USE OF STRUCTURED PUBLIC INVOLVEMENT TO IDENTIFY COMMUNITY PREFERENCES FOR A SUPERFUND SITE END STATE VISION

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BACKGROUND

The Paducah Gaseous Diffusion Plant is a uranium enrichment facility built in the mid-1950s in western Kentucky. Many thousands of people over several generations have been employed at, or in activities devoted to, the PGDP. Over the years, the plant has also generated significant nuclear and industrial contamination. This contamination is composed of various surface disposal activities, such as burial grounds, which have resulted in multiple potential sites across the plant grounds, and in surface and subsurface water contamination, the extent and full nature of which is still subject to ongoing research and monitoring. Because of this, the PGDP retains a joint legacy as a regional economic engine and a major source of environmental contamination and worker exposure.

Because of advances in the technology of uranium enrichment, however, there are expectations that the plant eventually will be decommissioned. This will result in dramatic impacts on the region's economy and encourage the pursuit of replacement activities for the site. This, in turn, will highlight the complications arising from various sorts of contamination, as well as the strategies for mitigating them. Thus, envisioning a future for the plant site is a complex decision making process involving a wide range of variables that interact with each other in intricate and not altogether-understood ways. Proactively involving the affected community in a productive way is the challenge.

ISSUES WITH PUBLIC INFRASTRUCTURE PLANNING AND DECISION MAKING

It is useful to understand the distinctive nature of every public infrastructure project. Borrowing from the literature and their experience, the authors use the following properties to qualitatively distinguish projects (Panel on Public Participation in Environmental Assessment and Decision Making, 2008; Bieirle and Cayford, 2002). This analytic is useful in thinking about public participation in the larger sense and helps situate the PGDP project. The major facets of any project include:

Time Frame

- Lower Predictive Model Accuracy with Increasing Time

Time frame matters because, all things being equal, any predictive model becomes less reliable over lengthening time frames. This is important because it becomes difficult for experts or the public to trust the efficacy of any decision they might make based on predictive models.

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- Need For Long –Term Monitoring of Processes And Outcomes

A corollary of the problem of increasing unreliability over time is the need to then consider monitoring strategies. Any current planning will need to include a method to specify decision-making in the out years. In our case, the time frame for the vision of the PGDP is arbitrarily bounded at approximately 10 years hence, but the nature of some of the issues to be dealt with, especially underground water contamination, have 100 year timelines, twice as long as PGDP has existed. Thus, current preferences that are most applicable to the near term and longer term monitoring and management will be a concern of the public.

Spatial Extent

- Problems Reaching All Affected People When Broadly Distributed

Projects that are spatially extensive can impact and link people across longer distances. For example, air quality on the east coast is linked to the activity of power plants in the Ohio Valley. Careful thought will need to be given to the problem of adequately reaching potentially affected people across space. In the case of PGDP, the scale is that of a rather large region, with different scales attached to different aspects of the plant. It boasts the largest TCE contamination plume in the world, at approximately 3000 acres, but the labor shed for the plant is much larger, covering several counties, and recreational activities in the surrounding wildlife management area attract participants from across the country.

- Arranging Agency Involvement across Political and Administrative Boundaries

This problem of scale is also relevant from the side of the sponsoring agency(ies), as it increases the likelihood that agencies with overlapping spatial responsibilities will be affected and thus implicated. While one agency (US DOE) may be charged with primary responsibility for the project, the needs of other overlapping agencies will be an associated obligation of the lead agency.

In the PGDP case, the immediate site involves at least three agencies at different levels. Beyond the usual national agencies implicated in environmental cleanup, there are regional ones: a TVA plant supplies power to the facility and forms the northern boundary of the facility, while the Western Kentucky Wildlife Management Area surrounds the facility on the other three sides. The US Geological Survey's seismic risk assessments also underlay a large portion of the site and are of key interest in future determinations about the risk associated with various activities.

Complexity of Problem

- Dealing with Many Possible Outcomes

Overall project complexity, in terms of the number of possible variables affecting outcomes and thus the number of possible outcomes, is also a major consideration. Such conditions work against the ability of large, or even small, numbers of well-meaning laypersons to comprehend and contribute to a reasoned consideration of how to proceed. This condition, especially, often encourages professionals to rely almost exclusively on their conclusions.

The PGDP is indeed a highly complex decision environment, as it is composed of considerations about many potential types of cleanup, both above and below ground. Another aspect of the

decision matrix is the future land use of both the immediate facility and the surrounding landscape, some of which is underlain by the contamination discussed earlier. This land use decision is itself composed of considerations about the options for economic activity that will 'replace' the existing activities and all of the attendant, typical economic development considerations, such as site suitability, regional location, and so forth.

For example, even where the range of possible options for site land use, surrounding facility land use, surface remediation strategies, underground water contamination, plant waste and plant cleanup (decommissioning and destruction of structures) are each limited to only three possible general outcomes, the complex of total possible scenarios approaches 250! Adding one more factor (for example, three options for the overall monitoring strategy) would expand the number of distinct future scenarios to 250 x 3 = 750, and so on. This quickly exceeds the capacity of typical public processes.

- Identifying Relevant Aspects of Problem

A typical strategy in dealing with a complex decision matrix is to attempt to focus on the most relevant aspects, so as to limit the geometric proliferation of alternatives. This is more difficult to do in the case where the interaction of factors is complex or not well understood, because the risk of neglecting a critical consideration for the decision-making is increased, and the sensitivity of the decision to a wide range of possible considerations is difficult to assess.

In the case of the PGDP, the factors listed above are presumed to influence each other in ways that are only approximately understood. For example, an important aspect of the technical analysis of the PGDP involves innovative methods for dealing with subsurface water contamination. The lifespan of these mitigation strategies reaches out to 100 years, at present, with the attendant problems of predictive reliability mentioned earlier. However, the relevance of faster or slower plume attenuation to decisions regarding land use is somewhat unknown. It may be that the decision about the most appropriate remediation strategy for underground water does not rely on, and does not affect, other decisions about the site.

Type of Product from Process

- Decisional/Negotiation/Agreement

These types of projects typically are more difficult to execute, as the nature of the outcome is expected to be negotiated among many of the parties discussed above. This may require the more extensive use of outside professionals such as facilitators or mediators, which implies more intensive kinds of activities to reach an agreement. Policy-setting agreements, Records of Decision, and so forth fall into this category of outcome type.

- Information Gathering/Preference Measuring/Values Measuring

Projects that need information regarding public preferences, values, or performance to inform professional or agency decisions require less intensity of interaction. The nature of the information acquisition is somewhat more one-directional, in that neither the agency nor the public is expected to share values or agree about outcomes as a condition for successful completion of the project. However, the quality of the information being gathered may be lower when the agency is clearly removed from any obligation to honor public preference or wishes. Research has shown that when

the agency's engagement is seen to be overtly presumptive, the level of participation by the public, and thus the accuracy of the preferences being measured, diminishes (Bieirle and Caywood, 2002; Bradbury 1999).

In the case of the PGDP, the latter situation applies. The researchers are charged with gathering and organizing the preferences of the community into a coherent and durable report and information base which will then be delivered to US DOE for their consideration. As thus described, there may be little or no opportunity for iterative or interactive work between the public that is being asked to contribute and US DOE. This qualifies as an important procedural risk that must be recognized in the context of project design.

Properties of Uncertainties

- Level or Type of Control People Can Assert Over Unknowns

Uncertainties about outcomes, in a context of high perceived risk, may lead to very complex strategic behaviors on the part of the public. Some of this can be ameliorated by recognizing the level or type of control the public can exert over these uncertainties. The famous example is of the greater acceptability by the public of the risks associated with driving an auto (individual control), even though they are statistically greater than the risks of flying (not under individual control).

Individual Verification/Enforcement

The value of individual verification (transparency) has roots in anthropology and political science (Rawls 2001). It has been shown, for example, that externally-verifiable rules for compliance can form the basis of very robust agreements (Trawick 2002). At the PGDP, many claims for various aspects of the plant are often based on individual, anecdotal evidence. In the absence of other, higher-quality (transparent) verification strategies, it is reasonable for individuals to rely on their own limited, but highly trusted, observations.

This reality helps explain much of the disagreement about what the effects of the PGDP plant have been over the years, as cultural attitudes have been forged across several generations. These constructs are built around the personal and social stories shared with individuals, and form the reliable basis for their opinions and decision-making. Expecting expert opinions that have been interpreted as unreliable in the past to be given precedence over these complex cultural constructs is unrealistic.

Collective Monitoring and Enforcement

Similarly, there are many existing and potential types of monitoring that can be implemented in any given project to mitigate some of the problems of time frame and uncertainty mentioned earlier. Such formal monitoring agreements can provide the bridge into the smaller social/cultural circles that have maintained coherence in the absence of any credible external input.

In the case of PGDP, there are already extensive monitoring efforts being conducted by US DOE and its contractors. What is not clear is the extent to which the monitoring output has credence with the general public, or specific portions of the public.

Breadth/Depth of Public Impact

Beyond the geography of impact, the nature of the impact of a given project will be qualitatively different for different subgroups. This is, of course, the impetus for Environmental Justice work, with its emphasis on distributional justice for specifically identified groups sorted by race or income. In the practical world of projects, there are, of course, a wide array of possible 'groups' that can be hypothesized to be impacted in different ways by a particular project.

• Understanding Which Groups Will Be Affected

As project complexity increases, it is likely that the number of identifiable subgroups will be impacted as well. It is easy to begin to identify, as we have, a wide range of subgroups that have identifiable potential impacts from a change at PGDP, including for example those employed there, those who live nearby, those who use the facilities near the plant, and so forth (Ormsbee and Hoover, 2010). It is more difficult to be sure that every group that believes it is impacted has been identified and included.

• Understanding How Each Group Is Impacted

The way that different groups articulate with a given project will guide how they interact on project activities. Individuals may hold particular strategic positions vis-à-vis the questions being debated, and thus arrive at different conclusions about the best course of action. Those who live at some distance from the plant and determine that the impacts on them are primarily economic may not be interested in the niceties of the cleanup process, for example. Some participants may indeed assume the role of 'citizen' and engage in rule-making that they consider best for their community. Even under these circumstances, there remains uncertainty about the overall project, potential outcomes of different strategies, and sometimes hidden presumptions about the impact of various decisions.

• Gathering Appropriate Data for the Project

Because of the dual problem of differential group impacts, it will be important to be able to track which subgroups are providing which kind of data, relative to their engagement with the plant. When considering remediation for the contaminated water plume, for example, it may be inappropriate to give the opinion of workers living far from the plant the same weight as that of those living within the potential affected zone.

Different Perspectives, Capabilities, and Power Levels Among the Public

Dealing with the public successfully can be more challenging as the nature of the participants becomes more and more diverse in terms of perspectives, educational and income levels, experience with public agencies, and dealing in the public realm. Not all participants at a meeting are polished public speakers, not all are as gregarious, and not all have the same understanding of bureaucratic conversations and formal presentation tools. This can increase the risk of at least two undesirable outcomes.

• Inaccurate Measurements of Preferences and Values

From a purely functional point of view, such differential capabilities among the public can lead to increasingly unreliable feedback, even when well-intended. Especially in cases where there is little

provision for iterative feedback, errors in measuring or understanding the preferences that people are trying to communicate can proliferate throughout the project.

- Solutions With Long Term Weaknesses

Lack of understanding of substantial issues or values can lead to solutions that are unrepresentative of the public's wishes and thus lack long term robustness. If certain aspects of a project have obvious shortcomings, it causes other aspects of the project to be cast in doubt, as well. Because of the wide range of people affected by the PGDP, it is reasonable to conclude that this issue will require attention.

Public's Level of Trust of Agencies

It will come as no surprise to anyone that the level of trust by the public of the agencies it deals with can have manifest influences on a project. People with profound distrust of an agency can choose to opt out of the process altogether or to attempt to co-opt or subvert the process for the goals they think are more important. People with moderate levels of trust will tend to exert themselves only half-heartedly on the process, if at all. Thus the varieties of response that can be expected due to the usual issues listed above can all be compounded by the cross-cutting issue of trust. The National Research Council panel summarized this issue in this way, "Trust or its absence seems likely to be particularly important in cases in which scientific disagreement is an issue or in which adverse effects may be visited on identifiable social groups" (2008, p. 212). We would submit that this describes many environmental issues of the day, including PGDP.

Agency Culture, Approach, and Regulatory/Administrative Environment

In a review of US DOE SSAB's, Bradbury pointed out that if there was insufficient engagement or commitment by regulators to the recommendations of the boards, members would become apathetic, cynical, and stop participating (Bradbury 1999, p. iii). This fundamental observation is a challenge for regulatory agencies as they strive to make decisions under conditions of uncertainty and within certain administrative requirements. In this environment, agency administrators are risk-averse, and thus commitment-averse, an attitude that works against making long term commitments to ideas expressed by others. Especially in highly technical cases where the administrators feel that public expertise is lacking, and thus public input is questionable, agencies may be inclined to regard experts' opinions as more useful than the public's preferences.

This can tend to tip the public participation model toward technical adversarialism (Futrell 2003). This condition is distinguished mainly by the extent to which the value systems, and thus decision-making 'moral' authority, emerges from professionals as compared to this public. This type of process may be considered to be on the low end of Arnstein's (1969) Ladder of Public Participation (Figure 1).

The authors' work indicates that the Arnstein Ladder can be a useful heuristic for understanding both the perceptions and the aspirations of public and agency professionals regarding public involvement. In a wide range of public infrastructure projects over the past 10 years, it has been used to document a relatively consistent opinion among the public and professionals about the general state of public involvement and the desired state of that involvement. Using the Ladder as an 8-point scale, more than 2000 participants have responded to two questions: "Where Are We on the Arnstein Ladder?" and "Where Should We Be?" The results reveal that the public and

professionals agree that they should strive for a Partnership, and that it has not been attained yet (Figure 2). This is significant because it contradicts the oft-held claim that the public could and should assume full control of projects. It demonstrates that the public recognizes the need for expert input and participation, along with its own preferences. It also reveals that professionals have a higher opinion of how well they deliver public involvement than the public does.

A FRAMEWORK OF FAIRNESS=JUSTICE: STRUCTURED PUBLIC INVOLVEMENT

The complexity of the PGDP process is being addressed with two linked types of public involvement protocols. The initial phase of the project involves extensive interviews and focus group interactions. These activities are designed to help ensure identification of which groups are impacted and in what ways, and how their value systems and positionality vis-à-vis the PGDP conditions their perspectives on the various facets of the future vision question (Anyaegbunam, Hoover, and Schwartz, 2010; Ormsbee and Hoover, 2010).

The second phase of the project involves creating a broad-based forum interface with the community so as to measure their preferences for future outcomes as thoroughly and accurately as possible. This phase is based on the work of the authors in Structured Public Involvement (SPI). SPI is derived of a fundamental set of justice/fairness principles posited by John Rawls.

Rawls' Principles

John Rawls (1971, 2001) set out to derive an ideal set of procedural rules that would be agreed to by a heterogeneous population. His work was aimed at addressing the 'big' questions of democracy and fairness, and initiated a considerable literature on the topic, much of it theoretical (Macedo 1999; Sen 2009). He theorized that, when individuals are under conditions of extreme uncertainty (the 'veil of ignorance'), they will reasonably adopt risk-minimizing rules. Thus, when the range of outcomes is heavily conditioned by as-yet-unknown circumstances (including individual positionality relative to those outcomes), the public could be expected to adopt rules and strategies for themselves (and by extension, everyone else) that would minimize the maximum adverse impacts on any individual (the 'maximin' rule). Although he was explicit in saying that this was a narrowly idealistic conception and not a broadly applicable 'rule' (Rawls 2001, p. 97), the authors nonetheless are intrigued by the implications of this idea for the general public. Will the considerable levels of risk and uncertainty associated with a situation such as the PGDP yield maximin attitudes on the part of the general public? This logic is considerably different than a cumulative cost-benefit analysis. It also suggests that processes that tend toward the desired 'Partnership' on the Arnstein Ladder will deliver a result that is more useful to agencies, as it would help reduce the postulated tendency toward hyperconservatism in public preferences.

Rawls derived from this a set of three fairness principles: 1) Fairness of Access, 2) Fairness of Process (Procedural Justice), and 3) Fairness of Impact (Distributional Justice). We have built our processes for engagement on adherence to these principles, in particular principles 1 and 2. In practice, and in the case of the PGDP Future Vision Project, these principles translate into a specific set of practices under SPI.

The PGDP future vision implicates many different kinds of participants with widely varying backgrounds and education levels. The project is geographically, demographically, and culturally diverse. Different subgroups have substantially different types of engagement with the plant and

see themselves as impacted in a myriad of ways, ranging from a means of livelihood for some to a threat to livelihood for others. A major challenge is to find ways to maximize both the breadth and depth of the participation levels and to provide a means for participants to incorporate these widely varying impacts into their preferences for the future of the community.

In terms of content, the PGDP future vision has many possible components, making it a very complex decision environment. The reliability of many of the predictive models is unknown, and the time frames are long. The relationship between the community and US DOE is not marked by high levels of trust, and the deliverable of the project is a report on the preferences of the community, which requires little or no direct interaction with US DOE. Also, there is no firm commitment from the agency to respond to the report in any particular way. Thus another major challenge is to find ways to encourage community members to donate their time and effort toward a distant vision, under conditions which make the efficacy of their input uncertain, at best.

STRATEGIES AND TOOLS COMPRISING THE STRUCTURED PUBLIC INVOLVEMENT PROTOCOL

While these are daunting challenges, there are steps that can be taken to mitigate the effects of at least some of these issues. SPI integrates dialogic group methods and tools, representation technologies, and decision support modeling tools to help realize the Rawlsian principles of fairness. For each project, the particular combination of tools and strategies is customized to deal with its specific properties and challenges.

Dialogic Tools and Methods

SPI typically incorporates the use of Audience Response Systems (ARS) or some similar feedback method. ARS systems have several properties that are useful in public participation. They are expandable, so that additional participants can be accommodated without diminishing the quality of input from others. Thus, large scale public meetings can be arranged to accommodate situations such as PGDP, where many people are involved whose input can and should be included. The overall feedback strategy is adaptable to repetition, so that the same information-gathering interface can be executed repeatedly and the results summed. This facilitates multiple meetings held across a region in different venues to help ensure that all groups and all areas are adequately represented. Similarly, certain of the interfaces can be customized for access over the internet to further broaden access for the public, if it is deemed appropriate given the context.

ARS are characterized by anonymity and simultaneity of input, which helps ensure participants' legitimacy and honesty and protects individuals from social or peer pressure. Also, our experience shows that the keypads are easy to use, helping to ensure that we have accurate input from those who participate. The 'one person-one vote' aspect of the system promotes procedural fairness so that those with more public speaking skills do not commandeer public meetings to the detriment of everyone else. ARS also provide the ability to gather information very rapidly, minimizing the time investment that individuals must volunteer vs. the amount of information they can provide. Further, the results of each polling question are displayed in real time, so that participants can verify for themselves the legitimacy of the information gathering process. Also, this becomes a useful method of demonstrating to a diverse group just how diverse they are, which can sometimes be a surprise to individuals who believe they are speaking for a silent majority. As importantly,

each keypad holds a unique ID, which allows the team to gather information by subgroup simultaneously merely by asking the appropriate distinguishing demographic questions.

While ARS systems are typically associated with 'set' multiple choice or rating questions, they can also be used in dynamically generated lists for prioritizing or other sorting, as well as for more complex multi-criteria evaluations of items. Consequently, meeting processes can accommodate novel or unanticipated input if the occasion arises.

Representation Tools

Due to the complex nature of the decision environment, a major challenge is helping participants understand the implications of the questions being asked so they can express informed and thus reliable preferences. In the case of PGDP, the relevant information is both conceptual (economic impact in the region) and specific (How would a steel plant fit on the site? Where would a disposal site go? What will be the extent of the underground water plume over time, under different treatment regimes?). To help clarify, or perhaps standardize, the nature of the 'knowns' and 'unknowns' the authors are using 2D and 3D visualizations of a range of future scenarios for the PGDP site. These scenarios include information about the questions above, plus information about likely impacts or affects regionally on the community and the general level of uncertainty associated with the projections. One should not expect that visualization tools will create or invent unity in terms of preferences, though. It is equally possible that such tools will clarify differences of outcomes and impacts. Thus, it is unrealistic to expect greater participation to necessarily result in greater agreement (Stirling 2008). Nonetheless, to the extent that individuals' preferences are clarified, the tools have performed their intended function. Participants are invited to engage in the discussions about the various merits and drawbacks of future visions and then register their overall preference for each of the scenarios using the ARS systems as the feedback mechanisms.

Decision Support Modeling

In this as in many projects, it is not practical for large groups of individuals to productively engage in the simultaneous discussion about the implications of many hundreds of different possible conditions or outcomes. As well, it is problematic even to specify the nature of those conditions or outcomes at the outset in terms that reflect the fundamental considerations of the individuals involved. Further, even in cases where the preference mechanism is straightforward, as in aesthetic preferences, it is impractical to expect consistent feedback from participants for more than about an hour (Bailey et. al. 2006). Similarly, in the case of PGDP, it is important that we are able to focus on the considerations that are of the most import to the public. That is part of the goal of the focus group and interview process (Anyaegbunam, Hoover & Schwartz, 2010).

SPI relies on the use of appropriate data modeling approaches to characterize the feedback gathered through the interfaces. In this case, the problem of complexity and a large number of possible outcomes is dealt with through the use of Fuzzy Set Analysis, which allows a small (10%) sample of possible outcomes to provide sufficient information to build a model of the public's entire preference set, thus greatly maximizing the information gathered from the public. It also allows the future scenario set to be kept to a manageable size for a public meeting. This application is discussed further in an associated paper (Bailey, Grossardt, Ripy and Blandford, 2010).

SUMMARY

All public infrastructure planning and design problems are characterized by certain properties relative to their chronological and spatial scale, complexity, uncertainty, risk, public characteristics, and agency culture and regulatory context. The PGDP project composes a more challenging project than many and is being addressed in part by the SPI protocol that provides high levels of procedural fairness and broad access to participation, through the novel integration of appropriate technologies of participation, representation, and decision support.

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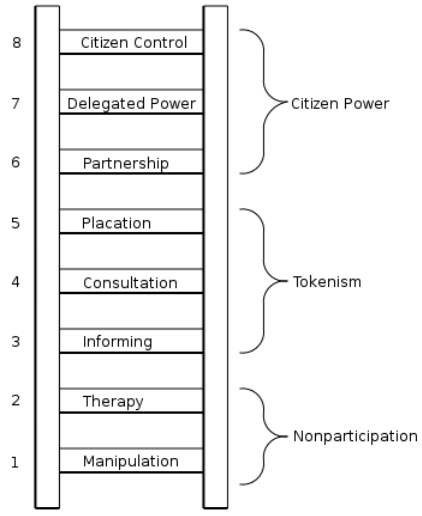

FIGURE 1: ARNSTEIN LADDER OF PUBLIC PARTICIPATION

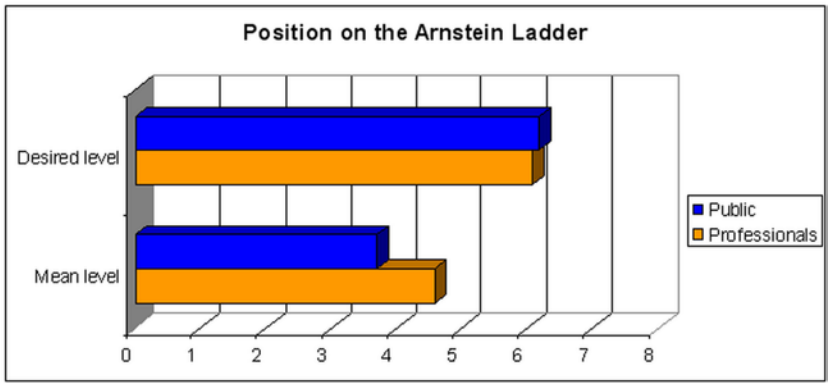

FIGURE 2: PUBLIC AND PROFESSIONALS' DESIRED AND CURRENT LEVEL ON ARNSTEIN LADDER