list of potential clean-up actions, their tradeoffs and resolution, but it does present many of the most common downsides discussed for each clean-up scenario and helps to explain why some scenarios after the forums were accepted while others were not. For example, leaving dioxins in place had the downside of not reducing the risk of living in a contaminated environment. There is no resolution of the problem. The most common psychological response is to minimize the potential harm that living in a dioxin contaminated environment might pose. The issue guide and forum leaders maintained that the scientific evidence demonstrates that a dioxin contaminated environment at this level likely poses risks, may have resulted in few participants expressing that doing nothing and leaving contaminants in place is an acceptable solution.

Table 5.3 Examples of tradeoffs and resolutions

Action	Cross Pressure	Cross pressure resolution
Move residents	Expense too high, Dow may leave	
	Infringe on people's rights to live where they wish	Make it voluntary
Dredge	Expensive	Yes, but clean up is worth the cost
	Expensive, Dow will have layoffs or leave	They'll probably shut down anyway
	Downstream contamination or contamination of communities that live near the landfill	If it can be done safely, than okay.
Leave dioxins in place & cover & or take no action at all	Doesn't reduce exposure	
Ban agricultural activities on contaminated land	(not discussed)	
Use new technologies to neutralize dioxins	Unintended consequences	Test on a small scale first

Knowledge change is the fourth variable examined to determine quality of the group decisions. Data from two survey questions are presented in Tables 5.4 and 5.5. According to these measures, in aggregate form only a slight increase in knowledge following participation in a forum was observed. For example, Table 5.4 shows the change in percentage of correct quiz answers. The biggest increase in correct answers was in response to the true false question "Due to elevated dioxin levels, the Michigan Department of Community Health has issued a fish advisory for the Tittabawassee River Downstream of Midland" (correct answer is true). While these questions were asked to assess the general knowledge level of forum participants and to see if they learned during the forums, they do not provide the whole picture about learning during the forums. As

demonstrated in the open ended response questions about preferred solution, participants demonstrated a great improvement in their ability to articulate the problem and their preferred solution. This learning was best demonstrated on a case-by-case basis and not in aggregate. The survey questions are presented here to demonstrate that the survey attempted to quantify the learning, but was inadequate for capturing the learning that was achieved. Participants were also asked in the surveys to assess their own knowledge about the dioxin issue (Table 5.5). Participation in the forum resulted in an overall shift in self-reported gains in knowledge. For example before the forum, 37% of participants expressed that they felt they had a "low level of knowledge or understanding of the Tittabawassee dioxin contamination issue" which was reduced to 12% after the forum. See Table 5.5 for the changes measured using two survey questions.

Table 5.4 Change in percentage of correct quiz answers

Quiz question	Pre-forum	Post-forum
Whether or not a chemical will cause harm to a person's health depends in part upon the amount of the chemical that enters the body.	80	82
Toxic substances such as dioxins may pose less of a health risk to young children because of their smaller body size.	84	86
All people living across the United States have at least a very small amount of dioxin in their bodies.	65	80
Due to elevated dioxin levels, the Michigan Department of Community Health has issued a fish advisory for the Tittabawassee River Downstream of Midland.	77	88
If a toxic substance is stored in a way that no one is exposed to it, the risk of injury or illness is zero (i.e. none)	39	27
In the case of the Tittabawassee dioxin contamination, which government agency is responsible for approving any dioxin clean-up plan? (Options were Michigan Department of Environmental Quality, US Environmental Protection Agency, Michigan Department of Community Health, Local municipal government, or don't know.)	55	56

N=51

Table 5.5 Change in knowledge self-assessment

Questionnaire question	Level of knowledge	Pre forum % (n=49)	Post forum % (n=51)
"What is your current level of knowledge or understanding of the Tittabawassee dioxin contamination issue?" Response: "I have a..."	... low level of knowledge	37	12
	... medium level of knowledge	47	65
	...high level of knowledge	16	24
		100	100
"Mark the box that best reflects your knowledge of dioxins and their effects" Response: "I have . . . "	...no knowledge	24	4
	...some knowledge	71	86
	...a lot of knowledge	6	10
	Total	*100*	*100*

The survey asked six questions about participants' failings about the fairness of the process (Table 5.6). According to the survey responses (Table 5.6) and the open ended comment section, participants expressed near unanimity that the research experience was fair. 100% of participants reported that they found participating in the forum to be a positive experience; 94% answered "false" to the statement that "The facilitator seemed biased and favored some solutions over others;" and so on as shown in the table.

The lack of spread to the survey data on process fairness limited the opportunity to observe the relationship of its influence on the assessment. If process fairness were observed as a problem, it is expected that it would affect individual's ability to come to quality decisions. Thus, it would be expected to have as high an order of importance in the assessment as adherence to consensus position and decision stability. However, because concerns about fairness were not observed process fairness was calculated as a

lesser factor along with perception change, resolution of cross pressures, and knowledge increase.

Process fairness is an area that would benefit from future study. Public participation efforts are usually sponsored by an agency, not by a neutral third party, and the trust relationships may not always be present. I suspect that because the research was conducted by a university and sponsored by the U.S. EPA, we were able to operate with a solid level of basic trust. If the forum were conducted by one of the major stakeholders on the issue, I suspect that trust would have been a more influential variable.

Having a neutral third party, and having the effort as a research exercise, probably contributed significantly to the high level of trust exhibited in the surveys. Practitioners should take care to develop processes that support to the best of their ability a fair process: protecting individual identity, checking power in the discussions through the use of a facilitator, through transparency and responsiveness to participant's concerns. Because all of the groups expressed satisfaction with the fairness it is treated as a prerequisite for forming a good group decision. Non participation may be interpreted as resulting from potential participants' uncertainty of process fairness.

Table 5.6 Process fairness

Fairness Variable	% and (n)
Satisfaction with forum experience:	
"Did you find participating in the issue forum to be a positive experience?"	
Yes	100(51)
Neither positive nor negative	0
No	0
No answer	0
Neutrality of the Facilitator:	
"The facilitator seemed biased and favored some solutions over others"	
True	6(3)
False	94(48)
Opportunity to express their views:	
"The facilitator made certain that all participants were given the opportunity to express their views"	
True	98(50)
False	2(1)
Respect from other participants:	
"During the issue forum, my views were respected by other participants"	
True	98(50)
False	0
No answer	2(1)
Neutrality of the information in the issue guide:	
"The issue guide provided an unbiased overview of the Tittabawassee contaminated sediments and soils issue"	
True	88(45)
False	8(4)
No answer	4(2)
"I found the issue guide difficult to read or understand"	
True	0
False	96(49)
No answer	4(2)

Finally, decision stability was assessed by comparing respondent's post-forum preferred solution to their response to the same question one month after the forum. A decision was stable if the response was the same before and after the forum. The

summary of the stability measures for each focus group is shown in table 5.7. 61% percent of the participants had stable decisions, 18% did not have stable decisions, and 22% did not provide enough information to determine whether their position was stable.

Table 5.7 Decision Stability

Focus group	Decision is stable % (n)	Decision is not stable % (n)	Not enough information n.a.	Total n
McGliggot Road (MCG)	100(8)	0(0)	0(0)	100(8)
Gratiot and River Roads Group 1 (GRR1)	57(4)	0(0)	43(3)	100(7)
Gratiot and River Roads Group 2 (GRR2)	75(3)	25(1)	0	100(4)
Falcon View Estates (FVE)	45(5)	36(4)	18(2)	100(11)
Freeland Mobile Home (FMH)	50(2)	0(0)	50(2)	100(4)
Maple Street Group 1 (MSG1)*	50(2)	25(1)	25(1)	100(4)
Maple Street Group Two (MSG2)*	33(1)	33(1)	33(1)	100(3)
Maple Street Group 3 (MSG3)*	100(4)	0(0)	0	100(4)
North Saginaw (NSA)	33(2)	33(2)	33(2)	100(6)
Total	*61(31)*	*18(9)*	*22(11)*	*101(51)*

*Maple street groups 1, 2, and 3 were made up of participants from neighborhoods "Maple Street East" and "Maple Street West"

In aggregate form, some key findings from the data are as follows:

1) 95% of forum participants felt the process was fair.

2) Few participants demonstrated gains in knowledge as measured by survey quiz questions.

3) The spread of mean levels of acceptance of different clean-up scenarios increased with some scenarios becoming more acceptable such as new technology, dredging, and banning agricultural activities, and other actions becoming less acceptable including taking no action, and leaving contaminated sediments and soils in place.

4) 61% of participants demonstrated stable decisions.

Group decision assessments

Earlier in this chapter the scale for assessing decisions by using the six factors that characterize decisions was introduced. Factor scores were derived from comparing participant responses before forum participation to their responses to the same question after the forums. As described above, group assessments were determined by tallying the assessments for each individual in that group. The individual assessments were developed by tallying the assessments of each factor for that individual. The first part of this chapter also presents the rules for group assessments. The following section presents a discussion of the group assessments organized by level of quality.

Good group decisions

Three of the nine focus groups produced "good" decisions. This was determined on the basis of demonstration of individual positions consistent with the group position, expression of process fairness, the stability of the group participants' views over time, participants' demonstration of change in preferences and lasting gains in knowledge following group participation. As explained in chapter 4, to receive the assessment of good group decision, the majority of the individuals had to have a score of 1. This trend was measured and reflected in the total factor proportion. Factor proportions amounting to 80% or greater received a "good" assessment. Maple Street Group Three (MSG3), McGliggot Road (MCG), and Gratiot and River Roads group 2 (GRR2) all were determined to have good group decisions. The results for these three groups are summarized in Tables 5.8 through 5.10.

Maple Street Group Three (MSG3) demonstrated the clearest case of reaching a good group decision with all of the factors examined for a good decision reflected by all

of the participants. The consensus position reached by MSG3 was to "dredge just the hot spots with ongoing testing and re-dredging if necessary over time" (see appendix). This decision was a quality decision in part because there was 100% agreement among participants on the preferred solution. Also contributing to the quality decision was that it was unanimous and stable for group participants. None of the participants came to the discussion with the position yet all participants came out of the forum agreeing with the position and it persisted.

Another factor that contributed to the group decision being a good one was that the tradeoffs of dredging that were identified by this group were incorporated into the decision. The tradeoffs of dredging identified by MSG3 included: the expense given the uncertainty of the health risk posed by dioxin; the pollution could be so widespread that dredging would be ineffective; and, that dredging might increase the risk of exposure by spreading dioxin. To address the expense of dredging given the uncertainty of its effectiveness, the group decided to dredge just the hot spots. To address the concern that dredging may be ineffective, they incorporated testing into the solution. The third downside was not widely incorporated into the group position. However, #129 expresses understanding that containment would likely ameliorate the problem because it would "help keep the stirred up dioxins from getting into the air or further flowing down river," one of the identified downsides of dredging.

Table 5.8 Maple street group three (MSG3)

Case	Fair Process	Consist-ent with con-sensus position	De-cision is stable	Prefe-rence changed	Trade-offs resolved	Know-ledge increased	N/ total	Assess-ment
94	1	1	1	1	1	1	6/6	1, good
118	1	1	1	1	Na	1	5/5	1, good
122	1	1	1	1	1	1	6/6	1, good
129	1	1	1	1	1	1	6/6	1, good
Factor Pro-portion	4/4	4/4	4/4	4/4	3/3	4/4	6/6	4/4, good

1=yes, observed, 0=not observed, 1/2 = partially observed.

Unlike Maple Street Group 3, McGliggott Road Group (shown in table 5.9) did not have 100% "Yes" for every factor analyzed. However, the position reached by the McCliggott Road Group (MCG) was assessed as a quality group decision because the participants in MCG were in 100% agreement with the consensus position, for 75% of participants the decision was stable over time, and the factor proportion for the additional variables was greater than 50%. The consensus position for MCG was to turn the floodplain into an "open space corridor" and following successful pre-testing, neutralize the dioxin with a chemical treatment. Most of the participants maintained this position over time. The other factors of preference change and increase in knowledge were demonstrated my most MCG participants.

Furthermore, the MCG group position incorporated tradeoffs. The downside of the chemical treatment voiced by the group was the uncertainty of the safety of the treatment. This downside was addressed by deciding that more testing should be conducted before applying the chemical treatment on a wide scale. #335 states "a combination of open space corridor and neutralizing dioxins via chemicals *after the*

technology has been further developed and more is known about the side effects" (emphasis added).

A downside of the open space corridor is the challenge inherent in relocating residents. Participants neither raised nor resolved this particular downside, a sign that the full impact of the solution may have been overlooked. Although MCG reached general agreement on open space corridor and chemical treatment and 75% of participants maintained their positions, some people returned, in part, to their original preferences prior to participating in the forum. #331 indicated a preference for dredging prior to participating in the forum, did not mention dredging immediately after the forum, but added dredging into their preferred solution one month later in the final questionnaire. #337 wrote "?" in the final questionnaire and #327 wrote "nothing should be done," an indication that the forum left some individuals uncertain or feeling that no action should be taken, deviating from the consensus to treat the contaminated soil.

MCG selected the high tech solution as their group position, a position most widely accepted by all of the preforum survey respondents (Table 5.2). The neighborhood is a frequently flooded neighborhood and the issues inherent in relocating residents were not fully discussed nor resolved. However, the decision to develop an open space corridor and neutralize the hot spots following a testing period was widely accepted by the majority of the participants over time, indicating an effective-enough group discussion.

Table 5.9 McCliggott Road (MCG)

Case	Fair Process	Consist-ent with con-sensus position	De-cision is stable	Prefe-rence changed	Trade-offs resolved	Know-ledge increased	N/ total	Assess-ment
313	1	1	1	1	1	1	6/6	1, good
330	1	1	1	1	n.a.	1	5/5	1, good
331	1	1	1	1	1	1	6/6	1, good
335	1	1	1	1	1	1	6/6	1, good
342	1	1	1	1	1	1	6/6	1, good
345	1	1	1	1	1	1	6/6	1, good
327	1	1	0	n.a.	0	1	3/5	1/2 mid
337	0	1	0	1	n.a.	0	2/5	1/2 mid
Factor Proportion	7/8	8/8	6/8	7/8	5/6	7/8		7/8, good

1=yes, observed, 0=not observed, 1/2 = partially observed.

Gratiot and River Roads Group Two (GRR2) developed a group decision that fit the criteria for a "good group decision" (Table 5.13). 100% of the GRR2 participants mentioned some type of flood control to address the dioxin contamination problem, demonstrating good agreement with the consensus position. It is important to note that the GRR neighborhood is a frequently flooded area. Flood control would immediately address a serious contamination problem for this community and therefore locally is not a contentious clean-up choice.

The respondents reported little discussion of tradeoffs.

The group position of flood control persisted for more than 50% of GRR Group Two participants (3/4). Those for whom the position did not persist reverted back to their original positions of "undecided" (#274) and "Total clean up" (#244).

A non-controversial solution of flood control yielded an easily agreed upon consensus position. The added benefit of reducing water damage made up for the possibility that dioxin is not harmful and thus treatment an unnecessary use of resources.

Table 5.10 Gratiot and River Roads Group two (GRR2)

Case	Fair Process	Consist-ent with con-sensus position	De-cision is stable	Prefe-rence changed	Trade-offs resolved	Know-ledge increased	N/ total	Assess-ment
269	1	1	1	1	n.a.	1	5/5	1, good
275	1	1	1	1	1	1	6/6	1, good
244	1	1	1	0	n.a.	0	3/5	1, good
274	1	1	0	1	n.a.	1	4/5	1/2 , mid
Factor Proportion	4/4	4/4	3/4	3/4	1/1	3/4		3.5/4, good

1=yes, observed, 0=not observed, 1/2 = partially observed.

Partially developed group decisions

Three groups, Falcon View Estates (FVE), North Saginaw (NSA), and Gratiot and River Roads Group One (GRR1), had moderate quality decisions. Falcon view Estates (FVE) and Gratiot and River Roads Group One (GRR1) were moderate quality decisions because they had difficulty forming a group decision. North Saginaw (NSA), on the other hand, formed a group position; however the position was not stable for 50% of those who returned the surveys.

As shown in the appendix, FVE did not arrive at a single group decision. Instead, they developed a series of solutions and individuals mentioned components of the group position. However, most of the individual preferences did not include the entire sequence of the clean-up scenario. The complete sequence developed during the meeting was to reduce exposure to people by controlling flooding and creating an open space corridor. Those changes would be followed by dredging just the areas with high concentrations of dioxins and then in the future, if determined safe, the group suggested applying

bioremediation techniques to remediate floodplain contamination. 18% (two participants #4, and #5) expressed this complete sequence in the post forum questionnaire. 72% expressed some component(s) of the sequence, but not the entire sequence. 18% reported an entirely different position and 9% did not provide a response. The individual who did not agree with the group position (#11) stated that no action should be taken.

By including so many clean-up scenarios, FVE group members built in contingencies for the individual scenarios (resolution of tradeoffs). For example, reducing exposure and moving people out of the contaminated areas would not get the dioxin out of the environment, but only address the problem for people in the immediate vicinity. Limiting the dredging to just the hot spots addresses the expense and invasiveness of dredging the entire contaminated site. The unresolved downside however seems to be whether dioxin is actually harmful enough to warrant action. This uncertainty was unresolved preventing 27% (#4, #5, and #11) from fully supporting the group position. Other unresolved tradeoffs included the potential spread of dioxins from dredging (#14).

The position was stable for 64% of the participants who provided responses. Case #4 reverted to his or her original position one month following the forum. Case #30 was undecided a month later. #43 and #23 expressed one element of the group position immediately following and a different component one month later.

In sum, the FVE group wrestled with the clean-up scenarios and developed an approach that most participants agreed with. The position was not fully developed because some of the participants concerns were not incorporated. In the end, this resulted in a moderate quality group decision because there were several individuals who were not in support of the group position. Falcon View Estates findings are reported in table 5.11.

Table 5.11 Falcon View Estates (FVE)

Case	Fair Process	Consist-ent with con-sensus position	De-cision is stable	Prefe-rence changed	Trade-offs resolved	Know-ledge increased	N/ total	Assess-ment
5	1	1	1	n.a.	1	1	5/5	1, good
27	1	1	1	1	n.a.	1	5/5	1, good
34	1	1	1	1	n.a.	1	5/5	1, good
14	1	1	1	0	1	1	5/6	1, good
23	1	1	0	n.a.	1	1	4/5	1/2, mid
30	1	1	0	1	n.a.	1	4/5	1/2, mid
43	1	1	0	1	n.a.	1	4/5	1/2, mid
4	1	1	0	1	0	1	4/6	1/2, mid
11	1	0	1	0	0	0	2/6	0, low
9	1	n.a.	n.a.	0	n.a.	1	2/3	n.a.
16	1	n.a.	n.a.	n.a.	n.a.	0	1/2	n.a.
Factor Proportion	11/11	8/9	5/9	5/8	3/5	9/11		6/9, mid

1=yes, observed, 0=not observed, 1/2 = partially observed.

The position developed by the North Saginaw (NSA) focus group (table 5.12) was determined to be a moderate quality group decision. There was agreement about the solution. The participants who completed a questionnaire agreed on dry dredging as the preferred solution. Another positive aspect of the group decision was that downsides to dredging were alluded to in responses by several participants. For instance, #180's response includes concerns about the destruction by dredging. Less invasive treatment, bioremediation was suggested for floodplain areas to not disturb homes and trees. Another downside alluded to by #180 is the uncertainty of effectiveness of dredging. The solution incorporated testing to determine if save levels have been achieved before applying the treatment throughout the basin. Participant #221 identified another downside to dredging: the health concerns of those conducting the clean-up. Incorporated into his/her solution was providing protective gear.

However, not all participants' concerns were adequately addressed. Participant #176's concerns about the effectiveness of dredging to address the problem were not adequately addressed during the forum and his or her position returned to their original position. The other participants who returned the final questionnaire and who provided answers about clean-up maintained the group position one month following the forum, an indication of quality group decisions. However lasting consensus was only expressed by two of the North Saginaw participants. To be a higher quality position the other participants also need to demonstrate evidence of long term learning and/or long term preference change.

Table 5.12 North Saginaw (NSA)

Case	Fair Process	Consist-ent with con-sensus position	De-cision is stable	Prefe-rence changed	Trade-offs resolved	Know-ledge increased	N/ total	Assess-ment
221	1	1	1	1	1	1	6/6	1, good
180	1	1	1	0	1	1	5/6	1, good
176	1	1	0	1	0	1	4/6	1/2, mid
196	1	1	0	1	n.a.	0	3/5	0, low
178	1	1	n.a.	n.a.	n.a.	1	3/3	n.a.
222	1	n.a.	n.a.	n.a.	n.a.	n.a.	1/1	n.a.
Proportion	6/6	5/5	2/4	3/4	2/3	4/5		2.5/4, mid

1=yes, observed, 0=not observed, 1/2 = partially observed.

The decision that was developed by Gratiot and River Roads Group One (GRR) (Table 5.13) was of moderate quality. 57% of GRR1 participants agreed with the group consensus to study the health impact of dioxin. However 28% provided no answer. Furthermore, participant #267's views were not included at all in the group decision. #267 said they prefer dredging in the frequently flooded areas and to cover the non-flood areas. Though this participant preferred dredging, a position which was not agreed upon by the group, they did mention the group position of gathering more information in additional comments section of the final questionnaire, reflecting some consistency with

the group position. There was also disagreement about moving people and dredging. #226 contrasts with #245: #226 wrote, "Further study of the health impact *before* moving" (emphasis added), while #245 wrote, "*Immediately* move people out of area highly contaminated." More time and further discussion may have been needed to agree upon a timeline.

The downside to continued study as the solution, referred to by #245, is that while the study is going on people continue to be exposed to a potentially dangerous contaminant. The solution incorporated was to assist people with moving out of the area. The downsides of action (as opposed to just study) were not explicitly stated by those opposing action (#226 and #252). Further discussion and an attempt to resolve the downsides of action may have helped #226 and #252 move closer to agreement about taking action.

Although they didn't form agreement, the positions were stable among 100% of those participating. 50% (#226 and #245) demonstrated changed preferences. #245 entered the group discussion preferring testing, but exited the forum with desire for action first, testing later. #252 and #267 did not change their views during participation.

GRR1 did not come to group consensus. They started to discuss the issues and identify solutions, but did not agree as a group on a solution. It is possible that the polarized views in the neighborhood, as evidenced by presence of a lawsuit may make it identifying a common solution more challenging in this neighborhood.

Table 5.13 Gratiot and River roads group one (GRR1)

Case	Fair Process	Consist-ent with con-sensus position	De-cision is stable	Prefe-rence changed	Trade-offs resolved	Know-ledge increased	N/ total	Assess-ment
245	1	1	1	1	n.a.	1	5/5	1, good
226	1	0	1	1	0	1	4/6	1/2 Mid
267	1	0	1	0	n.a.	1	3/4	1/2 Mid
252	1	0	1	0	0	0	2/6	0 Low
224	1	n.a.	n.a.	n.a.	n.a.	n.a.	1/1	n.a.
250	1	n.a.	n.a.	n.a.	n.a.	n.a.	1/1	n.a.
264	1	1	n.a.	n.a.	n.a.	1	3/3	n.a.
Proportion	7/7	2/5	4/4	2/4	0/2	4/5		2/3 Mid

1=yes, observed, 0=not observed, 1/2 = partially observed.

Low quality group decisions

No groups had low quality decisions.

Forums with too little information to assess

Three groups, Maple Street Group One (MSG1), Maple Street Group Two (MSG2), and Freeland Mobile Home (FMH) were assessed as n.a. because 50% or more of the individual assessments were scored n.a. (tables not shown) or there were too few group participants to confidently assess the quality of the decision.

Summary of assessments and reasons for differences observed

Nine forums were held across three groupings of neighborhoods: frequently flooded, City of Saginaw and Adjacent to Floodplain. Three of them did not have enough information to assess the quality of the group decision; three groups had partially developed decisions; and three groups were assessed as good quality decisions. Table 5.14 shows the pattern of quality of the group decisions in relationship to proximity to the river. Location appears to have been a significant factor in the quality of the decisions made. None of the frequently flooded neighborhoods had "not enough information" or

"no forum held". In fact, one neighborhood, Gratiot and River Roads (GRR), had so much interest that two forums were held. Alternatively, the neighborhoods adjacent to the floodplain did not produce any good decisions. The quality of the decisions that came out of the City of Saginaw forums were spread across the range from good to no forum held.

Table 5.14 Quality of group decisions based on proximity to river

	Frequently Flooded	**City of Saginaw**	**Adjacent to floodplain**
Good decisions	MCG (n=8) GRR2 (n=4)	MSG3 (n=4)	
Partially developed decisions	GRR1(n=7)	NSA (n=6)	FVE (n=11)
Not enough information		MSG1(n=4) MSG2 (n=4)	FMH (n=4)
No forum held		ESA (n=0)	FLT (n=0)

In addition to location, it appears that participation is also related to the quality of the decisions: the lesser the participation, either by not showing up, or not completing surveys, the lesser the quality of the decisions. Not enough information (n.a.) could result either from not enough people showing up to attend the forum or for incomplete answers to survey questions. Participation, as discussed above seems to have a geographic relationship. Neighborhoods where there was either no forum held or there was not enough information to assess the forums came from the City of Saginaw neighborhoods and the adjacent to the floodplain neighborhoods. The Saginaw neighborhoods are not located on the Tittabawassee River and at the time of the study there was little popular

knowledge about the high levels of dioxin contamination in the Saginaw River, which is adjacent to the surveyed neighborhoods.

Location and participation are likely related to salience: the closer one is to the issue, by means of having dioxin contaminated soils flooding their basements, the more likely one is to participate in a discussion about the issue. Some survey questions offer further insight into the salience of the issue for residents: shown in tables 4.4 and 4.5. They asked asking about participant's knowledge about the issue. The findings support the observation that fewer people from the adjacent to floodplain neighborhoods and Saginaw neighborhoods participated than the frequently flooded neighborhoods: 86% of survey respondents who said they've never heard of the issue were from the Saginaw neighborhoods. In the Saginaw neighborhoods, survey respondents were more likely to have heard about the issue from television or radio than from other sources. Another survey question that provided insight into salience was the screen question (for details, see footnote of Table 3.1). The frequently flooded neighborhoods had the highest rates of being screened from participation due to their close affiliation with the issue, such as being part of a lawsuit related to the issue against Dow or the DEQ. Based on survey responses for "reasons offered for not attending," (table 4.2) people living in the Saginaw neighborhoods had more difficulty attending a forum. They more frequently reported that they were caregivers, had to work, and couldn't get out because of a disability. Most extreme barriers to participation were observed from the East Saginaw Neighborhood where residents had very low average education (Table 4.1).

Education and income were considered as possible explanations for the quality of decisions and there appears to be some association. The fifth column in Table 4.1 shows

the income and education of the forum participants. The frequently flooded neighborhoods had the highest incomes compared to the City of Saginaw neighborhoods and the Adjacent to floodplain neighborhoods. The good quality decisions were developed in forums where participants had the highest median incomes (>$35K), and 100% of participants had a high school diploma. MSG1 had similar demographics but a not enough information decision.

Freeland Town (FLT) was an exception. Freeland Town had high levels of education and income, but low levels of participation (no forum held). They are adjacent to the floodplain, potentially explaining their low levels of participation. However respondents from FLT expressed high levels of awareness of the issue as compared to the City of Saginaw neighborhoods (Table 4.5), only one person surveyed answered "no" to "have you heard of the issue?." Also, with higher education levels and higher incomes, the barriers present in attending were less in Freeland Town than for neighborhoods where people have fewer resources such as in Saginaw. When surveyed residents from that neighborhood reported higher than average comments that they "don't like to get involved in things" and that talking about the issue causes people anxiety. Those comments suggest perhaps a lack of desire to confront an emotionally difficult problem. Freeland Town is also the neighborhood in closest proximity to the City of Midland, where the company responsible for the dioxin contamination is located. The desire to avoid the problem to avoid conflict may be stronger among residents in the Freeland Town neighborhood, especially since they do not flood and are therefore not likely to face direct exposure to the contaminants.

Education, income and salience (including location) do not provide adequate explanation about the partially developed (mid quality) decisions. These decisions came from across all three neighborhood groupings (frequently flooded, City of Saginaw, and adjacent to floodplain). The partially developed decisions also had higher numbers of participants (n) (Table 5.14). One explanation for lower quality decisions may be re the numbers: perhaps it is more difficult to come to consensus the more people trying to make a decision. However, upon investigation, a comparison of the factor assessments across groups does not show a pattern that it is lack of agreement on a decision that caused the poor quality decision, although that does seem to be somewhat of a factor for all three partially developed decisions. A clearer pattern is observed when making individual factor assessment comparisons across the groups: the presence of 0's for certain factors signal lower quality individual decisions. All the individuals with good decisions had no unresolved tradeoffs (0's) and all individuals expressing unresolved tradeoffs (0's) had partially developed decisions. Similarly, for most individuals scored 0's for knowledge gain or preference change, the individual score was less than "good." The exception was preference change. Several individuals scored a 0 for preference change, but had an overall individual assessment of good.

Also, the presence of "blocking statements" may explain why some groups were unable to develop quality decisions. Table 4.8 shows that with the exception of NSA, forums with partially developed decisions (GRR1, NSA, FVE) had higher frequencies of "anti-solution attitudes" (blocking statements) expressed by their participants on the baseline survey. Blocking statements include 7 categories of comments expressing negative attitudes for reaching a solution such as "nothing can be done" and "talking

about it causes stress." Two of the three forums with partially developed decisions (GRR1 and FVE) had 11 and 12 "anti-solution" attitudes respectively. Alternatively, the three groups with good decisions (MCG, GRR2, and MSG3) had far fewer "anti-solution" attitudes with 6, 3, and 2 respectively.

The exception to this trend was North Saginaw (NSA) where only one anti solution comment was expressed. The individual assessment table (5.12) and associated quotes (Appendix) provides insight into why NSA was unable to develop a good decision. The reason for the lower decision score for NSA was that for one participant (#176) the decision wasn't stable. He or she went back to their original view that dredging is too difficult to be successful. Another participant (#196) was given a low individual score because his or her final questionnaire response was not specific. If the decision were more firm for these participants then this would have been a good quality decision.

In summary, proximity to known contaminated areas, income and education, resolution of tradeoffs, saliency, barriers to participation, and presence of "anti-solution" attitudes, are some observed associations with low rates of participation and lower quality decisions. Higher levels of salience, higher levels of income and education, mobility, resolution of cross pressures, and lower levels of anti-solution attitudes, are associated with higher response rates and quality decisions.

CHAPTER 6: CONCLUSION

Democratic governance depends on effective public participation. Contaminated sites clean-ups, siting of landfills, and location of new highways are among the more challenging public policy problems. Engagement is needed, but working with the public is often emotionally challenging due to the possible health impacts on the people living near the site. Although risk managers have been advised to incorporate public participation early and often when developing risk management policy, too often the public involvement efforts fail to result in satisfying policy outcomes (Gregory 2002). Some of the problems with existing options include the perceived amount of time and energy required to engage the public, loss of control of the decision, and difficulty in engaging the silent majority. Recent literature on public involvement suggests practitioners employ deliberative methods and actively seek participation of underrepresented populations. The larger study tested the National Issues Forums for developing decisions about a contaminated site. This thesis assessed the quality of the group decisions that resulted from the deliberations.

The first part determined the extent to which forum participants were representative of the sampled neighborhoods. From the data collected and the low numbers it is difficult to assess definitively, but it appears that people with certain characteristics participated at higher rates than others. Those living in the contaminated floodplain and those with more knowledge about the issue participated at higher rates than those living outside of the contaminated area or who have no knowledge about the issue. People who reported that they heard about the issue from Dow or DEQ mailings, or from a public meeting (survey did not differentiate if the public meeting was about this

issue) also participated at disproportionately higher rates than residents reporting gaining knowledge of the issue from other sources of information such as newspaper and word of mouth. Alternatively, people who reported that they heard about the issue from TV or radio participated at lower rates.

Some barriers to participation reported by survey respondents included lack of time, need to stay home to be a caretaker, lack of transportation or other mobility problems. Conflict avoidance and concern about openly sharing their views about what should be done was also expressed by some residents. Two of nine neighborhoods had no forum because no showed up both outside of the flooded areas. One neighborhood in the frequently flooded area had two forums because so many residents expressed interest. Survey respondents expressing blocking views when asked about what should be done or other impacts participated at higher rates than respondents expressing altruistic concerns, and problem solving attitudes such as views that dioxin harms the environment or impacts land uses, or that the solution is to raise awareness about the issue or regulate the problem. Participants were more likely than non participants to be opposed to dredging.

To assess the quality of the group decisions, a decision tool was built with 6 factors identified in the literature from Yankelovich, Gregory, Jasanof, Slovic, Webler and Tuler. Three focus groups developed good decisions, three came to partially developed group decisions, and three groups did not have enough information for a complete assessment. The decisions from the frequently flooded neighborhood forums tended to be of good quality while decisions from the adjacent to floodplain neighborhood forums tended to be of low quality or were not held. The decisions from the Saginaw neighborhood forums were spread across the quality spectrum.

The assessment tool combined individual factor scores of 1 (yes), 0 (no) and n.a. (not enough information). Consensus or personal agreement with the group decision, and stability of the decision were the two major factors contributing to a decision assessment. Despite a mathematical possibility in the assessment, certain lesser factors (consensus, knowledge change, preference change, and resolution of cross pressures) signaled lack of developed individual decisions when the factors were assessed 0 (for "no"). For example, where tradeoffs are unresolved, individuals did not learn during the forum individuals do not develop quality decisions. The expression of blocking views also signaled difficulty reaching agreement.

One implication of this finding is that the decision assessment tool can be useful for helping practitioners charged with helping groups make decisions, identify issues that need further exploration. For example, where "0's" were observed for resolution of tradeoffs, practitioners can look back at the data and record the critical concerns that need to be overcome before participants may be ready to come to a decision. In this case, the forums raised a number of critical concerns regarding action to clean up the Tittabawassee River and floodplain. For example participants were sometimes blocked from coming to a lasting decision to dredge because of their concern about contaminating downstream residents. On the other hand, participants were blocked from a comfortable decision of doing nothing because of unresolved concerns about people remaining exposed to dioxin. This type of analysis can yield valuable knowledge about the public's views. It is significant for practitioners also that not a lot of data must be gathered to get quality insight. Simply asking an open ended question (important) about people's

preferred solution before, after and one month following their involvement in a deliberation can provide useful information.

One of the challenges faced by risk managers that this study attempted to find a solution to is that of engaging and learning about the interests of the "silent majority." Personal, face to face invitations to forums being held in their neighborhoods at a time convenient to them, and offering a $25 gift card, did not appear to be enough to get those other than for whom the issue is most salient, to participate. One risk of engaging a non-representative sample (people with views differing from the general population) is that it is difficult to determine if the outcomes will serve the interests of those who did not participate. The implication for future research is that more it may be necessary to do more to attract people to participate. It may be important to raise awareness of the problem in areas with lower literacy and higher poverty rates. Providing child care, transportation, or recruitment by community members, known and trusted by residents may also yield additional participation for underrepresented groups. Perhaps most importantly for improving citizen participation in decision making is for the agency to demonstrate taking the citizens views and preferred solutions into serious account in deciding a clean-up plan of action.

Finally, settling on assessment criteria can be difficult because assessing outcomes is inherently subjective. One implication of this tool is that it could be replicated and used in other settings to evaluate group decisions and identify issues that need further definition. The tool can help groups know when deliberations can cease (a stable agreement is found), and take action on the chosen course. On the other hand, when a decision is poorer, it can help practitioners identify those issues and attitudes that

need work to come to a decision. The assessment tool could possibly be adapted by interchange other factors that the researcher or practitioner may wish to include. One implication is that practitioners wishing to use an abbreviated method to reduce transaction costs associated with group decision making, can reduce their data collection to just one open ended question asked at three points in time.

Agencies need manageable public involvement methods that yield quality group decisions. The engagement approach outlined in this thesis and the group decision assessment tool gains ground toward the goal of developing methods that are useful for public involvement in risk assessment and other difficult collective decision making scenarios.

Research limitations & validity

A limitation of the study is that even though forum participants were reasonably representative of their neighborhoods' population, a representative sample does not imply that the general public will be satisfied with the conclusions of the citizens in the issue forums. Participating in the process may be a critical component to resolving cross-pressures, so others may not be satisfied with the decision if they did not go the decision making process, because they themselves did not think through the tradeoffs between the various scenarios to come to group consensus.

The research artificially excludes special interest groups from the dialogue. In a real clean-up decision making process, special interest groups would likely participate and from this research we can't predict how more polarized activist participants would have affected the decision outcomes. Our design deviated from what would likely occur

in an open process where more powerful stakeholders would have access to manipulating the situation.

The purpose is to gain insight about the effectiveness of the NIF for cases where the tradeoffs are difficult and decision-makers wish to gain reliable information about the affected public's interests and concerns. Generalization to a particular population is not possible with purposeful sampling and small samples (Patton, 2002). From this study we can explore the variation within this community, investigating the nuance and potential patterns within the case.

Credibility of the research conclusions is sought through rigor of data collection and analysis, triangulation of data and analysis, and by making researcher biases explicit. During data collection, an effort was made to minimize reactivity. During the survey data collection, the survey instruments remained the same and surveyors spoke with each other to check that they were conveying the same information in the same manner. Possible influences of differences in appearances such as gender, age, or race could not be controlled for, but an attempt was made to reduce variation by wearing uniform University shirts, wearing identifying name badges, and approaching homeowners in a friendly and professional manner. The affiliation with Michigan State University aided in being perceived by residents as a neutral and credible organization.

Different residents perceived surveyors in different ways: a few residents expressed suspicion that surveyors were undercover spies for Dow or that we represented environmental groups. Neutrality was attempted, but residents' preconceptions affected their reaction to researchers. For example, during forums, maintaining the neutrality of the facilitators was attempted by not voicing personal opinions, and attempting to treat all

responses the same. Similarly, when administering surveys, surveyors avoided expressing their opinions or validating the views of respondents. An attempt was made to minimize participant reactivity to the survey by asking questions worded in the same fashion at different times and asking the same questions of all participants.

In addition to these measures seeking to minimize participant reactivity, researchers followed rigorous and systematic data collection procedures. Issue forum groups were audio and video tape recorded and the facilitator used the same semi-structured format for each issue forum.

Table A1 MSG3 Preferred Solution Quotes

Group decision: Dredge hot spots, ongoing testing and re-dredging over time

Case #	*Baseline*	*Immediately after forum*	*One month later*
94	Dow needs to do something about it. If we did something that endangered health we'd have to do something about it.	I think they should concentrate on hot spots - dredge them a few times, then watch to see if the levels drop over a period of time and if they don't then try something more - but I think if you hit the hot spots over and over the levels would drop	Finding the hot spots and dredging them and see if there is any drop. Then go from there.
118	Clean it up. Whatever it takes to clean it up.	Dredge hot spots and let nature take its course.	Dredge the HOT SPOTS.
122	Studies.	Wet dredge the areas that seem to have the highest concentrations and study these areas over a period of time	It seems to me that the best solution would be a compromise to help alleviate the above mentioned fears, such as wet dredging the areas of the river that are considered to be the most polluted.
129	Monitor all companies on the river with access. Monitor the residents	Help just the hot spots that would be where you could see the most calculable effects.	Concentrate on the "hot spots." Build some form of containment area on the hot spots to help keep the stirred up dioxins from getting into the air of further flowing down river. Remove the high concentrations on a yearly or biyearly level and record progress in these areas where progress would be most noticeable.

Table A2 MCG Preferred Solution Quotes

Group Decision: Open space corridor; neutralize hot spots (bioremediation); test on GM property before using wide scale

Case #	*Baseline*	*Immediately after forum*	*One month later*
313	Educate people about the ppt and the low % we're talking about here. 1% of ppm is 0,000 x - we're talking trillions here. Low % in ground and water.	A combination of neutralizing the soil and river with new technological chemicals and an open space corridor.	Control future land use to new development, ie, no new homes, parks, access sites etc. coupled with new chemical treatment of the soil and water which will be available in a few years is the most cost effective method of dealing with the problem. Not some misinformation currently in the press and public scare tactics by some residents who are affected.
327	Dow is responsible; high tech; conflict approach	Either let time clean the problem unless neutralizing chemicals can be proven safe.	Nothing should be done.
330	don't know	Combination of corridor and increased testing of chemicals and microorganisms in small areas over time starting with high concentration.	Natural corridor with isolation testing of biological and chemical treatments to begin.
331	clean up the river; dredging	*Chemical* with more information.	I believed with more information on side effects that the chemical clean up would be best. Then come in and replace the soil but only in residential areas where people come n contact with the soil every day.
335	People should be more aware of the issue.; don't know	A combination of open space corridor and neutralizing dioxins via chemicals after the technology has been further developed and more is known about the side effects.	Waiting until the chemical treatment has been better researched and then apply it to the problem.
337	Move treatment ponds away from the river. Never dump anything again. They've got to prove that its an issue. They don't have any facts. Dow killed the river. Was so bad it wouldn't freeze.	Chemicals.	? – NA

Table A2 Cont'd

Group Decision: Open space corridor; neutralize hot spots (bioremediation); test on GM property before using wide scale

Case #	*Baseline*	*Immediately after forum*	*One month later*
342	Leave it be; do nothing, don't disturb, let nature take care of it in time	Neutralizing chemicals or heat along with open space corridor use and possibly flood control measures.	I think the area should be cleaned up, using the technologies available, the use of thermal technology to neutralize the dioxins or possibly chemical neutralizing agents. If these possibilities have been tested and have little or no adverse side effects.
345	Test all homes, cover soil, clean river	Neutralize dioxin with open space corridor.	Purchase home so can move from contaminated area at a price to get a comparable home in a non-affected area. 2- for clean up all proposed solutions need to be implemented.

Table A3 GRR2 Preferred Solution Quotes
Group Decision: Dredge hot spots in river & floodplain; flood control; insure residents against illness; cap low concentration areas

Case #	*Baseline*	*Immediately after forum*	*One month later*
275	Insurance for the future; dredging; buy out, move people, people should leave;	Flood control, voluntary buy-out, option of insurance or settlement paid by Dow if not interested in moving, control of floodplain use with a compensatory package to not affect a person's way of producing income.	Clean up high level areas by removing contamination. Flood basins to stop water overflow that would cause recontamination.
269	clean up seems almost impossible; don't know	New tech if we are sure of end result.	Retention ponds.
274	Objective study, reach conclusion; don't know	Control flooding and dredging high concentration areas.	Undecided.
244	Complete clean up. Stop Dow from emitting anything. It doesn't make sense that Dow can still dump.	Flood control and clean up	Total clean up.

Table A4 FVE Preferred Solution Quotes
Group Decision: reduce exposure, flood control, open space, dredge hot spots and wait for bioremediation for the floodplain when available

Case #	*Baseline*	*Immediately after forum*	*One month later*
4	Studies to see if there is a health problem. Until that's done, then act.	A step by step process starting with Flood Plain Management progressing to River Corridor Access Planning and finally to removal of dioxins (if necessary) combine w/bioremediation process.	Identify where they exist and make efforts to avoid exposure to them. Continue to focus technological-biological research methods to negate dioxin contamination.
5	If you dredge where do you put it?	Control flooding in spring by digging canal above Dow Chemical to channeling river and shut flow off to river in summer. Then you could clean up hot spots and control floodplain.	If it has to be removed from the river bottom I would like to see the river redirected to the Kawkalkin River by digging a canal and a few dikes when the water flow is almost nil in the summer. Then the river and floodplain could be dry dredged. I also think new technologies could save our problems in the near future and save us a lot of money and not have to dredge or move people.
14	Dredge	I guess dry dredging but being able to treat the soil so it may be used again	I guess dry dredging as long as precautions were taken to keep the dust and dirt from blowing around and causing more problems.

Table A4 Cont'd

Group Decision: reduce exposure, flood control, open space, dredge hot spots and wait for bioremediation for the floodplain when available

Case#	*Before forum*	*After*	*One month later*
27	*Baseline*	*Immediately after forum*	*One month later*
34	Whatever is needed.	Bioremediation	The use of microorganisms to break down the dioxins.
11	Nothing can do. Stop the cause.	Leave things as they are	Unless it is a very great health problem I think everything should be left alone.
16	Don't know	I don't think there is just one solution.	That it can be cleaned up.
23	They need to go after the source. Have Dow clean it up. They are the chemists, they could come up with ways to reverse the problem. If residents could do something . . . we want clean air and clean water.	More study needs to be done. People should stay away from the area.	Dredge up all contaminated soils and sediments. Dispose of this waste in a safe structured way, as not to contaminate any other area. If Dow could work on a chemical solution which could clean up the river.
30	Lots of testing. People on the river should be more involved.	Re-route river and dry dredge.	?
43	Don't know.	Bioremediation	Dry dredging.
9	If dig it up how deep do you go?	Na	I think dredging is the way to go.

Table 6A NSA Preferred Solution Quotes

Group Decision: Control flooding, dry dredge, bioremediation on the floodplain.

Case #	*Baseline*	*Immediately after forum*	*One month later*
180	Where is it coming from? Find new ways of disposal and clean up what is there.	Dry dredging and control the floodplains. Dry dredging only if tested every 6 months to check safety for 2 yrs then annual. Also bioremediation for the soil to save the things that are already present (homes, trees, etc)	A combination of dredging with new technology
221	Stop dumping. Filter water. Clean up trash.	Dry dredging.	Dry dredging if the people involved in the dry dredging can be geared up in protective gear.
196	Don't know.	Dredge the river and put a barrier in between and but sand over it.	Make sure there is 100% free of the problem Dow Chemical has caused such as in humans, animals, water, soil problems we are having around here.
176	Ludicrous to think they can get it out of there. Stirring it up will spread it to Great Lakes.	Some type of flood control. Dry dredging and biological or chemical use in on about personal property.	Leave well enough alone and make people aware of the situation so they could choose whether to live on or near or use the area for recreation. I think the removal idea is impossible especially in the floodplain areas.
178	No answer.	Contain it and stop it from going further.	
222	Whoever is at fault, Dow and State Government, should foot the bill to clean it up.	Na	

Table A7 GRR1 Preferred Solution Quotes

Group Decision: voluntary relocation in high contamination areas; wildlife area; do nothing elsewhere but do monitor health

Case #	*Baseline*	*Immediately after forum*	*One month later*
226	Don't know.	Further study of the health impact before moving, dredging, etc.	Further study to see if there is a high risk of danger to people. If there is a risk, then consider possible clean up or compensation to those affected (ie, farmers with un-usable crop land)
245	Test each individual property, both flooded and not flooded.	Immediately move people out of area highly contaminated and all property should be tested individually at different depths. Do health studies yearly of residents and offspring.	Buy our property [relocation] and financial compensation and continued health study of residents and their children.
252	The way they are going is all right - - doing the study. I thought it was funny how they [Dow] skewed the results and said right in the article that they skewed the results. I approve of their approach.	Evaluate health risk on people first. What level can we live with? Wait and see.	Need more answers to how people and wildlife are affected.
267	Clean it up. High tech option.	100 yr flood plain to be left alone. Yearly floodplain to be cleaned up.	To remove contamination in flooding areas and cover non-flood areas.
224	They won't tell you - not sure we're contaminated. Don't know.	Na	Na
250	I don't think they can do anything. It would be too costly. What are they going to do, move us out?	Na	Na
264	More studies, set fixed level allowable. Don't sue Dow.	Corridor refuge. Ensure health studies, surveys are completed	

BIBLIOGRAPHY

Abel, T. D., & Stephan, M. (2000). The limits of civic environmentalism. *American Behavioral Scientist, 44*(4), 614-628.

Abelson, J., Eyles, J., McLeod, C. B., Collins, P., McMullan, C., & Forest, P. G. (2003). Does deliberation make a difference? Results from a citizens panel study of health goals priority setting. *Health Policy, 66*(1), 95-106.

Arnstein, S. R. (1968). A ladder of citizen participation. *Journal of the American institute of planners, 35*(4), 216-225.

Arvai, J., & Gregory, R. (2003). Testing alternative decision approaches for identifying cleanup priorities at contaminated sites. *Environmental Science & Technology, 37*(9), 1469-1476.

Beierle, T. C. (2002). The quality of stakeholder-based decisions. *Risk Analysis, 22*(4), 739-749.

Council, N. R. (1996). *Understanding Risk: Informing Decisions in a Democratic Society*. Washington, D.C.: National Academy Press.

Diebel, A. Chibucos, M. & Beckwith, J. (2005). *Dioxin Contamination of the Tittabawasssee River and Flood Plain: Overview of Issue Forum Outcomes*. East Lansing: Michigan State University.

EPA, M. S. U. U. (2003). *Dioxin Contamination and the Tittabawassee River and Floodplain: Managing the Risks: An Issue Guide*.

Fischer, F. (2000). *Citizens, Experts, and the Environment: The politics of local knowledge*. Durham and London: Duke University Press.

Gregory, R. (2000). Using stakeholder values to make smarter environmental decisions. *Environment, 42*(5), 34-44.

Gregory, R. S. (2002). Incorporating Value Trade-offs into Community-Based Environmental Risk Decisions. *Environmental Values, 11*, 461-488.

Habermas, J. (2006). Political Communication in Media Society: Does Democracy Still Enjoy an Epistemic Dimension? The Impact of Normative Theory on Empirical Research. *Communication Theory, 16*(4), 411-426.

Jasanoff, S. (1991). Acceptable evidence in a pluralistic society. In D. G. Mayo & R. D. Hollander (Eds.), *Acceptable Evidence: Science and Values in Risk Management* (pp. 29-47). New York: Oxford University Press.

Kelly, T. (2004). Unlocking the Iron Cage Public Administration in the Deliberative Democratic Theory of Jürgen Habermas. *Administration & Society, 36*(1), 38-61.

Kothari, B. C. a. U. (Ed.). (2001). *Participation the new tyranny?* London: Zed Books.

Lachapelle, P., McCool, S., & Patterson, M. (2003). Barriers to effective natural resource planning in a "messy" world. *Society & Natural Resources, 16*(6), 473-490.

Mathews, D. (1994). *Politics for People*. Urbana: University of Illinois Press.

Mathews, D., & McAfee, N. (2000). *Making choices together: the power of public deliberation*. Kettering, OH: Ruffolo Press.

McComas, K. C. W. S. (1998). Reassessing Public Meetings as Participation in Risk Management Decisions. *Risk: Health, Safety & Environment, 9*, 347-360.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods* (3 ed.). Thousand Oaks: Sage Publications.

Pellizzoni, L. (2003). Uncertainty and Participatory Democracy. *Environmental Values, 12*, 195-224.

Putnam, R. D. (1995). Bowling Alone: America's Declining Social Capital. *Journal of Democracy, 6*(1), 65-78.

Renn, O. W., Wiedemann, P. (Ed.). (1995). *Fairness and competence in citizen participation: Evaluating models for environmental discourse*. Dordrecht: Kluwer Academic Publishers.

Slovic, P. (1997). Public perception of risk. *Journal of Environmental Health, 59*(9), 22-23.

Smith, G. (2003). *Deliberative democracy and the environment*. London, New York: Routledge.

Spano, S. (2001). *Public Dialogue and Participatory Democracy*. Cresskill, New Jersey: Hampton Press, Inc.

Thompson, P. (2004). *Seminar on Ethical Considerations in Risk Assessment*.

Webler, T., & Tuler, S. (2000). Fairness and competence in citizen participation: theoretical reflections from a case study. *Administration & Society, 32*(5), 566-595.

Webler, T., Tuler, S., & Krueger, R. (2001). What is a good public participation process? Five perspectives from the public. *Environmental Management, 27*(3), 435-450.

Yankelovich, D. (1991). *Coming to public judgment: making democracy work in a complex world* (1st ed.). Syracuse: Syracuse University Press.