VISUAL REALITY: USING A BOARD GAME TO ENHANCE UNDERSTANDING OF COST/BENEFIT DECISION MAKING

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ABSTRACT

Some say that "seeing is believing." At the very least, we know there are moments when everything becomes clear. The "aha" moment. It's when the person struggling to understand changes expression, the tension leaves the face, a smile appears, and the eyes look up in a gesture of spiritual appreciation. Teachers yearn for this with their students -- parents with their kids. Many times this moment comes after trying a new approach when presenting information, one that makes more sense to the learner. One method that helped the West Valley Citizen Task Force was a board game.

The New York State Energy Research and Development Authority (NYSERDA) owns the 3,340-acre Western New York Nuclear Service Center (Center), located about 35 miles south of Buffalo, New York. The Center is home to the West Valley Demonstration Project (WVDP), a joint federal/state high-level radioactive waste cleanup project situated on approximately 200 acres of the Center. The U.S. Department of Energy (DOE) manages the WVDP, paying 90% of the project costs, while NYSERDA pays the remaining 10%. Also at the Center is a shut-down State-Licensed Low-Level Radioactive Waste Disposal Area that is managed solely by NYSERDA. Together, DOE and NYSERDA are currently in the process of developing a closure option for the future management of the Center.

In January 1997, NYSERDA convened the West Valley Citizen Task Force, with support from DOE, to advise and provide community input on closure options for the future management of the Center. Members of the Task Force were selected from the local community, representing a diverse cross-section of interests and concerns. In many cases, Task Force members did not have a great deal of technical training or experience in dealing with radioactivity or environmental restoration. The site managers brought them up-to-speed by presenting technical information about the Center via handouts, presentations, charts, and graphs. However, as the process moved forward, the Task Force needed to use all of this information to be able to "see" the potential impacts of taking certain actions. To aid the Task Force in this endeavor, a simple, interactive "game" was developed by the site managers to provide a more visual understanding of the cost/benefit balancing required in decision making.

The game, called ConsenSite, consists of a large, laminated map of the site, with the four

most significant waste management areas (WMAs) clearly defined. This serves as the board. There are five individual "puzzle pieces" for the four WMAs, each representing the five different options for site closure. On the top of each piece, the data regarding the various impacts of the option is shown using symbols (i.e., dollar bill for cost). The puzzle pieces match the shape of the corresponding WMA on the map, and can easily be placed on, or removed from, the board during the game. The object of the game is to have two people reach consensus on an optimum cleanup solution for the entire site in less than one hour. To do this, the players use the puzzle pieces to compare potential impacts of taking certain actions and, when in agreement on a cleanup option for a particular WMA, place the appropriate puzzle piece onto the map. It's a mix-and-match game that requires the players to discuss their values, negotiate a solution, and decide if they can live with the potential impacts of their decision.

The game was used by the Task Force at a critical time in the process -- after being given a great deal of technical information and before beginning to draft their recommendations. Using this game provided a fast, uncomplicated, visual way to determine which factors controlled which decisions at each WMA, what impacts may result from their decisions, and how the remedial picture would look for the entire site. It provided the "aha" moment for many of the Task Force Members.

BACKGROUND

NYSERDA, a public benefit corporation established by the State Legislature in 1975, owns and manages the 3,340-acre Western New York Nuclear Service Center (Center) located about 30 miles south of Buffalo, New York (see Figure 1). The Center is home to the West Valley Demonstration Project (WVDP), a joint federal/state high-level radioactive waste cleanup project situated on about 200 acres of the Center. The U.S. Department of Energy (DOE) manages the WVDP, paying 90% of the project costs, while NYSERDA pays the remaining 10%. NYSERDA also has sole management responsibility for the shut-down State-Licensed Low-level Radioactive Waste Disposal Area (SDA) located adjacent to the WVDP property.

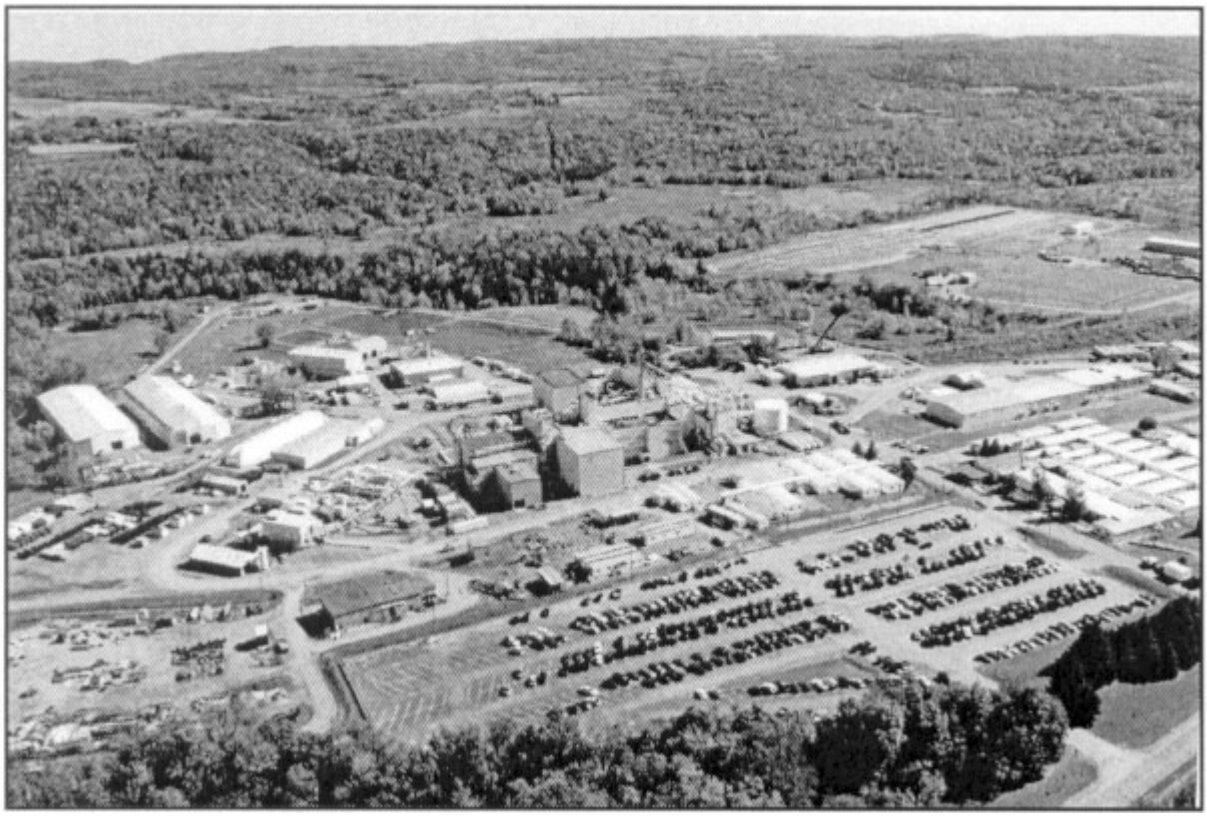

Figure 1 - Aerial View of the Center

In March 1996, NYSERDA and DOE issued a Draft Environmental Impact Statement (DEIS) for public comment which focused on evaluating closure options for the future management of facilities at the Center. The DEIS provided analyses of four generic options for closing facilities and managing the Center over the long term. The options ranged from complete removal of the facilities and the associated waste for off-site disposal or on-site storage, to stabilizing the waste in place, to managing the Center as-is and providing for long-term monitoring and maintenance. A fifth option, the hypothetical "walk-away" alternative, was also analyzed to provide a baseline of potential long-term hazards.

During the development of the DEIS, NYSERDA perceived a need for broader public participation, above and beyond the public comments on the DEIS, to help in the development of a closure option for the Center. Forming a community advisory group seemed to be the best way to ensure that the issues and concerns of the community were understood. To make this a reality, NYSERDA first obtained the support of DOE, its site partner in the joint DEIS and decision-making process. DOE agreed to participate and NYSERDA agreed to take the lead in managing the process.

NYSERDA contracted with an independent facilitator, Clean Sites, Inc., to assist in convening the group and to facilitate its meetings. NYSERDA and Clean Sites interviewed over 50 people in the surrounding area to identify potential members. Clean Sites recommended NYSERDA invite individuals from local and regional interests including business/commerce,

local government, Native-American, environmental protection, local medical, citizens at large, and the site work force. In late December 1996, NYSERDA extended invitations to participate and 16, of those invited, agreed to become members of the group.

The West Valley Citizen Task Force held its first meeting in late January 1997. In preparation, NYSERDA had developed the following objective for the group, which was later agreed upon by the Task Force:

> *...to assist in the development of a preferred alternative for the completion of the West Valley Demonstration Project and cleanup, closure and/or long-term management of the facilities at the site. (from Task Force Ground Rules)*

During the first eight months, the Task Force increased their understanding about the site and focused on the issues affecting NYSERDA and DOE decision-making. The meetings were spent familiarizing the members with the 12 Waste Management Areas (WMAs) identified in the DEIS. The site managers shared technical information about the types and volumes of wastes, the engineering of the five alternatives evaluated, and the analyses of performance and cost. After the group had become informed about the site, they were ready to take the lead in the direction of the process. With a good working knowledge of the site, the Task Force directed its discussions on the four WMAs at the site which they believed to be the most significant and likely to drive long-term decisions. A more detailed description of the Task Force is covered in another paper of the WM 99 Proceedings. **[**See Paper # 3 (Session 45), **Citizen Gain: The Story of the West Valley Citizen Task Force]**.

INFORMATION MANAGEMENT - Bringing it all Together

The Task Force was presented with extensive technical, historical, and regulatory information about the site and the 12 WMAs. They were challenged with using this information to weigh the risks, benefits, and costs of taking particular actions. Focusing on the four major WMAs, the Task Force evaluated the five closure options for each area. The impacts of each option were portrayed by at least nine key parameters which described the consequences of actions taken as part of that option. Table I provides an example of the data summary for each alternative for one WMA (the Main Process Building).

Table I - Data Summary for the Main Process Building

WMA # 1- Main Process Building				DEIS ALTERNATIVES			
Parameter	**Units**	**Removal and Off-Site Disposal**	**Removal and On-Site Storage**	**In-Place Stabilization (Option A)**	**In-Place Stabilization (Option B)**	**Monitor and Maintain**	**Baseline - "Walk Away"**
Dose - Max. Exposed Off-Site Individual.	mrem/year	0	0	0.15	0.15	0	88
Cumulative Population Dose	person-rems	760	608	13.7	13.7	0	220
Intruder Dose	mrem/year	<15	1,500,000	380,000	380,000	5,800,000	58,000,000
Fatalities	deaths	0.97	0.61	0.06	0.12	0.73	0.11
Implementation Jobs	jobs	179	154	45	96	8	0
Post-Implementation Jobs	jobs	0	0.07	3	3	20	0
Total Cost	$ million	492	345	82	420	152	0
Waste Volume Handled	cubic yards	7,222	7,222	489	1,815	0	0
Time to Implement	years	15	15	7.5	25	0	0

In order to help the Task Force assimilate and use this data, NYSERDA and Clean Sites decided to look for a more useful tool in communicating information. At the Fernald Environment Management Project, in Cincinnati, Ohio, the citizen's group was faced with a similar challenge of evaluating a large volume of environmental and economic information to make decisions that considered the risks, benefits, and costs of taking certain remedial actions. The Fernald group used a board game to better understand the risk reduction of excavating contaminated soil. The game was used as a tool to allow players to incrementally excavate soil and see the associated impacts on cost (increases) and risk (decreases). One could use this data to identify a point of diminishing returns and an optimal amount of contaminated soil removal.

A BOARD GAME FOR THE WEST VALLEY SITE

NYSERDA and DOE contacted the Fernald Environmental Management Project to learn more about the development of the game used at the site. It was clear that the Fernald game was not readily adaptable to the West Valley Site because much of the contamination at West Valley was inside of structures (such as the former reprocessing building, the high-level waste tanks, and the disposal areas) and the cleanup alternatives evaluated were different. To more accurately portray the West Valley Site, a board game was developed called ConsenSite.

The game board was a map of the Center with the WMAs outlined (see Figure 2). The game pieces were cutout shapes of the four major WMAs. Five separate pieces, representing each of the five closure alternatives, were available for placement on the board.

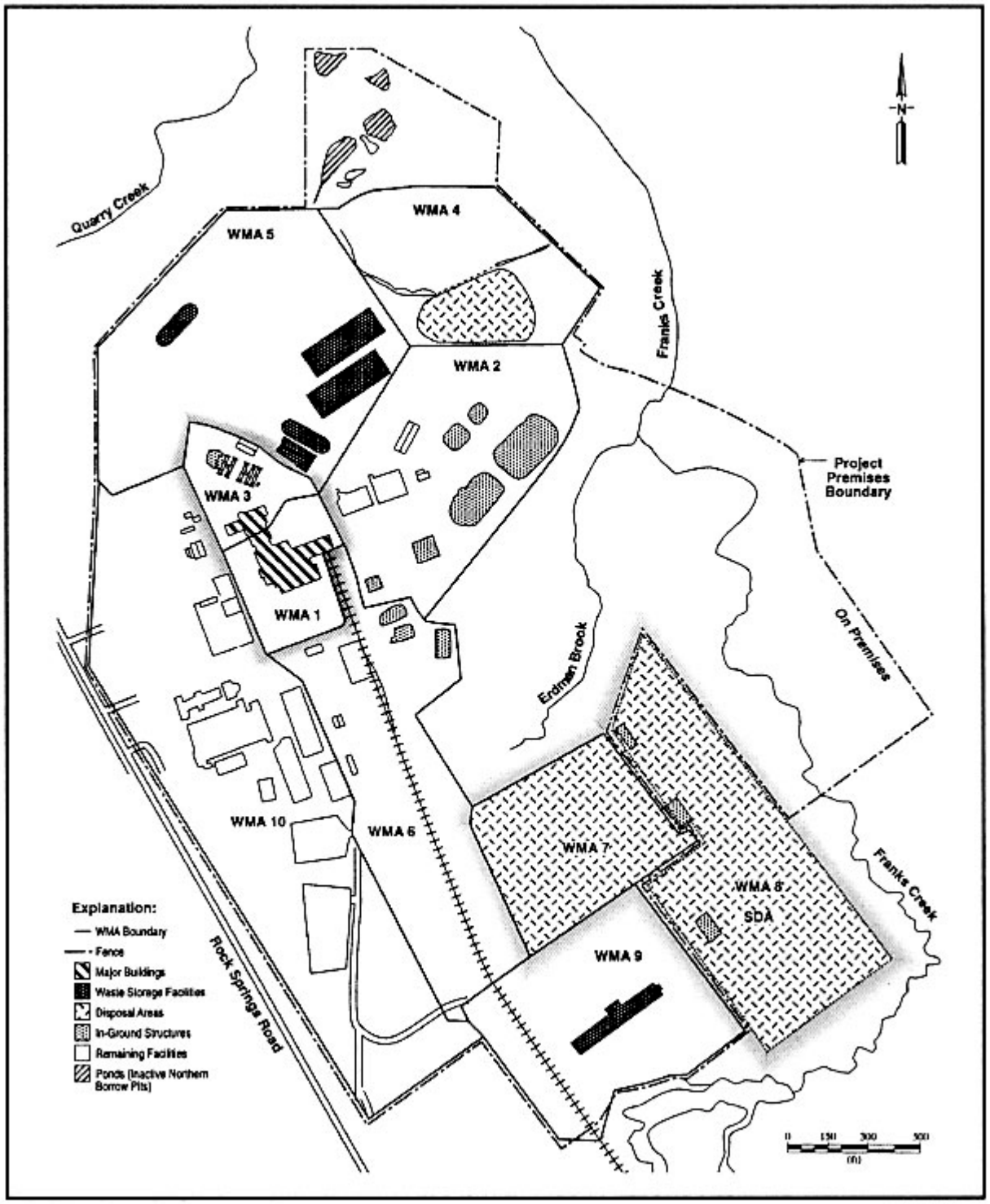

Figure 2 - ConsenSite Game Board (map of the site showing four major WMAs)

The face of each game piece contains symbols that represent some of the nine key parameters listed in Table I above. For example, dollar symbols represented the total cost of taking that action. Each symbol represents a specific number of units. Again, for example, each dollar symbol represents $100,000,000. Fractional symbols were used in one-half increments, so that two and one-half dollar symbols equals $250,000,000. The symbols shown in Figure 3

were obtained from commonly available computer clip art and were laminated onto the piece representing a potential closure option. On the back of each alternative piece was the radiation exposure that an inadvertent intruder would receive in the year of peak dose.

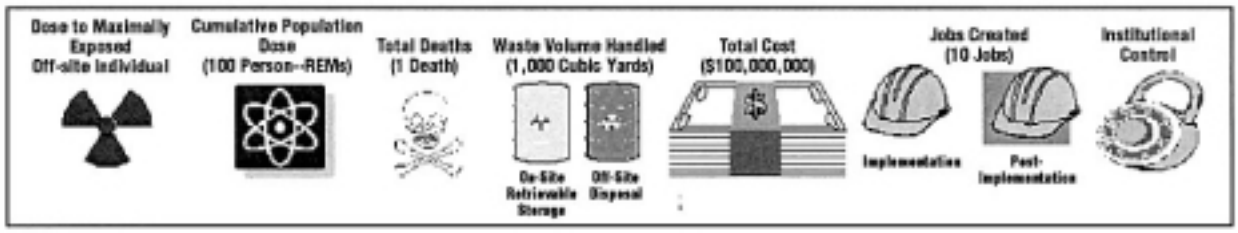

Figure 3 - Symbols Used on Game Pieces

USING CONSENSITE

The game is played by two participants. The object of the game is for the two players to reach consensus on a closure option for the entire site in less than an hour. The time limit was set to ensure completion of the game. It was suggested that the participants begin the game by discussing what is important to them regarding the cleanup of the site. This allowed each participant to get a sense of the other's values and priorities. Then, the players used the board game to help identify their preferred closure options for each of the four WMAs. The symbols on the game pieces provide a visual, quantitative analysis of the costs, benefits, and risks for each alternative. These symbols also allowed participants to assess site-wide totals for a complete picture of Center closure and to see which parameters control decisions. The players were asked to achieve consensus, within one hour, by replacing the pieces until a balance of costs, benefits, and risks is reached that is satisfactory and acceptable to both individuals (Figure 4).

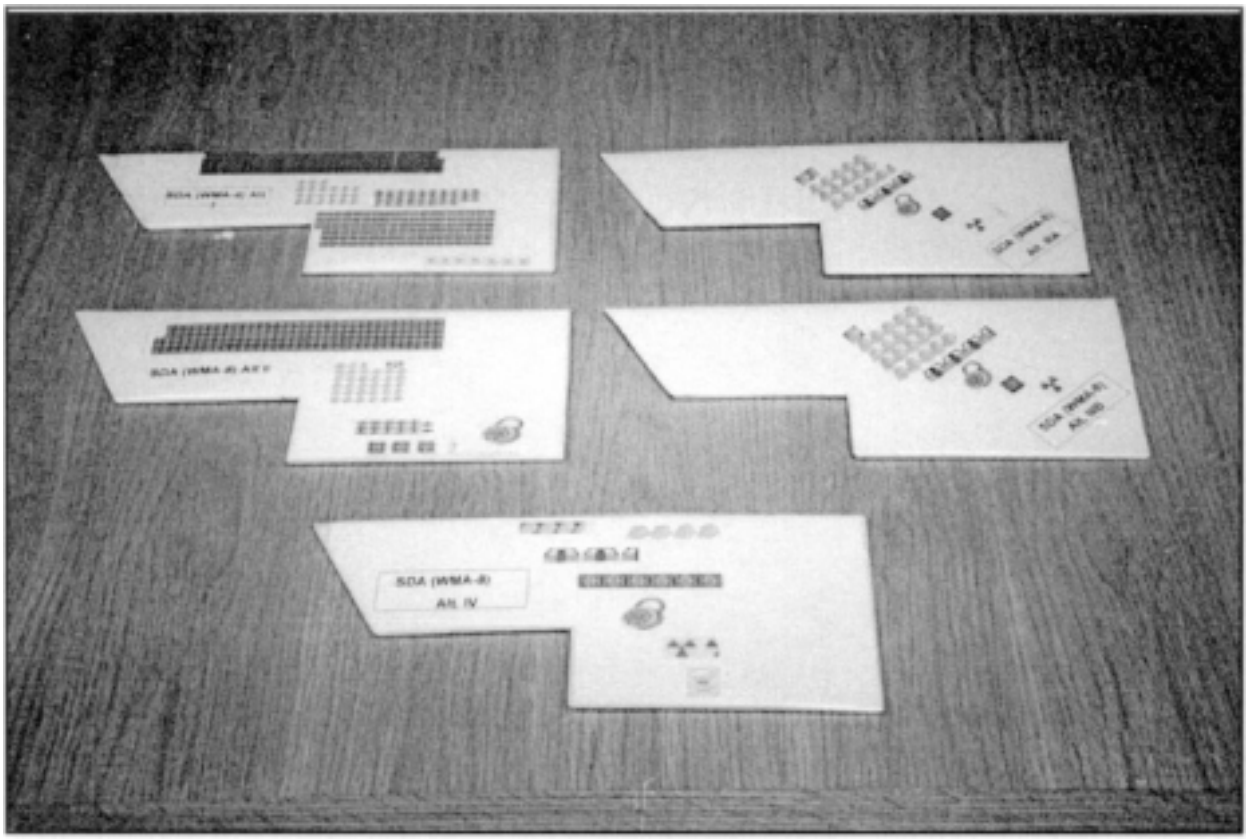

Figure 4 - ConsenSite Game Pieces

RESULTS - Did ConsenSite Work?

Prior to introducing ConsenSite to the Task Force, it was tested on site staff. The test players were familiar with the site and had technical backgrounds. Based on their experience with the game, refinements were made to make the game more user-friendly. For example, it became clear that some proposed symbols, such as the clock (representing time of implementation), did not add relevance to the decision-making process and, as such, were removed from the game pieces.

The Task Force was initially reluctant to use ConsenSite. The game was introduced to the Task Force at a difficult time in the process -- after being given a great deal of technical, historical, and regulatory information and before beginning to draft their recommendations. Nearly a year had gone by since they had begun meeting and many members were ready to be more self-deterministic in their decision-making processes. The game was presented to the Task Force at a regular meeting. It was placed on a table at the side of the room. A NYSERDA staff person explained the concept and potential use of the game but it generated only moderate interest from the Task Force.

To help stimulate interest, Task Force members were invited to play the game on a night between regularly scheduled meetings of the group. Three members showed up and quickly realized the game's utility in understanding the decision-making process and using the data to make informed decisions individually, and as a group. At the next Task Force meeting, these three members encouraged the other members to play the game, saying the game was a useful tool in understanding the decision-making process. Based on the recommendations of these

three members, the entire group agreed to play the game at the next meeting.

The Task Force members were all able to achieve consensus as they played ConsenSite, but all had to "give" at least a little in their initial positions to do so. By quickly assessing the consequences of choosing alternatives through the visual symbols, the players found the "give" acceptable and ultimately contributed to agreeing on the site-closure option. After playing the game, several Task Force members noted that the game was very useful in providing a holistic understanding of site closure (see Figure 5).

Figure 5 - CTF Members Receive Game Directions from NYSERDA Staff Member

The game provided an uncomplicated, visual way to understand which factors most influenced decision making for each WMA, what potential impacts might result from decisions, and how the remedial picture might look for the entire site. The ConsenSite game gave the Task Force an appreciation for the:

- Sitewide impacts of certain actions at each WMA;
- Importance of discussing the trade-offs before making decisions;
- Importance of maintaining flexibility before taking positions; and,
- Importance of discussing each member's values, priorities, and principles as choices are made.

The use of ConsenSite provided a visual, hands-on tool to help the Task Force members to organize, assimilate, and understand a large amount of technical data. A board game like ConsenSite can help people "see the forest for the trees" by presenting the information in a

different, more understandable, way.