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Well Siting Recommendation to DOE From the Nevada Test Site Community Advisory Board: A Case Study on Public Involvement

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ABSTRACT

The U.S. Department of Energy (DOE) has the responsibility to characterize and monitor the potential movement of residual radioactivity from underground nuclear weapons testing at the Nevada Test Site (NTS). Many underground tests in the Western Pahute Mesa area of the NTS were emplaced at or below the water table, where groundwater could be contaminated. The DOE’s underground test area (UGTA) environmental management program is developing a flow path model for the Western Pahute Mesa corrective action unit, to characterize and predict contaminant movement in groundwater from the NTS toward off-site communities. A community advisory board (CAB) has been established to give the DOE public feedback on environmental management decisions for the NTS. This advisory board has spent several years studying the DOE's UGTA EM program, and expressed concerns about serious data gaps in the Pahute Mesa groundwater flow model. In response, the DOE invited the advisory board to recommend a location for a new data well in this area. This paper analyzes the NTS Community Advisory Board’s research and decision-making process in developing a well siting recommendation to the DOE.

INTRODUCTION

The U.S. Department of Energy (DOE) has the responsibility to characterize and monitor the potential movement of 132 million Curies of residual radioactivity remaining from underground nuclear weapons testing at the Nevada Test Site (NTS).[3] Most of this radioactivity was released in shots conducted on Pahute Mesa, including several that were emplaced at or below the water

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[2] The authors acknowledge the support of Kaye Planamento, Navarro Research and Engineering; Kelly Snyder, DOE-NSO EM; Carla Sanda, Consensus by Design and the NTS CAB leadership and members.
[3] The U.S. Department of Energy’s Nevada Operations Office (DOE NV) Environmental Management (EM) Underground Test Area (UGTA) project characterizes subsurface contamination from the 828 underground nuclear weapon tests at the Nevada Test Site (NTS).

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table, where groundwater could be contaminated. The Western Pahute Mesa corrective action unit (CAU) is being monitored and modeled by the DOE’s underground test area (UGTA) environmental management program, in order to measure and predict groundwater contamination movement toward downgradient private wells and springs.

A community advisory board (CAB) for the NTS has been established to provide public feedback on all DOE environmental management programs at the NTS, including the UGTA program on groundwater contamination. This paper analyzes developments subsequent to the NTS Community Advisory Board’s use of a peer review, provided by the American Society of Mechanical Engineers (ASME), to evaluate gaps in the UGTA monitoring and characterization project.[4] Based in part on this peer review, the CAB identified Western Pahute Mesa as the highest priority for collecting additional subsurface data, due to the proximity of communities downgradient from the NTS boundary, inadequate groundwater monitoring, and insufficient field data coverage to support the DOE’s on-going three dimensional groundwater flow modeling [1].

In response, Assistant Manager for Environmental Management Carl Gertz invited the CAB to select a location for a new data well. The DOE provided in-depth technical support for the CAB’s subsequent study of the complex geographic and geophysical factors that impact groundwater flow from Western Pahute Mesa [4]. Members of the full advisory board who were willing and able to make the time commitment required for this technical research project formed a CAB sub-committee called the ‘UGTA committee’. Most of the research and discussion on this project was delegated to this sub-group of the NTS CAB, which made regular progress reports to the full board on their research and decision-making process.

SYSTEM DYNAMICS APPROACH

To assess the CAB’s use of this unique opportunity for citizen involvement in expanding the available data for UGTA, we used a system dynamics approach that Stave recommends as a “consistent and rigorous problem-solving framework” for complex environmental management decisions that depend on public involvement [5]. The five elements of a system dynamics approach that focus on improving stakeholder awareness and participation in arriving at a decision are: (1) focusing on the problem, (2) seeking specific problem causes in the structure of a complex environmental system, (3) focusing the discussion on policy levers that impact this environmental system at key leverage points in the system’s structure, (4) providing stakeholders with a feedback tool for learning and policy design, and (5) documenting the entire process of learning and building stakeholder consensus. While the CAB did not apply a system dynamics research strategy themselves, we used this system dynamics framework as a lens through which to analyze their research and public involvement process. We describe in the following sections how the UGTA committee’s work has met each of these criteria and in what way each of these five qualities of their work contributed to the practical success of their research project.

[4] The underground test area project (UGTA project) involves characterization and monitoring of five geographically organized corrective action units (CAUs) on the NTS, as directed in the UGTA strategy specified in the Federal Facility Guidelines and Consent Order’s (FFACO) guidelines.

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Focus on the problem

The first of these criteria is consistency in focusing on the problem, rather than debating the likely outcomes of various possible solutions or other side-issues that distract from addressing the root problem. Did the UGTA Committee achieve consensus in problem definition, and focus all their research and discussion on the problem itself? Problem definition “is a dynamic process in which intellectual understanding and institutional behavior guide one another over time” [6]. But the research problem must be clarified early in the decision making process, because it frames the choice of evidence that will be considered, how solutions will be evaluated, who will be expected to identify as stakeholders, and how the environmental policies that bear on the problem will be implemented and assessed [6].

To guide the application of this primary criterion Stave asks, “What is the problematic behavior or behaviors we are trying to change?” [5]. The fundamental behavior the UGTA Committee is trying to change is the potential for *undetected or unanticipated migration* of radionuclides or other toxic products of underground testing off-site. This is a complex problem statement, with both a policy dimension (early detection and transport modeling efforts) and an environmental dimension (contaminant transport rates). The UGTA Committee’s research focuses on one specific aspect of the fundamental problem: major and persistent gaps in the DOE’s three dimensional spatial and hydrologic data to support a model that will be used to characterize groundwater contamination in the Underground Test Area and predict rates of transport in the downgradient region from Pahute Mesa to Oasis Valley. The committee considered both the policy dimension of this problem – the implementation of monitoring and flow path characterization programs – and the subsurface environmental context, focusing their research on hydrologic and geologic data relating to several problematic uncertainties in the groundwater flow model.

The committee frequently reviewed their priorities to keep the work focus on enhancing the quality of contaminant transport rate estimates. This focus on the research problem maximized the effectiveness of the CAB volunteers’ use of their limited meeting time, the time committee members spent independently reviewing information for the research project, and the resources and support provided to the CAB by DOE. The efficient use of time is critical to the CAB’s ability to effectively represent the public. “Public participants in environmental management discussions also tend to be self-selecting. That is, if they participate, they do so because they are invested somehow in the issue. Voluntary participants also may have less time for participation…[they] use their leisure time to participate in such exercises” [5].

Seek problem causes in the structure of a complex environmental system

When policy makers neglect complex system dynamics and “jump to solutions,” the underlying causes of a persistent environmental problem may be overlooked. This can be avoided by first asking, “how does the system generate the problematic behavior?” [5]. The UGTA committee studied the complex physical structure of the Pahute Mesa-Oasis Valley hydrologic system, in

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order to discover what aspects of the system the model lacks sufficient information to represent effectively. Their iterative and multidisciplinary research strategy avoided “jumping to solutions” by considering all physical and theoretical dimensions of the system relevant to the model’s construction. This holistic research method allowed the committee to evaluate the relative significance of many perceived data gaps, by piecing together information from reports related to many different layers of the groundwater model.

Several specific features of the groundwater system were targeted as major causes of model uncertainty, because these geologic structures could constrain groundwater flow in various ways and their impact on the system is not yet well understood. These geologic structures of interest included the fracture flow alignment and connectivity in the area of the Tybo and Benham tests, the Thirsty Canyon Lineament, and the bench between the Silent Canyon Caldera and the Timber Mountain Caldera. The UGTA committee’s focus on these features and their impact on the groundwater system reflected a research process directed at identifying key elements of a larger environmental system that drive the ‘problem behavior’ which, in this case, can be framed as the generation of uncertainty about groundwater flow paths.

Use policy levers that target key points in the environmental system’s structure

The third criterion Stave uses in evaluating a problem-solving process is that decision-makers focus on policy levers that can be used to impact the environmental system at key leverage points in the system’s structure. “In the environmental arena, the process of collaboration is important, but achieving outcomes is essential” [3]. A specific policy lever was provided in the DOE’s request that CAB members recommend a new well location. The implementation date for drilling a well sited by the NTS CAB has not been set, and for this reason funding has not been set aside, but the DOE is committed to follow such a recommendation if the location is feasible. This gives the CAB’s UGTA committee the opportunity to have a direct impact on the groundwater modeling system.

The final recommendation has not been drafted, but it may encourage the DOE to drill three or more new data wells at specific locations that would provide information on several major uncertainties in the modeling of environmental constraints on groundwater flow paths. The committee’s focus on the actual number of geographically distinct problem areas in the Pahute Mesa-Oasis Valley model is an ambitious and pragmatic response to the limited usefulness of the given policy lever – the request that they recommend a location for one new well. The committee’s decision to present the DOE with several recommended sites, rather than a single well site, has been received positively. The DOE UGTA group has agreed to review around five well siting recommendations from the NTS CAB, and to comment on each site’s feasibility and usefulness before the committee produces a final recommendation.

Provide stakeholders with a feedback tool for learning and policy design

The fourth criterion is that environmental decision makers should provide stakeholders with a feedback tool for learning and policy design. Environmental management feedback from government agencies to stakeholders “is often obstructed by delays, imperfect information, and

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misperceptions of feedback, among other factors [..] internal consistency [is] difficult to achieve in discussion” [5]. The UGTA Committee has addressed these problems and engaged stakeholders in southern Nevada over the course of their work, facilitating public dialogue with the DOE and enhancing the quality of information and feedback exchanged through continual research, study, deliberation, and focused follow-up information requests.

The UGTA committee’s presentations and workshops with stakeholders in Oasis Valley, Amargosa and Pahrump have provided the public with continual and responsive up-to-date feedback about the DOE’s UGTA programs and the NTS CAB’s well siting research progress. Committee members have given focused briefings on salient details of technical reports on Pahute Mesa’s groundwater at rural NTS CAB public meetings and in specially scheduled discussion sessions. These briefings facilitate public learning about the environmental system of concern and the DOE’s role in monitoring and managing groundwater contamination risks. These presentations, question and answer sessions, and roundtable workshops have also kept community leaders and interested stakeholders directly involved in the UGTA committee’s research process as they develop a well siting recommendation. The UGTA Committee’s success demonstrates how “an in-depth citizen-participation process can help to transcend the barriers to effective policy created by our sound-bite media culture” [2].

Document the entire process of learning and building stakeholder consensus

The UGTA committee’s DOE support staff have played an important role in thoroughly documenting the committee’s entire process of assessing the groundwater flow system from Pahute Mesa to Oasis Valley. The minutes of committee meetings with UGTA experts and with stakeholders are an important component of these records. Committee members have also compiled timelines of their research and discussion process, prepared annotated bibliographies on their key reference materials, and maintained their own files of notes on relevant environmental reports. The product of this research is now being finalized as a CAB white paper on the well siting recommendation, which will fully describe the scientific basis of the CAB’s decision and describe how stakeholders have been involved in arriving at this decision. This white paper will make the NTS CAB’s decision transparent to the public and will summarize the UGTA committee’s evaluation of the gaps that remain in the Pahute Mesa to Oasis Valley groundwater modeling strategy.

CONCLUSION

The UGTA committee’s well siting recommendation project is not yet complete, but their work illustrates a successful community advisory process for DOE. The committee has achieved its key objectives: (a) identifying and resolving the Pahute Mesa-Oasis Valley groundwater flow path model’s most critical data gaps, (b) involving the public directly in this effort, and (c) positively engaging the DOE in a larger, on-going effort to improve the groundwater modeling and monitoring activities of greatest concern to nearby downgradient communities. Stave’s five criteria for evaluating a collaborative decision process for environmental problem solving can be used to describe how the UGTA committee’s decision-making process enabled them to meet these objectives.

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The committee’s consistent focus on the problem of data gaps in the groundwater flow path model was crucial to keeping the public involved through an efficient research and discussion schedule. Focus on this problem also made it possible for the committee to develop substantive well siting recommendations based on a sharp scientific understanding of the focus area of the environmental system. The well locations selected by the committee reflect a holistic approach to the environmental problem which sought specific problem causes in the structure of the complex groundwater system, namely uncertainties about major constraints on groundwater flow direction and rate. The committee is using a specific policy lever to target environmental leverage points in the system’s structure, by preparing a DOE-requested well siting recommendation to collect critical information currently missing from the groundwater model. Throughout the research and decision process, the UGTA committee has made involving stakeholders’ feedback a priority. Through workshops, technical briefings at public meetings, and open discussions with community leaders and interested citizens, the committee has helped the public learn about the groundwater system and the DOE’s contaminant boundary monitoring and prediction efforts, in an iterative process designed to gain *well-informed feedback* from the public. By documenting their process of learning and building stakeholder consensus, the committee was able to track their own progress toward achieving a thorough understanding of the environmental system’s dynamics, and building consensus on their well siting decision.

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